

# Members Training Requirements, Opportunities and Capabilities in Meteorology and Hydrology

WMO Survey 2006

Education and Training Programme

ETR-No. 19



World  
Meteorological  
Organization  
Weather • Climate • Water

Secretariat of the World Meteorological Organization

Geneva – Switzerland

April 2007

WMO/TD-No. 1380



**WORLD METEOROLOGICAL ORGANIZATION**

**MEMBERS TRAINING REQUIREMENTS, OPPORTUNITIES AND CAPABILITIES**

**IN METEOROLOGY AND OPERATIONAL HYDROLOGY**

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#### NOTE

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## INTRODUCTION

In the years 1985, 1989, 1994, 1998 and 2002, five world-wide surveys on Members' training requirements, opportunities and capabilities were undertaken by the WMO Secretariat and their results were submitted to the Tenth (1987), Eleventh (1991), Twelfth (1995), Thirteenth (1999) and Fourteenth (2003) World Meteorological Congresses, respectively.

In reviewing the last survey's result (see WMO/TD-No. 1154 published in April 2003), Fourteenth Congress (May 2003) agreed, inter-alia, that it would constitute a useful source of information for a number of users and would be a basis for modifications and improvements in the Education and Training Programme. Accordingly, Congress requested that another survey should be conducted during the fourteenth financial period (2004-2007).

To carry out the sixth worldwide survey on Members' training requirements, opportunities and capabilities, an updated questionnaire was prepared in consultation with the Executive Council Panel of Experts on Education and Training and its Expert Team on Accreditation and Certification (ETAC).

The goals of this *Survey 2006* are as follows:

- (a) *To assess Members' training requirements from an international perspective in order to identify specific national gaps, common regional concerns, and major global trends;*
- (b) *To establish world-wide priorities that would provide a basis for adjustments and improvements in the planning and implementation of the WMO's Education and Training Programme (ETRP);*
- (c) *To explore Members' capabilities and capacities to further assist WMO in meeting one of its major objectives - to assist Members in obtaining adequately educated and trained personnel for the continued development of their National Meteorological and Hydrological Services;*
- (d) *To explore the current status of accreditation and certification in meteorological education and training worldwide, focusing on that of aeronautical meteorological personnel and the extent to which NMHSs have public education and outreach.*

## QUESTIONNAIRE STRUCTURE

The questionnaire is composed of three parts, namely: Part A – Meteorology, Part B – Hydrology, and Part C, which was added to the traditional questionnaire and addresses in particular item (d) above. Part A and Part B address the following matters:

- (i) *Current status of national education and training in meteorology and operational hydrology;*
- (ii) *Human resources development - assessment and plans;*
- (iii) *Assessment of WMO training activities;*
- (iv) *Future education and training requirements, opportunities and capabilities.*

Part C has two subsections intended to deal with the following two issues:

- (i) *Education and Training of Aeronautical Meteorological Personnel;*
- (ii) *Public Education and Outreach.*

The global survey of Members' training requirements represents an objective basis for a proper assessment and planning of the WMO training activities and for introducing modifications and improvements to the Education and Training Programme. In this context, the Fourteenth World Meteorological Congress (May 2003) urged Members to participate actively in this survey by completing the questionnaire with all the required information.

## **MEMBERS' RESPONSES BY REGION**

The Questionnaire was distributed to Members (the Permanent Representatives of Member countries with WMO) by the Education and Training Department on 16 June 2006 with a request to return the completed Questionnaire by 18 August 2006. At the same time, an electronic version of the questionnaire (e-questionnaire) was also sent to the National Focal Point on education and training designated by the Permanent Representative of each Member to facilitate his/her the response through by e-mail, which contributed to the enhancement of the returning rate and the timely processing of the concerned information and data. A copy of the Questionnaire is included as Annex IV.

In an effort to ensure a representative global sampling, reminders and then urgent reminders, were sent and subsequently the number of replies reached 95 out of 187 Members of WMO as shown in Table 1. The Regional response rate varies from 27% for RA IV to 60% for RA VI (*Figure A*).

The quality of responses was good in general. As in the previous case, the following barriers in the process of data analysis and the production of reliable results are still remaining:

- Low level of response from in particular Least Developed Countries Members where information is desperately needed;
- Poor response level to Hydrology part, which may cause a distorted analysis;
- Some responses include inconsistency in the information, which imply uncertainty of data;
- Some countries did not provide answers to certain sections of the questionnaire, perhaps they did not have national activities pertaining to the particular sections or they may not have the data;
- Some questions were answered carelessly.

Table 1 – Members responded to the Sixth WMO Survey (2006)

	Part A	Part B	Part C
<b>Region I - Africa</b>			
1 Algeria	0	-	0
2 Cameroon	0	-	-
3 Central African Republic	0	0	0
4 Côte d'Ivoire	0	0	-
5 Egypt	0	-	0
6 Eritrea	0	0	0
7 Ethiopia	0	0	0
8 Gambia	0	0	0
9 Guinea-Bissau	0	0	0
10 Kenya	0	0	0
11 Liberia	0	0	0
12 Libyan Arab Jamahiriya	0	-	0
13 Malawi	0	-	0
14 Mali	0	0	0
15 Mauritius	0	0	0
16 Mozambique	0	-	0
17 Nigeria	-	0	-
18 Democratic Republic of Congo	0	0	0
19 Senegal	0	0	0
20 South Africa	0	-	0
21 Sudan	0	-	-
22 Tunisia	0	-	-
23 Uganda	0	0	0
24 Zambia	0	0	0
25 Zimbabwe	-	-	0
<b>Region II - Asia</b>			
26 Bahrain	0	-	-
27 Bangladesh	0	0	0
28 Bhutan	0	0	0
29 China	0	-	-
30 Hong Kong, China	0	-	0
31 Iran	0	-	-
32 Japan	0	0	0
33 Kazakhstan	0	0	0
34 Republic of Korea	0	-	0
35 Kyrgyz Republic	0	0	0
36 Lao People's Democratic Republic	0	0	0
37 Macao, China	0	-	0
38 Mongolia	0	0	0
39 Qatar	0	-	0
40 Thailand	0	-	0
41 United Arab Emirates	0	-	0
42 Uzbekistan	0	0	0
43 Viet Nam, Socialist Republic of	0	0	0
44 Republic of Yemen	0	-	0

	Part A	Part B	Part C
<b>5 Region III - South America</b>			
45 Argentina	0	-	-
46 Chile	0	-	0
47 Colombia	0	0	0
48 Ecuador	0	-	-
49 Guyana	0	0	0
50 Peru	0	0	0
51 Uruguay	0	-	-
<b>Region IV - North America, Central America and the Caribbean</b>			
52 Antigua and Barbuda	0	-	0
53 Canada	0	0	0
54 Costa Rica	0	0	0
55 Dominican Republic	0	-	0
56 Saint Lucia	0	0	0
57 Trinidad and Tobago	0	0	0
<b>Region V - South-West Pacific</b>			
58 Australia	0	0	0
59 Brunei Darussalam	0	-	0
60 Fiji	0	0	-
61 Indonesia	0	0	-
62 Malaysia	0	-	0
63 New Zealand	0	-	0
64 Philippines	0	0	0
65 Samoa	0	0	0
66 Singapore	0	-	0
<b>Region VI - Europe</b>			
67 Armenia	0	0	0
68 Belarus	0	0	0
69 Bosnia and Herzegovina	0	0	0
70 Cyprus	0	-	0
71 Czech Republic	0	0	0
72 Denmark	0	-	0
73 France	0	0	0
74 Georgia	0	0	0
75 Germany	0	0	-
76 Hungary	0	-	0
77 Ireland	0	-	0
78 Israel	0	-	0
79 Latvia	0	0	0
80 Lebanon	0	-	0
81 Lithuania	0	0	0
82 The former Yugoslav Republic of Macedonia	0	0	0
83 Malta	0	-	0
84 Republic of Moldova	0	0	0
85 Monaco	0	0	0
86 Norway	0	-	0

	Part A	Part B	Part C
87 Poland	0	0	0
88 Portugal	0	-	-
89 Romania	0	0	0
90 Russian Federation	0	0	0
91 Spain	0	0	0
92 Sweden	0	0	0
93 Turkey	0	0	0
94 United Kingdom	0	-	0
95 Ukraine	0	0	0
Number of responses to each Part	<b>93</b>	<b>55</b>	<b>80</b>

50 countries replied to all Parts (A, B and C)  
3 countries replied only to Part A and Part B  
8 countries replied to Part A only  
1 country replied to Part B only  
1 country replied to Part C only

Table 2: Summary of Responses to the sixth WMO Survey 2006

Region	Nr of Members	Nr of replies from Members	Replies to each Part		
			Part A	Part B	Part C
I	52	25 (48%)	23 (44%)	15 (29%)	20 (38%)
II	34	19 (56%)	19 (56%)	9 (26%)	16 (47%)
III	12	7 (58%)	7 (58%)	3 (25%)	4 (33%)
IV	22	6 (27%)	6 (27%)	4 (18%)	6 (27%)
V	19	9 (47%)	9 (47%)	5 (26%)	7 (37%)
VI	48	29 (60%)	29 (60%)	19 (40%)	27 (56%)
<b>Total</b>	<b>187</b>	<b>95 (51%)</b>	<b>93 (50%)</b>	<b>55 (29%)</b>	<b>80 (43%)</b>

### Regional Response rate

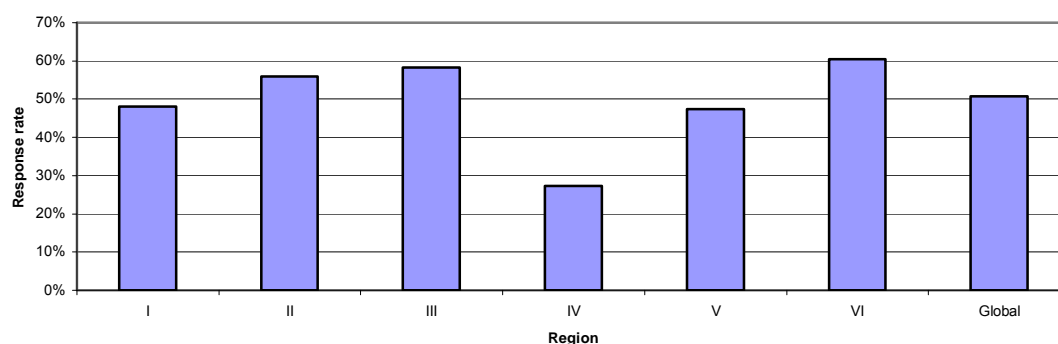
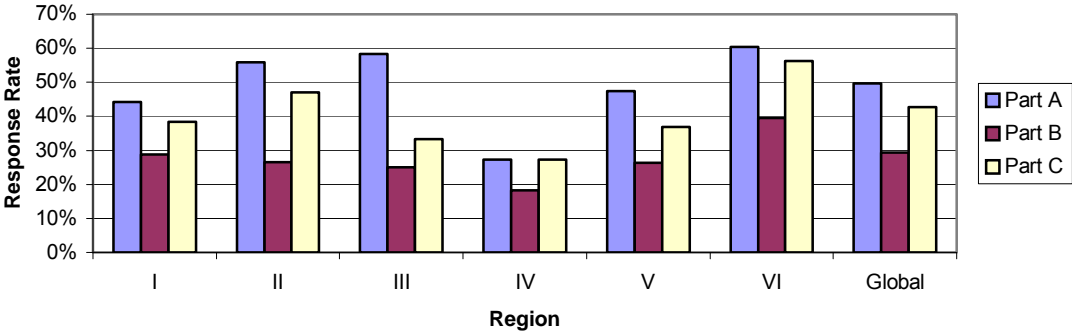


Fig. A – Ratio of received responses to number of countries in 6 WMO Regional Associations.

**Regional Response rate for each Part**



*Fig. B – Regional response rate for each Part*

## **PART A: METEOROLOGY**





## I. CURRENT STATUS OF NATIONAL EDUCATION AND TRAINING PROGRAMMES IN METEOROLOGY

The aim of this section is to assess; the job-entry-level requirements for Meteorologists and Meteorological Technicians<sup>(#)</sup>; continuing education and training programmes available for meteorological personnel at the National Meteorological and Hydrological Services (NMHSs); and the factors, which may adversely affect the education and training in meteorology.

### I.1 What is the usual qualification for job-entry-level Meteorologists in the national Service responsible for meteorological activities?

Members were requested to choose the relevant item(s) among the following four options and specify duration for each chosen item(s).

- (a) First degree in meteorology;
- (b) Postgraduate Diploma/Master's degree in meteorology, for holders of a degree in a scientific/engineering/computational subject;
- (c) Foundation training in meteorology, organized by the Service, possibly in partnership with other national institutions, for holders of a degree in a scientific/engineering/computational subject;
- (d) Another approach;

Table I.1 – Frequency statistics on the usual qualification programmes and their duration of study for job-entry-level Meteorologists

	Frequency													
	Region						Global	Duration						
	I	II	III	IV	V	VI		3mns	6mns	1yr	2yrs	3yrs	4yrs	5yrs
(a)	17	13	6	5	3	18	<b>62</b>	1	0	1	4	5	<b>16</b>	<b>12</b>
(b)	16	10	4	2	7	15	<b>54</b>	0	0	<b>13</b>	<b>15</b>	3	3	2
(c)	6	11	1	0	5	9	32	2	5	<b>10</b>	2	2	1	0
(d)	3	2	2	1	1	4	13	0	2	0	0	1	0	0

The result shows that, in more than 70% of responding Members, the first degree and the postgraduate diploma/master's degree in meteorology are taken as the usual qualification for job-entry-level Meteorologists. However, in the regional aspect, particularly RA II and RA V Members show flexibility compared to other regions in recruiting job-entry-level meteorologists. Most often the duration required for the first and the postgraduate diploma/master's degree is of 4-5 years and 1-2 years, respectively. It also reveals that foundation training carried out in NMHSs takes mostly 1 year.

<sup>(#)</sup> Please note that the new WMO scheme for classification of personnel in meteorology and hydrology is being used throughout this Questionnaire; see the definitions for 'Meteorologist' and Meteorological Technician' under Chapter 1 of WMO-No. 258, Vol. 1 – Meteorology; fourth edition 2002. For reference, a brief overview is provided as Annex V.

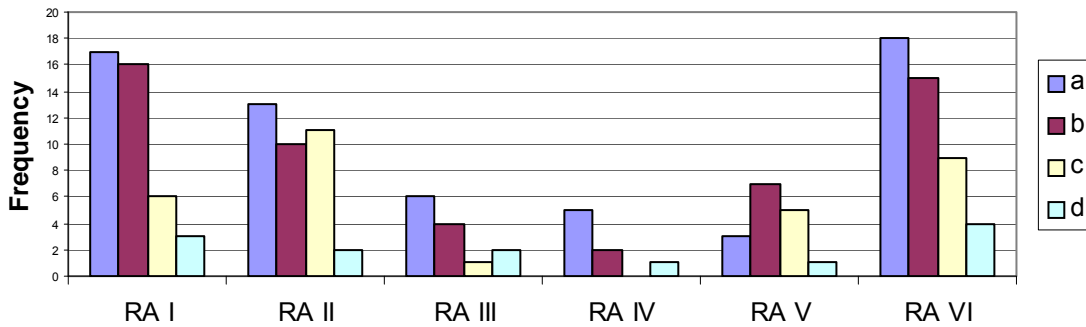


Figure I.1 – Regional distribution of the usual qualification for job-entry-level Meteorologists

Following are samples of other approaches specified by some Members as the usual qualification for job-entry-level Meteorologists.

#### Region I – Africa

- BSc in Mathematics or Physics + BIP-M Course + Diploma in meteorology.
- Assistant meteorologist level exists in some countries.
- In absence of holders of a degree in Meteorology, those holding a degree in Physics or Mathematics can be applicable.
- On-the-job training at competent meteorological training institution.
- The newly recruited employees are sent to obtain postgraduate diploma or master degree in meteorology.

#### Region II – Asia

- Degrees in Physics/Mathematics/ICT are acceptable.
- The first degree in meteorology is required for becoming a meteorologist. Most job-entry-level Meteorologists are employed through open competitive recruitment examination, which requires no academic limitation to take the exams. Currently, the main subjects of the exams include general meteorology, meteorological analysis and forecast. In addition, non-competitive recruitment examinations are administered as a supplementary method when competitive recruitment examinations cannot fulfil recruitment of necessary talents, in which case most new employees are BSc or MSc holders in meteorology and related sciences. They are trained for one month prior to beginning their work.

#### Region III – South America

- First degree plus a three years' experience in meteorology and/or the former Class II training.
- Professional title in Meteorology, Geography, Statistical Environmental, Physical, Mathematical, Chemical Electronics.

#### Region IV – North America, Central America and the Caribbean

- A mix of (a) and (b). Typically, about 75% of hired candidates have a B.Sc. and 25% an MSc.

#### Region V – Southwest Pacific

- Through recruitment of degree holders preferably in science, sent overseas for specialized training in meteorology

- Minimum entry level is Bachelor degree, not post graduate degree. A graduate diploma of meteorology recognized by Australian Universities is nationally accredited.

### Region VI – Europe

- Bachelor Degree in Geography, Physics for job-entry level meteorologists, training programmes in meteorology organizes by the Service.
- First degree in Meteorology / Physics / Mathematics / Natural Sciences.
- BSc in Mathematics and/or Physics + 26 weeks theoretical/practical training at UK Met Office College + approx 6 months OJT.
- Diploma in engineering or master in a scientific domain.
- (a) & (c) + 1 year job training.

## I.2 What is the usual qualification for job-entry-level Meteorological Technicians in the national Service responsible for meteorological activities?

In this question, Members were required to choose the relevant item(s) among the following four options and specify duration for each chosen item(s).

- (a) Meteorological training at a technical/vocational secondary school;
- (b) Meteorological training at a post-secondary school institution;
- (c) Meteorological training organized by the Service, possibly in partnership with other national institutions;
- (d) Another approach;

Table I.2 – Frequency statistics on the usual qualification programmes and their duration of study for job-entry-level Meteorological Technicians

	Frequency													
	Region						Global	Duration						
	I	II	III	IV	V	VI		3mns	6mns	1yr	2yrs	3yrs	4yrs	5yrs
(a)	6	7	0	0	1	13	27	0	0	1	1	4	4	1
(b)	8	7	1	4	2	8	30	0	3	1	6	5	2	1
(c)	12	12	5	2	5	13	49	6	7	9	4	3	0	0
(d)	4	2	1	2	3	8	20	2	0	3	1	1	0	0

The result shows that the usual qualification for job-entry-level Meteorological Technicians varies country-by-country and region-by-region. As a whole, many Services usually organize meteorological training, possibly in partnership with other national institutions to secure qualified job-entry-level Meteorological Technicians responsible for meteorological activities.

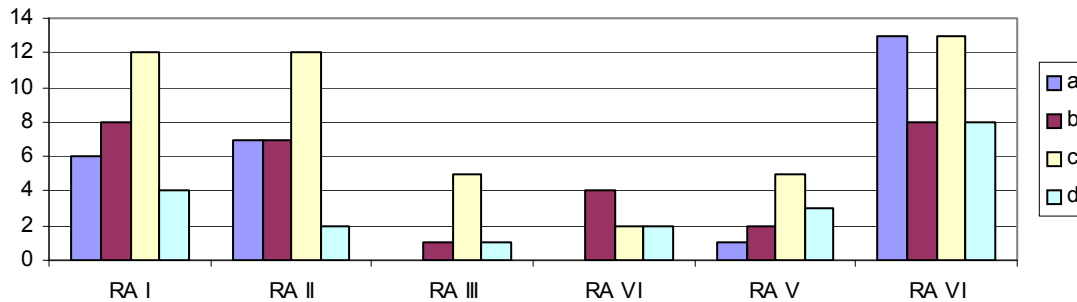


Figure I.1 – Regional distribution of the usual qualification for job-entry-level Meteorological Technicians

Following are samples of other approaches specified by some Members as the usual qualification for job-entry-level Meteorological Technicians.

#### Region I – Africa

- After studying for seven (5 + 2) years at Secondary Education Level and then (c).
- Secondary school graduates with good science credits are recruited to undergo technicians course.

#### Region II – Asia

- In most cases, no meteorological background is required. Without any training, they can start their work. They are trained on the job by their mentors. Most job-entry-level Meteorological Technicians are university graduates.
- Meteorological training organized by the Service for the holders of a certificate from a technical/vocational secondary school as well as those who were graduates from the high school.

#### Region III – South America

- Passes in CSEC Exams. Must pass Mathematics, English and Science subject.
- Bachelor in Basic Sciences and Auxiliary Meteorological Course for Met Technicians.
- Bachelor in Basic Sciences and Auxiliary Course of Weather observation for Weather observers.

#### Region IV – North America, Central America and the Caribbean

- A High School diploma and 2000+ hours in electronics are required for technicians in charge of station maintenance This is followed by an on-the-job three-year training period (covering various topics including meteorology).
- Meteorological training at a regional training institution.

#### Region V – South-West Pacific

- GCE 'O' level or equivalent and meteorological training organized by the Service.
- Meteorological technicians are no longer recruited.

#### Region VI – Europe

- Secondary school education for job-entry level meteorologists, training programmes in meteorology organizes by the Service.
- The Met Office no longer employ at Met Technician level.
- Diploma of Higher Technical Institute or of Equivalent Institution in Electrical Engineering, Computer Science/Mechanical Engineering or Leaving Certificate of

Secondary School (Science) or Leaving Certificate of Technical School in relevant subjects.

- 'A' level grade in GCE at Physics and Mathematics.
- The Service does not employ any specialized technician in meteorology.

### I.3 Have you already completed the transition to the new classification of personnel as stated in WMO-No. 258 Vol. I, Edition 4?

	Total	RA I	RA II	RA III	RA IV	RA V	RA VI
<b>YES</b>	40	8	9	4	3	4	12
<b>NO</b>	53	15	10	3	3	5	17

*If No, please answer the following questions.*

(a) Do you anticipate completing the transition by 1 January 2007?

	Total	RA I	RA II	RA III	RA IV	RA V	RA VI
<b>YES</b>	14	5	2	1	0	2	4

The purpose of this question was to explore the extent to which Members are in compliance with WMO-No. 258 and diagnose the anticipating difficulties in implementing the new classification of personnel (which should come into full effect on 1 January 2007).

It was revealed, as shown in the above result, that less than 50 % of the respondents had completed the transition to the new classification. Fourteen out of 53 Members who said "No" answered that they anticipated completing the transition by 1 January 2007, which means that nearly 60 % of the responding Members will have already been in compliance with the new classification by January 2007 (see Fig I.3).

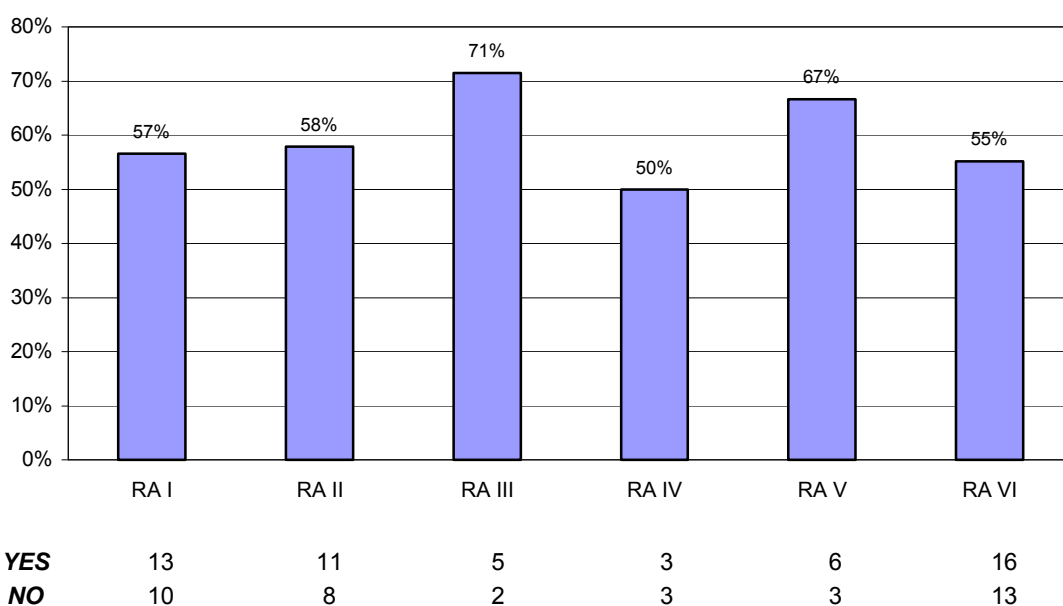


Fig I.3 – Implementation of New classification of personnel foreseen by 01 Jan 2007

Following is an overview of the main issues preventing Members from completing the transition.

#### *Region I – Africa*

- The new classification of personnel is yet not available in our service
- Insufficient comprehension of the new classification of the personnel and the means for its implementation.
- The principle is generally accepted but the implementation is still under negotiation between the relevant governmental bodies.

#### *Region II – Asia*

- The classification of hydromet staff differs from the WMO classification, but there is conformity between international and national classification.
- Late qualification of new employees, and the continuation of the evaluation of current workers due to the recent establishment of the Training Centre.
- The general requirements of the National Civil Service do not accept the WMO new classifications.

#### *Region III – South America*

- The laws of Civil Service and Administrative career do not allow compliance with the WMO classifications as they should. The classification of INAMHI staff complies with the national law and regulations, but the information from WMO contributes to the implementation of the proposal.

#### *Region IV – North America, Central America and the Caribbean*

- Lack of knowledge.

#### *Region V – South-West Pacific*

- Short of staff in the training area in meteorology. The present structure has no staff on the training field.
- The changes in staffing structure to go through a specific committee, which would not be performed by 2007. Hopefully this can be performed by the year 2008.

#### *Region VI – Europe*

- Due to reorganization plan, the transition has been postponed to 2008.
- The meteorological service is a part of the Service of the Environmental Agency.
- The national qualifier of specialties does not provide such transition.
- Lack of resources.
- Lack of educational institutions of meteorological type.
- Because of absence of technical and financial means, we are is not ready to complete the transition to the new classification of personnel.
- All forecasting staff and the head of the Meteorological Office are not BSc graduates however new entrants, when these are recruited will be as per WMO-No. 258 Vol. I, Edition 4.
- Due to National legislation.
- Classification of the personal is connected with national regulations concerning the job classification.

**I.4 What are the main activities in continuing education and training in meteorology presently undertaken by the Service, and their frequency?**

Members were requested to choose among the following

- (a) Periodic refresher training for Meteorologists;
- (b) Periodic refresher training for Meteorological Technicians;
- (c) Specialized training for Meteorologists, organized by the Service as required;
- (d) Specialized training for Meteorological Technicians, organized by the Service as required;
- (e) Other activities in support of continuing professional development such as stimulating employees for self-study, promoting the lifelong learning culture, etc.

Table I.4 summarizes the responses to this question, showing that 61% of the respondents undertake periodic refresher training for Meteorologists, 67% run periodic refresher training programmes for Meteorological Technicians; 66% organize specialized training for Meteorologists and 75% for Meteorological Technicians, as required. Also, 49% implement other activities in support of continuing professional development such as stimulating employees for self-study, promoting the lifelong learning culture, etc. It was revealed that most of the responding Services to this question provide yearly training for their meteorological staff. Meanwhile it is understood that those who chose "Other" may have either short or long frequency of training given to their staff rather than annual or biennial.

*Table I.4 – Frequency of the main activities in continuing education and training in meteorology presently undertaken by the Services, and their frequency*

	<i>Frequency</i>				
	<i>n/a</i>	<i>1 year</i>	<i>2 years</i>	<i>Other</i>	<i>No answer</i>
(a)	24	24	13	20	12
(b)	22	29	10	23	9
(c)	21	25	7	29	11
(d)	14	23	10	37	9
(e)	15	11	3	32	32

The following table shows the regional activities in continuing education and training in meteorology and their frequency.

		<i>n/a</i>	<i>1 yr</i>	<i>2yrs</i>	<i>Other</i>			<i>n/a</i>	<i>1 yr</i>	<i>2 yrs</i>	<i>Other</i>
RA I	(a)	7	7	2	3	RA IV	(a)	2	2	0	1
	(b)	6	11	0	5		(b)	3	1	0	1
	(c)	9	4	1	5		(c)	2	2	0	1
	(d)	7	5	1	6		(d)	1	1	1	2
	(e)	7	1	0	5		(e)	1	1	0	3
RA II	(a)	5	7	3	4	RA V	(a)	2	0	1	6
	(b)	5	5	4	5		(b)	2	1	1	5
	(c)	4	4	1	9		(c)	1	4	1	3
	(d)	1	4	3	10		(d)	1	2	1	5
	(e)	3	2	1	9		(e)	0	3	1	5
RA III	(a)	3	2	0	0	RA VI	(a)	5	6	7	6
	(b)	1	3	1	1		(b)	5	8	4	6
	(c)	2	1	0	1		(c)	3	10	4	10
	(d)	1	4	0	2		(d)	3	7	4	12
	(e)	1	0	0	2		(e)	3	4	1	8

Following are other activities for continuing professional development carried out by some of responding Members.

#### *Region I – Africa*

- Through fellowship and short-term training granted from donor countries or WMO.
- Seminars, Workshops, E-learning activities.
- Employees are encouraged to read materials and rarely meet to brainstorm on their level of understanding in the relevant subjects.

#### *Region II – Asia*

- The process is not yet well structured. Just some individual initiatives.
- KMA operates Meteorological College in the evening for the staff without B.Sc. in meteorology by credit bank system. Also, KMA provides various continuing professional development programs for the staff in domestic and overseas universities and related institutes.
- Specialized training for Meteorologists and Met Technicians is organized average 3 times every year per person. Meanwhile, in support of continuing professional development, seminars, training attachments and visits, e-learning, experience sharing sessions, career posting and self-study are organized.
- Meteorological Training Institute of BMD organizes specialized training course as and when required beyond the schedule courses for the continuation of the professional development of the Services.
- Community of Practice (COP) just did their planning in July 2006 and is now try to continue.
- Stimulate employees for self study.

#### *Region III – South America*

- Period 2005-2006: Basic computation (80 hours), Formulation and Evaluation of Projects (72 hours).

#### *Region IV – North America, Central America and the Caribbean*

- When available, meteorologists are sent out to the Washington Desk Programme or at the National Hurricane Centre.
- Staff is encouraged to pursue personal development through internet web tools.

#### *Region V – South-West Pacific*

- Organize one-day seminar on a variety of topics every six months.
- Conduct seminars on current development in meteorology for Meteorologists and Met Technicians.
- Other constraints:
  - Due to limited funds in the training budget allocated to the Meteorological Service, a lot the staff development and training programs cannot happen.
  - Training for Meteorologist and the Meteorological technicians are not conducted due to lack of training personnel and facilities.
  - Loss of skilled and experienced staff, especially at professional level, due to migration in search of greener pastures impacts on staff turnover.
- Encourage to undertake courses at the National University.
- Seminar, workshop, symposium & conference (Mostly overseas attended by meteorologists).



*Region VI – Europe*

- Internal scholarships for educational purposes. Use of CAL
- Normally support is given to employees attending university level courses i.e. to complete MSc. or PhD.
- We operate a refund of fees scheme where staff do/study degree programmes in the own time and we pay the fees (in advance). Also we pay membership of professional bodies e.g. Irish Computer Society etc.
- International courses organized by EUMETSAT, WMO, DWD, Mete-France, Met Office, NOMEK etc., conferences, seminars, workshops.
- (i) Training in various computer programs; (ii) Short training in management; (iii) Taking part in various COST programs.
- Access to Internet allows for permanent self-studying, CAL modules.
- Self learning by Internet / Repetition with learning material (CD ROM/Script).

Based on the replies by Members to the following question, it is shown that 75% of the responding Members use Information and Communication Technology (ICT) in continuing education and training activities.

- (f) Does your Service use Information and Communication Technology (ICT) in continuing education and training activities? (Yes / No)

Following is the result of the statistics based on the answers given by Members.

	Total	RA I	RA II	RA III	RA IV	RA V	RA VI
<b>YES</b>	70	14	13	7	4	7	25
<b>NO</b>	23	9	6	0	2	2	4

The following table shows that most of those who chose “Yes”, utilize electronic media or website as a tool for the activities.

	FREQUENCY			
	Video Conf. Sys.	Electronic media	Web site	Others
RA I	2	8	11	2
RA II	4	11	12	4
RA III	2	7	4	4
RA IV	2	3	2	0
RA V	1	6	7	2
RA VI	3	21	18	5
Total	14	56	54	17

**I.5 If the overall performance of the meteorological education and training undertaken in your country is not fully satisfactory, what are the principal weaknesses?**

The purpose of this question is to explore through the following choices the main weaknesses that each Member is facing in undertaking the meteorological education and training.

- (a) Low visibility of Meteorology at national level: lack of teaching staff and/or teaching facilities;

- (b) Insufficient meteorological and/or teaching expertise: outdated documentation for specialized training in meteorology; lack of staff development programmes for meteorological instructors;
- (c) Limited co-operation between institutions giving meteorological education: ambiguous objectives; unpractical institutional fragmentation;
- (d) Inflexible accreditation arrangements for previously acquired competencies; rigid access to meteorological qualifications and progression routes, including the bridging routes in between different pathways;
- (e) Other constraints

Responses are summarized in the following table, where each figure represents the frequency of choices for a given item.

Table I.5a – Principal weaknesses brought up by Regional respondents for the given options

	Frequency						
	Total	RA I	RA II	RA III	RA IV	RA V	RA VI
(a)	<b>51</b>	12	11	4	3	7	14
(b)	<b>44</b>	11	10	2	2	7	12
(c)	<b>29</b>	6	5	3	2	2	11
(d)	<b>21</b>	4	4	2	0	4	7
(e)	<b>22</b>	8	3	2	3	2	4

The statistics shows that low visibility of Meteorology at national level is the main constraint and weakness in performing the meteorological education and training in the country, which is still the same situation as in the last survey carried out in 2002. Another main obstacle that Members are facing in performing the education and training is the lack of expertise and staff development programmes for instructors, which is also similar to the result of the last survey.

Considering the low level of responses to this Part (Meteorology) from Members of which is 50% globally and in particular 27% from RA IV, the result of the analysis could not be regarded as the one that is representative of each Region. In this regard, in order to obtain more reasonable results, another approach based on Country Classification made public in July 2006 by World Bank was applied to the analysis, which comprises five groups, namely: Low Income Countries (LIC), Lower Middle Income Countries (LMC), Upper Middle Income Countries (UMC), High Income Countries (HIC), and High Income OECD Countries (OECD) (See Annex I).

Table I.5b – Principal weaknesses brought up by income-group respondents for the given options

	Frequency					
	Total	LIC	LMC	UMC	HIC	OECD
(a)	<b>51</b>	18	14	10	5	4
(b)	<b>44</b>	17	13	5	7	2
(c)	<b>29</b>	7	10	7	3	2
(d)	<b>21</b>	5	6	6	3	1
(e)	<b>22</b>	8	6	2	4	2

This approach also shows that low visibility of Meteorology at national level and insufficient meteorological and/or teaching expertise are the main constraints and weakness. It reveals that even most of OECD countries also indicated that one of the major weaknesses is the low visibility of Meteorology, as other groups did. It also shows that the limited co-operation between institutions is another constraint for developing countries.

Following are some other constraints specified by respondents:

#### *Region I – Africa*

- Financial constraints
- So far limited training possibilities are provided to our service
- Financial constraints / Lack of budgets
- Unfriendly government policies which discourage continued enhance training
- Lack of funds
- Lack of resources in terms of human and adequate instrument/equipment, as well as meteorological stations for operational purpose
- Lack of laboratories and equipment for experiments
- Lack of institutional development: clear administrative organization at national level.
- Apart from the former Class IV training which is offered at national level, the other levels of training are undertaken from outside and this gives a big financial constraint

#### *Region II – Asia*

- Presently the Service is conducting the training as required but there is no meteorological Institute in the country. The other problem is the financial constraints
- Lack of degree course in meteorology at the tertiary level
- Low remuneration and lack of material and morale encouragement relative to similar job in the country
- Limited budgets to create educational and training cooperation between the Service and those in other country.

#### *Region III – South America*

- Little governmental support for formation of new pictures
- Lack of institutions at level of superior education that give a preparation in the specialization of meteorology
- Lack of institutional budget for qualification

#### *Region IV – North America, Central America and the Caribbean*

- Budgetary constraints

#### *Region V – South-West Pacific*

- Lack of students pursuing meteorological career courses
- Due to limited funds in the training budget, a lot of the staff development and training programs do not eventuate
- Training for Meteorologists and Meteorological Technicians are not conducted due to lack of training personnel and facilities
- Loss of skilled and experienced staff, especially at professional level due to migration in search of greener pastures impacts on staff turnover
- Lack of domestic suppliers of meteorological personnel and of co-ordination and collaboration between the meteorology departments
- Lack of readily available information on course conducted by WMO RTCs

#### *Region VI – Europe*

- Lack of a national training facility
- Unavailability of suitable institution for training of Meteorologists.
- Very small staff - all deployed on operational duties
- The profession is not economical attractive therefore there are few students interested in this area
- Most of the constraints are connected with lack of financial means.
- The limited possibilities of using ICT

## II. HUMAN RESOURCES DEVELOPMENT (HRD) - ASSESSMENT AND PLANS

This section aims to find an estimation of the development that took place for human resources during the period 2003 to 2006, and to identify the projected staffing requirements for the year 2009. It also aims to recognize the factors that impact staff numbers and the development of human resources, as well as the amount of external support received and/or provided for training.

### II.1 What is the staffing of the Service from 2003 to 2006, and what is the projection for 2009.

The figures in Table II.1a show the number of staff per million people of each country, given by the responding Members. Detailed statistics are attached as Annex II-M.

Table II.1a – Regional distribution of Meteorological staffing in 2003 and 2006, and its projection for 2009

Year	Total Nr of Met staff			Women rate (%)			Nr of Meteorologists			Nr of Met Technicians		
	2003	2006	2009	2003	2006	2009	2003	2006	2009	2003	2006	2009
Average	38.43	35.98	42.37	27.40	29.40	29.24	9.86	9.40	11.22	28.57	26.48	31.01
RA I	14.93	14.95	18.95	12.42	14.64	20.07	2.36	2.49	3.56	12.57	12.46	15.39
RA II	60.70	61.56	76.99	27.25	29.85	26.17	13.79	14.14	17.55	46.91	47.42	59.43
RA III	25.05	18.56	17.11	34.77	41.71	31.50	1.80	1.90	2.64	23.25	16.66	13.99
RA IV	91.93	87.06	94.01	18.79	23.01	27.48	23.84	20.99	28.52	68.09	62.06	65.49
RA V	46.50	41.58	56.96	24.14	24.09	24.74	8.92	9.85	12.98	37.57	31.73	43.99
RA VI	35.50	30.37	31.17	43.59	43.31	42.40	14.02	11.90	12.17	21.48	18.47	19.00

Figure II.1a shows that the number of meteorological staff tended to decrease as a whole. Figure II.1b shows the ratio of Meteorological Technicians against Meteorologists varies region by region, where the value each bar indicates represents ratio of meteorological technicians to meteorologists.

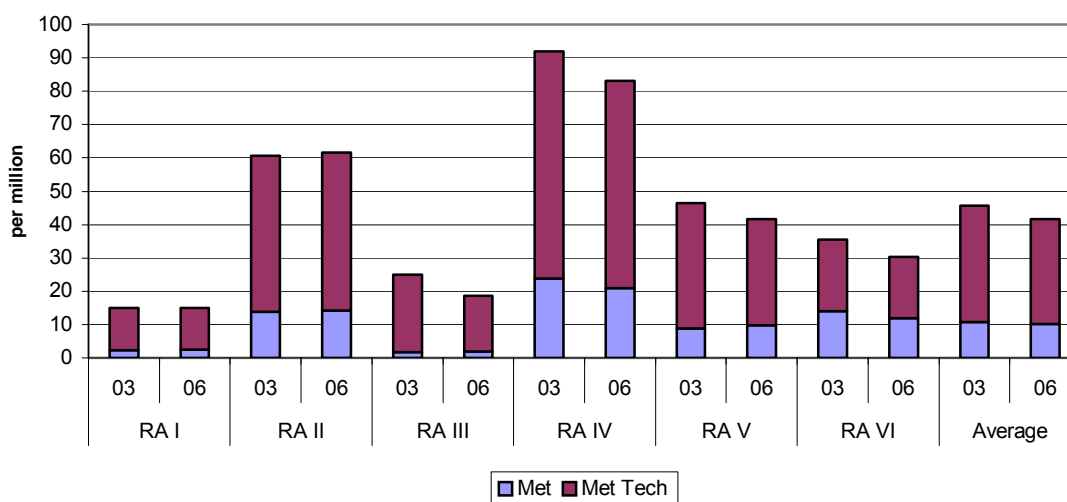


Figure II.1a – Proportions of Meteorologist and Met Technicians to total meteorological staff

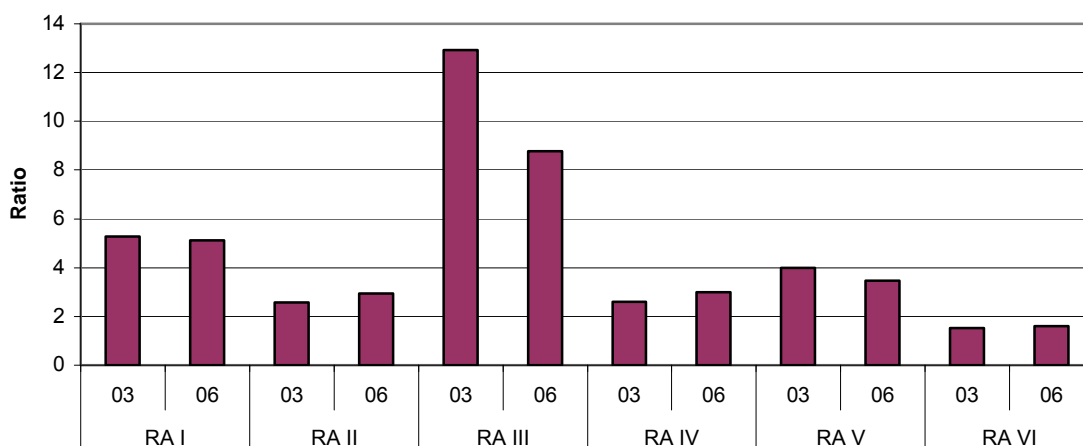


Figure II.1b - Ratio of Met Technicians to Meteorologists  
(Example: in RA I, the number of Met Technicians in average is 5 times more than that of Meteorologists in 2006)

Table II.1b shows status of meteorological staffing in 2003 and 2006, and the projection for 2009, considering the economic classification of responding countries based on the level of income, as for the previous approach.

Table II.1b – Status of Meteorological staffing in 2003 and 2006, and its projection for 2009, based on economic grouping

Year	(per million)											
	Total Nr of Met staff			Women rate (%)			Nr of Meteorologists			Nr of Met Technicians		
	2003	2006	2009	2003	2006	2009	2003	2006	2009	2003	2006	2009
Global Avg.	31.78	31.25	34.98	26.13	28.15	28.05	8.02	8.52	9.75	23.47	21.79	24.85
LIC	8.20	9.13	11.51	18.22	20.17	23.13	1.71	2.05	2.42	6.50	7.08	9.10
LMC	28.99	22.57	29.83	31.58	34.95	32.31	6.68	6.31	7.09	22.04	15.80	21.40
UMC	36.49	35.50	31.97	33.38	37.39	33.11	7.45	6.91	7.98	29.04	27.31	23.99
HIC	62.15	66.10	79.55	18.54	18.85	20.75	12.16	13.69	17.47	50.26	50.51	62.24
OECD	23.07	22.97	22.01	28.93	29.40	30.94	12.09	13.65	13.79	9.53	8.22	7.52

At each group, minimum and maximum values were excluded in the calculation of the average to avoid extreme deviation that could cause distorted results.

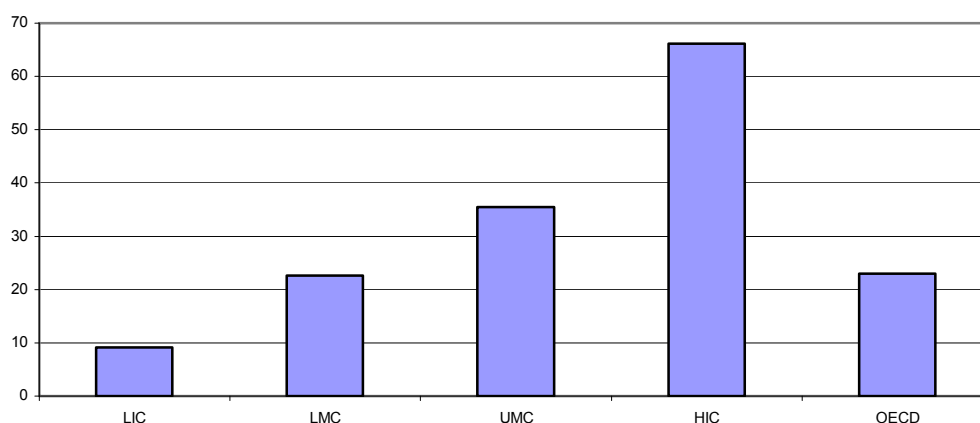


Figure II.1c – Average number of meteorological staff per million people in 2006

Figure II.1c shows that number of staff, except for OECD group, correlates well with countries' income. One reason of comparatively low staffing in OECD group could

be related to the utilization of new technologies and automation of the services particularly the observing system. The OECD group also shows the lowest proportion of meteorological technicians to meteorologists. Another explanation could be that in many OECD countries, private sector takes some portion of public weather services that has been traditionally undertaken by NMHSs.

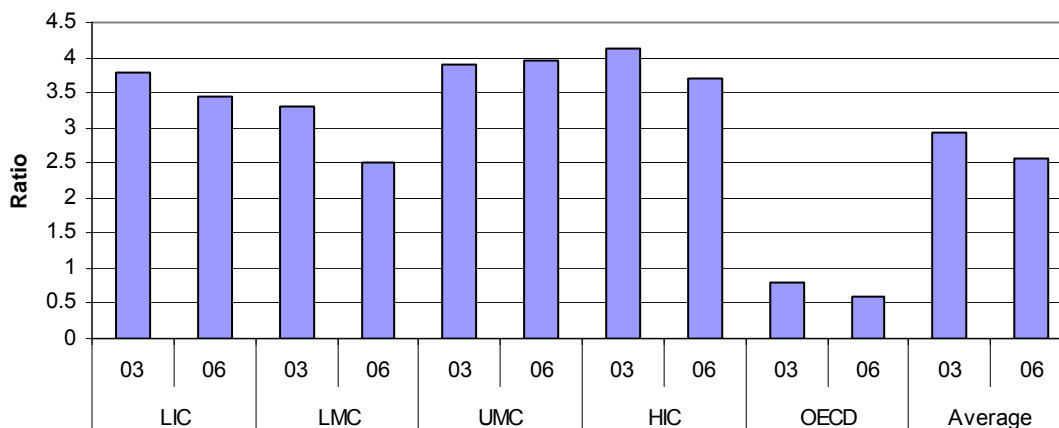


Figure II.1d – Ratio of Met Technicians to Meteorologists  
(Example: in LIC, the number of Met Technicians in average is 3.5 times more than that of Meteorologists in 2006)

Meanwhile from *Figure II.1d* the trend of meteorological staffing shows that the number of meteorological technicians tends to decrease as a whole.

## II.2 When making plans for human resources development during the period 2006-2009, what are the main issues that have to be considered by your Service?

- Expertise required for new tasks/services;
- Introduction of new equipment;
- Re-deployment of staff to other jobs;
- Increased recruitment;
- Lack of expertise in meteorology and/or management;
- Other factors.

Members were requested to specify in priority order the main issues that have been considered when planning for human resources development. Their responses were summarized in *Table II.2* below.

Table II.2 – Frequencies of priorities for issues

	Frequencies of priorities chosen					Weight	Percent
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>		
(a)	39	20	12	8	3	56.1	27.7
(b)	18	23	21	12	5	41.2	20.3
(c)	5	11	13	20	21	25.4	12.5
(d)	23	11	16	10	12	39.7	19.6
(e)	10	15	13	18	19	30.8	15.2
(f)	2	4	1	3	4	9.2	4.6

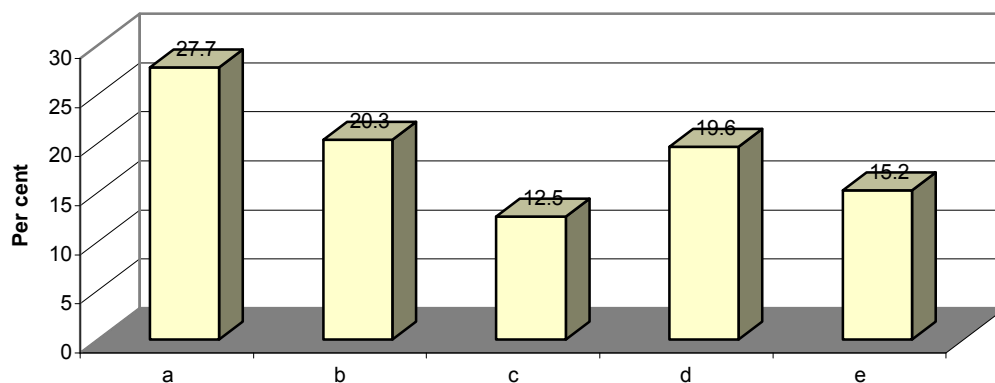


Figure II.2 – Importance of various issues in the plan of HRD

In Figure II.2 the weight of each factor was calculated according to the order of priority indicated by the respondents. For example if factor (a) came under priority 1, it takes one unit weight, if under priority 2, it takes 1/2 unit weight, if under priority 3, it takes 1/3 unit weight and so on. The sum of units for each factor gives the total weight, which was then divided by the total possible weight to be presented in a relative weight. This percentage value reflects the importance of each element in the human resource development process.

Generally, this data analysis of the importance of various issues for the development of human resources shows the same order of priority as in the previous Survey (2002). This confirms that the requirement of expertise for new tasks and services appears to still be the most important factor and has the highest priority in the process of HRD. The introduction of new equipment and the increased recruitment are of the second and third priorities, respectively. Lack of expertise in meteorology and/or management falls in the fourth priority order while lowest priority was for the re-deployment of staff to other jobs.

Several countries indicated some issues under 'Other Factors' to be considered when planning for HRD, among those were the following:

#### *Region I – Africa*

- Establishment of National Meteorological Service
- Lack of expertise and good opportunities for human resource development such as fellowship and other and access to ICT,
- Capacity Building in natural hazards including Tsunami. Further integration of Meteorological outputs in various socio-economic sectors.
- Increased recruitment is our first priority.
- Lack of trained manpower and instrument/equipment; over 85% have not accessed training opportunities to enhance adequate professional service delivery within the past 15 years,
- In view of broadened applications of meteorology HRD programmes, consider acquisition of skills in other related fields e.g. GIS/Remote sensing.

#### *Region II – Asia*

- Financial constraints, Training needs

### *Region III – South America*

- Lack of economic resources for qualification and creation of new jobs. Policies of State do not allow the creation of seats of work in the area of Meteorology

### *Region IV – North America, Central America and the Caribbean*

- Shortage of staff and succession planning including loss of corporate background due to demographics
- Funding for training specialists

### *Region V – South-West Pacific*

- The vision for the human resource development unit is to recruit the best candidates for the Meteorological technician. This will be achieved by recruiting people with higher qualifications like Diploma in Environmental Science, Diploma in Computing Science or possibly candidates with Bachelors Degree in Science or Computing. This can be made possible as a lot of graduates are seeking employment and the employment market has limited vacancies each year.
- Using new technologies to facilitate human resources development

### *Region VI – Europe*

- Training the staff for implementation and use of new methodologies and technologies
- Competition from other meteorological services and to private sectors

## **II.3 What external support for training has your Service received from agencies other than WMO from 2003 to 2006?**

Members were requested to provide information about donors by filling in the blank field for each type of the following donor.

	<i>Nr of fill-ins made by respondents</i>
(a) Countries:	54
(b) International organizations/institutions:	48
(c) Private sector companies:	11
(d) Other donors:	9

As shown above, countries and international organizations/institutions through bilateral relations are the main supporters for training other than WMO. The private sector cannot be considered as a major contributor / supporter, as only few case of training were supported by the private sector among the responding countries to this question.

Table II.3a is the list of donor Members providing support for training to the individual Region, which shows that the external support provided by donor countries tends to fall on mainly to Region I (Africa) and Region II (Asia). Among the donors, following are the countries that provided external support to more than 5 countries during the last four years, based on the responses to this question: USA (21), UK (12), China (11), France (11), Japan (11), Germany (9), the Republic of Korea (9), and Spain (8). The numbers in brackets denote the frequency of appearance in the responses.



Table II.3a – List of donor Members providing support for training to the individual Region.

Region	Donor Members
I	UK (9), China (5), France (3), Netherlands (3), USA (3), Germany (2), India (2), Italy (2), Japan (2), Niger (2), Spain (2), Portugal (2), Australia, Belgium, Canada, Denmark, Egypt, Finland, Israel, Kenya, Sweden, Turkey
II	Japan (6), Korea Rep (6), China (5), USA (5), India (3), Hong Kong, China (2), Russian Fed. (2), Thailand (2), Australia, France, Germany, Israel, Italy, Malaysia, Nepal, Norway, Philippines, Spain
III	Spain (3), USA (3), France (2), Argentina, Brazil, Germany, Korea Rep.
IV	Finland (3), USA (3), Spain (2), China, Israel, Mexico, Sweden, Venezuela
V	USA (4), Japan (3), Australia (2), Korea Rep (2), Malaysia, Netherlands, New Zealand
VI	France (5), Germany (5), UK (3), USA (3), Slovakia (2), Austria, Belgium, Croatia, Czech Rep., Finland, Iceland, Norway, Romania, Russian Fed, Slovenia, Turkey

Table II.3b is the list of International organizations/institutions that provided support for training to the individual Region during the survey period. The figures in brackets denote the frequency of appearance in the responses.

Table II.3b – List of International organizations/institutions having provided support for training to the individual Region during the survey period.

Region	Int'l organizations/institutions
I	EUMETSAT (8), ACMAD (3), AGRHYMET (3), FAO (2), ECMWF (2), EU (2), Banque Arabe de Developpement Economique en Afrique (BADEA), Ecole Africaine de la Météorologie et de l'Aviation Civile (EAMAC), Institute for BioMeteorology (IBIMET), ICSC, IPCC, Observatoire du Sahara et du Sahel (OSS), UNDP/GEF, UNFCCC, UNISDR, The United Nations Office for Outer Space Affairs (UNOOSA), UNESCO, World Bank, World Food Programme
II	Asian Disaster Preparedness Centre (ADPC) (2), Centre for Space Sci. & Tech. Education in Asia & the Pacific (CSSTEAP) (2), Typhoon Committee Trust Fund (2), UNESCO (2), APEC Climate Centre, Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA), ASEAN, Colombo Plan, Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), European Space Agency (ESA), ENSG, International Research Institute for Climate Prediction (IRI), JWA, Panel on Tropical Cyclones Trust Fund, UNESCAP, World Bank
III	IRD (2), IPCC, Universidad de Marburg
IV	IAI, IPCC
V	CSSTE-AP, Institute for Geo Info, SOPAC, SPREP, UNDP, UNEP, University of Ryukyus,
VI	EUMETSAT (13), ECMWF (7), EUMETNET (3), EU, FAO, ICTP, UNCCD, World Bank

Table II.3c shows the list of donor Members and the amount of their contributions relating to training and fellowships provided to WMO Voluntary Co-operation Programme during the years from 2002 to 2005.

Table II.3c – Members' contributions relating to Training and Fellowships under the WMO Voluntary Co-operation Programme over the years from 2002 to 2005

Donor Member	(US \$)	Donor Member	(US \$)
	2002-2005		2002-2005
Argentina	15,100	Japan	1,000,000
Australia	383,440	Kenya	8,924
Brazil	50,360	Philippines	6,545
Chile	35,796	Portugal	91,332
China	736,040	Republic of Korea	460,400
Finland	10,800	Russian Federation	638,530
France	2,931,292	South Africa	4,220
Germany	304,900	Spain	1,164,244
Hong Kong, China	164,000	Switzerland	49,000
India	1,300	United Kingdom	1,079,139
Iran, Islamic Rep. of	21,901	United Status of America	3,565,315
Israel	377,000		

\* Source: Final Reports of Informal Planning Meetings on the VCP and related Technical Co-operation Programmes published in 2003, 2004, 2005, and 2006, respectively

#### II.4 What external support for training has been provided by your Service to other countries from 2003 to 2006?

Following is the types of trainings that have been provided by NMHSs of the responding Members to candidates from other countries.

Reg	Country	Support/Remark
I	Egypt	Activities of Cairo-RTC: Organization of 9 courses for 123 foreigners from some of African and Arab League States during the years 2003-2006
I	Mali	- Organization des ateliers sous régionaux au niveau National. - Appui au Tchad et au Sénégal dans le cadre de la mise en œuvre de l'assistance météo
I	Mauritius	Logistic support to Comoros, Seychelles and Madagascar in Tropical Cyclone Impact Mitigation
I	Senegal	Hosting the events, provision of experts
I	South Africa	Tanzania / Lesotho / MSG training for Liberia, Uganda / Sierra Leone / Jordan
II	Bahrain	Practical training provided for 3 forecaster from United Arab Emirates
II	Bhutan	We have not been able to provide any support for training due to lack of required human resources in the Service. Financial constraint is the other reason.
II	Hong Kong, China	6 WMO VCP training courses were organized by the Hong Kong Observatory for WMO Members from 2003 to 2006
II	Iran, Islamic Rep. of	- Supporting Afghan Meteorological Authority for equipping observing stations in Afghanistan and providing a training course for observers and technicians.

Reg	Country	Support/Remark
		<ul style="list-style-type: none"> <li>- Organizing a refresher training course for Iraqi meteorological personnel's for updating observers and technicians knowledge about new methods in meteorology.</li> <li>- Organizing some specialized training courses for Iraqi personnel's in meteorology.</li> <li>- Organizing a training course for Tajikistani managers in meteorology.</li> </ul>
II	Japan	JMA provides 3 months training course on meteorology in cooperation with the Japan International Cooperation Agency (JICA) for 8-10 staff members of NMHSs of developing countries every year.
II	Republic of Korea	<p>KMA held the Training Course on Weather Forecasting for Operational Meteorologists for 17 (13 countries), 19 (14 countries) and 14 (12 countries) meteorologists in 2003, 2004 and 2005 respectively for four weeks. The objectives of the course were to provide participants with advanced skills and knowledge of weather forecasting by introducing modern techniques, both theoretical and practical, in the field of operational weather forecasting, and with an opportunity for the further development of meteorological cooperation among participating countries.</p> <p>In 2006, KMA provided the Training Course on Information and Communication Technologies for Meteorological Services (April, 2006) for 14 engineers and meteorologists from 12 WMO Member countries. The objectives were to increase the abilities to use WMO basic IT technologies and state-of-the-art IT technologies applied to WMO pilot projects; to understand various ICT for the provision of weather information, including NWP products; to understand and gain the techniques for agrometeorological information, including the use of the World Agrometeorological Information Service (WAMIS); and to gain the techniques for the establishment and management of Automatic Weather Station Network, including real-time data collection.</p>
II	Viet Nam	Staff training for the Department of Meteorology and Hydrology of Lao PDR in station network management, forecasting methodologies and telecommunication
IV	Antigua and Barbuda	Training assessment and attachment
IV	Canada	None except those already planned in bilateral agreements with other countries- specifically members of the China Meteorological Administration
IV	Costa Rica	Panama: Weather forecasting Colombia: CLIMA TEMP
V	Australia	Places have been made available on our Meteorologist course with no tuition costs for staff from NMHSs in Fiji, Singapore, Samoa, Papua New Guinea, Namibia, Tonga and Lesotho. We have assisted some of these students with a full bilateral fellowship funded by the Bureau, some others through WMO VCP fellowships programme of WMO. In the case of Singapore and Fiji, costs other than tuition fees have been covered by the respective governments. In addition to the places on courses we are providing access to ETR materials via our website and access to near real-time data for people using the JAM Sataid system for training in satellite meteorology. Several of our staff have been involved in ETR activities in this period (Satellite, WWRP and WMO ETR Seminars) as well as bilateral activities with Vietnam and countries in the SW Pacific.

Reg	Country	Support/Remark
		The Principal of the Training Centre is Vice Chair of the CoCOM Group and Co Chair of the WMO/CGMS Virtual Laboratory for Satellite Meteorology Education and Training.
V	Fiji	From 2003 to 2005, provision of training to ten Pacific Island countries each year.
V	Philippines	Provided tuition fee and stipend to 3 VCP scholars (Vanuatu, Sri Lanka and Myanmar) in 2003-2006, OJT in Hydrology for a Bhutan national and one from Mongolia is currently attending the Aeronautical Meteorology Forecasting Training Course.
VI	Czech rep	- CLIDATA - climatological database for developing countries - Maintenance of the network for monitoring of the ozone layer in developing countries
VI	Denmark	Instructors for courses arranged jointly by Iceland, Norway, Finland, Sweden and Denmark
VI	Germany	- International Seminar about NWP and Satellite Meteorology - Two WMO training seminars (hosting and contributions)
VI	Israel	Activities of WMO RTC-Bet Dagan during the survey period - Provision of training to 178 foreign students - Provision of support to other RTCs
VI	Portugal	Provided experts to support training activities organized by international organization, namely EUMETSAT, to the Portuguese speaking countries.
VI	Romania	Courses and accommodation for participants from ICCED

### III. ASSESSMENT OF WMO TRAINING ACTIVITIES

The aim of this section is to assess the use and effectiveness of WMO training activities, including WMO support for training publications, audio-visual aids, participation in training events; fellowships and/or other financial support.

#### III.1 What use is made by your Service of WMO Training Materials?

Following are the statistics based on answers given by responding Members where the figures represent frequency of choices:

	<i>N/A</i>	<i>low</i>	<i>med.</i>	<i>high</i>
(a) Extent of use of the WMO Training Publications:	<b>4</b>	<b>20</b>	<b>32</b>	<b>28</b>
(b) Extent of the use of the WMO Virtual Training Library:	<b>21</b>	<b>43</b>	<b>14</b>	<b>3</b>
(c) Extent of use of the WMO Training Library Services:	<b>23</b>	<b>34</b>	<b>14</b>	<b>8</b>

The items from (a) to (c) are to assess the extent of use of WMO training materials by Members. The result shows as follows:

- Use of the WMO Training Publications: over 70% of respondents from developing countries rated the usefulness of WMO publications as medium or high in their training activities. However, in OECD countries the extent of use of *WMO Training Publications* is not so high, which means that they do apparently not rely on them, but may have their own materials for the activities.
- Use of the WMO Virtual Training Library: 51% of respondents rated this item as low and 25 % as not applicable (N/A) in the usefulness of WMO Virtual Training Library (VTL). Only 21% of respondents used VTL at the medium or high level.
- Use of the WMO Training Library Services: 40% of respondents rated the usefulness of the Services as low and 27 % as "Not applicable". Only 27% of respondents used the Services at the medium or high level. The low use of the WMO TBL may reflect the fact that during the last ten years, most Members have already obtained copies of available training materials subject to their needs. The low income countries rarely use the *WMO Virtual Training Library* or the *WMO Training Library Services* for their training activities.

The items (d) and (e) are to assess what types of tools are most often employed in the training activities by NMHSs, and the trends as a whole. The result shows as follows:

	<i>slide</i>	<i>video</i>	<i>CAL</i>	<i>other</i>
(d) Types of training materials used at present:	<b>34</b>	<b>36</b>	<b>38</b>	<b>21</b>
(e) Types of training materials likely to be needed for future training activities:	<b>19</b>	<b>33</b>	<b>65</b>	<b>25</b>

It is foreseen from the trend in the use of types of tools in the training activities by NMHSs that CAL method would be the most highly used tools in the future as shown in the following figure III.1. The portion of CAL among the training tools is increasing in contrast with others.

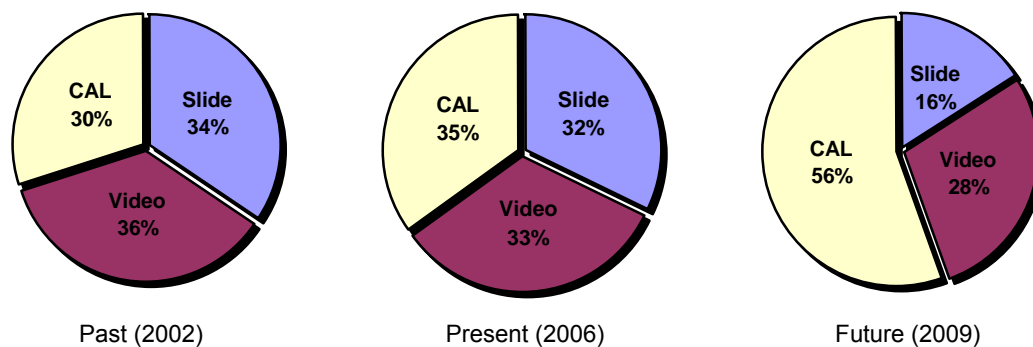


Figure III.1 – Trend in the utilization of training tools

Following are the comments given by respondents on the range and quality of these services.

#### Region I – Africa

- WMO should send us updated training materials and inform us how we can make use of the virtual training library and training library service.
- They are good but in different mechanisms WMO should create awareness about the resources to the users.
- Materials found to be useful as they provide latest information in the field.
- CAL and Multimedia are of very good quality.
- Good.
- Satisfactory, but the access to these benefits is not often easy because of the technical level.
- Extensive and useful.
- We expect to start the CAL module in the future.
- Training materials in various meteorology applications e.g. Energy and Water Resources.

#### Region II – Asia

- Good.
- These services provide useful training resources in meteorology in different formats and through different channels.
- KMA have been translating the modules into Korean serviced by MetEd (<http://meted.ucar.edu>) to provide them not only to KMA staff members but also to students in universities. We wish the Distance Learning Courses in the WMO Virtual Training Library were translated.
- These services improve knowledge and capability of staffs of NMHSs.

#### Region III – South America

- Most of texts, scientific publications and documents are published in English language, which limits the self-study by the personnel. The distance training material available in the WMO WEB is limited in very few subjects.

#### Region IV – North America, Central America and the Caribbean

- More text books of General Meteorology are required.
- Training material is very limited and consists mostly of COMET modules.

- Little or no in-house training is done. Where possible PowerPoint presentations are utilized to inform staff of materials received by other staff members who received further training.

#### *Region V – South-West Pacific*

- We use material that is in the Training Library but we have generally sourced it directly from the group that has developed the resources. This occurs due to our involvement in groups such as CoCOM and CALMET.
- "CalMet" includes many modules relevant to New Zealand. Sometimes they are specific to an area (usually in Northern Hemisphere) and are less relevant.
- WMO granted computer units for library use and continuously provides books and publications.
- Do not know - rarely used.

#### *Region VI – Europe*

- Training materials (Video, CAL) in Russian (mainly) and English will be very useful.
- High.
- Generally hard copies of WMO training publications are used.
- The recently updated training publications are excellent.
- Too little focus on polar and arctic meteorology.

### **III.2 What use has been made by your Service of training events under WMO Major Programmes from 2003 to 2006?**

Following is the result based on the responses to this question. Each figure in bold represents frequency of choices against the given criteria:

	<i>n/a</i>	<i>1-3</i>	<i>4-9</i>	<i>&gt;9</i>
(a) Number of events attended by the staff in your Service:	<b>13</b>	<b>19</b>	<b>21</b>	<b>32</b>
(b) Number of participants co-sponsored by WMO:	<b>15</b>	<b>16</b>	<b>24</b>	<b>26</b>
(c) Number of participants financed by other sources:	<b>27</b>	<b>22</b>	<b>13</b>	<b>13</b>
	<i>n/a</i>	<i>low</i>	<i>med.</i>	<i>high</i>
(d) Adequacy of the attended training events:	<b>10</b>	<b>5</b>	<b>27</b>	<b>39</b>

The analysis of the above result considering regional distribution is shown on the following graphs. The Z-axis on each graph represents the proportion in percent to the given criterion. The graphs analytically reveal the following hints:

- For the item (a), the result shows that more than 60% of countries except RA V and RA VI Members participated in four or more training events during the last four years, in particular the most dominant number of the events participated by RA III Members was more than nine.
- For item (b), more than 70 % of RA I, RA III and RA IV Members tended to usually send four or more participants to the WMO co-sponsored training events during last four years.
- For item (c), the number of participants financed by other sources varied region by region, not showing a representing trend.

- For item (d), most countries evaluated the adequacy of the attended training events as medium or higher.

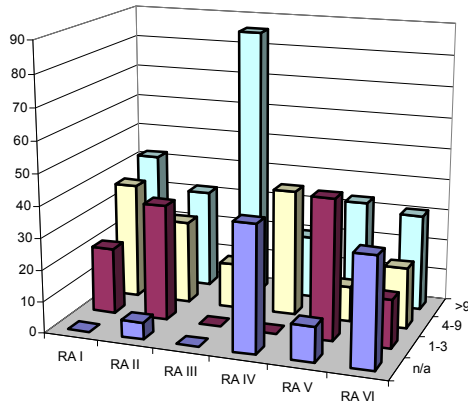


Fig. III.3a – Number of training events attended

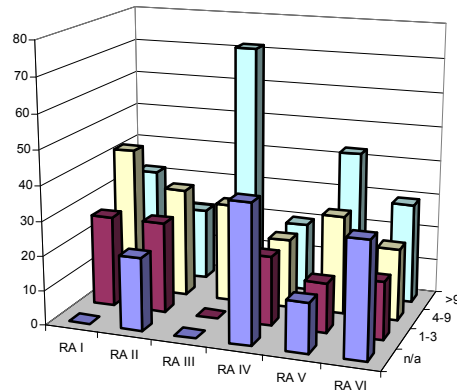


Fig. III.3b – Number of participants co-sponsored by WMO

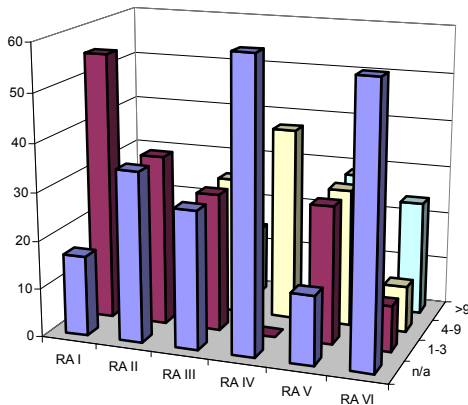


Fig. III.3c – Nr of participants financed by other sources

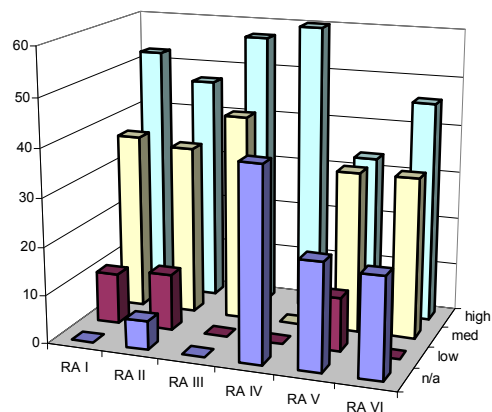


Fig. III.3d – Adequacy of the attended training events

Following are the comments made by respondents upon the quality and range of these training events.

#### Region I – Africa

- The range of the training events was 2-3 weeks and they can't be said that they are adequate enough to change the knowledge of our staff.
- Regarding quality it is good but the range is very low, so it needs further improvement.
- Provide current information in the field.
- One staff member attended the RTC-Cairo, Egypt for 6 months in Climatology while the current Director of the Liberia's Meteorological Service is undergoing master degree study at the Kenya Meteorological Training Centre in Nairobi, Kenya.
- Good.
- WMO training workshops on tropical cyclones, SIAC, CLIVAR, WWW and climate outlook for a have been very useful.
- Satisfactory, but the number of participant remains insufficient.
- The quality and range are generally fine but there is a little use and follow-up of trained personnel.
- Some are very useful.
- Most of the training events are of short term except one or two of the 6 months, but the quality of them is excellent.



- Most of the training events were necessary as they mainly in fields such as short range forecasting, aviation meteorology and climate change related training.

#### *Region II – Asia*

- Very good especially some field, Sat. application, CLIPS, CLIMAT.
- Good.
- Technically advanced for system.
- These training events covered a wide range of topics in meteorology. They achieved the training objectives and provided participants with good opportunities to share their experiences.
- Appropriate.
- Quality and range of most training events were satisfactory and suitable.
- These training events develop skills and explore potential of forecasters.

#### *Region IV – North America, Central America and the Caribbean*

- Training ranges from Class IV Observers to Meteorologist.
- We think that the duration of WMO fellowship must be extended longer, in particular for meteorologists from developing countries considering their financial difficulties.
- Training events other than Hurricane Forecasting are relatively infrequent in our region.

#### *Region V – South-West Pacific*

- We have not had any Bureau staff as participants in WMO training events held outside Australia. We have included and self funded some in events such as Public Weather Services and Tropical Cyclone workshops held in BMTC. We have also provided staff as lecturers for WMO training events.
- Training and development is an important part of the Fiji Meteorological Service and the courses/seminars offered by WMO were of high quality. This has enhanced the potential and the performance of the participants who attended the courses. The training events also helped in the development of the staff of Nadi RSMC in updating skills of participants with new technology and forecasting techniques.
- The training event involved workshops and seminars in different fields of meteorology i.e. monsoon and tropical cyclones agricultural meteorology, meteorological instruments, etc.
- Mostly participants involved in workshops assist only managers with Met. Background.
- For short-term and long-term training events, very little involvement.

#### *Region VI – Europe*

- The training events were excellent.

### **III.3 What use has your Service made of the WMO Regional Training Centres (RTCs) from 2003 to 2006?**

Following are the result based on the responses to this question. Each figure in bold represents frequency of choices against the given criteria:

	<i>n/a</i>	<i>1-3</i>	<i>4-9</i>	<i>&gt;9</i>
(a) Number of staff in your Service trained at WMO RTCs during the last 4 years:	<b>27</b>	<b>23</b>	<b>18</b>	<b>13</b>
▪ RA I	2	7	6	3
▪ RA II	7	7	2	3
▪ RA III	2	1	2	1
▪ RA IV	1	1	3	0
▪ RA V	3	0	1	2

▪ RA VI	12	7	4	4
	<i>n/a</i>	<i>1-3</i>	<i>4-9</i>	<i>&gt;9</i>
(b) Number of participants co-sponsored by WMO:	<b>34</b>	<b>23</b>	<b>18</b>	<b>4</b>
▪ RA I	5	6	7	0
▪ RA II	9	5	2	2
▪ RA III	3	1	2	0
▪ RA IV	2	3	0	0
▪ RA V	3	0	3	0
▪ RA VI	12	8	4	2
	<i>n/a</i>	<i>low</i>	<i>med.</i>	<i>high</i>
(c) Value of the RTCs' training to the development of your Service:	<b>18</b>	<b>6</b>	<b>12</b>	<b>43</b>
▪ RA I	0	3	2	13
▪ RA II	3	2	3	10
▪ RA III	2	0	0	4
▪ RA IV	1	0	1	3
▪ RA V	2	1	0	3
▪ RA VI	10	0	6	10

From the above information, it could be interpreted that during the survey period (2003-2006), most participants trained in WMO RTCs were co-sponsored by WMO and its value was rated high.

Following are the comments given by some of respondents upon the quality and range of training provided by RTCs.

#### *Region I – Africa*

- Met and climatology activities improved.
- Egyptian Met. Authority host RTC-Cairo.
- Our service had never received any training possibility in the RTCs after 1998.
- It needs improvement. The major problem here is unavailability of fund to train in RTCs
- RMTc provides specialized and focused training.
- Very good.
- The WMO Class II training provided by RTCs is of good quality and useful.
- The training meets the needs of the Services but it is more necessary to organize better training modules for the professionals.
- Quality - satisfactory. Range – insufficient.
- RTC provides a wide range of training. However, the quality of training is often low due to the fact that teaching staff have other commitments and that laboratory and equipment for practical and experiments are often lacking.
- The quality of the training is excellent but most of the training period is very short.
- The training at RTC-Nairobi is mainly for Class II (weather forecasting) and is very qualitative (meteorological technician).

#### *Region II – Asia*

- Good.
- We have not heard of RTCs conducting any training till date.
- Hong Kong Observatory staff attended training in meteorology at the RMTc in Nanjing and Beijing, China. The courses were well organized and taught by experienced lecturers.
- Good quality.
- Unable to comment upon the quality and range of training, as we have never sent staff to be trained at any WMO RMTc by our own budget. . We believe that the RTCs

Training would be valuable to the development of our Service if we could take advantage of it.

- Preferred to satisfy the national need and specification of each national centre.
- The training course of RTCs helped meteorologists of Viet Nam in the field of climate prediction. Participating these training, meteorologists can get experiences and progressive technology of developed countries in the world.

#### *Region III – South America*

- The only qualification has been made in the INM of Spain with very good results. The training delivered by the RTC is very good but the participation of Ecuador has been practically null.

#### *Region IV – North America, Central America and the Caribbean*

- Quality and range adequate.
- In our case in the last four years we have attended two events organized by RMTC-Costa Rica, on Environmental satellites and Fast swellings (flash flood).
- Training in core courses does not reflect the current operational demands and realities of a modern Met Service. Increased emphasis should be placed on the operational aspect of Meteorology.
- The quality and range of training provided is high and mandatory. The range of training is limited basically to Washing Desk and the National Hurricane Centre in Miami.

#### *Region V – South-West Pacific*

- Philippines RTC training events included training for meteorologists and technicians and seminar/workshops in the field of meteorology, agricultural meteorology, high resolution modelling and others.
- Samoa has never utilized of the service of RMTC in the past.

#### *Region VI – Europe*

- High.
- Adequate.
- Organized training programmes and lecturers significantly contributed to improvement of knowledge and skills of participants.

### **III.4 Are there any ways in which the present interaction/collaboration between RMTCs and national Services could be improved or expanded?**

Following are the remarks grouped by region provided by some of respondents on the ways in which the present interaction/collaboration between RTCs and the national services could be improved or expanded.

#### *Region I – Africa*

- In light of the very limited HR capacity in our service training some personnel at a time could not solve the problem, if possible a program can be arranged so that IMTR Nairobi bring their experts and curricula and train the needed number of personnel for one year. Such method can produce several personnel of different classes.
- RTCs should assess the needs of users from time to time and set up various cooperation programs to train personnel under its promise.
- Tailor made courses.
- Arrange for visiting lecturers from NMHS to WMO RTCs.
- Visits exchange.

- Usage of video lecture.
- Implication of the national experts in the distance learning.
- Given the inadequate service delivery and economic transition nature of the Meteorological service in Liberia, we would appreciate fellowship awards at 100% level to personnel of our Service so as to rapidly increase productivity and our image.
- By organizing courses in application of meteorological information to socio-economic sectors and which are sector-specific.
- The possibility of short courses being provided in countries to benefit more staff.
- Establishment of a dynamic partnership with NMHSs.
- The availability of sponsorships is always a problem.
- Active interaction and collaboration required.
- Regular publication/updating and distribution of prospectus.
- Inclusion of significant IT component in courses.

### *Region II – Asia*

- WMO-RTCs should assist the WMO members on open requests.
- WMO-RTCs may wish to develop training material on topics of special relevance to the region for use by the respective NMCs.
- Direct contact between WMO-RTCs and members in the Region.
- No information from WMO-RTCs.
- Increasing of short term specialized courses.
- In case of Thailand, we require experts or lecturers from the WMO-RTCs or any source to provide knowledge in some specific training courses required at Thai Met. Dept. Local expenses from national budget are possible to support for the experts. We would like the WMO to assist in coordination with the WMO-RTCs on possibility in supporting of experts and consider supporting for partial expenses.
- Financial assistance.
- Organize more training seminars and working visit to develop skills and explore potential of staff.

### *Region III – South America*

- Greater diffusion of the training program offered by WMO-RTC is necessary.
- Greater information on the different courses or workshops to distribute itself on behalf of WMO-RTC.
- A greater delivery of the training that provides offers and that takes control it of the due time able to fulfil the different requirements that it demands and, that stops the developing countries has but financing opportunities since this is one of the great constraints to be able to participate.

### *Region IV – North America, Central America and the Caribbean*

- Period of attachments for specialized work and research.
- It is important to find specific financing for courses such as Taller de Capacitacion para Instrucores Nacionales de la Regionales III y IV, Buenos Aires, Argentina, May 14-28 2004.
- Member NMHS' should be given a greater role in curriculum development at WMO-RTCs.
- The present interaction would be improved by providing training in micro-modelling and could be expanded by focusing on small islands developing states.

### *Region V – South-West Pacific*

- We have tried to build bridges with WMO-RTC in the Philippines and have had staff from there on secondment in our training centre. We are happy to look at collaborative opportunities with them. We have had more interaction with WMO-RTC in Costa Rica, Barbados, Niamey, Nairobi and Nanjing through WMO.

- WMO-RTCs should promote some awareness programmes to inform other Meteorological Training Centres of the facilities and the training materials/aids available for utilization.
- WMO-RTCs should tailor make courses to meet specific training needs of NMSs,
- Distance education and learning among WMO-RTCs, and other training institutions should vigorously be promoted.
- More information is required from WMO or WMO-RTCs.
- Improve info dissemination of courses offered by WMO-RTCs to NMSs.

*Region VI – Europe*

- Organization of local courses (outdoor) with support of WMO, also organization of distance learning.
- The e-learning modules or programmes, virtual learning courses in WMO-RTCs for continuous professional development, certification of the learners.
- Extended application of modern technologies such as CAL, distance learning, tele-conferencing, etc.
- Regular information about organization of training events, financial supporting.
- By re-initiating the activities of the WMO-RTC for the Portuguese speaking African countries.
- We propose a Sub Regional Training Centre on nowcasting and radar meteorology
- Through activity on the part of the NMHSs.
- WMO-RTCs and NMSs can organize joint training events and we believe it improve the collaboration between them.

**III.5 What use has your Service made of the WMO Fellowships Programme from 2003 to 2006?**

- (a) The number of fellowships awarded to staff in your Service and the host countries and their institutions/organizations where the awarded fellowships were implemented.

Annex III shows WMO Fellowship requests from Members (2003-2006), which is based on the responses to this Survey.

Considering low level of responses to this question, the statistics derived from a Fellowship database which is maintained in WMO Secretariat to process WMO Fellowship requests from Members could be regarded more reliable, whose covering period is from 2004 to 2006. The following graph Fig III.5 is based on this statistics.

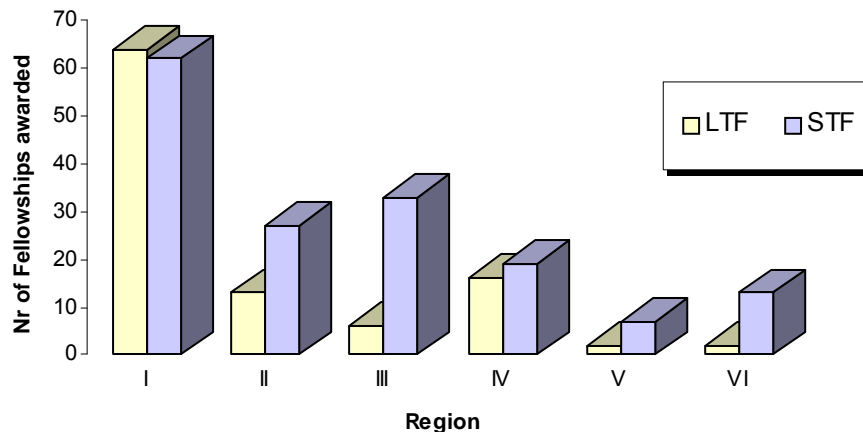


Fig. III.5 – Number of Fellowships awarded during 2004-2006

The statistics from which the above graph was derived shows that Region I was awarded 38% of all short-term fellowships (STF) and 63% of all long-term fellowships (LTF). In the other Regions, particularly in RA III and RA VI, most awarded were of short-term.

With regard to (b), (c) and (d), replies are as follows.

	<i>n/a</i>	<i>low</i>	<i>med.</i>	<i>high</i>
(b) Improvement in knowledge and skills of fellows	17	0	18	16
(c) Relevance of training to current work of your fellows	16	0	12	22
(d) Impact of fellows on promoting new applications, operations or services	15	2	22	12

Assuming that those countries that chose “n/a” from the criteria given are those who were not awarded WMO fellowship during the survey period, of those countries having fellowship awards, 53% of replies indicated that the improvement in knowledge and skills of fellows is medium, 47% rated as high. Also, 35% rated the relevance as medium, 65% as high, and 61% rated the impact of fellows on promoting new applications, operations or services as medium and 33% as high. Only two replies from RA I rated the impact of former fellows on promoting new applications, operation or services as low.

Some countries provided other comments regarding this issue as follows.

- Fellows have proved to be good weather forecasters especially in aviation weather services.
- We hope and ask WMO to give us many chances for long-term fellowship especially to get to the level of former Class II and MSc degree.
- WMO has committed two fellowships (long-term) but not executed yet. This Service would request for more fellowships in coming years.
- Re-evaluation and revision of the current training materials and manuals.
- WMO-RTCs should actively exchange experts supported by NMHSs and WMO in conducting specialized courses.
- Samoa has benefited very little from this Programme.
- Increasing of funds and number of fellows.

### **III.6 Are there any ways in which the present WMO training activities, services and materials could be improved or expanded?**

Some countries provided comments on how the present WMO activities, services and materials could be improved or expanded. Following is a list of comments that are common and grouped by region.

#### *Region I – Africa*

- WMO training activities should be efficiently communicated and like those commissions for hydrology, agrometeorology etc. There should be a person who can be communicated, if such arrangements are already in place.
- Strengthening of National Meteorological Training Centre should be given more emphasis.

- Financial support should be enhanced for long and short term training and provide trainings for National Meteorological Training team personnel to handle the train.
- Provide both electronic and hard copies to cater for all situations of IT loads.
- In-country training for meteorological technicians for more personnel while for specialized and advanced training should be conducted outside of the country of interest.
- Take into consideration the expressed needs of the countries and increase the trainings for the applications.
- Act on the responses and improve the procedures.
- Training of trainers in sector-specific subjects, such as climate-health, climate agriculture etc.
- Training has only been concentrated on the science of meteorology and hydrology. The training activities of WMO should take into account evolving needs such as disaster prevention and mitigation, management and resource mobilization.
- MSG training is required but there are already plans on the table from EUMETSAT
- Consideration should be given for more WMO fellowships especially for weather forecasting course.

### *Region II – Asia*

- Organize more frequent training seminars/courses that are of regional/global interest.
- Organizing some workshops and conferences relevant to these matters, and show these activities especially to those countries that do not have access to the internet.
- Organize a training to improve its capacity to meet the requirements for introduction of current meteorologists to the CAL in training.
- Organize joint planning, implementation and evaluation of training activities with NMHSs
- E-learning (coursework and content), management of training system and to support expert in Meteorology and others that are concerned.
- Disseminate more meteorological information and news in community especially in schools and colleges.

### *Region III – South America*

- Greater contributions of the developed countries to the generation of economic resources that allow the training of scholarship holders as well as the technical publication edition in all the official languages of the WMO.
- Give the weight more to training for meteorologists/forecaster.

### *Region IV – North America, Central America and the Caribbean*

- Further training targeted research and IT development.
- Pensamos que es necesario facilitar el acceso a la bibliografía meteorológica ,por lo menos la basica ,a un ejemplar y los SMNH ,harian la divulgacion de los textos.
- More frequent training workshops in relevant subject areas in the Region.

### *Region V – South-West Pacific*

- Promote more co-ordination and collaboration between the national meteorological services to cover needs for a sufficient number of recruits of the correct skills.

### *Region VI – Europe*

- Training in using NWP, Interpretation of climatic models, training in using Ensemble predication system, modern statistical methods.

#### IV. FUTURE EDUCATION AND TRAINING REQUIREMENTS, OPPORTUNITIES AND CAPABILITIES IN METEOROLOGY

The aim of this section is to assess the national priorities for training and development, identify the national capability for providing external assistance for education and training activities, and suggest possible new requirements for specific WMO activities, services or materials that would be of value to NMHSs.

##### IV.1 What short-term professional development training in meteorology has the highest priority for your Service?

The following table shows the frequency of priority fields brought up by responding Members for future short-term professional development training in meteorology.

Table IV.1a - Priority fields sorted by total frequency

Fields of Specialization	Frequency						
	Total	Region					
		I	II	III	IV	V	VI
Numerical Weather Prediction (NWP)	32	9	6	4	2	5	6
Satellite meteorology	19	5	5	2	1	3	3
Weather forecasting	19	5	4	2	1	2	5
Agrometeorology	14	8		2	2		2
Climatology	14	5	3		1	1	4
Aeronautical Meteorology	13	5	1	2			5
Marine Meteorology	11	7	2				2
Instrumentation	10	6	2			1	1
Climate monitoring and prediction	9	1	2	2		1	3
Data processing	8	4	1	2			1
Database management	8	3	2		2		1
General Meteorology	8	3	3			1	1
Radar meteorology	8		2	1	1	1	3
Synoptic Meteorology	8	3	4				1
Urban meteorology and air pollution	8		1	1			6
Tropical Meteorology	7	2		1	1	3	
Hydrometeorology	6	5	1				
Remote sensing	6	4				1	1
Climate Change	5	2		1	1		1
Mesoscale Meteorology	5			2			3
Automatic Weather Station	4			1	1		2
Economic meteorology; marketing and management	4	1	1				2
Natural Disasters Prevention and Reduction	4	1		1			2
Dynamic meteorology	3		1				2
Methods of measurements and observations	3				2		1
Numerical Modelling and Data Assimilation	3			1	1		1
Physical meteorology	3	1					2
Seasonal forecasting	3	2	1				
Applied meteorology	2	1		1			
Biometeorology	2						2
Commercialization of meteorological products	2	2					
Information and Communication Technology	2	1	1				
Seismology	2		1			1	



Fields of Specialization	Frequency						
	Total	Region					
		I	II	III	IV	V	VI
Telecommunication system	2		1				1
Air pollution	1			1			
Air traffic Management	1						1
AMDAR	1						1
Application of Meteorological Products	1		1				
Digital Forecasting	1		1				
Geo-informatics	1	1					
Meteo media	1	1					
Meteorological Communication System	1		1				
Nowcasting	1		1				
Numerical methods for mathematical monitoring	1						1
Quality Management System	1	1					
Treatment of NDVI	1	1					

Table IV.1a reveals that Numerical Weather Prediction (NWP) is regarded as the top priority subject among the nations over the world for the short-term development training requirement in meteorology, and followed by the subjects satellite meteorology and weather forecasting. For countries in Region VI (Europe), urban meteorology and air pollution is one of the important subjects, which is believed that it is related to urbanization and industrialization.

Table IV.1b shows that NWP is regarded as the top priority subject followed by weather forecasting and satellite meteorology.

Table IV.1b - Priority fields sorted by number of potential candidates

Fields of Specialization	Total	Region					
		I	II	III	IV	V	VI
Numerical Weather Prediction	242	47	29	25	105	21	15
Weather forecasting	139	48	29	14	10	4	34
Satellite meteorology	107	16	39	14	10	13	15
Numerical Modelling and Data Assimilation	103			2	100		1
Aeronautical Meteorology	83	46	3	6			28
Agrometeorology	62	51		4	3		4
Marine Meteorology	62	27	18				17
General Meteorology	54	10	42			2	0
Climatology	53	22	17		3	2	9
Instrumentation	53	22	24			4	3
Synoptic Meteorology	51	11	37				3
Data processing	36	18	10	6			2
Radar meteorology	36		13	2	4	4	13
Remote sensing	32	22				8	2
Telecommunication system	32		30				2
Tropical Meteorology	30	2		2	10	16	
Natural Disasters Prevention and Reduction	27	1		3			23
Climate monitoring and prediction	26	5	5	6		5	5
Database management	26	7	8		8		3
Climate Change	24	8		10	3		3
Hydrometeorology	22	18	4				
Air traffic Management	20						20
Application of Meteorological Products	20		20				

Fields of Specialization	Total	Region					
		I	II	III	IV	V	VI
Methods of measurements and observations	19				16		3
Information and Communication Technology	16	6	10				
Urban meteorology and air pollution	16		3	1			12
Economic meteorology; marketing and management	15	2	10				3
Applied meteorology	12	10		2			
Automatic Weather Station	12			2	3		7
Mesoscale Meteorology	12			6			6
Quality Management System	10	10					
Physical meteorology	7	2					5
Seasonal forecasting	6	4	2				
Dynamic meteorology	5						5
Air pollution	4			4			
Biometeorology	4						4
Commercialization of meteorological products	4	4					
Seismology	3		3				
Geo-informatics	2	2					
Meteo media	2	2					
Meteorological Communication System	2		2				
Nowcasting	2		2				
Numerical methods for mathematical monitoring	2						2
Treatment of NDVI	2	2					
AMDAR	1						1

The subjects listed in the table above can be grouped by representative fields, which results in the following chart showing a priority of each field.

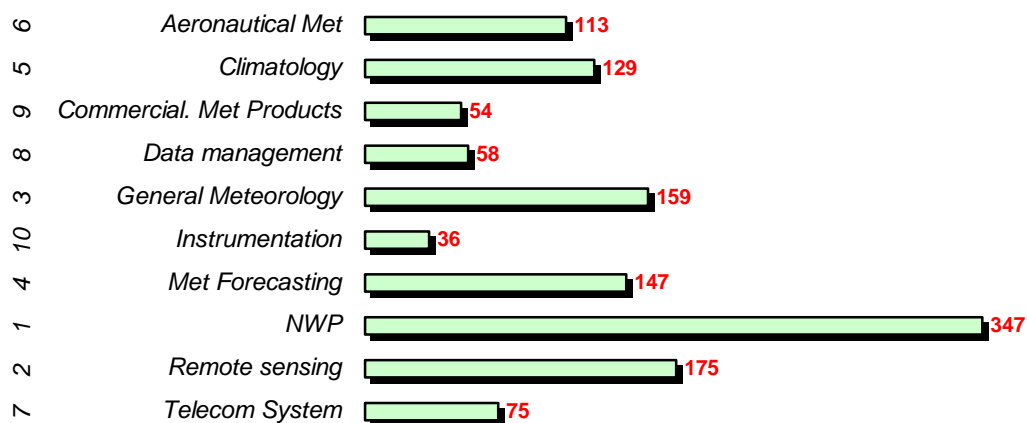


Figure IV.1 – Top 10 priority field and the number of potential candidates subject by subject

The frequency of the teaching language requested in the training is shown as follows. It varies region by region depending on the languages spoken in home or host countries.

	Global	I	II	III	IV	V	VI
English	152	42	39	3	8	20	40
French	18	18					
Spanish	19			18	1		
Russian	8		2				6
Chinese	4		4				
Arabic & English	8	6	2				

English & French	22	19		2	1
English & Spanish	13		6	5	2
English & Russian	20		2		18
English & Portuguese	5	5			

#### IV.2 What are the expected future requirements for fellowship for your Service?

The following are self-explanatory tables for fellowship requirements in each Region and fields of specialization were taken as first and second priority. The figures in the brackets represent the frequency of choices for the fields. The subject without figure is the one that has been chosen once.

A: Number of Meteorologists    B: Number of Met Technicians    C: Number of Candidates

Region	Fellowship		Foundation Training		Advanced-specialized Training	
	Type	Period	A	B	Fields of Specialization and their frequencies	C
RA I	STF (≤ 6 months)	2007	68	105	Satellite meteorology (5), Numerical Weather Prediction (4), Aeronautical meteorology (3), Weather forecasting (3), Climate change (2), Marine meteorology (2), Agrometeorology, Climatology, General meteorology, Instrumentation, Oceanography, Remote sensing, Statistics, Tropical meteorology, Weather modification	85
		2008-2009	97	128	Marine meteorology (4), Aeronautical meteorology (3), Agrometeorology (2), Data processing (2), Instrumentation (2), Satellite meteorology (2), Seasonal Forecasting (2), Weather forecasting (2), Air pollution, Applied meteorology, Automatic Weather Station, Hydrology, Radar Meteorology, Remote sensing	102
	LTF (> 6 months)	2007	75	143	Numerical Weather Prediction (7), Agrometeorology (2) Climatology (2), Environmental meteorology (2), Weather forecasting (2), Advanced meteorology, Aeronautical meteorology, Data processing, Instrumentation, Seasonal Forecasting	86
		2008-2009	104	150	Agrometeorology (3), Numerical Weather Prediction (2), Computer, Database management, Data processing, Hydrology, Hydrometeorology, Marine meteorology, Socio-economic benefits, Tropical meteorology, World Weather Watch,	80
RA II	STF (≤ 6 months)	2007	70	52	Weather forecasting (3), Climatology (2), Marine meteorology (2), Aeronautical Meteorology, Air pollution, Atmospheric dynamics, Climate data processing, Management and administration, Numerical Weather Prediction, Radar Meteorology, Satellite meteorology	64
		2008-2009	88	73	Satellite meteorology (3), Marine meteorology (2), Radar Meteorology (2), Weather forecasting (2), Aeronautical meteorology, Climate data processing, Air pollution, Climatology, General meteorology, Numerical Weather Prediction, WMO Class III course	78
	LTF (> 6 months)	2007	39	37	Aeronautical meteorology, Digital forecasting, General meteorology, Marine meteorology, Numerical Weather Prediction, Public Weather Services, Telecommunication, Typhoon forecast, WMO Class II course	32
		2008-2009	60	50	Application of Met. Products, Data assimilation, Digital forecasting, Weather forecasting, WMO Class I course	34

A: Number of Meteorologists    B: Number of Met Technicians    C: Number of Candidates

Region	Fellowship		Foundation Training		Advanced-specialized Training	
	Type	Period	A	B	Fields of Specialization and their frequencies	C
RA III	STF (≤ 6 months)	2007	13	29	Numerical Weather Prediction (3), Weather forecasting (3), Synoptic and mesoscale meteorology (2), Climate Change, Data processing, Instrumentation, Observation, Nowcasting, Satellite meteorology	24
		2008-2009	15	36	Climatology (2), Weather forecasting (2), Instrumentation, Nowcasting, NWP, Observation	31
	LTF (> 6 months)	2007	12	20	Agrometeorology, Radar Meteorology, Dynamic meteorology	10
		2008-2009	16	24	Atmospheric modelling, NWP, Climatology, General meteorology, Tropical meteorology	13
RA IV	STF (≤ 6 months)	2007	9	69	Agrometeorology, Climatology, NWP, Synoptic and mesoscale meteorology	4
		2008-2009	15	16	Agrometeorology, Climatology, Data processing	8
	LTF (> 6 months)	2007	5	20	Agrometeorology, Climatology, Dynamic meteorology, Instrumentation, Physical meteorology, Radar Meteorology	13
		2008-2009	12	13	Network maintenance, Agrometeorology (2), Climatology, Marine meteorology	14
RA V	STF (≤ 6 months)	2007	20	27	Aeronautical Meteorology, Climatology, Marine meteorology, NWP, Public Weather Service, Radar Meteorology, Satellite meteorology, Seismology forecasting, Tropical Cyclone Forecasting	19
		2008-2009	27	37	NWP (2), Radar Meteorology, Satellite meteorology, Seismology forecasting	24
	LTF (> 6 months)	2007	13	8	Applied Meteorology, Climate prediction, General meteorology	10
		2008-2009	20	14	Satellite meteorology, Applied Meteorology, GIS Applications	13
RA VI	STF (≤ 6 months)	2007	37	40	Weather forecasting (6), Aeronautical meteorology (5), Numerical Weather Prediction (5), Mesoscale meteorology, Satellite meteorology (2), Automatic Weather Station, Climate change, Climatology, Environmental monitoring, General meteorology, Instrumentation, Management and administration	42
		2008-2009	48	34	Climatology (5), Numerical Weather Prediction (3), Aeronautical Meteorology (2), Instrumentation (2), Marketing, Management and administration (2), Radar Meteorology (2), Weather forecasting (2), Air pollution, Climate change, Natural extreme events, Climate modelling, Remote sensing, Data processing, Satellite meteorology, Synoptic meteorology, Urban meteorology	54
	LTF (> 6 months)	2007	8	9	Aeronautical meteorology, Agrometeorology, Biometeorology, Dynamic meteorology, Environmental meteorology, Numerical Weather Prediction, Satellite meteorology, Weather forecasting	8
		2008-2009	12	9	Aeronautical meteorology, Climatology, Climate Modelling, Database management, Data processing, Remote sensing, Statistics in Applied Meteorology, Synoptic meteorology, Telecommunication	9

The following graph shows the expected future requirements for fellowships based on the responses made by Members to this survey. It reveals that there are huge needs of both short-term and long-term fellowships from RA I, and also that the need for Meteorological Technicians appears to be higher than for Meteorologists. At the same time, RA VI expressed the highest needs of short-term fellowships for advanced training compared to the others.

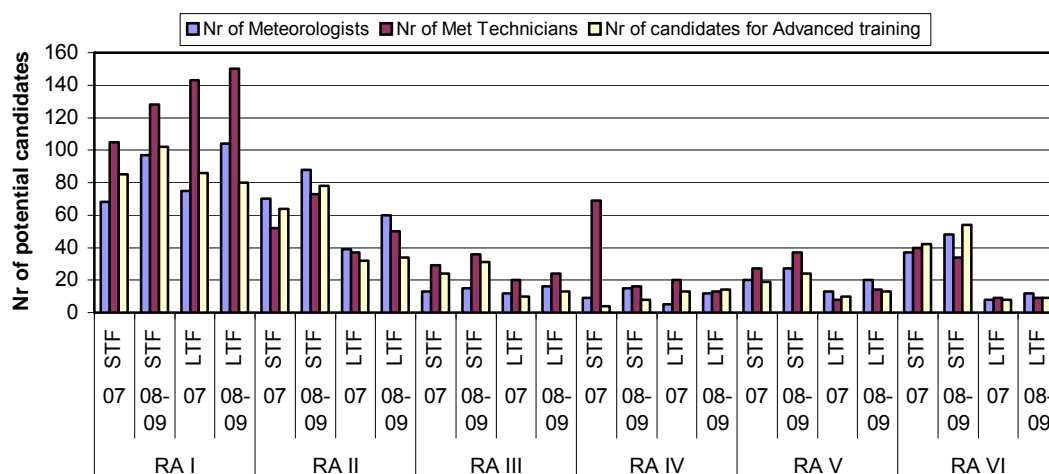


Figure IV.2 – Expected future requirements for fellowship

### IV.3 What is the national capability for providing external assistance for education and training in meteorology?

The following is self-explanatory table of national capability for providing external assistance for education and training in meteorology in regional aspect. Each figure represents the frequency of occurrence of “Yes”. The item (c) Supporting WMO training events is frequently chosen globally, which means the readiness of Members to host WMO training events is fairly high.

	I	II	III	IV	V	VI	Total
(a) Offering education and training to foreign students:	4	7	3	3	4	11	<b>32</b>
(b) Assisting in the preparation of WMO training publications:	5	7	4	2	3	11	<b>31</b>
(c) Supporting WMO training events:	16	11	3	3	9	16	<b>58</b>
(d) Supplying training materials to the WMO Training Library:	5	7	2	2	4	7	<b>27</b>

### IV.4 Are there any comments you would like to make about your training requirements, opportunities and capabilities that have not been covered elsewhere?

Following are the comments provided by some Members on training requirements, opportunities and capabilities.

<b>Country</b>	<b>Comments</b>
Bangladesh	BMD needs meteorological training fellowship for MSc degree leading to PhD for the development of the forecasting as well as research capability
Bosnia and Herzegovina	As we have lack of teaching staff and facilities, it would be great to establish more effective co-operation and exchange knowledge between experts with neighbouring country It is important to know that training is an essential component of the long -term maintenance of new technology. Improvement linkage between Universities and Service in the region is also important.
Canada	We currently have a fairly good initiation training program for newly-hired meteorologists and are developing a plan to setup an integrated training program to improve our efforts in this field. We also aim at developing closer links with other countries, WMO and other bodies in the coming years
Côte d'Ivoire	Aid needed for basic training
Czech Republic	Main problem in our institute is lack of human resources
Egypt	RTC-Cairo passed by an operation of complete innovation included infrastructure, training facilities, administration, etc. WMO training events are welcomed with the necessary arrangement with EMA
Ethiopia	Enable to provide quality meteorological services to users we need consecutive trainings in different fields of specialization and refreshing courses in the area of weather forecast, agrometeorology, hydrology, climatology, data management and remote sensing, aeronautical meteorology and the likes. The current status and range of training that allocated to NMA was very limited but for the future it should be improved to deliver quality services to users.
Fiji	The Status of FMS training school needs to be upgraded preferably by: <ul style="list-style-type: none"> <li>· Providing up to date training aids such CAL modules and other electronic materials.</li> <li>· Developing trainers at the technician level and professional level in particular.</li> <li>· The training school at the Fiji Meteorological Service provides a variety of training to personnel of the Meteorological Services of the Southwest Pacific Region. Upgrading the knowledge and skills of the training instructors is necessary for improvement in performance. The level of expertise of the training personnel should change with the change in technology and latest techniques devised for observing and forecasting purposes.</li> <li>· Accrediting the courses offered by FMS is necessary.</li> </ul>
Gambia	Due to developments in aviation and increasing threat from extreme weather events, the need for regular and accurate forecasts is being called for in many quarters and thus the need for more foresters
Georgia	It will be very useful to organize the training of trainers in the various fields of meteorology
Kenya	Integration of meteorology into other fields as the science cuts across
Mali	The reinforcement of our capacities in the domains of the meteorological applications notably the Public Works and Buildings and health thus the economical social advantages and their recovery is not treated.
Malta	Sending staff for training could be difficult due to their operational duties with little margin for their release to attend courses abroad.

<b>Country</b>	<b>Comments</b>
Norway	The countries within WMO obviously have very different training needs/ interests. With our very limited resources we have to be strongly focused on national requirements. And these might be better solved within international cooperation on a smaller scale? (Nordic, European)
Portugal	Due to the lack of financial resources, the training materials and events are very few.
Sudan	We are now preparing to start teaching programmes for meteorology, the level of diploma, BSc, MSc, with computerization of Sudan Universities. We are in urgent need of training facilities e.g. Lab, library.
Thailand	Due to limited national budget allows for capacity building of staff each year and insufficient for sending staff to training at WMO RTCs abroad, we think that in-country training is necessary and practical way to increase knowledge and skill of staff in meteorology and related fields. In this regard, lecturers and experts from WMO RTCs/advance technological NMHSs are required. National budget should be available to support for local expenses for experts and lecturers.
Yemen	The relevant applications to Energy and Environment as well as Health.
Zambia	a) Training in quantifying economic benefits of using weather/climate data b) Training in more rigorous methods/techniques of climate data analysis





**PART B: HYDROLOGY**



## I. CURRENT STATUS OF NATIONAL EDUCATION AND TRAINING PROGRAMMES IN HYDROLOGY

The aim of this section is to assess the job-entry-level requirements for Hydrologists and Hydrological Technicians<sup>(#)</sup>, continuing education and training programmes available for hydrological personnel at the National Meteorological and Hydrological Services (NMHSs), and the factors, which may adversely affect the education and training in hydrology.

### I.1 What is the usual qualification for job-entry-level Hydrologists in the national Service responsible for hydrological activities?

Members were required to choose the relevant item(s) among the following four options and specify the duration of each chosen item(s).

- (a) First degree in hydrology;
- (b) Postgraduate Diploma/Master's degree in hydrology, for holders of a degree in a scientific/engineering/computational subject
- (c) Foundation training in hydrology, organized by the Service, possibly in partnership with other national institutions, for holders of a degree in a scientific/engineering/computational subject;
- (d) Another approach

Table I.1 – Frequency statistics on the usual qualification programmes and their duration of study for job-entry-level Hydrologists

	Frequency													
	Region						Global	Duration						
	I	II	III	IV	V	VI		3mns	6mns	1yr	2yrs	3yrs	4yrs	5yrs
(a)	8	6	3	3	1	13	<b>34</b>	0	0	0	3	1	<b>10</b>	<b>8</b>
(b)	9	6	3	3	3	9	<b>33</b>	0	0	2	<b>14</b>	0	5	1
(c)	5	4	1	1	2	4	17	1	3	<b>5</b>	3	1	1	0
(d)	6	1	1	0	2	5	15	1	0	1	0	1	0	0

The result shows that, in about 70% of responding Members, the first degree and the postgraduate diploma/master's degree in hydrology are taken as the usual qualification for job-entry-level hydrologists. However, due to low level of responses to this part of the survey, it is not easy to determine the tendency region by region. Most often the duration required for the first and the postgraduate diploma/master's degree is 4-5 years and 2 years, respectively. It also reveals that foundation training carried out in NMHSs takes on average 1 year.

<sup>(#)</sup> Please note that the new WMO scheme for classification of personnel in meteorology and hydrology is being used throughout this Questionnaire; see the definitions for 'Hydrologist' and 'Hydrological Technician' under Chapter 1 of WMO-No. 258, Vol. II – Hydrology; fourth edition 2003.

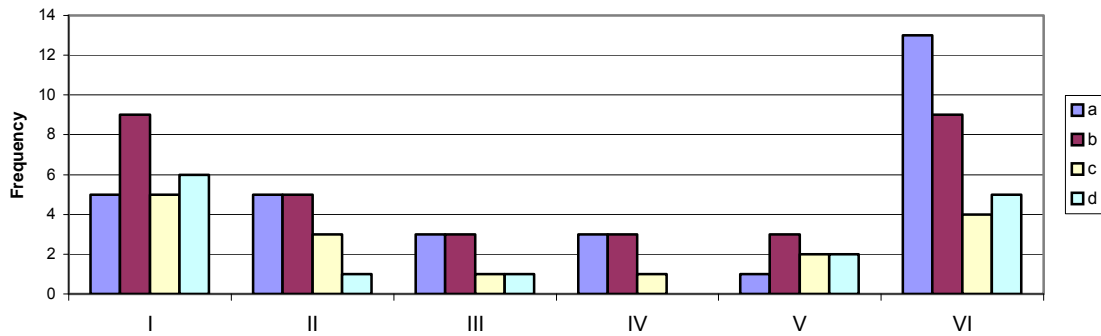


Figure I.1 – Regional distribution of the usual qualification for job-entry-level Hydrologists

Following are other approaches specified by some of responding Members as the usual qualification for job-entry-level Hydrologists.

#### Region I – Africa

- On the job training.
- In absence of holders of degree in Hydrology, those with a degree in Physics or Mathematics or Geology are selected.
- Hydrology training at post-secondary school. Institution organized by the organization.
- First degree in Civil/Agricultural Engineering/Physical Sciences.
- Training workshops on Operational hydrology.

#### Region II – Asia

- Current there is a single hydrologist under the division. Most of the operational hydrology works are done by Civil Engineers who were trained through short training courses on hydrology.

#### Region III – South America

- Degree in scientific/engineering subject plus Class II in hydrology.

#### Region IV – North America, Central America and the Caribbean

- None.

#### Region V – South-West Pacific

- There are no specialist hydrology courses in Australia. Hydrologists typically come from an engineering or natural resource/environment background and we will take on personnel with a 3 year degree.
- Form 6 education/Diploma in Civil Engineering and work experience up to Technical Officer for 3-5 years.
- Through recruitment of degree holders preferably a science degree, send overseas for specialized training in hydrology.

#### Region VI – Europe

- Bachelor Degree in Hydrology or relevant branches (Geography) for job-entry level meteorologists, training programmes in meteorology organizes by the Service.
- Civil Engineering Faculty.
- Diploma itself engineer or mastery in a scientific domain.

- University degree in physics, mathematics, hydro-technique, hydro-energy, geography with one year study of hydrology.

## I.2 What is the usual qualification for job-entry-level Hydrological Technicians in the national Service responsible for hydrological activities?

In this question, Members were required to choose the relevant item(s) among the following four options and to specify the duration of each.

- Hydrological training at a technical/vocational secondary school;
- Hydrological training at a post-secondary school institution;
- Hydrological training organized by the Service, possibly in partnership with other national institutions;
- Another approach;

Table I.2 – Frequency statistics on the usual qualification programmes and their duration of study for job-entry-level Hydrological Technicians

	Frequency												
	Region						Global	Duration					
	I	II	III	IV	V	VI		3mns	6mns	1yr	2yrs	3yrs	4yrs
(a)	5	4	1	0	0	9	19	0	0	1	3	3	5
(b)	9	2	0	4	1	4	20	1	0	1	5	3	2
(c)	6	5	2	1	1	8	23	2	4	3	2	2	0
(d)	2	1	0	0	2	4	9	0	0	0	2	0	2

The result shows that the usual qualification for job-entry-level Hydrological Technicians varies country by country and region by region. In general, many Services usually organize hydrological training, possibly in partnership with other national institutions, to secure qualified job-entry-level Hydrological Technicians responsible for hydrological activities.

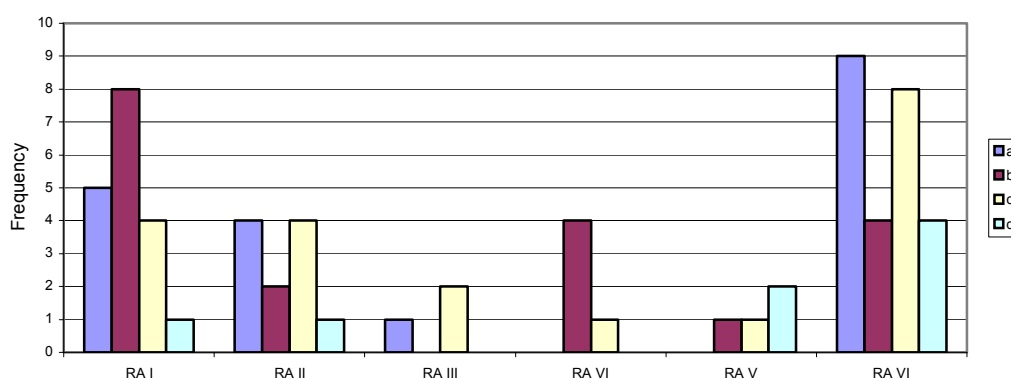


Figure I.2 – Regional distribution of the usual qualification for job-entry-level Hydrological Technicians

Following are other approaches specified by some of responding Members as the usual qualification for job-entry-level Hydrological Technicians.

### Region I – Africa

- After studying 7 years (5 + 2) at Secondary School Level then training at University of Mauritius and on the job.
- Diploma in Civil/Water Engineering/Building Engineering.
- Training workshops as above.

### Region II – Asia

- Candidates who have completed secondary school could be recruited and trained by the Hydromet Service. Organizing one year certificate level course on Hydrometeorology.

### Region III – South America

- Passes in CSEC Exams - Must pass mathematics, English and science subject.

### Region IV – North America, Central America and the Caribbean

- None.

### Region V – South-West Pacific

- The minimum entry level requirement is a Diploma from a post secondary technical institute (or equivalent university studies). We also have people moving from the Observer and Technical Engineer category into this grouping with similar academic backgrounds but strong skills and knowledge of other Bureau disciplines. There are TAFE (Technical and Further Education) Colleges with subjects in related areas that are also a useful supplement.
- Form 6 level education with Scientific subjects.

### Region VI – Europe

- Secondary school diploma with training in the Service.

### I.3 Have you already completed the transition to the new classification of personnel as stated in WMO-No. 258 Vol. I, Edition 4?

	Total	RA I	RA II	RA III	RA IV	RA V	RA VI
<b>YES</b>	9	2	2	1	0	1	3
<b>NO</b>	46	13	7	2	4	4	16

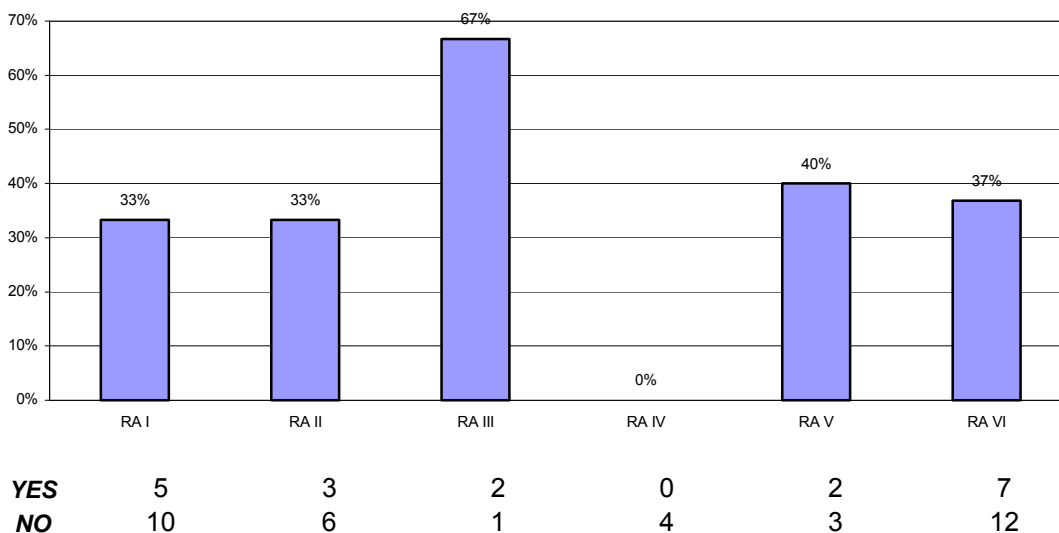
*If No, please answer the following questions.*

(b) Do you anticipate completing the transition by 1 January 2007?

	Total	RA I	RA II	RA III	RA IV	RA V	RA VI
<b>YES</b>	10	3	1	1	0	1	4

The purpose of this question was to explore the extent to which Members are in compliance with WMO-No. 258 and diagnose the anticipating difficulties in implementing the new classification of personnel (which should have come into full effect on 1 January 2007).

It was revealed as shown in the above result that only 16% of the respondents had completed the transition to the new classification as of the year 2006. Only ten out of 49 Members who said “No” answered that they anticipated completing the transition by 1 January 2007, which means approximately only 35% of the Members will have been in compliance with the new classification as of January 2007, see *Fig. 1.3*. In this context, it was confirmed that it was still far away to realize the satisfactory level of implementing the new classification of personnel in hydrological services.



*Figure 1.3 – Implementation of New classification of personnel foreseen by 1 January 2007*

Following are some outlines on the main issues preventing Members from completing the transition.

#### *Region I – Africa*

- The document WMO-No.258 Vol.1, Edition 4 is not available in our NHS.
- Insufficient number of personnel and the needed qualification is not yet in place.
- The structure of the Department does not allow this.

#### *Region II – Asia*

- We have not received the documents.
- The classification of hydromet staff of Uzbekistan a little differs from the WMO classification, but there is conformity between international and national classification.

#### *Region III – South America*

- None.

#### *Region IV – North America, Central America and the Caribbean*

- The Water Survey of Canada follows the Government of Canada classification guidelines
- Establishment of new Water Management Authority behind schedule.

### *Region V – South-West Pacific*

- We do not know the new classification No. 258 Vol. II, Edition-4.
- Lack of staff - no training officer position in current structure.

### *Region VI – Europe*

- Because of absence of technical and financial means Armstatehydromet is not ready to complete the transition to the new classification of personnel.
- Lack of human resources.
- The Czech Hydrometeorological Institute is going to be transferred (by law) to the category of "Public Research Institution", having specific classification system of personnel.
- Classification of the personal is connected with national regulations concerning the job classification.
- Lack of contacts with WMO concerning Hydrological Education.
- The national qualifier of specialties does not provide such transition.
- We do not specify in the recruitment of hydrologist or of specialized technician in hydrology.
- Not planned yet.
- Wrong management.

#### **I.4 What are the main activities in continuing education and training in hydrology presently undertaken by the Service, and their frequency?**

Members were requested to choose among the following items and give their frequency in order to get information about the main activities in continuing education and training undertaken by them.

- (a) Periodic refresher training for Hydrologists;
- (b) Periodic refresher training for Hydrological Technicians;
- (c) Specialized training for Hydrologists, organized by the Service as required;
- (d) Specialized training for Hydrological Technicians, organized by the Service as required;
- (e) Other activities in support of continuing professional development such as stimulating employees for self-study, promoting the lifelong learning culture, etc.

Table I.4 summarizes the responses to the question, showing that 62% of the respondents undertake periodic refresher training for Hydrologists, 69% run periodic refresher training programmes for Hydrological Technicians, 79% organize specialized training for Hydrologists, and 82% for Hydrological Technicians, as required. Also 71% implement other activities in support of continuing professional development such as stimulating employees for self-study, promoting the lifelong learning culture, etc. It was revealed that most of the responding Services to this question provide yearly training with their hydrological staff. Meanwhile it is understood that those who chose "Other" may have either shorter or longer frequency of training given to their staff rather than annual or biennial.



Table I.4 – Frequency of the main activities in continuing education and training in hydrology presently undertaken by the Services

	Frequency				
	n/a	1 year	2 years	Other	No answer
(a)	15	13	5	6	16
(b)	12	13	7	7	16
(c)	8	10	8	13	16
(d)	7	11	6	15	16
(e)	7	8	1	8	31

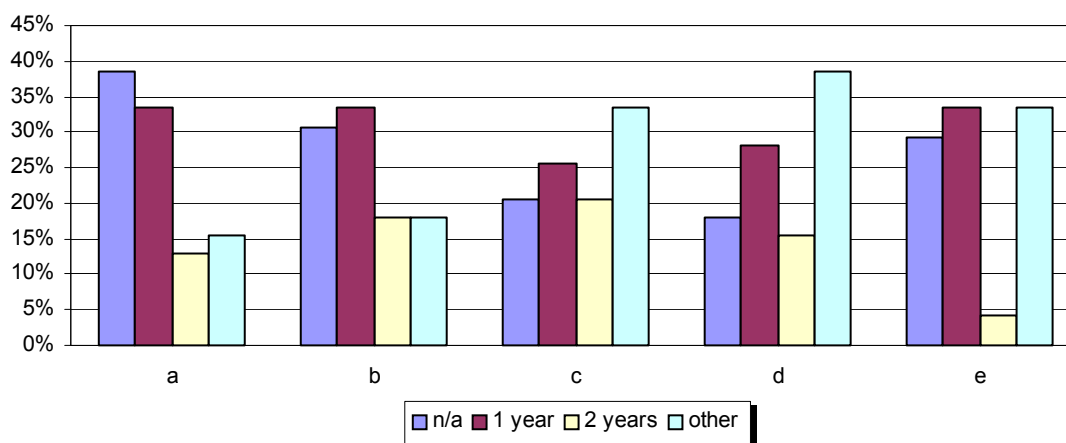


Figure I.4 – Tendency of the main activities in continuing education and training in hydrology presently undertaken by the Services

Following are other activities for continuing professional development carried out by some of responding Members.

#### Region I – Africa

- Workshop in the service if necessary.
- Working alongside Technical Advisor.
- In Service training for postgraduate degree programmes abroad.

#### Region II – Asia

- None.

#### Region III – South America

- None.

#### Region IV – North America, Central America and the Caribbean

- Training generally undertaken in-house for technicians.
  - 1) Associate degree in water resources.
  - 2) Technician degree in water resources.

#### Region V – South-West Pacific

- Carried out by Water Resources Division.

## Region VI – Europe

- Training depends on requirements.
- International courses, conferences, seminars, workshops.
- From time to time, dependent on interest of single hydrologist.
- PhD, Master, individual study.
- The COMET program, Interactive training modules from its website.

Based on the replies to the following question, it is shown that 75% of the responding Members use Information and Communication Technology (ICT) in continuing education and training activities.

- (f) Does your Service use Information and Communication Technology (ICT) in continuing education and training activities? (Yes / No)

Following is the result of the statistics based on the answers given by Members.

	Total	RA I	RA II	RA III	RA IV	RA V	RA VI
<b>YES</b>	31	4	6	3	1	3	14
<b>NO</b>	24	11	3	0	3	2	5

As shown in the following table, most of those who chose “Yes” utilize electronic media or website as a tool for their activities.

	FREQUENCY			
	Video Conf.	Sys. Electronic media	Web site	Others
RA I	0	2	2	0
RA II	0	5	2	0
RA III	0	3	3	1
RA IV	0	2	1	2
RA V	0	2	3	1
RA VI	2	11	7	3
Total	2	25	18	7

### **I.5 If the overall performance of the hydrological education and training undertaken in your country is not fully satisfactory, what are the principal weaknesses?**

The purpose of this question is to explore through the following choices the principal weaknesses that each Member is facing in undertaking the hydrological education and training.

- (a) Low visibility of Hydrology at national level: lack of teaching staff and/or teaching facilities;
- (b) Insufficient hydrological and/or teaching expertise: outdated documentation for specialized training in hydrology; lack of staff development programmes for hydrological instructors;
- (c) Limited co-operation between institutions giving hydrological education: ambiguous objectives; unpractical institutional fragmentation;
- (d) Inflexible accreditation arrangements for previously acquired competencies; rigid access to hydrological qualifications and progression routes, including the bridging routes in between different pathways;
- (e) Other constraints.

Responses to this question are summarized in the following table.

Table I.5a – Principal weaknesses brought up by Regional respondents for the given options

	Frequency						
	Total	RA I	RA II	RA III	RA IV	RA V	RA VI
(a)	<b>32</b>	11	7	3	2	3	6
(b)	<b>32</b>	10	6	3	3	4	6
(c)	<b>17</b>	5	2	2	0	3	5
(d)	<b>10</b>	4	2	2	0	1	1
(e)	<b>11</b>	4	1	1	1	0	4

The statistics shows that low visibility of hydrology at the national level and insufficient hydrological and/or teaching expertise are the main constraints and weakness in performing the meteorological education and training in the country, which is still the same situation as in the previous Survey (2002). These two factors seem to have a significant negative impact on the development of NMHSs.

Considering the low level of responses to this Part (Hydrology) from Members, 29% globally and in particular 18% from RA IV, the result of the analysis could not be regarded as the one that is representative for each Region. In this regard, in order to obtain more reasonable result, another approach based on Country Classification made public in July 2006 by World Bank was applied to the analysis, which comprises five groups, namely: Low Income Countries (LIC), Lower Middle Income Countries (LMC), Upper Middle Income Countries (UMC), High Income Countries (HIC), and High Income OECD Countries (OECD) (See Annex I).

Table I.5b – Principal weaknesses brought up by income-group respondents for the given options

	Frequency					
	Total	LIC	LMC	UMC	HIC	OECD
(a)	<b>32</b>	16	9	6	0	1
(b)	<b>32</b>	14	11	4	0	3
(c)	<b>17</b>	7	7	2	0	1
(d)	<b>10</b>	6	4	0	0	0
(e)	<b>11</b>	5	3	2	1	0

This approach also shows that low visibility of Meteorology at national level and insufficient hydrological and/or teaching expertise are the main constraints and weakness. Although the poor response level from HIC and OECD groups undermines the reliability of statistics, particularly for HIC group, and considering that the intention of this question was to assess the principal weakness in performing the hydrological education and training focusing more on developing or lower income country group, the statistics could be regarded as showing reasonable trends.

Following are the other constraints specified by respondents:

- No training centre that offers hydrological sciences and no fellowship offered so far from WMO.
- Lack of awareness, creation training and capacity building training.
- Formation dispensée est générale et manque de filière de spécialisation.
- Insufficiency of specific documentation, lack of laboratory for professional training.
- Poor remuneration discouraging potential candidates.
- Lack of budget and facilities for education and training.
- Lack of educational institutions of hydrological type.
- No specified education for hydrological technicians.

## II. HUMAN RESOURCES DEVELOPMENT (HRD) - ASSESSMENT AND PLANS

This section aims to find an estimation of the development that took place for human resources during the period 2003 to 2006, and to identify the projected staffing requirements for the year 2009. It also aims to recognize the factors that have impacted staff numbers and the development of human resources, as well as the amount of external support received and/or provided for training.

### II.1 What is the staffing of the Service from 2003 to 2006, and what is the projection for 2009?

The following table, based on the number of staff provided by the responding Members, shows the staffing status and its projection for 2009 per million people. Detailed statistics is attached as Annex II-H. At each group, minimum and maximum values were excluded in the calculation of the average to avoid extreme deviation, which could cause distorted results.

Table II.1a – Hydrological staffing in 2003 and 2006, and its projection for 2009

(per million)

Year	Total Nr of Met staff			Women rate (%)			Nr of Hydrologists			Nr of Hyd Technicians		
	2003	2006	2009	2003	2006	2009	2003	2006	2009	2003	2006	2009
Average	<b>11.18</b>	<b>11.51</b>	10.03	<b>30.32</b>	<b>30.81</b>	33.42	<b>2.93</b>	<b>2.83</b>	3.20	<b>7.94</b>	<b>8.50</b>	6.77
Maximum	112.62	114.89	116.78	81.13	77.94	77.14	59.33	60.47	62.36	53.29	54.42	54.42
Minimum	0.33	0.36	0.19	0.00	0.00	2.50	0.00	0.00	0.00	0.03	0.03	0.06

Meanwhile, due to the low level of responses to this Part (Hydrology), 29% globally, the result of the analysis could not be regarded as the one representing each Region. Therefore, as in the question I.5, it is considered more appropriate to apply to the analysis the World Bank country classification. In this analysis, HIC group was excluded because of no responses to this question from this group.

Table II.1b – Status of Meteorological staffing in 2003 and 2006, and its projection for 2009, based on economic grouping

(per million)

Year	Total Nr of Met staff			Women rate (%)			Nr of Hydrologists			Nr of Met Technicians		
	2003	2006	2009	2003	2006	2009	2003	2006	2009	2003	2006	2009
Global Avg.	<b>11.18</b>	<b>11.51</b>	10.03	<b>30.32</b>	<b>30.81</b>	33.42	<b>2.93</b>	<b>2.83</b>	3.20	<b>7.94</b>	<b>8.50</b>	6.77
LIC	6.26	8.12	6.01	16.03	16.13	23.83	1.23	1.64	1.78	4.71	6.07	4.23
LMC	16.22	14.56	11.89	45.62	45.35	45.35	3.73	2.57	3.34	10.39	10.07	7.29
UMC	14.12	14.57	14.32	43.14	44.31	43.83	4.40	4.29	6.07	9.25	9.80	7.24
OECD	1.64	1.26	1.16	15.28	23.53	26.56	0.82	0.99	0.80	0.53	0.45	0.41

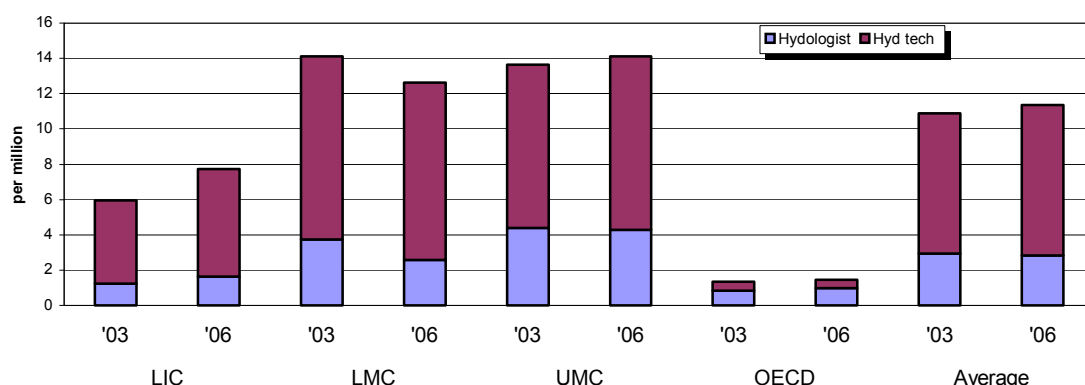


Figure II.1 – Trend of hydrological staffing per million people

Figure II.1 illustrates that the hydrological staffing varies depending on the economic status of the country. Particular attention is drawn to the OECD group, which is showing the lowest staffing among the groups, which could be related to the utilization of new technologies and the automation of the services particularly the observing system. The latter explanation is supported by higher proportion of hydrologists to hydrological technicians, which is showing an opposite tendency to the other groups.

## II.2 When making plans for human resources development during the period 2006-2009, what are the main issues that have to be considered by your Service?

- Expertise required for new tasks/services;
- Introduction of new equipment;
- Re-deployment of staff to other jobs;
- Increased recruitment;
- Lack of expertise in meteorology and/or management;
- Other factors.

Members were requested to specify, in priority order, the main issues of those mentioned above that have to be considered when planning for human resources development. The data included in the responses are summarized in Table II.2 below.

Table II.2 – Frequencies of priorities for issues

	Frequencies of priorities chosen					Weight	Percent
	1st	2nd	3rd	4 <sup>th</sup>	5 <sup>th</sup>		
(a)	17	15	6	5		28.3	26.3%
(b)	9	14	12	6		22.8	21.2%
(c)	2	4	3	11	14	10.9	10.1%
(d)	11	5	15	6		21.5	20.0%
(e)	8	6	5	11	11	17.6	16.4%
(f)	3	1	0	2		6.5	6.0%

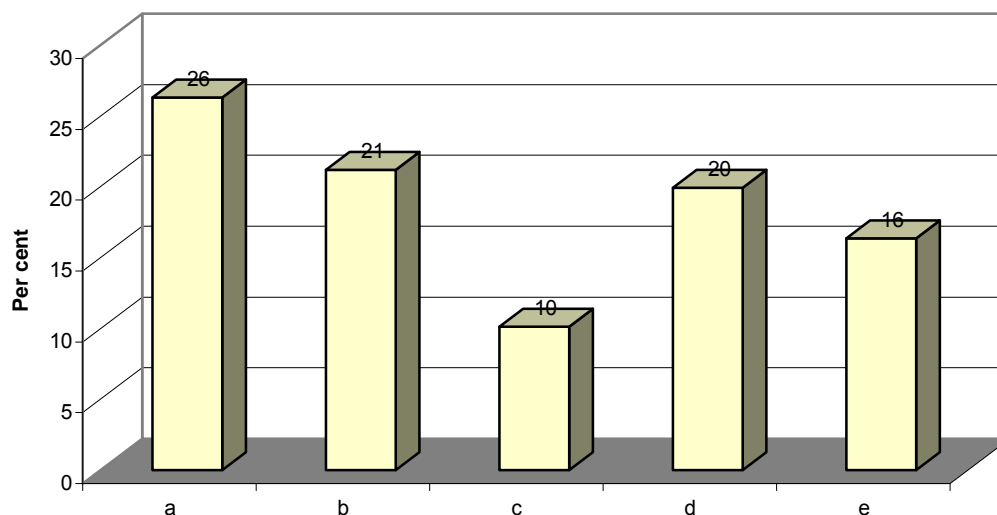


Figure II.2 – Importance of various issues in the plan of HRD

In Figure II.2 the weight of each factor was calculated according to the order of priority indicated by respondents. For example if factor (a) came under priority 1, it takes one unit weight, if under priority 2, it takes 1/2 unit weight, if under priority 3, it takes 1/3 unit weight and so on. The sum of units for each factor gives the total weight for each unit, which is then divided by the total possible weight to be presented in relative weights. This percentage value reflects the importance of each element in the human resource development process.

Generally, this data analysis of the importance of various issues for the development of human resources shows the same order of priority as in the previous Survey (2002), which indicates that requirement of expertise for new tasks and services appears to still be the most important factor and has the highest priority in the process of HRD. The introduction of new equipment and the increased recruitment are of the second and third priorities, respectively. Lack of expertise in hydrology and/or management falls in the fourth priority order while lowest priority was for the re-deployment of staff to other jobs.

Several countries indicated some issues under ‘Other Factors’ to be considered when planning for HRD, among those were the following:

- Better motivation of personnel.
- Filling all 60 technician positions at district levels.
- Network expansion and computational capacity.
- Reinforcement and improvement of the work conditions (technical equipments, motivation).
- Lack of support concerning education.
- Training the staff for implementation and use of new methodologies and technologies.

### II.3 What external support for training has your Service received from agencies other than WMO from 2003 to 2006?

Members were requested to provide information about donors to the following by filling in the blank field for each type of donor.

	<i>Nr of fill-in made by respondents</i>
(a) Countries:	31
(b) International organizations/institutions:	21
(c) Private sector companies:	5
(d) Other donors:	7

As shown above, countries and international organizations/institutions through bilateral relations are the main supporters for training other than WMO. The private sector cannot be considered as a major contributor/supporter, as only few case of training were supported by the private sector among the responding countries to this question.

Table II.3a is the list of donor Members providing supports for training to the WMO Regions. The numbers in brackets denote the frequency of appearance in the responses.

*Table II.3a – List of donor Members providing support for training to the individual Region.*

Region	Donor Members
I	Netherlands (6), Denmark (2), Japan (2), China, Egypt, Germany, Italy, Niger, Norway, Tanzania, USA
II	Japan (4), Belgium, Germany, India, Israel, Netherlands, Norway, Russian Fed, Sweden, USA,
III	France, Japan, Venezuela, Spain
IV	Belgium, Denmark, France, Japan, Sweden, USA
V	New Zealand (2), Japan
VI	USA (4), Slovak Republic (2), Australia, Germany, Hungary, Italy, Korea Rep, Netherlands, Norway, Poland, Russian Fed., Serbia Montenegro, Switzerland, UK

Table II.3b is the list of International organizations/institutions having provided supports for training to WMO Regions during the survey period. The figures in brackets denote the frequency of appearance in the responses.

*Table II.3b – List of International organizations/institutions having provided supports for training to the individual Region during the survey period.*

Region	Int'l organizations/institutions
I	World Bank (2), AGRHYMET (2), HYCOS (2), EU, UNESCO, WATERNET
II	AGRHYMET, AIEA, ETSHER-EIER, GWP, IHP, MASHAV, SIDA, UNESCO, VLIR
III	IRD, UNESCO
IV	UNESCO
V	EU, Public Works Research Institute, SOPAC
VI	EUMETSAT, UNESCO

#### **II.4 What external support for training has been provided by your Service to other countries from 2003 to 2006?**

The following table shows the external support for training that has been provided to candidates from other countries by some of NMHSs.

Region	Country	Remark (Support to other countries)
I	Nigeria	Common Wealth Training in Water Engineering
	Senegal	Punctual supports to other national technical directions
II	Japan	MLIT River Bureau provides 3 months training on river and dam engineering in cooperation with the Japan International Cooperation Agency (JICA) for about 10 staff members of developing countries every year.
	Viet Nam	Lao, PDR, Cambodia
IV	Canada	Water monitoring network design; gauging station installation and operation; water level, velocity and discharge measurement and computation; to selected Mexican, African, Middle-east and Polish agencies
V	Australia	Secondment of engineers from China (Chiangjiang Water Resource Commission) for training in flood forecasting under aid funding
	Philippines	Accommodate 1 from Bhutan for OJT in Hydrology (June 06)
VI	Germany	a) Training course on hydrological droughts, 2005 b) Hydrogeology in arid catchments, 2005
	Sweden	Hydrology courses for developing countries almost every year.



### III. ASSESSMENT OF WMO TRAINING ACTIVITIES

The aim of this section is to assess the use and effectiveness of WMO training activities including WMO support for training publications, audio-visual aids, participation in training events, fellowships and/or other financial support.

#### III.1 What use is made by your Service of WMO Training Materials?

Following is the statistics based on answers given by responding Members where the figures represent frequency of choices made by respondents.

	<i>N/A</i>	<i>low</i>	<i>med.</i>	<i>high</i>
(a) Extent of use of the WMO Training Publications:	<b>6</b>	<b>11</b>	<b>19</b>	<b>8</b>
(b) Extent of the use of the WMO Virtual Training Library:	<b>21</b>	<b>11</b>	<b>5</b>	<b>2</b>
(c) Extent of use of the WMO Training Library Services:	<b>20</b>	<b>9</b>	<b>9</b>	<b>2</b>

The items from (a) to (c) are to assess the extent of use of WMO training materials by Members. The result shows as follows:

- Use of the WMO Training Publications: 61% of respondents from developing countries rated the usefulness of the WMO publications as medium or high in their training activities. However, in OECD countries, the extent of use of *WMO Training Publications* is not so high, which means that they may have their own materials for the activities.
- Use of the WMO Virtual Training Library: 28% of respondents to this item rated as low and 54 % as not applicable (N/A) in the usefulness of WMO Virtual Training Library (VTL). Only 18% of respondents used VTL at medium or high level.
- Use of the WMO Training Library Services: 46% of respondents rated the usefulness of the Services as medium or low and 50 % as N/A. Only 28% of respondents used the Services at medium or high level.

The items (d) and (e) are to assess what types of tools are mostly employed in the training activities by NMHSs and its trend as a whole. The results were as follows:

	<i>slide</i>	<i>video</i>	<i>CAL</i>	<i>other</i>
(d) Types of training materials used at present:	<b>10</b>	<b>9</b>	<b>9</b>	<b>13</b>
(e) Types of training materials likely to be needed for future training activities:	<b>10</b>	<b>15</b>	<b>26</b>	<b>12</b>

It is foreseen from the trend in the use of types of tools in the training activities by NMHSs that CAL methods would be the most highly used tools in the future as shown in the following figure III.1. The data from Survey 2002 showed a more dramatic trend. The portion of CAL among the training tools is increasing in contrast with others.

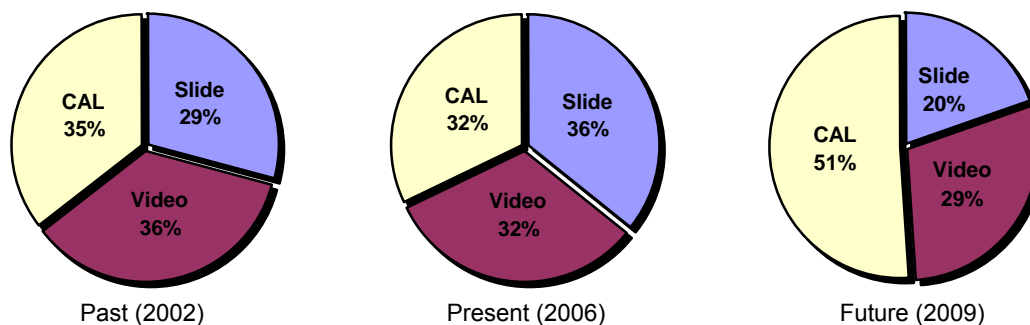


Figure III.1 – Trend in the utilization of training tools

Following are the comments made by respondents on the range and quality of these services.

- The range of hydrological training is not so satisfactory.
- Educational equipment is poorly known and very often in English.
- The quality is low but need more training in hydrology to enhance experience and increase professional development within and outside the Services.
- These services improve knowledge and capability of staffs of NMHSs.
- Very good but not regularly received.
- Rarely used.
- Guide to hydrological practices, no other use of WMO material in Hydrology.

### III.2 What use has been made by your Service of training events under WMO Major Programmes from 2003 to 2006?

Following is the result based on the responses to this question. Each figure in bold represents frequency of choices made by the responding Members.

	<i>n/a</i>	<i>1-3</i>	<i>4-9</i>	<i>&gt;9</i>
(e) Number of events attended by the staff in your Service:	<b>10</b>	<b>17</b>	<b>6</b>	<b>4</b>
(f) Number of participants co-sponsored by WMO:	<b>10</b>	<b>18</b>	<b>6</b>	<b>1</b>
(g) Number of participants financed by other sources:	<b>12</b>	<b>10</b>	<b>3</b>	<b>2</b>
	<i>n/a</i>	<i>low</i>	<i>med.</i>	<i>high</i>
(h) Adequacy of the attended training events:	<b>10</b>	<b>6</b>	<b>9</b>	<b>12</b>

Due to the low level of responses to this Part (Hydrology), 29% globally, which is insufficient enough to analyze the statistics by Region, it is considered more appropriate to apply to the analysis the World Bank country classification than regional distribution. The result is shown as the following graphs. The Z-axis in each graph represents the proportion in percent to the given criterion. The graphs analytically reveal the following hints:

- For the item (a), the result shows that most countries except OECD countries participated in one to three training events during the last four years. 50% of responding Members from OECD group participated in more than nine events.

- For item (b), the dominant number of participants was one to three during the survey period, among the groups except OECD group in WMO co-sponsored training events.
- The statistics for the item (c) shows the number of participants financed by other sources was mostly one to three.
- For item (d), most countries except OECD countries evaluated the adequacy of the attended training events as medium or higher.

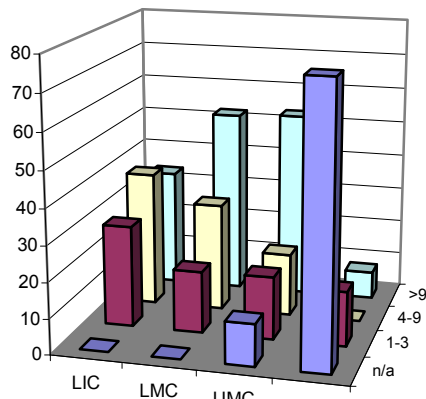


Fig. III.3a – Number of training events attended

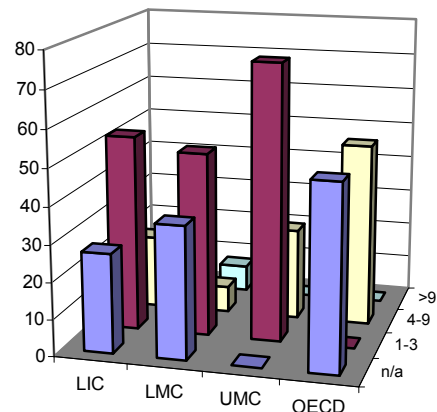


Fig. III.3b – Number of participants co-sponsored by WMO

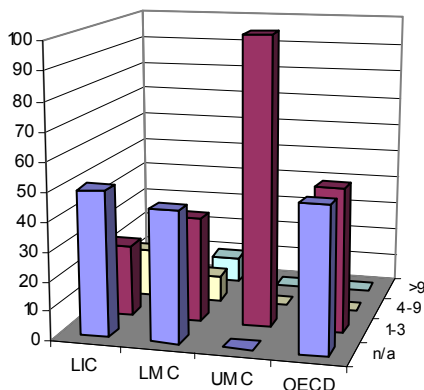


Fig. III.3c – Nr of participants financed by other sources

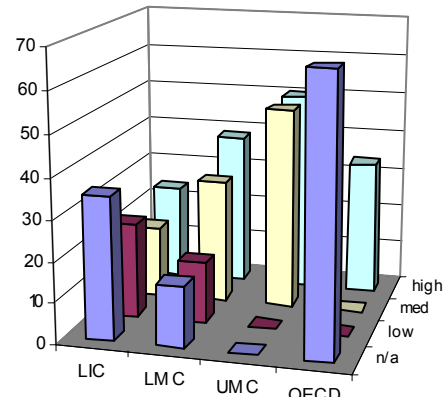


Fig. III.3d – Adequacy of the attended training events

Following are the comments made by some respondents on the quality and range of these training events:

- The range of the training events is unsatisfactory.
- The quality is high and transfer of acquired knowledge to other professionals.
- So far Hydrology Service has not received any training offers from WMO.
- Invitation/Notification to programmes should be forwarded at least 3 months in advance.
- Very good quality but need to be more frequent.
- Limited training events in hydrology were available.
- Rarely used.
- High.
- Training Events are great opportunities concerning Hydrological Education and introducing to work with new equipment.

### III.3 What use has your Service made of the WMO Regional Training Centres (RTCs) from 2003 to 2006?

Following are the result based on the responses to this question. Each figure in bold represents frequency of choices against the given criteria made by the responding Members.

	<i>n/a</i>	<i>1-3</i>	<i>4-9</i>	<i>&gt;9</i>
(d) Number of staff in your Service trained at WMO RTCs during the last 4 years:	<b>15</b>	<b>16</b>	<b>3</b>	<b>2</b>
(e) Number of participants co-sponsored by WMO:	<b>15</b>	<b>13</b>	<b>2</b>	<b>1</b>
	<i>n/a</i>	<i>low</i>	<i>med.</i>	<i>high</i>
(f) Value of the RTCs' training to the development of your Service:	<b>11</b>	<b>2</b>	<b>8</b>	<b>12</b>

From the above information, it could be interpreted that during the survey period (2003-2006), most participants trained in WMO-RTCs were co-sponsored by WMO and the events' values were rated medium or higher.

Following are the comments given by some of respondents on the quality and range of training provided by WMO-RTCs:

- There was very limited training that was provided by WMO-RTCs for this reason, the range was unsatisfactory.
- Good.
- The quality is high, the lectures drawn from renowned professionals and the duration perfect.
- Insufficiencies in the new techniques of hydrometric measures.
- The quality was good and covered a big range as required for technicians.
- Good, especially data processing.
- Good quality.
- High.

### III.4 Are there any ways in which the present interaction/collaboration between WMO-RTCs and national Services could be improved or expanded?

Following are the remarks, grouped by region, provided by respondents on the ways in which the present interaction/collaboration between WMO-RTCs and the national services could be improved or expanded.

#### *Region I – Africa*

- WMO-RTCs need to assess the current need for training in their respective regions and present a project proposal for upgrading the hydrological services of LDCs.
- Need for WMO-RTCs to keep us informed regularly about their training Programmes.
- Work together to design courses.
- Through funding of projects and participation of more staff.
- Better coordination of the relations between WMO-RTC and national services to adapt program them WMO-RTC to the real needs of the services.
- Working together to design courses.
- Improve a communication to allow ample time to prepare candidates.

#### *Region II – Asia*

- Sharing of expertise and attachment courses for our staff at WMO-RTCs in various fields.
- Organize more training seminars and working visit to develop skills and explore potential of forecasters.

*Region III – South America*

- None.

*Region IV – North America, Central America and the Caribbean*

- None.

*Region V – South-West Pacific*

- No WMO-RTC in the region with specialist skills in hydrology. If there was, it could be useful for some exchanges.
- Development Regional Training Centre for Hydrology (RHTC).
- Exchange of experts and training materials.
- More information required.

*Region VI – Europe*

- Organization of local courses (outdoor) with support of WMO, also organization of distance learning.
- The e-learning modules or programmes, virtual learning courses at WMO-RTCs for continuous professional development, certification of the learners.

### III.5 What use has your Service made of the WMO Fellowships Programme from 2003 to 2006?

- (a) The number of fellowships awarded to staff in your Service and the host countries and their institutions/organizations where the awarded fellowships were implemented.

Table III.5 below shows WMO Fellowship requests from Members (2003-2006) that is based on the responses to this Survey.

Table III.5 – WMO Fellowship requests from Members (2003-2006)

Region	Home country	Nr of Fellows		Host country	Institutions/Organizations
		STF	LTF		
I	Ethiopia		1	Tanzania	University of Dar es Salaam
	Nigeria	2		Egypt	RCTWS
		2		Niger	AGRHYMET Regional Centre
	Senegal	2		Niger	AGRHYMET/NIGER
		2	Niger	AGRHYMET/NIGER	
II	Kazakhstan		2	India	
	Lao PDR	1		Costa Rica	
		3		China	
		1		Israel	
		1		Malaysia	
	Viet Nam	2		Sweden	SIDA
		1		Malaysia	IHP
		1		Netherlands	
			1	Japan	
		1	Belgium	VLIR	
III	Colombia		1	Russian Fed	Hydrometeorological Service
IV	St. Lucia		1	Barbados	Caribbean Institute for Meteorology and Hydrology
V	Philippines	2		Japan	JICA, Public Works Research Institute
VI	Poland	2		China	China Meteorological Administration

With regard to (b), (c) and (d), replies are as follows.

	<i>n/a</i>	<i>low</i>	<i>med.</i>	<i>high</i>
(b) Improvement in knowledge and skills of fellows	11	0	4	6
(c) Relevance of training to current work of your fellows	10	0	4	7
(d) Impact of fellows on promoting new applications, operations or services	10	0	4	5

Assuming those countries that chose “n/a” from the criteria given are those who were not awarded WMO fellowship during the survey period, of those countries having fellowship awards, 40% of replies indicated that the improvement in knowledge and skill of fellows is medium, 60% rated as high; 36% rated the relevance as medium and 64% as high; and 44% rated the impact of fellows on promoting new applications, operations or services as medium and 56% as high.

Some countries provided other comments regarding this issue as follows:

<b>Country</b>	<b>Comments</b>
Bhutan	Not a single staff was awarded WMO fellowship to pursue short term and long term study
Eritrea	We would like to have communication with WMO on this issue so as to develop a plan for capacity building and training for our personnel.
Ethiopia	The quality and range of the training should be improved and attention should be given for developing countries like Ethiopia
Indonesia	Need More Information about Training Activities.
Macedonia, TFYR	We need direct contact with responsible staff for WMO training activities.
Nigeria	The training has been of utmost benefits to both participants and the nation at large.

### **III.6 Are there any ways in which the present WMO training activities, services and materials could be improved or expanded?**

Some countries provided comments on how the present WMO activities, services and materials could be improved or expanded. Following is a list of comments that are common and grouped by region:

#### *Region I – Africa*

- Yes, WMO-RTCs can devise a mechanism to train more personnel by sending their staff to countries. This can solve the problem of insufficient manpower in terms of skill and knowledge in the hydrological services.
- Through collaboration with international institutions and countries the training can be improved and through need assessment and also post training assessment.
- Provide more training opportunities to develop staff competencies.
- Improve broadcasting and multiply the products in French.
- Yes. In the areas of course content, it can be structured to accommodate present issues facing various African countries.
- -Octroi de bourses de formation  
-Fournitures de séminaires sur CD  
-Fournitures d'experts dans les domaines ciblés
- The service did not receive any training.

#### *Region II – Asia*

- By providing trainings to right people and working under right institutions.
- Needs to improve the capacity in introduction to the CAL.
- Disseminate more hydrological information and news in community especially in schools and colleges.

#### *Region III – South America*

- Ensure that information is delivered in a more timely manner.

*Region IV – North America, Central America and the Caribbean*

- Award of fellowships, identification of training courses conduction and of regional seminars, provision of publications, books and reference materials.

*Region V – South-West Pacific*

- Facilitation of a structured online course for Hydrological Technicians. More involvement by WMO in the development of online CAL by groups such as COMET in the US.
- More training events for hydrologists.

*Region VI – Europe*

- Organization of local courses (in Russian) with support of WMO, also organization of distance learning, preparation of training material in Russian.



#### IV. FUTURE EDUCATION AND TRAINING REQUIREMENTS, OPPORTUNITIES AND CAPABILITIES IN HYDROLOGY

The aim of this section is to assess the national priorities for training and development, identify the national capability for providing external assistance for education and training activities, and suggest possible new requirements for specific WMO activities, services or materials that would be of value to NMHSs.

##### IV.1 What short-term professional development training in hydrology has the highest priority for your Service?

Following table shows the frequency of priority fields brought up by responding Members for future short-term professional development training in hydrology.

Table IV.1a - Priority fields sorted by total frequency

Fields of Specialization	Total	Region					
		I	II	III	IV	V	VI
Hydrological data process	19	8	3		3	2	3
General Hydrology	13	2	4	2	1	1	3
Water Resources Management	12	6	1	1	1	2	1
Flood forecasting	11	2	3		1	3	2
Operational Hydrology	11	5	2	2			2
Hydrological forecasting	10	2			2		6
Instrumentation	10	4	2		1	1	2
Hydrometry	6	2					4
Hydrological prediction modelling	6			2	1		3
Geographical Information system	6	2		1		1	2
River basin management	5	2			2		1
Modelling of hydrological processes	4	1					3
Hydrometeorology	3	1		1			1
Hydrological analysis	3	1	1				1
Hydrogeology	2	2					
Telecommunication	2		1			1	
Ground water hydrology	2				1		1
Hydraulics	2				1		1
HOMS	1		1				
Limnology and wetland ecosystems	1		1				
Glaciology	1		1				
Stochastic Hydrology	1						1
Management and Administration	1		1				
Drought Management	1					1	
Dangerous Hydrological Phenomena	1		1				
Application of Hydrological Products	1		1				
Hydroinformatics	1		1				

Table IV.1a reveals that Hydrological Data Process is regarded as the top priority subject among the nations over the world for the short-term development training requirement in hydrology and followed by the subjects General Hydrology meteorology, and Water Resources Management. For countries in Region VI (Europe), Hydrological Forecasting is one of the important subjects.

Table IV.1b shows that General Hydrology is regarded as the top priority subject followed by Operational Hydrology and Hydrological Data Process.

Table IV.1b - Priority fields sorted by number of potential candidates

Fields of Specialization	Total	Region					
		I	II	III	IV	V	VI
General Hydrology	61	5	38	4	2	5	7
Operational Hydrology	60	36	12	7			5
Hydrological data process	59	21	6		19	8	5
Geographical Information system	57	17		3		2	35
Flood forecasting	45	14	7		8	9	7
Water Resources Management	44	22	2	3	8	7	2
Hydrological prediction modelling	44			6	4		34
Hydrometry	44	25					19
Instrumentation	33	8	12		4	6	3
River basin management	28	8			15		5
Hydrological analysis	27	2	10				15
Hydrometeorology	27	15		4			8
Hydrological forecasting	26	3			5		18
Telecommunication	25		20			5	
HOMS	20		20				
Modelling of hydrological processes	14	5					9
Ground water hydrology	12				10		2
Management and Administration	10		10				
Application of Hydrological Products	10		10				
Dangerous Hydrological Phenomena	6		6				
Hydrogeology	5	5					
Stochastic Hydrology	5						5
Drought Management	5					5	
Hydraulics	4						4
Glaciology	3		3				
Hydroinformatics	2		2				
Limnology and wetland ecosystems	2		2				

The subjects listed in the table above can be grouped by representative fields, which result in the following chart showing the priority of each field.

The frequency of the teaching language requested in the training is shown as follows. It varies region by region, depending on the languages spoken in home or host countries.

	Global	I	II	III	IV	V	VI
English	82	26	19	2	8	12	15
French	14	14					
Russian	14		2	1			11
Spanish	7			1	5		1
English & French	4				1		3
English & Russian	10		3				7
Eng & Span & Port	5			5			

## IV.2 What are the expected future requirements for fellowship for your Service?

The following are self-explanatory tables for fellowship requirements in each Region where fields of specialization were taken as first and second priority. The figures in the brackets represent the frequency of choices for the fields. The subject without a figure is one that has been chosen only once.

A: Number of Hydrologists    B: Number of Hyd Technicians    C: Number of Candidates

Region	Fellowship		Foundation Training		Advanced-specialized Training	C
	Type	Period	A	B	Fields of Specialization and their frequencies	
RA I	STF (≤ 6 months)	2007	55	40	Operational hydrology (5), Geographical Information System (3), Data processing (2), Database management, Instrumentation (2), Hydrological modelling, Water resources management	35
		2008-2009	90	94	Operational hydrology (4), Data processing (2), Flood forecasting (2), Hydrological modelling (2), Water assessment (2), Water resources management (2)	34
	LTF (> 6 months)	2007	38	31	Operational hydrology (3), Flood forecasting (2), Hydrogeology, Hydrological modelling, Remote sensing, Sediment and water quality control	24
		2008-2009	37	16	Analytic hydrology, Data processing, GIS, Hydrological modelling, Hydrometric Network, Sedimentation, Water assessment, Water resources management	21
RA II	STF (≤ 6 months)	2007	25	30	Data processing, Hydrological modelling, Management and administration, Satellite meteorology	21
		2008-2009	40	30	Instrumentation, Flood forecasting, Hydrological modelling, Telecommunication	26
	LTF (> 6 months)	2007	22	23	Operational hydrology (2), HOMS, Hydrological modelling, Sediment engineering	19
		2008-2009	33	31	Computer, Hydrological modelling, Radar technology, Surface water hydrology, Telemetry	23
RA III	STF (≤ 6 months)	2007	5	4	Hydrological forecasting, Hydrological modelling	5
		2008-2009	6	6	Operational hydrology, Tropical hydrology	6
	LTF (> 6 months)	2007	4	7	Hydrology	2
		2008-2009	4	4	Hydrological modelling	2
RA IV	STF (≤ 6 months)	2007	3	5	Ground water, Hydrological forecasting	4
		2008-2009	32	3	Ground water, Hydrological modelling	3
	LTF (> 6 months)	2007	2	3	Sedimentation	2
		2008-2009	6	7	Ground water	1
RA V	STF (≤ 6 months)	2007	13	17	Operational hydrology (3), Drought forecasting, Flood forecasting, Hydrological modelling	8
		2008-2009	9	9	Operational hydrology (2), Data processing, GIS Applications	4
	LTF (> 6 months)	2007	7	8	Drought forecasting, Flood forecasting, Instrumentation, GIS Applications	4
		2008-2009	10	8	Hydrology, GIS Applications, Water Management	4
RA VI	STF (≤ 6 months)	2007	30	9	Flood Forecasting (5), Operational hydrology (2), Drought forecasting, Ground water, Hydrological modelling, Hydrometry, Water management	40
		2008-2009	49	14	Hydrological modelling (4), Flood forecasting (2), Hydrology (2), Frequency analyses, Ground water, Hydrometeorology, Water Assessment, Water management	49
	LTF (> 6 months)	2007	17	4	Data processing, Geographical Information System, Hydrometry	16
		2008-2009	18	5	Hydrology (2), Instrumentation	16

The following graph shows the expected future requirements for fellowships based on the responses made by Members to this survey. It reveals that there are large needs of short-term fellowships from RA I for years 2008 and 2009. At the same time, RA VI expressed the highest needs of short-term fellowships for advanced training compared to the others while also the training need for Hydrologists appears to be higher than for Hydrological Technicians in contrast with others.

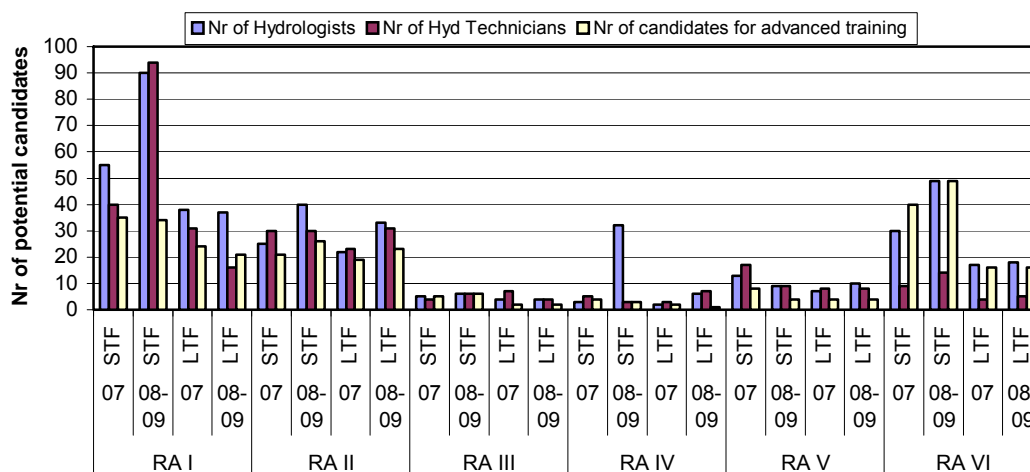


Figure IV.2 – Expected future requirements for fellowship

### IV.3 What is the national capability for providing external assistance for education and training in hydrology?

The following is self-explanatory table of national capabilities for providing external assistance for education and training in hydrology in a regional aspect. Each figure represents the frequency of occurrence of “Yes”. The item (c) Supporting WMO training events is frequently chosen globally, which means the readiness of Members to host WMO training events is fairly high.

	I	II	III	IV	V	VI	Total
(c) Offering education and training to foreign students:	3	1	0	2	2	8	<b>16</b>
(d) Assisting in the preparation of WMO training publications:	2	5	1	2	1	6	<b>17</b>
(d) Supporting WMO training events:	5	6	1	3	4	7	<b>26</b>
(e) Supplying training materials to the WMO Training Library:	1	3	1	1	1	5	<b>12</b>

### IV.4 Are there any comments you would like to make about your training requirements, opportunities and capabilities that have not been covered elsewhere?

Following are the comments provided by some Members on training requirements, opportunities and capabilities.

<b>Country</b>	<b>Comments</b>
Australia	Would be good to see practical examples of competency documentation of job skills for hydrometeorology and flood forecasting areas.
Bhutan	There is shortage of manpower both in terms of numbers, skills as well as knowledge under the Hydromet Services in the country. Currently there is not single qualified hydrologist who can carry out data analysis and other works related to hydrological services.
Canada	Water Survey of Canada needs to update much of its existing training materials and create new training materials in support of the introduction of new monitoring technologies and models to support data production applications.
Côte d'Ivoire	Training in GIS needed.
Eritrea	The hydrological service of Eritrea is grossly understaffed. Hence, it is required to develop the needed human resources, and this gap can be minimized by training ample number of technicians and experts.
Ethiopia	As much as possible training opportunities should be facilitated in different field of specialization.
Fiji	Fiji did not benefit from this training.
Gambia	As the hydrological division has suffered immensely from high attrition at all levels, funding of training at middle and senior technician levels as well as hydrologists is highly required to improve the currently low levels of staffing.
Georgia	It will be useful to organize the training of trainers in the various fields of hydrology.
Germany	The questionnaire was completed for the situation at the Federal Institute of Hydrology, Germany. Due to the Federal system in Germany, different training requirements exist in the 16 federal states.
Lao PDR	- Flood forecasting - Water Resource Management
Macedonia, TFYR	60% of Hydrologists in HMS have language problem.
Mali	Following are the needs to be considered more: Maintenance of the measuring equipments, Hydrological Database, Data processing
Senegal	-Besoins d'appui par la fournitures de séminaire sur CD -Besoins d'appui pour le recyclage des hydrologues concernant les nouvelles techniques de mesure en hydrométrie -Fourniture de matériel audiovisuel, de logiciels et d'équipements hydrologiques mode
St. Lucia	A new Water Management Agency is expected to assume the responsibility for Hydrological Services. The date for formation and activation of this Agency is not known.
Trinidad and Tobago	Two programmes have been developed to support the training of technicians and professionals, WMO support would be important in covering specialize modules and also enhancing the programmes.
Uganda	The training curriculum should be harmonized with the requirements of member nations.
Zambia	Training in quantifying economic benefits of using weather/climate data, and training in more rigorous methods/techniques of climate data analysis



## CONCLUSIONS

This document provides an updated assessment of training requirements, opportunities and capabilities of WMO Members. It ensures the availability of valuable information necessary for the world-wide planning and implementation of manpower development measures. As such, it can be considered as a contribution to a co-ordinated strategic approach to assist Members in their training for national manpower development in meteorology and hydrology and in the identification of training opportunities. To this effect the following remarks are worth to be noted:

### *For Part A: Meteorology*

- For more than 70% of responding Members, the first degree and the postgraduate diploma/master's degree in meteorology are taken as the usual qualification for job-entry-level Meteorologists. However, in the regional aspect, particularly RA II and RA V, Members show flexibility compared to other regions in recruiting job-entry-level meteorologists. Most often the duration required for the first and the postgraduate diploma/master's degree is 4-5 years and 1-2 years, respectively. It also reveals that foundation training carried out in NMHSs takes on average 1 year.
- The usual qualification for job-entry-level Meteorological Technicians varies country by country and region by region. As a whole, many Services usually organize meteorological training, possibly in partnership with other national institutions, to secure qualified job-entry-level Meteorological Technicians responsible for meteorological activities.
- Less than 50 % of the respondents had completed the transition to the new classification. It was foreseen that nearly 60 % of the responding Members would have been in compliance with the new classification by January 2007.
- Most of the respondents undertake periodic refresher training programmes and organize specialized training for Meteorologists and Meteorological Technicians. 49% implement other activities in support of continuing professional development such as stimulating employees for self-study, promoting the lifelong learning culture, etc. It was revealed that most of the responding Services to this question provide yearly training with their meteorological staff.
- 75% of the responding Members use Information and Communication Technology (ICT) in continuing education and training activities.
- Low visibility of Meteorology at the national level is the main constraint and weakness in executing the meteorological education and training in the country, which is still the same situation as shown in the last survey carried out in 2002. Another main obstacle that Members are facing in performing the education and training is the lack of expertise and staff development programmes for instructors, which is also similar to the result of the previous survey.
- The number of meteorological staff tends to decrease and the ratio of Meteorological Technicians against Meteorologists is also declining. Meanwhile comparatively low staffing in OECD group could be related to the utilization of new technologies and automation of the services particularly the observing system. It could be explained that in many OECD countries, private sector takes some portion of public weather services that has been traditionally undertaken by NMHSs.

- Requirement of expertise for new tasks and services is still the most important factor and has the highest priority in the process of HRD. The increased recruitment and the introduction of new equipment are of the second and third priorities, respectively. Lack of expertise in meteorology and/or management falls in the fourth priority order while lowest priority was for the re-deployment of staff to other jobs.
- It is foreseen from the trend in the use of types of tools in the training activities by NMHSs that CAL methods would be the most highly used tools in the future. The portion of CAL among the training tools is increasing in contrast with others.
- Region I was awarded 38% of all short-term fellowships and 63% of all long-term fellowships. In the other Regions, particularly in RA III and RA VI, most awarded fellowships were short-term.
- Numerical Weather Prediction (NWP) is regarded as the top priority subject among the nations over the world for the short-term development training requirement in meteorology, followed by the subjects satellite meteorology and weather forecasting. For countries in Region VI (Europe), urban meteorology and air pollution is one of the most important subjects, believed to be related to urbanization and industrialization.
- There are strong needs for both short-term and long-term fellowships for RA I, and the need for Meteorological Technicians appears to be higher than for Meteorologists. At the same time, RA VI indicates the highest needs of short-term fellowships in advanced training compared to the others.

*For Part B: Hydrology*

- In about 70% of responding Members, the first degree and the postgraduate diploma/master's degree in hydrology are taken as the usual qualification for job-entry-level hydrologists. The duration required for the first and the postgraduate diploma/master's degree is 4-5 years and 2 years, respectively. Foundation training carried out in NMHSs takes on average 1 year.
- Many Services usually organize hydrological training, possibly in partnership with other national institutions, to secure qualified job-entry-level Hydrological Technicians responsible for hydrological activities.
- It was foreseen that approximately 35% of the responding Members would have been in compliance with the new classification by January 2007. In this context, it was confirmed that it was still far away to realize the satisfactory level of implementing the new classification of personnel in hydrological services.
- 62% of responding Members undertake periodic refresher training for Hydrologists, 69% run periodic refresher training programmes for Hydrological Technicians, 79% organize specialized training for Hydrologists and 82% for Hydrological Technicians, as required. Also, 71% implement other activities in support of continuing professional development such as stimulating employees for self-study, promoting the lifelong learning culture, etc. Most of the Services provide yearly training for their hydrological staff.



- As the case of meteorology, low visibility of hydrology at national level and insufficient hydrological and/or teaching expertise are the main constraints and weakness in performing the meteorological education and training in the country, which is still the same situation as shown in the previous Survey 2002. These two factors seem to have a significant negative impact on the development of NMHSs.
- The hydrological staffing varies depending on the economic status of respective countries. The particular attention is drawn to OECD group showing the lowest staffing among the groups, which could be related to the utilization of new technologies and the automation of the services particularly the observing system. The latter explanation is supported by higher proportion of hydrologists to hydrological technicians, which is showing opposite tendency to the other groups.
- Requirement of expertise for new tasks and services is still the most important factor and has the highest priority in the process of HRD. The increased recruitment and the introduction of new equipment are of the second priority at the same time. Lack of expertise in hydrology and/or management falls in the fourth priority order while lowest priority was for the re-deployment of staff to other jobs.
- Countries and international organizations/institutions, through bilateral relations, are the main supporters for training other than WMO. The private sector cannot be considered as a major contributor/supporter.
- It is foreseen from the trend in the use of types of tools in the training activities by NMHSs that CAL methods will be the most highly used tools in the future. The portion of CAL among the training tools is increasing in contrast with others.
- Hydrological data process is regarded as the top priority subject among the nations over the world for the short-term development training requirement in hydrology and followed by the subjects General Hydrology meteorology and Water Resources Management. For countries in Region VI (Europe), Hydrological forecasting is one of the most important subjects.
- There are strong needs of short-term fellowships for RA I for years 2008 and 2009. At the same time, RA VI expressed the highest needs of short-term fellowships for advanced training compared to the others and also the training need for Hydrologists appears to be higher than for Hydrological Technicians in contrast with others.



## **PART C**



## PART C

### I. EDUCATION AND TRAINING OF AERONAUTICAL METEOROLOGICAL PERSONNEL

#### I.1 What is the minimum qualification for personnel who are to be trained as aeronautical forecasters?

	Certificate/Diploma	BSc in Meteorology	Batchelor or higher degree in appropriate scientific subject	Other approach
Forecasters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Each figure represents the frequency of choice made by respondents.

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
➤ Certificate/Diploma	10	5	2	5	1	9	32
➤ BSc in Meteorology	2	1	1	0	1	5	10
➤ Bachelor or higher degree	6	4	0	0	4	8	22
➤ Other approach	2	3	1	1	1	2	10

The statistics reveal that most respondents chose "Certificate/Diploma" as the minimum qualification for personnel who are to be trained as aeronautical forecasters, followed by Bachelor or higher degree, except for RA III and RA IV where Certificate/Diploma seems to be enough to meet the minimum condition for aeronautical forecasters rather than the others.

Following are other approaches given by some respondents:

#### Country Other approach

*Bhutan* Senior observers and senior officers with minimum 10 years of experience in Aeronautical Meteorology.

*Canada* Graduation with a degree from a recognized university with acceptable specialization in meteorology; **OR** in mathematics or physics *WITH* a diploma or certificate in Meteorology; **OR** graduation with a degree from a recognized university in other field of Sciences *WITH* an acceptable number of courses in meteorology and related subject.

*Cyprus* First degree in Meteorology / Physics / Mathematics / Natural Sciences.

*Egypt* BSc in Math or Physics.

*Macedonia, TFYR* The candidate must have BSc in Meteorology, and must complete one year of training in Aeronautical Met., then pass the examination in order to obtain license for work.

*New Zealand* Postgraduate Diploma for holders of a degree in a scientific subject (Physics, Mathematics).

<b>Country</b>	<b>Other approach</b>
<i>Republic of Korea</i>	In general, it requires the first degree in meteorology. However KMA employs meteorologists from various fields. Anyone who passed the exams can be employed as a regular KMA staff member for meteorological duty and be qualified as a trainee to become as a meteorologist. Most job-entry-level Meteorologists are employed through open competitive recruitment examinations, which require no academic limitation to take the exams. Currently, the subjects of the exams include general meteorology, meteorological analysis and forecast, Korean and English. In addition, non-competitive recruitment examinations are administered as a supplementary method when competitive recruitment examinations cannot fulfil recruitment of necessary talents. Most new employees are BSc or MSc holders in meteorology and related sciences. They are trained for one month to start their work.
<i>Republic of Yemen</i>	Anyone of the above qualifications + basic observing course (Met Cl. IV) + Met Cl. II
<i>Senegal</i>	Baccalauréat série scientifique ou Licence.
<i>Uzbekistan</i>	Hydromet college.

## I.2 What is the minimum entry level qualification for personnel who are to be trained as Aeronautical observers

	Lower than secondary school level	Certificate/Diploma	Vocational training in Met. at secondary or post-secondary level	Other approach
Observers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Each figure represents the frequency of choice made by respondents.

	RA I	RA II	RA III	RA IV	RA V	RA VI	Total
➤ Lower than secondary school level	1	1	0	0	0	1	3
➤ Certificate/Diploma	9	8	3	5	4	4	33
➤ Vocation training	6	2	0	1	1	13	23
➤ Other approach	4	2	1	0	1	5	13

This statistics shows that in most countries “Certificate/Diploma” and “Vocational Training” are the minimum entry qualification for personnel who are to be trained as aeronautical observers, followed by only “Vocational Training”. In particular, RA VI Members tend to take the vocational training as the minimum condition for aeronautical observers among others.

Following are other approaches given by some respondents.

<b>Country</b>	<b>Other approach</b>
<i>Antigua and Barbuda</i>	Five Caribbean Examinations Council (CXC) passes including Mathematics, English, Physics or (Integrated science or 'A' level Geography).
<i>Brunei</i>	Upper secondary level with at least 4 credits (ordinary level) (one of which

<b>Country</b>	<b>Other approach</b>
<i>Darussalam</i>	must be a science subject) - Brunei Cambridge.
<i>Cyprus</i>	Diploma of Higher Technical Institute or of Equivalent Institution in Electrical Engineering / Computer Science / Mechanical Engineering or Leaving Certificate of Secondary School (Science) or Leaving Certificate of Technical School in relevant subjects.
<i>Egypt</i>	Secondary school (Math. or Physics) or technical institute for 2 years after secondary school.
<i>Gambia</i>	After finishing high (secondary) school professional training is provided to new staff.
<i>Guyana</i>	Passes in CSEC Exams - Must pass mathematics, English and science subject.
<i>Hong Kong, China</i>	Experienced observer with meteorological training.
<i>Ireland</i>	Secondary school level with honours in mathematics.
<i>Republic of Korea</i>	KMA selects Meteorological Technicians by examining their applications and interviewing them. In most cases, no meteorological background is required. Without any training they start their work. They are trained on the job by their mentors. Most job-entry-level Meteorological Technicians are university graduates.
<i>New Zealand</i>	Observations performed by Air Traffic Controllers.
<i>Philippines</i>	Two years college education in engineering and related science.
<i>Senegal</i>	Diplome de fin d'Etudes du Premier Cycle (DFEM).
<i>Sweden</i>	At least secondary school level.
<i>United Kingdom</i>	Most aeronautical observing carried out by private contractor; entry level secondary school qualification. NMS does not recruit observers, duties carried out by forecasters.
<i>Uzbekistan</i>	Preparation on workplace.
<i>Zimbabwe</i>	Minimum of 5 'O' level passes including Maths and a physical science subject.

### **I.3 What is the duration of basic training?**

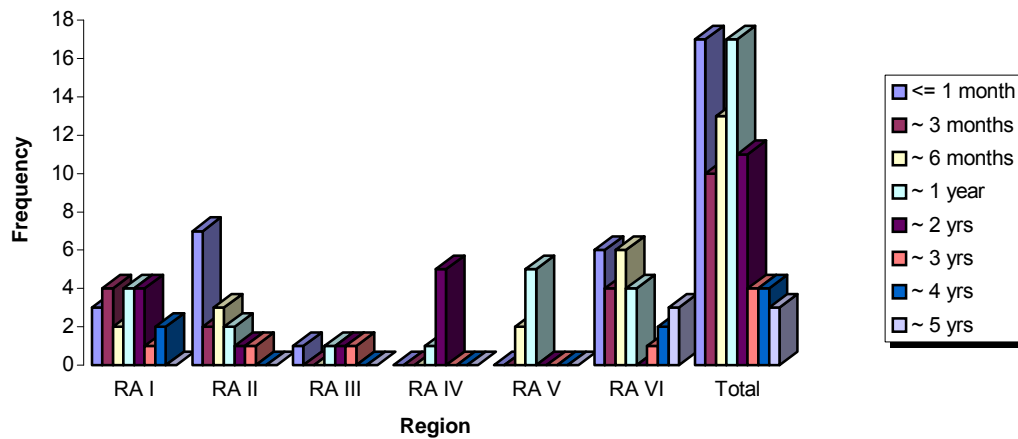
	Theoretical training	'On-the-job' training	Is the 'On-the-job' training assessed
Forecasters	( weeks/months)	( weeks/months)	(Yes / No)
Observers	( weeks/months)	( weeks/months)	(Yes / No)

The statistics on the duration of basic training provided by Members is summarized as follows:

(a) For forecasters

➤ *Theoretical training*

Duration	Total	Frequency					
		RA I	RA II	RA III	RA IV	RA V	RA VI
≤ 1 month	17	3	7	1	0	0	6
1 mn - 3 mns	10	4	2	0	0	0	4
3 - 6 mns	13	2	3	0	0	2	6
6 - 12 mns	17	4	2	1	1	5	4
1 yr - 2 yrs	11	4	1	1	5	0	0
2 - 3 yrs	4	1	1	1	0	0	1
3 - 4 yrs	4	2	0	0	0	0	2
4 - 5 yrs	3	0	0	0	0	0	3

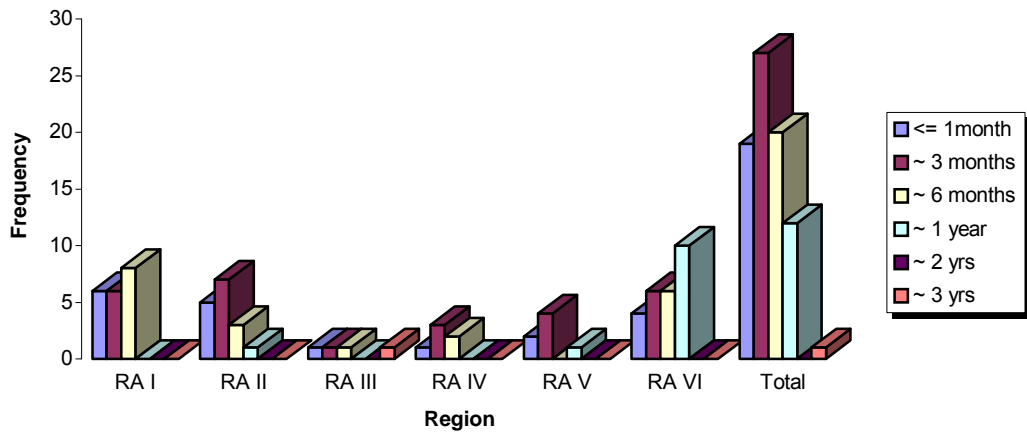


The above result shows that the duration of the theoretical training for aeronautical forecasters varies region by region. Most countries in Region II take one month or less; RA V takes 6 to 12 months for the theoretical training, while RA IV takes one to two years. Countries within the other regions don't show noticeable trends.

➤ *'On-the-job' training*

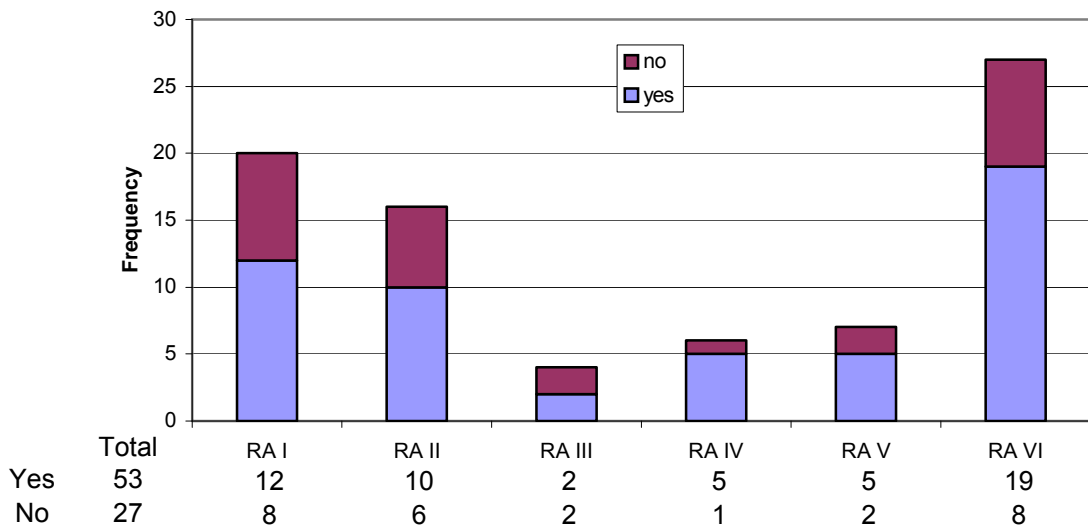
Duration	Total	Frequency					
		RA I	RA II	RA III	RA IV	RA V	RA VI
≤ 1 month	19	6	5	1	1	2	4
1 mn - 3 mns	27	6	7	1	3	4	6
3 - 6 mns	20	8	3	1	2	0	6
6 - 12 mns	12	0	1	0	0	1	10
1 yr - 2 yrs	0	0	0	0	0	0	0
2 - 3 yrs	1	0	0	1	0	0	0





As expected, the duration of the On-the-Job training for aeronautical forecasters is primarily less than 6 months, except for RA VI whose most frequent choice falls on 6 to 12 months. The most frequent duration taken is one month to 3 months.

➤ *Assessment of 'On-the-job' training*

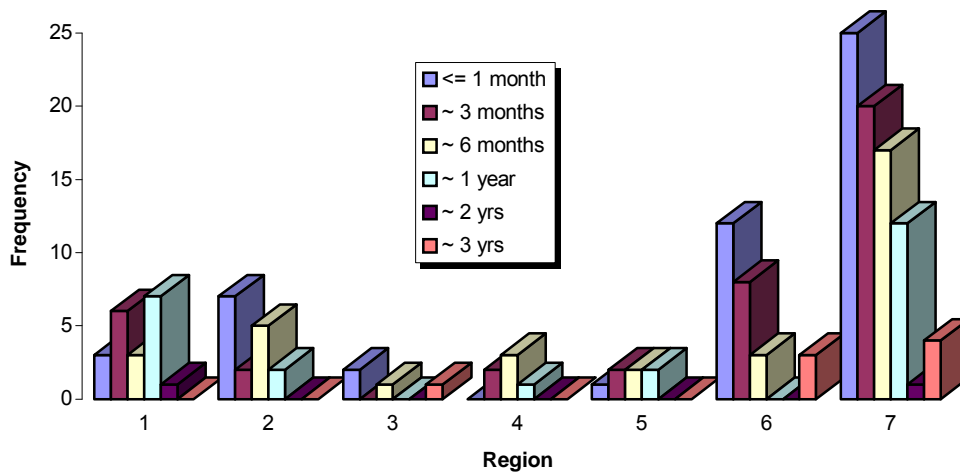


As seen from the above, 66% of the respondents answered that they assessed the on-the-job training for aeronautical forecasters.

(b) For observers

➤ *Theoretical training*

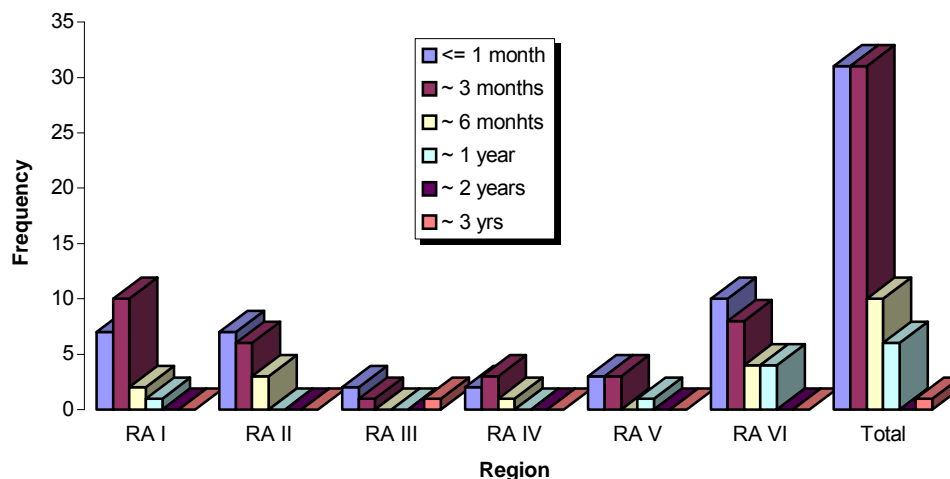
Duration	Total	Frequency					
		RA I	RA II	RA III	RA IV	RA V	RA VI
≤ 1month	25	3	7	2	0	1	12
1 mn - 3 mns	20	6	2	0	2	2	8
3 - 6 mns	17	3	5	1	3	2	3
6 - 12 mns	12	7	2	0	1	2	0
1 yr - 2 yrs	1	1	0	0	0	0	0
2 - 3 yrs	4	0	0	1	0	0	3



The above result shows that the duration of the theoretical training for aeronautical observers varies region by region, although the most chosen duration is “one month or less” and followed by “one to three months”. Most countries in Region II and Region VI tend to spend “one month or less” for the theoretical training, while the other regions don’t show noticeable trends.

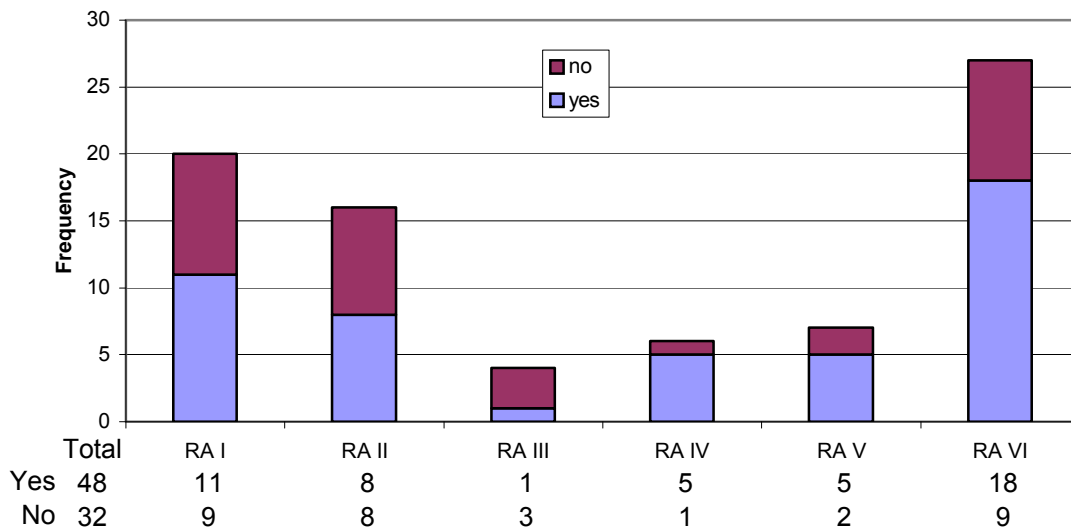
➤ ‘On-the-job’ training

Duration	Total	Frequency					
		RA I	RA II	RA III	RA IV	RA V	RA VI
≤ 1month	31	7	7	2	2	3	10
1 mn - 3 mns	31	9	6	1	3	3	8
3 - 6 mns	10	2	3	0	1	0	4
6 - 12 mns	6	1	0	0	0	1	4
1 yr - 2 yrs	0	0	0	0	0	0	0
2 - 3 yrs	1	0	0	1	0	0	0



The above result shows that the OJT training for aeronautical observers tends to be taken “one month or less” or “one month to three months”, which is less than that for aeronautical forecaster.

➤ Assessment of 'On-the-job' training



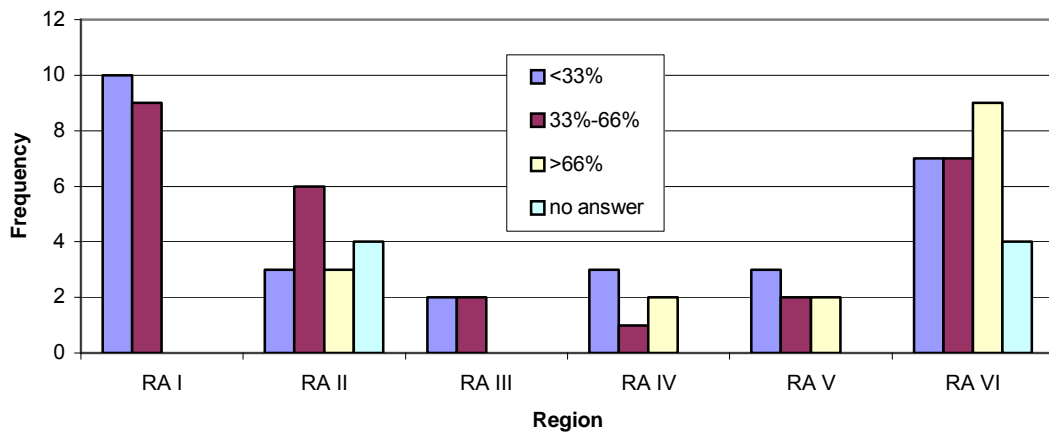
As seen from the above, most respondents answered that they assessed the OJT training for aeronautical forecasters except RA III countries, which dominantly gave negative answers.

**I.4 After personnel have taken up operational appointments, do your personnel participate in a Continuous Professional Development (CPD) programme?**

Following are the statistics based on responses to this question:

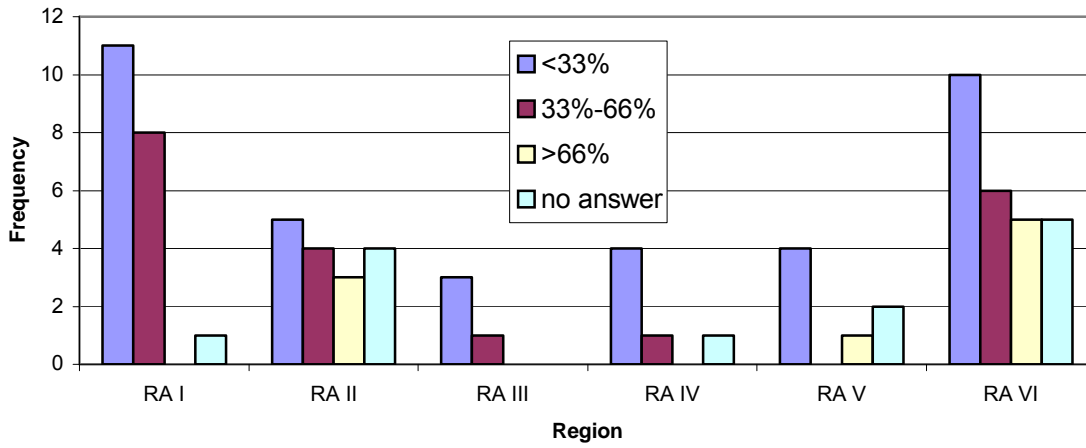
< For forecasters >

	Total	Frequency					
		RA I	RA II	RA III	RA IV	RA V	RA VI
<33%	28	10	3	2	3	3	7
33%-66%	27	9	6	2	1	2	7
>66%	16	0	3	0	2	2	9
no answer	8	0	4	0	0	0	4



< For observers >

	Total	Frequency					
		RA I	RA II	RA III	RA IV	RA V	RA VI
<33%	29	11	5	3	4	4	10
33%-66%	27	8	4	1	1	0	6
>66%	16	0	3	0	0	1	5
no answer	9	1	4	0	1	2	5



## II. PUBLIC EDUCATION AND OUTREACH

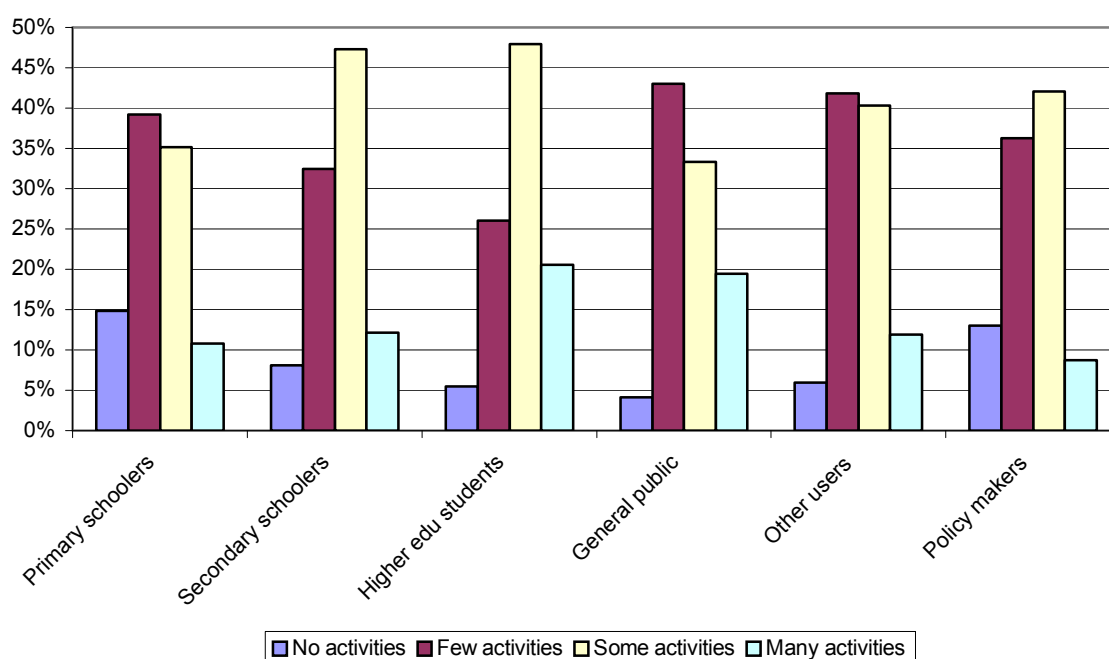
Part of the strategy of WMO is to encourage and facilitate the production, distribution and use of public education material in cooperation with others as appropriate. This section deals with the extent to which NMHSs have public education and outreach.

### II.1 For the various groups of people, what is the extent of the public education and outreach programmes?

The following table and graph show the global status for public education and outreach programmes. Each figure outside brackets represents the number of hits made by respondents.

#### ➤ Global status

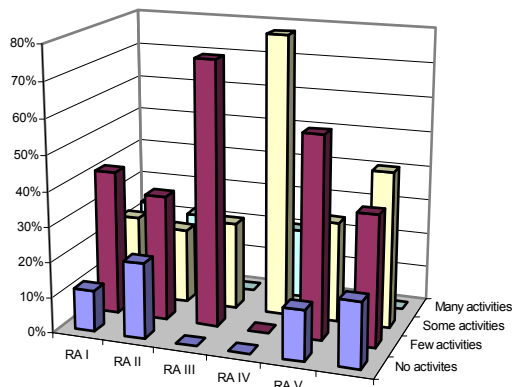
	No activities or materials	Few activities or materials	Some activities or materials but could be more	Many activities or materials
Primary school children	11 (15%)	29 (39%)	26 (35%)	8 (11%)
Secondary school children	6 (08%)	24 (32%)	35 (47%)	9 (12%)
Higher education students	4 (05%)	19 (26%)	35 (48%)	15 (21%)
General public	3 (04%)	31 (43%)	24 (33%)	14 (19%)
Users other than general public	4 (06%)	28 (42%)	27 (40%)	8 (12%)
Policy and decision makers	9 (13%)	25 (36%)	29 (42%)	6 (09%)



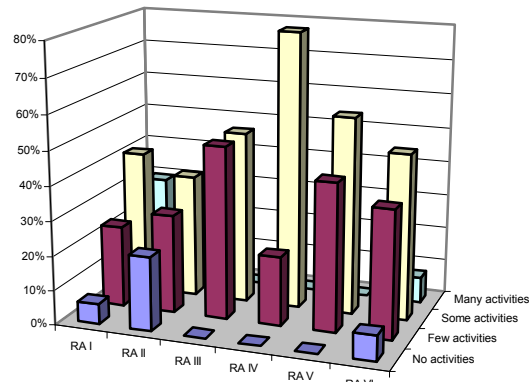
From above result, it is analyzed as follows:

- More than 70% of countries have limited to some activities for the public education and outreach programmes
- The extent of the public education delivered to higher education students is the highest among the target groups, followed by general public, according to the weight analysis for each target group based on the responses to this question. The lowest shown in this analysis is the one for policy and decision makers.

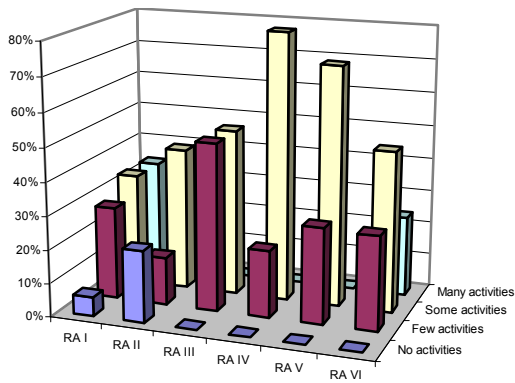
The following graphs show the regional status on the extent of the public education and outreach programmes targeting to:



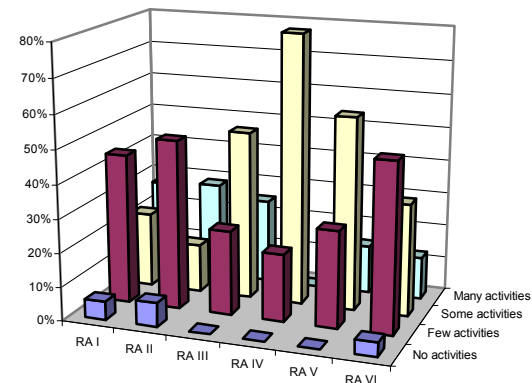
Primary school children



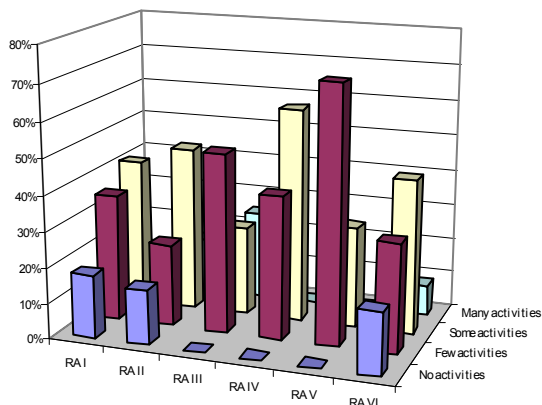
Primary school children



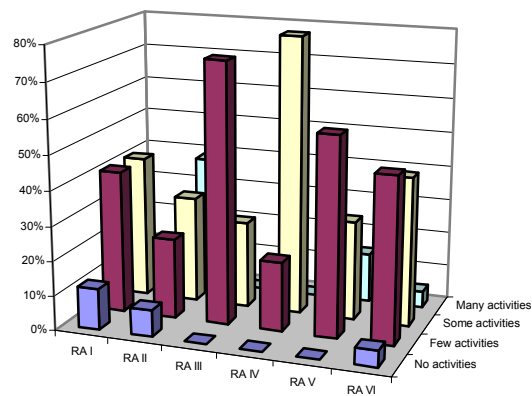
Higher education students



General Public



Other users

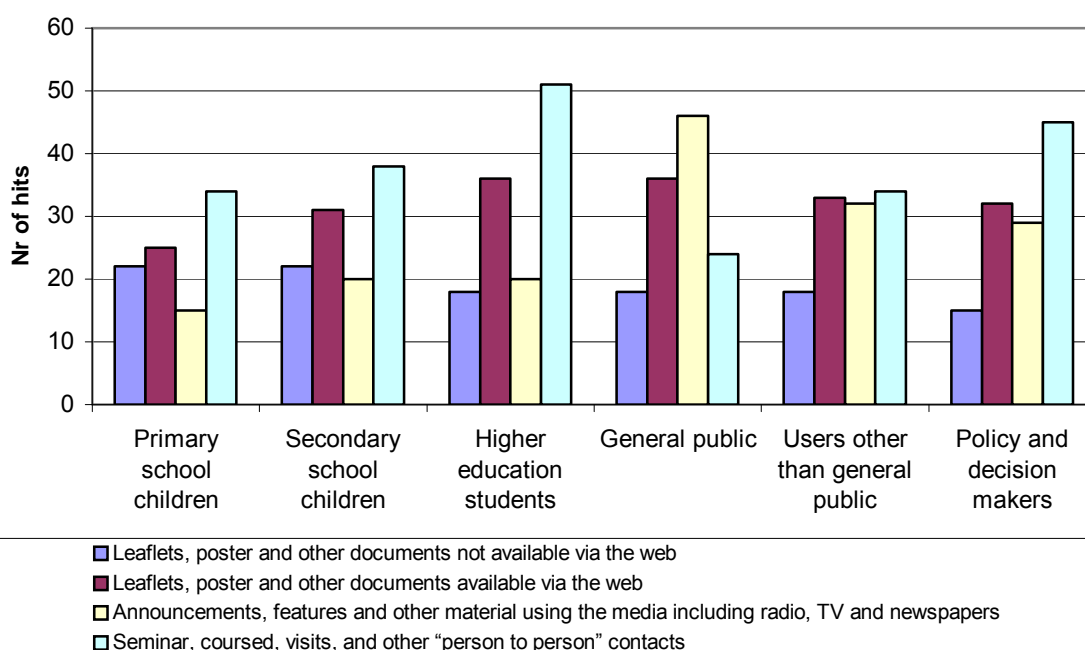


Policy makers

## II.2 What types of materials and approaches are used for the public education and outreach programmes?

The following table and graph show the global status for the types of materials and approaches used for the public education and outreach programmes for respective target groups. Each figure represents the number of hits made by respondents.

	Leaflets, poster and other documents not available via the web	Leaflets, poster and other documents available via the web	Announcements, features and other material using the media including radio, television and newspapers	Seminar, courses, visits, and other "person to person" contacts
Primary school children	22	25	15	34
Secondary school children	22	31	20	38
Higher education students	18	36	20	51
General public	18	36	46	24
Users other than general public	18	33	32	34
Policy and decision makers	15	32	29	45



From the above result, it is revealed that *seminars, courses, visits, and other "person to person" contacts* are the most-used types of materials and approaches used for the public education and outreach programmes, while for the general public *announcements, features and other material using the media including radio, television and newspapers* are generally used.

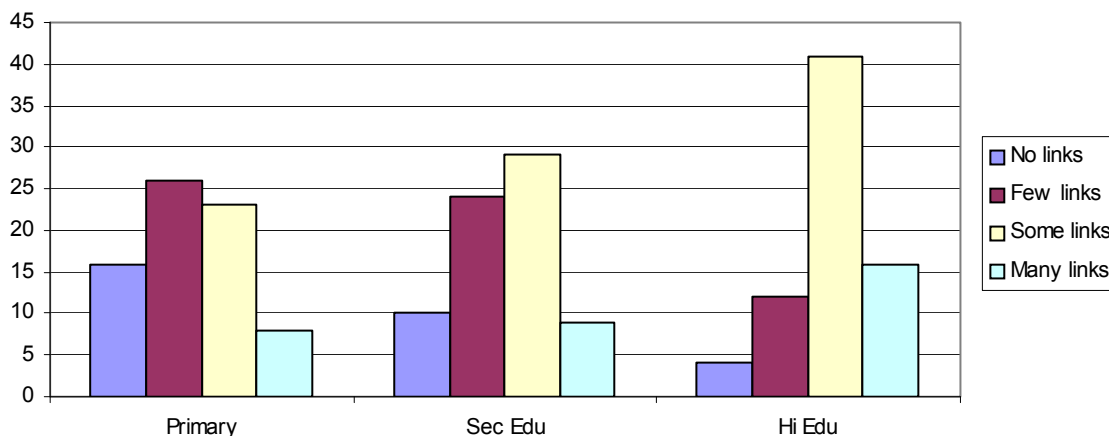
Follow are the other material and approaches specified by some respondents:

- Publications in newspapers.
- For policy and decision makers, invitations for NMS personnel to explain issues like seasonal forecasts are commonly employed.
- Organize "Weather Diary Activity", Rain-gauge Design Competition, and in 2006 a year-long Science in the Public Service Campaign.
- We generally encourage some site visits to our Public relations area or actual observing sites. Current the PR area is restricted due to building move some years ago. Public viewing area still to open.
- Visits, videoconferencing tools.

### II.3 How would you describe the level of collaboration and coordination with your National Education Service?

The following table and graph show the global status for the level of collaboration and coordination with National Education Services. Each figure represents the number of hits on the relevant options made by respondents.

	No links	Few links	Some links	Many links
Primary education	16	26	23	8
Secondary education	10	24	29	9
Higher education	4	12	41	16



From the above statistics, it is revealed that the higher level of education, the more collaboration and coordination with national education services.

The following table shows the regional statuses.

	No links	Few links	Some links	Many links
<b>RA I</b>				
Primary education	5	3	4	4
Secondary education	3	3	6	4
Higher education	1	1	10	5



	No links	Few links	Some links	Many links
<b>RA II</b>				
Primary education	5	4	6	1
Secondary education	4	4	5	2
Higher education	3	2	7	4

<b>RA III</b>				
Primary education	0	2	2	0
Secondary education	0	1	3	0
Higher education	0	1	3	0

<b>RA IV</b>				
Primary education	0	2	2	2
Secondary education	0	3	2	1
Higher education	0	2	4	0

<b>RA V</b>				
Primary education	1	5	1	0
Secondary education	1	4	2	0
Higher education	0	2	5	0

<b>RA VI</b>				
Primary education	5	10	8	1
Secondary education	2	9	11	2
Higher education	0	4	12	7

Follow are the other comments on the level of collaboration and coordination with National Education Services given by some respondents:

- Only existing link with education service is through climate change activities under UNFCCC
- Lors des événements comme la journée météorologie mondiale, ces relations sont mises en évidence.
- Department regularly participates in schools career guidance days and hosts education tours all year.
- Aeronautical Meteorology Division of LHMS collaborates with Vilnius Gediminas Technical University and Vilnius University.
- Funding for our education activities is provided by UK Department for education and skills.

#### II.4 For a recent public education and outreach campaigns, ...

Following are the answers given by respondents to respective questions:

Which was considered to be successful?

##### *Region I – Africa*

- **Eritrea:** Rainfall forecast
- **Ethiopia:** Media including radio and television and leaflet
- **Kenya:** World Meteorological Day and World Water Day
- **Malawi:** Outreach campaign during 1999 to 2002 in Malawi schools and colleges

- **Mali:** Meteorological camp for school children
- **Mauritius:** Multi-hazard related campaign application of climate information in agro industries
- **Mozambique:** ABC of Meteorology publish every week in a newspaper
- **Senegal:** dans l'engouement affiché par les élèves, étudiants et particuliers
- **Zambia:** Weather Information for Agricultural Applications using Drama
- **Zimbabwe:** Dissemination of 2006/07 climate outlook

### *Region II – Asia*

- **Bangladesh:** Meteorology should be included in the syllabus at all levels (seems to be comment)
- **Hong Kong, China:** The "Weather Diary" activity attracted around 1500 students who made weather observations every day for a month in 2005
- **Japan:** Water Fairs
- **Republic of Korea:** Weather Camp
- **Lao PDR:** Opening ceremony of a radar system on March 2006
- **Macao, China:** Visits and Seminars
- **Yemen:** Primary schools site visits.

### *Region III – South America*

- **Guyana:** Going to High Schools

### *Region IV – North America, Central America and the Caribbean*

- **Canada:** To have a meteorologist, i.e. a weather expert that went in a community strongly affected by stormy weather.
- **St. Lucia:** Delivery of lectures and presentations at schools.

### *Region V – South-West Pacific*

- **Australia:** Pre tropical cyclone (TC) season preparation: Each year the Bureau, in partnership with the State Emergency Services and Local Government, visits areas affected by TCs to raise awareness of how to react to TCs should they occur in the area
- **Brunei:** Exhibition in conjunction with a university's Science Week.
- **Malaysia:** Exhibition
- **New Zealand:** Attendance at a national farming expo.
- **Singapore:** World Meteorological Day Exhibition and Forum

### *Region VI – Europe*

- **Denmark:** Participation in the "Day of Science" and "Night of Culture" organized by the Ministry of Science, the new column at our website, which is organized by DMI.
- **Hungary:** Night of Museums
- **Latvia:** Training courses for teachers
- **Lebanon:** Higher education
- **Lithuania:** The conference "Meteorology and hydrology in Lithuania: development and perspectives" was held at Vilnius University on 23 March 2005
- **Macedonia, TFYR:** Open visit day to Met Service
- **Malta:** We have never made a campaign due to lack of resources. However, during the scholastic year we encourage school visits to the Meteorological office
- **Moldova Rep:** The educational seminars, the materials distributed through mass media
- **Monaco:** Discovery of karstic caves which are sources of drinkable water
- **Poland:** Local flood monitoring and warning system
- **Turkey:** Seminar, course and visit to primary and secondary schools
- **UK:** Art Competition

Who was the campaign aimed at?

*Region I – Africa*

- **Eritrea:** Farmers and extension workers
- **Ethiopia:** to create awareness about the meteorology and weather forecast
- **Kenya:** Awareness and visibility
- **Malawi:** Students and their teachers
- **Mali:** Students to enhance their interests in meteorological activities
- **Mauritius:** public, vegetable growers, fishermen
- **Mozambique:** General public
- **Senegal:** aux étudiants, élèves et grand public
- **South Africa:** Secondary school students
- **Zambia:** Farming community in the southern province
- **Zimbabwe:** Extension workers /government

*Region II – Asia*

- **Bangladesh:** Ministry of Education (seems to be comment)
- **Hong Kong, China:** Secondary school students
- **Japan:** Elementary and junior high school students
- **Republic of Korea:** Elementary school students
- **Lao PDR:** General public and specific users
- **Macao, China:** Students and general public
- **Viet Nam:** General public
- **Republic of Yemen:** Improve understanding of meteorology.

*Region III – South America*

- **Guyana:** High School Students

*Region IV – North America, Central America and the Caribbean*

- **Canada:** To meet with local organizations and explain to them how weather works and how to access weather info to better prepare against bad weather.
- **St. Lucia:** Primary and Secondary school students.
- **Trinidad and Tobago:** The media and the general public

*Region V – South-West Pacific*

- **Australia:** Local communities, Emergency managers and industry groups
- **Brunei:** Secondary/upper levels as well as general public
- **Malaysia:** school children
- **New Zealand:** Farmers, general public
- **Singapore:** General Public and students

*Region VI – Europe*

- **Belarus:** Information and education
- **Denmark:** General public
- **Hungary:** Popularization of Meteorology
- **Latvia:** Secondary/primary school teachers
- **Lebanon:** Presenting the met services
- **Lithuania:** To present Lithuanian Hydrometeorological Service's priority tasks for general public
- **Macedonia, TFYR:** Met students from Universities

- **Republic of Moldova:** Public awareness
- **Monaco:** Secondary school students
- **Poland:** Local community
- **Turkey:** For primary, secondary and high schools
- **UK:** School children

*What were the main elements of the campaign?*

*Region I – Africa*

- **Eritrea:** forecast announcement
- **Ethiopia:** concept of meteorology, weather forecast and others
- **Kenya:** Benefits of Meteorological Products
- **Malawi:** Uses of meteorological information terms used in weather and climate forecasts; meteorological equipment and instruments
- **Mali:** Observation, equipment, forecasting, services to users
- **Mauritius:** safety of life and property. Strengthen food security
- **Mozambique:** Teach the audience to understand better what is meteorology and its role in socio-economic development
- **Senegal:** nos différents produits et en particulier notre système d'alerte précoce(SAP)
- **South Africa:** Workshops / Display
- **Zambia:** Sketches and Plays Depicting the importance of using weather information
- **Zimbabwe:** Education and Information

*Region II – Asia*

- **Bangladesh:** Administrative
- **Hong Kong, China:** To learn basic meteorology
- **Japan:** Spread of knowledge on weather services
- **Korea Rep:** Introduction of the basic procedure of weather forecasting and meteorological observation
- **Lao PDR:** Launch of radar and specific weather monitoring system
- **Macao, China:** Basic knowledge and disaster prevention and preparedness
- **Viet Nam:** Raise the public awareness for disaster reduction and improving the quality of weather forecasts and warnings
- **Republic of Yemen:** Air temperature, R.H., Sun Radiation, Wind speed & direction, Rainfall.

*Region III – South America*

- **Guyana:** Educating children about the importance of weather and climate

*Region IV – North America, Central America and the Caribbean*

- **St. Lucia:** Powerpoint and Video presentations.
- **Trinidad and Tobago:** To inform on meteorological terms and definitions used in the public forecast

*Region V – South-West Pacific*

- **Australia:** Face to face meetings, talks to groups and interviews with the media
- **Brunei:** Science of Meteorology, Instrumentation and public weather service delivery and career opportunity in meteorology
- **Malaysia:** Multi-hazards
- **New Zealand:** Promoting new services, especially web-based services
- **Singapore:** Exhibition on the WMD, forum involving invited speakers

### *Region VI – Europe*

- **Belarus:** Visits and information materials, meetings and publications through mass media
- **Denmark:** Visits to the service and presentations. Our website.
- **Latvia:** Meteorological, hydrological observations, principles of forecasting, natural disasters
- **Lebanon:** forecasting
- **Lithuania:** Various posters and presentations
- **Macedonia, TFYR:** Availability of job shadowing
- **Republic of Moldova:** Lectures, articles, interviews, press conferences
- **Monaco:** Visit to Caves - to project inside the caves focusing on hydrology in Monaco
- **Poland:** Leaflet, meetings, competition for schools
- **Turkey:** Introduction of meteorology with books, brochures, cd, and slide
- **UK:** Children sent in their weather related picture

### *What collaboration occurred at a governmental level?*

### *Region I – Africa*

- **Eritrea:** Cooperation through the media
- **Ethiopia:** Facilitate means of communication
- **Kenya:** Good
- **Malawi:** World Bank through government provided the funding
- **Mali:** Ministries of Education, Communication, Rural Development in the form of a sensibilization, broadcasting and assistance to the rural world
- **Mauritius:** Financial and logistic
- **Mozambique:** The disaster management institute supported the initiative
- **Senegal :** oui, dans la mesure ou nous avons un ministre de tutelle
- **South Africa:** Only information sharing
- **Zambia:** Programme undertaken in collaboration with agricultural extension officers
- **Zimbabwe:** Translation of message into farmer advisories

### *Region II – Asia*

- **Bangladesh:** To make liaison with the concerned Ministry (seems to be comment)
- **Hong Kong, China:** The activity was organized by the Hong Kong Observatory, which is government department.
- **Republic of Korea:** KMA provides teachers with various trainings in cooperation with the Ministry of Education and Human Resources Development.
- **Lao PDR:** High level between government of Lao PDR and Japan
- **Macao, China:** Seminars in preparation of the yearly typhoon season
- **Yemen:** NORAW, Environment Protection Authority, Ministry of Electricity.

### *Region III – South America*

- **Guyana:** Funding

### *Region IV – North America, Central America and the Caribbean*

- **St. Lucia:** Inter-ministerial.
- **Trinidad and Tobago:** This was organized in conjunction with the ministry of Public Utilities and the Environment

### *Region V – South-West Pacific*

- **Australia:** Ongoing collaboration with Emergency services and local government as there are shared outcomes between the groups
- **Brunei:** Rapport relationship with higher institution of learning (Data sharing and analysis).
- **Malaysia:** Exhibition program
- **Singapore:** Collaborated with the National Library Board (venue) and civil defence authority (speaker for forum)

### *Region VI – Europe*

- **Belarus:** Meetings, discussions, information to making decisions
- **Macedonia, TFYR:** Our representatives deliver lectures on meteorology at the National University
- **Republic of Moldova:** The organization and financial support of activities' realization
- **Monaco:** This education is managed by the Service of Environment in Monaco
- **Poland:** Collaboration on the country level
- **Turkey:** Turkish Meteorology Service has orderly and continuously collaboration with Ministry of Education and municipalities
- **UK:** WMO organized event

### *Why was the campaign successful?*

### *Region I – Africa*

- **Eritrea:** there was cooperation at all levels and the forecast went well
- **Kenya:** Involved government officials
- **Malawi:** There has been an increase of university graduates and school learners applying for meteorological jobs
- **Mali:** A lot of successes and very good collaboration
- **Mauritius:** feedback obtained. More training from users and end-users requested
- **Mozambique:** The number of readers of the paper has increased
- **Senegal:** au fait d'abord à une prise de conscience par la population, de l'importance de l'information dans ses activités de tous les jours et dans l'efficacité de ce système lors d'événements météo extrêmes
- **South Africa:** Many students, teachers and parents were in content with us
- **Zambia:** Sketches and Plays performed in local language
- **Zimbabwe:** Good cooperation from partners

### *Region II – Asia*

- **Bangladesh:** If Meteorology could be included in syllabus at different levels and teach properly
- **Hong Kong, China:** The government made use of various effective channels to publicize the activity including internet and press release. Also, relevant educational materials were posted on the internet for participants.
- **Japan:** Advance publicizing and past performance have made the campaign popular among the public
- **Republic of Korea:** Most participants actively participated in programs with interest
- **Lao PDR:** A system of identifying severe weather around Lao PDR was established
- **Macao, China:** The participants understood the essentials of the weather phenomena such as typhoon and enable them to be prepared for the season
- **Viet Nam:** It can help people make natural disaster prevention and preparedness as well as significantly reduce consequences of natural disasters.

- **Republic of Yemen:** Because of the legal frame was established and coordination of activities also implemented.

#### *Region III – South America*

- **Guyana:** Moderate success

#### *Region IV – North America, Central America and the Caribbean*

- **St. Lucia:** Schools were appreciative of presentations and follow-up lectures are anticipated.
- **Trinidad and Tobago:** Due to the thoroughness of the presentations and the use of a question and answer segment

#### *Region V – South-West Pacific*

- **Australia:** Ongoing relationship between the partners means it is done regularly and reviewed; it is very relevant to the target groups.
- **Brunei:** Most scientific communities in the country as well as the general public were aware of the main role of Brunei Meteorological Service in providing weather forecasts and early warning on weather extreme, as well as encouraging response to the exhibition.
- **Malaysia:** Staff commitment with support of the top management and government
- **New Zealand:** Personal contact with users of weather information
- **Singapore:** Moderate success

#### *Region VI – Europe*

- **Belarus:** Necessity in hydrometeorological information
- **Denmark:** We noted a huge interest in operational meteorology and climate research. The events were fully booked in hours. The website often ranks in top 10 Danish sites.
- **Hungary:** Attraction of Many participants
- **Latvia:** Increasing of the teachers qualification
- **Lithuania:** Ideal visual information
- **Macedonia, TFYR:** It gave the students idea of what they can expect after the studies
- **Republic of Moldova:** The good organization of the campaign and the financial support
- **Monaco:** Thanks to the collaboration with the National Education
- **Poland:** Because was comprehensive and on the local level
- **Turkey:** Because trainers of campaign are successful and request for this campaign is continuously increasing.
- **UK:** Lots of children invoiced, good publicity

### **II.5 Indicate which factors act as a constraint on instituting or extending a programme of public education and outreach.**

	Frequency						
	Total	RA I	RA II	RA III	RA IV	RA V	RA VI
• Lack of resource	57	17	9	3	5	5	18
• Lack of expertise	21	5	7	2	1	2	4
• Lack of guidance and/or sample material	30	8	7	2	3	3	7
• Lack of an effective distribution network	27	11	4	2	3	2	5
• Lack of partners	25	9	3	1	4	1	7
• Lack of top-level support	15	5	2	0	0	2	6
• Other factors	2	0	1	0	0	0	1

The above statistics shows that “Lack of resource” is the greatest constraint among the given factors brought up by respondents on instituting or extending a programme of public education and outreach, followed by “Lack of guidance and/or sample material” and “Lack of an effective distribution network”.

## II.6 What support would you wish to have provided by WMO to assist in initiating or extending public education and outreach activities?

Following are the answers given by respondents to this question.

### *Region I – Africa*

- **Algeria:** a) Technical assistance in data processing; b) Teaching methods used in the field of education and training of the public
- **Eritrea:** Provision of Public weather service to our service
- **Ethiopia:** a) Intensive training to enhance the capability and methodology of extending public education and outreach activities; (b) Provide training for education and training team leader how to coordinate the local and foreign trainings and how to extend public education and outreach systems.
- **Gambia:** Making success stories available to other countries through WMO
- **Kenya:** a) Support to visit schools and colleges many of which cannot afford to visit our Headquarters; b) Equip outstation with major facilities to provide services at those grass-root level.
- **Libya:** Distribution of more relating materials such as posters, leaflets, etc.
- **Malawi:** Funding
- **Mali:** Formation des formateurs et mise à disposition d’outils et de matériels didactiques en français
- **Mauritius:** Renewal of teaching aids to address hot topics
- **Mozambique:** Training in how to elaborate and implement a public education programme
- **Dem. Rep. Congo:** Training courses, documentation and computer materials
- **Senegal:** Des moyens: des possibilités de formation courtes et moyennes échéances, des matériels de prévisions et diffusion de l’information météorologique vers le grand public
- **Zambia:** Provision of WMO leaflets and brochures on the application of meteorology
- **Zimbabwe:** Materials in the form of videos, DVD based, posters and e-learning modules and materials which have been tested elsewhere and approved

### *Region II – Asia*

- **Bhutan:** Resources, expertise, guidance materials, support and training
- **Hong Kong, China:** More free training software and materials on basic meteorology
- **Republic of Korea:** We would like to suggest WMO to develop and publish a lot of educational materials, which contains more illustrations and images for the better understanding of meteorology by the general public.
- **Lao PDR:** a) Increase of training opportunities through sponsoring required funds.; b) Funds for printing booklets; c) Training on utilization of BUFR and ERIB products - Training on theory and techniques of SIGMET, ERIB, BUFE, encoding and decoding
- **Macao, China:** Multimedia material for specific topics
- **Mongolia:** Some funding for education and outreach activities
- **Thailand:** Provision of expertise, guidance and sample material via WMO website or training programme.
- **Viet Nam:** Finance, guidance of and sample material
- **Republic of Yemen:** Resource, expertise, guidance and sample material.



### *Region III – South America*

- **Guyana:** We need more trained staff members so that we can work towards improving the visibility of the Meteorological Service

### *Region IV – North America, Central America and the Caribbean*

- **Dominican Republic:** Material of support printed, as well as of didactic resources such as dat show, movable PC, among others
- **St. Lucia:** Guidance/training in the preparation of lectures/presentations for various sectors.
- **Trinidad and Tobago:** 1) Materials and supplies; 2) Providing specific training to accomplish his task; 3) Identifying how, where and when knowledge

### *Region V – South-West Pacific*

- **Australia:** To assist us work with policy makers it would be very useful for WMO to have material on the website that we could refer people that explained, to an educated lay audience, what WMO stood for and how it assists countries and economic and social activities. By using the WMO website, for example, it is seen as being somewhat independent of the NMHS. Whilst there is currently material that covers some of these aspects available on the website it is not necessarily in a form that is readily digestible to anyone outside the WMO circle.
- **Brunei:** Teaching materials on PWS and video documentary on the role of NMSs in the development of the country
- **Malaysia:** Material and resources
- **Samoa:** Resources and materials
- **Singapore:** Educational and publicity material on a wide range of weather related subjects

### *Region VI – Europe*

- **Armenia:** Organization of appropriate courses; Getting proper Guidelines (preferable in Russian)
- **Belarus:** experience exchange and more publications materials
- **Bosnia Herzegovina:** We would like to: a) Improvement the media (TV); b) presentation(software); c) Conduct seminars on particular forecasts problems and inform users on how to interpret and make use of the forecasts; d) Organise joint training activities conducted by the NMS and those government authorities
- **Cyprus:** Printed material, DVDs
- **Denmark:** Presentation material on the value of meteorology.
- **Latvia:** Guidelines for public education in NMSs, video materials on important topics (natural disasters, climate changes)
- **Lebanon:** Materials
- **Lithuania:** More newsletters, posters in the field of aeronautical meteorology
- **Macedonia, TFYR:** WMO can assist us with more educational materials such as CBT posters, presentations and other popular literature.
- **Malta:** Leaflets and booklets that can be distributed to schools or to visitors
- **Republic of Moldova:** Supporting materials, with an example (experience) of other countries on the realization of similar activity.
- **Monaco:** Posters
- **Norway:** Use existing material, e.g. cloud posters, but would like more to be web-based
- **Turkey:** We could demand best method and proceeding about meteorological education. Besides, we could take education for trainers from WMO for public education.
- **UK:** More WMO wide initiatives like art competition, however by UK policy and funding



## **ANNEXES**



## ANNEX I:

### *Classification of responding Members based on World Bank list of economies (July 2006)*

Income Group	Region	Country	Income Group	Region	Country
➤	Low Income Countries		➤	Upper Middle Income Countries	
		I Cent. African Rep.			I Libyan Arab Jamahiriya
		I Cote d'Ivoire			I Mauritius
		I Dem. Rep. Congo			I South Africa
		I Eritrea		III	III Argentina
		I Ethiopia		III	III Chile
		I Gambia		III	III Uruguay
		I Guinea-Bissau		IV	IV Costa Rica
		I Kenya		IV	IV Saint Lucia
		I Liberia		IV	IV Trinidad & Tobago
		I Malawi		V	V Malaysia
		I Mali		VI	VI Czech Republic
		I Mozambique		VI	VI Hungary
		I Nigeria		VI	VI Latvia
		I Senegal		VI	VI Lebanon
		I Sudan		VI	VI Lithuania
		I Uganda		VI	VI Poland
		I Zambia		VI	VI Romania
		I Zimbabwe		VI	VI Russian Federation
		II Bangladesh		VI	VI Turkey
		II Bhutan			
		II Lao PDR			
		II Kyrgyz Republic	➤	High Income non-OECD Countries	
		II Mongolia			II Bahrain
		II Republic of Yemen			II Qatar
		II Uzbekistan			II Untd Arab Emirates
		II Viet Nam			II Hong Kong, China
					II Macao, China
➤	Lower Middle Income Countries				IV Antigua and Barbuda
		I Algeria			V Brunei Darussalam
		I Cameroon			V Singapore
		I Egypt			VI Cyprus
		I Tunisia			VI Israel
		II China			VI Malta
		II Iran, Islamic Rep. of			VI Monaco
		II Kazakhstan			
		II Thailand	➤	High Income OECD Countries	
		III Colombia			II Japan
		III Ecuador			II Republic of Korea
		III Guyana			IV Canada
		III Peru			V Australia
		IV Dominican Rep			V New Zealand
		V Samoa			VI Spain
		V Fiji			VI Denmark
		V Indonesia			VI France
		V Philippines			VI Germany
		V Samoa			VI Ireland
		VI Armenia			VI Norway
		VI Belarus			VI Portugal
		VI Bosnia & Herzg			VI UK
		VI Georgia			
		VI Macedonia, TFYR			
		VI Rep. of Moldova			
		VI Ukraine			



## ANNEX II-M:

### Meteorological staffing per million people in 2003 and 2006, and projection for 2009

(per million people)

Reg	Country	Total Nr of Met staff			Women rate (%)			Nr of Meteorologists			Nr of Met Technicians		
		2003	2006	2009	2003	2006	2009	2003	2006	2009	2003	2006	2009
I	Algeria	23.70	22.49	24.61	8.68	5.79	7.75	2.24	1.97	2.51	21.46	20.52	22.10
I	Cameroon	6.07	4.53	11.03	24.24	22.97	29.44	0.18	0.12	0.61	5.88	4.41	10.42
I	Central Afr. Rep.	1.98	2.97	5.70	0.00	8.33	21.74	0.74	1.73	3.22	1.24	1.24	2.48
I	Côte d'Ivoire	4.85	4.85	6.89	0.00	0.00	10.40	0.44	0.44	1.38	4.41	4.41	5.51
I	Egypt	13.73	17.00	20.47	3.67	3.70	4.62	2.39	3.15	4.09	11.34	13.86	16.37
I	Eritrea	5.00	5.23	16.59	9.09	13.04	35.62	0.68	0.91	4.09	4.32	4.32	12.50
I	Ethiopia	2.98	4.04	5.20	15.11	13.77	17.86	0.42	0.84	1.19	2.56	3.21	4.00
I	Gambia	30.98	30.98	31.64	8.51	8.51	8.33	3.30	3.30	5.93	27.69	27.69	25.71
I	Guinea-Bissau	12.61	12.61	10.72	30.00	30.00	23.53	3.78	3.78	1.89	8.83	8.83	8.83
I	Kenya	15.50	15.06	16.93	10.55	9.88	12.07	2.36	2.36	2.04	13.14	12.70	14.89
I	Liberia	2.44	2.44	17.97	12.50	12.50	40.68	0.00	0.00	4.57	2.44	2.44	13.40
I	Libya	80.30	87.13	103.37	1.70	1.57	2.48	12.13	13.16	17.09	68.17	73.98	86.28
I	Malawi	6.13	5.28	10.56	18.99	22.06	29.41	0.93	0.78	1.24	5.20	4.50	9.31
I	Mali	10.73	11.02	12.58	4.14	4.03	6.47	2.00	2.22	2.59	8.73	8.80	9.99
I	Mauritius	69.88	64.26	65.06	9.20	17.50	28.40	12.85	12.05	12.85	57.03	52.21	52.21
I	Mozambique	3.54	5.31	9.50	18.57	24.76	21.28	0.81	1.72	3.44	2.73	3.59	6.06
I	DR Congo	2.40	2.48	4.90	1.45	2.80	12.41	0.00	0.02	0.43	2.40	2.47	4.47
I	Senegal	5.75	5.58	8.15	7.46	10.77	21.05	1.54	1.54	2.14	4.20	4.03	6.00
I	South Africa	0.40	0.36	0.42	42.11	64.71	60.00	0.30	0.15	0.21	0.11	0.21	0.21
I	Sudan	0.72	0.94	1.79	23.08	23.53	23.08	0.39	0.47	0.69	0.33	0.47	1.10
I	Tunisia	26.63	21.88	32.17	7.81	10.41	11.69	5.25	4.75	7.23	21.38	17.13	24.95
I	Uganda	5.07	5.93	6.35	10.27	11.11	13.11	0.73	1.08	1.21	4.34	4.86	5.14
I	Zambia	12.08	11.48	13.20	18.44	14.93	20.13	0.77	0.86	1.20	11.31	10.63	12.00
II	Bahrein	28.89	39.89	45.39	0.00	6.90	12.12	0.00	11.00	16.51	28.89	28.89	28.89
II	Bangladesh	0.07	0.07	0.16	18.18	18.18	50.00	0.05	0.05	0.08	0.02	0.02	0.08
II	Bhutan	4.62	5.09	7.86	0.00	0.00	17.65	0.00	0.00	0.92	4.62	5.09	6.93
II	Hong Kong, China	31.67	27.27	27.27	15.70	16.15	16.15	15.48	14.34	14.34	16.19	12.92	12.92
II	Iran	1.50	2.00	2.14	6.60	17.61	16.45	1.28	1.54	1.61	0.21	0.47	0.54
II	Kazakhstan	81.55	94.91		72.95	72.99		19.90	20.37		61.65	74.54	
II	Korea rep	17.55	18.42	19.76	28.13	30.08	31.75	15.27	16.10	17.36	2.28	2.32	2.41
II	Kyrgyz Rep	13.49	13.49		71.83	74.65		6.84	6.84		6.65	6.65	
II	Lao PDR	5.40	5.40	7.60	37.50	37.50	33.33	0.00	0.00	0.00	5.40	5.40	7.60
II	Macao, china	126.09	123.91	130.43	20.69	21.05	20.00	36.96	36.96	43.48	89.13	86.96	86.96
II	Mongolia	537.04	540.82	612.24	69.67	69.39	70.99	101.66	102.42	117.16	435.37	438.40	495.09
II	Qatar	82.41	109.47	172.20	0.00	1.12	7.14	8.61	9.84	18.45	73.80	99.63	153.75
II	Thailand	10.19	9.77	9.69	20.91	24.80	30.25	1.96	1.96	1.98	8.23	7.81	7.72
II	Untd Arab Emirates	4.67	5.34	6.90	4.76	8.33	9.68	2.45	2.89	3.78	2.22	2.45	3.11
II	Uzbekistan	17.97	18.05		61.92	62.29		7.52	7.26		10.45	10.79	
II	Viet Nam		23.26	24.46		35.80	36.55		5.92	6.48		17.34	17.99
II	Yemen	8.06	9.39	11.68	7.10	10.66	14.29	2.62	2.96	3.58	5.44	6.44	8.10
III	Argentina	23.90	23.70	24.45	27.93	27.32	28.43	1.08	1.23	1.45	22.83	22.48	23.00
III	Chile	10.92	10.25	10.43	10.11	14.97	23.53	4.79	4.36	4.91	6.14	5.89	5.52
III	Colombia		0.53			50.00			0.26	0.19		0.26	
III	Ecuador	3.93	3.86	5.37	17.31	19.61	28.17	1.81	1.74	2.34	2.12	2.12	3.02

Reg	Country	Total Nr of Met staff			Women rate (%)			Nr of Meteorologists			Nr of Met Technicians		
		2003	2006	2009	2003	2006	2009	2003	2006	2009	2003	2006	2009
III	Guyana	5.33	5.33	13.32	50.00	75.00	50.00	1.33	3.99	5.33	3.99	1.33	7.99
III	Peru	30.53	31.11	32.00	26.93	26.55	27.37	1.22	1.43	1.61	29.32	29.68	30.39
III	Uruguay	75.66	55.15		76.34	78.53		0.58	0.29		75.08	54.87	
IV	Antigua & Barbuda	222.22	197.53	283.95	22.22	12.50	17.39	74.07	86.42	111.11	148.15	111.11	172.84
IV	Canada	21.99	22.51	22.76	16.67	18.05	17.99	15.88	16.37	16.37	6.11	6.14	6.38
IV	Costa Rica			2.31			40.00		0.92	0.92			1.39
IV	Dominican Rep	10.79	17.65	24.85	28.13	36.94	41.18	1.35	1.35	1.69	9.44	16.30	23.16
IV	St. Lucia	180.12	167.70	198.76	20.69	29.63	31.25	24.84	12.42	31.06	155.28	155.28	167.70
IV	Trinidad Tbg	24.52	29.89	31.42	6.25	17.95	17.07	3.07	8.43	9.96	21.46	21.46	21.46
V	Australia	31.02	34.55	33.48	20.25	19.44	19.48	16.91	21.21	20.63	14.11	13.34	12.85
V	Brunei Darism	147.06	147.06	171.12	54.55	49.09	46.88	13.37	16.04	18.72	133.69	131.02	152.41
V	Fiji	76.65	64.86	80.19	7.69	7.27	8.82	10.61	5.90	14.15	66.04	58.96	66.04
V	Malaysia	25.45	29.27	32.04	20.93	26.42	26.72	3.47	5.96	6.67	21.97	23.32	25.37
V	New Zealand	14.44	16.85	18.05	25.00	27.14	33.33	14.44	16.85	18.05	0.00	0.00	0.00
V	Philippines	7.55	7.57	9.44	41.26	41.14	41.31	0.25	0.28	0.35	7.29	7.29	9.09
V	Samoa	43.24	5.41	81.08	0.00	0.00	0.00	5.41	5.41	16.22	37.84	0.00	64.86
V	Singapore	26.58	27.05	30.28	23.48	22.22	21.37	6.93	7.17	9.02	19.65	19.88	21.27
VI	Armenia	45.71	43.54	40.74	66.67	67.14	67.18	22.39	21.15	19.90	23.32	22.39	20.83
VI	Belarus	49.21	32.29	50.74	91.67	85.08	90.51	15.38	16.40	16.40	33.83	15.89	34.34
VI	Bosnia Herzg	9.98	12.03	14.85	17.95	19.15	22.41	1.79	2.56	3.58	8.19	9.47	11.26
VI	Cyprus	70.66	77.84	85.03	25.42	32.31	36.62	21.56	21.56	23.95	49.10	56.29	61.08
VI	Czech rep	25.32	22.89	25.32	30.77	29.79	30.77	5.84	4.87	5.84	19.48	18.02	19.48
VI	Denmark	33.14	32.04	28.17	39.44	39.08	39.22	27.62	27.62	24.86	5.52	4.42	3.31
VI	France	34.44	42.46	42.46	25.11	21.85	24.07	5.35	13.37	13.37	29.09	29.09	29.09
VI	Georgia	146.85	50.51	55.88	80.06	77.88	76.00	86.72	29.50	32.41	60.13	21.01	23.47
VI	Hungary	17.23	17.03	16.04	33.33	32.56	33.95	9.41	9.70	9.70	7.82	7.33	6.34
VI	Ireland	8.74	8.74	9.45	29.73	35.14	37.50	8.74	8.74	9.45	0.00	0.00	0.00
VI	Israel	8.68	7.54	6.97	57.38	58.49	42.86	4.13	3.42	5.27	4.55	4.13	1.71
VI	Latvia	41.18	44.65	47.25	94.74	93.20	88.99	13.00	14.30	17.34	28.18	30.34	29.91
VI	Lebanon	19.57	15.94	13.14	2.86	3.51	4.26	2.24	1.40	0.56	17.33	14.54	12.58
VI	Lithuania	50.42	51.01		85.55	81.14		21.86	24.19		28.56	26.81	
VI	Macedonia, TFYR	32.45	32.45	36.87	0.00	0.00	0.00	10.32	10.32	12.29	22.12	22.12	24.58
VI	Malta	37.31	34.83	47.26	0.00	0.00	10.53	0.00	0.00	7.46	37.31	34.83	39.80
VI	Moldova Rep	44.60	44.60	44.84	87.57	88.65	86.56	15.43	15.43	15.67	29.17	29.17	29.17
VI	Norway	39.37	31.02	27.81	40.22	40.00	42.31	13.69	12.84	12.84	25.67	18.19	14.98
VI	Poland	3.11	3.24	3.37	50.00	48.00	53.85	1.56	1.56	1.69	1.56	1.69	1.69
VI	Portugal	21.67	18.45	16.18	38.86	37.44	38.60	6.72	5.87	5.30	14.95	12.58	10.88
VI	Romania	43.39	42.56	41.45	51.27	51.41	52.22	12.48	13.08	14.74	30.91	29.48	26.71
VI	Spain	20.78	20.64	20.50	31.17	31.83	32.50	4.41	4.34	4.27	16.37	16.30	16.23
VI	UK	12.59	12.21	11.39	22.69	22.59	22.01	11.79	11.54	10.80	0.80	0.66	0.60



## ANNEX II-H:

### Hydrological staffing per million people in 2003 and 2006, and projection for 2009

(per million people)

Rgn	Country	Total Nr of Met staff			Women rate (%)			Nr of Meteorologists			Nr of Met Technicians		
		2003	2006	2009	2003	2006	2009	2003	2006	2009	2003	2006	2009
I	Central African Rep	0.99	0.99	2.97	0.00	0.00	33.33	0.74	0.74	1.73	0.25	0.25	1.24
I	Côte d'Ivoire	0.83	0.55	0.61	6.67	10.00	9.09	0.28	0.17	0.28	0.55	0.39	0.33
I	Eritrea	1.14	1.59	3.18	40.00	28.57	28.57	0.00	0.23	1.36	1.14	1.36	1.82
I	Gambia	17.14	19.12	21.75	7.69	17.24	21.21	1.32	0.66	1.98	15.82	18.46	19.78
I	Guinea-Bissau	5.67	5.67	11.98	0.00	0.00	47.37	2.52	2.52	5.67	3.15	3.15	6.31
I	Kenya	0.50	0.55	0.70	5.88	5.26	8.33	0.47	0.53	0.64	0.03	0.03	0.06
I	Liberia			10.66			42.86			4.57			6.09
I	Mali	0.89	0.96	1.26	8.33	7.69	11.76	0.30	0.30	0.44	0.59	0.67	0.81
I	Mauritius	13.65	16.06	18.47	17.65	25.00	26.09	5.62	4.02	6.43	8.03	12.05	12.05
I	Nigeria	0.38	0.45	0.48	20.00	11.67	21.88	0.30	0.35	0.38	0.08	0.10	0.11
I	Dem. Rep. Congo			0.23			30.77			0.07	0.10	0.07	0.16
I	Uganda	0.49	0.49	0.62	14.29	14.29	33.33	0.28	0.28	0.35	0.21	0.21	0.28
II	Bangladesh	1.72	2.03	2.47	9.80	10.30	12.81	0.57	0.65	0.89	1.14	1.38	1.58
II	Bhutan	35.60	47.62	8.78	15.58	21.36	31.58	2.77	5.55	1.85	32.82	42.07	6.93
II	Kazakhstan	20.44	23.95		72.94	72.68		4.99	5.26		15.45	18.68	
II	Kyrgyz Republic	5.51	6.46		48.28	44.12		1.71	2.28		3.80	4.18	
II	Mongolia	112.62	114.89	116.78	31.88	31.91	32.36	59.33	60.47	62.36	53.29	54.42	54.42
II	Uzbekistan	10.98	10.75		61.99	65.38		4.74	4.66		6.24	6.09	
II	Viet Nam		16.95	18.64		23.45	24.05		4.21	4.82		12.74	13.81
III	Colombia			0.19			62.50			0.10			0.10
III	Guyana	9.32	10.65	11.98	14.29	25.00	44.44	1.33	0.00	3.99	7.99	10.65	7.99
III	Peru							0.36	0.43	0.57			
IV	Canada	1.37	0.67	0.55	15.56	22.73	27.78	0.21	0.18	0.15	1.16	0.49	0.40
IV	Costa Rica							1.62	1.85				1.39
IV	Saint Lucia	12.42	12.42		50.00	50.00		0.00	0.00		12.42	12.42	12.42
IV	Trinidad & Tobago	36.02	34.48	36.02	31.91	37.78	36.17	3.07	1.53	3.07	32.95	32.95	32.95
V	Australia	2.03	1.93	1.93	7.14	7.50	2.50	1.40	1.30	1.45	0.63	0.63	0.48
V	Fiji	43.63	45.99	50.71	10.81	10.26	9.30	1.18	0.00	4.72	42.45	45.99	45.99
V	Indonesia	0.33	0.36	0.47	24.68	26.51	27.27	0.09	0.13	0.19	0.24	0.22	0.28
V	Philippines	0.45	0.45	0.50	31.71	31.71	33.33	0.00	0.00	0.00	0.45	0.45	0.50
VI	Armenia	33.90	32.65	29.23	44.95	44.76	45.74	14.62	13.37	12.13	19.28	19.28	17.10
VI	Belarus	7.18	6.97	7.18	78.57	77.94	77.14	4.10	3.90	4.10	3.08	3.08	3.08
VI	Bosnia Herzg	2.56	2.56	2.56	40.00	40.00	30.00	0.77	0.77	0.77	1.79	1.79	1.79
VI	Czech rep	14.22	13.73	13.15	45.21	45.39	44.44	8.57	8.28	7.99	5.65	5.45	5.16
VI	Georgia	33.75	15.20	17.88	37.75	27.94	31.25	14.75	6.03	7.82	19.00	9.16	10.06
VI	Germany	1.90	1.85	1.78	23.72	24.34	25.34	1.47	1.44	1.36	0.43	0.41	0.41
VI	Latvia	20.81	21.24	22.11	64.58	63.27	62.75	5.20	5.64	6.07	15.60	15.60	16.04
VI	Lithuania	15.45	17.20	12.24	81.13	71.19	61.90	4.95	4.95	6.12	10.49	12.24	6.12
VI	Macedonia, TFYR	10.32	10.32	11.31	33.33	38.10	34.78	3.44	3.44	4.42	6.88	6.88	6.88
VI	Moldova Rep	11.81	13.74	13.98	65.31	56.14	53.45	2.65	3.13	3.38	9.16	10.61	10.61
VI	Poland	6.85	7.79	8.90	39.02	38.00	40.23	5.01	5.87	6.75	1.84	1.92	2.15
VI	Romania	12.02	12.16	11.05	53.64	50.76	54.17	6.54	6.95	9.21	5.48	5.20	1.84
VI	Spain	0.46	0.46	0.46	15.00	35.00	50.00	0.23	0.23	0.23	0.23	0.23	0.23
VI	Sweden								8.02				
VI	Turkey	10.26	9.20	4.39	3.45	4.62	12.90	3.18	3.54	2.26	7.07	5.66	2.12



### ANNEX III:

#### WMO FELLOWSHIP REQUESTS FROM MEMBERS (2003–2006)

(based on the responses to WMO Survey 2006)

Region	Home country	Nr Fellows		Host country	Institutions/Organizations	
		STF	LTF			
I	Cameroon	2		Kenya	IMFR	
		2		Niger	EAMAC	
	Egypt	3		India	India Met. Department	
	Eritrea	1		Oman	NMS	
		1		Morocco	NMS	
		1		Mozambique	NMS	
	Ethiopia		5	UK		
	Gambia		1	Nigeria	RMTC-Lagos	
		2		Egypt	RMTC-Cairo	
	Guinea-Bissau		2	Portugal	University of Evora	
			2	Russian fed	University of St Petersburg	
	Kenya		1	Nigeria		
	Libya	1		Iran	RMTC	
		1		Italy	RMTC	
	Malawi		2	Kenya	RMTC	
	Mali		2	Madagascar		
			1	Senegal		
			2	Algeria	IHFR d'Oran	
	Mozambique		1	Zambia	University of Zimbabwe	
		1		USA	African Desk	
	Senegal		2	Niger	EAMAC	
		1		UK	Met Office College	
		2		UK	ECMWF	
	Sudan	1		Morocco		
	Uganda		1	Kenya	University of Nairobi	
			1	Uganda	ESAMI/Maastrictht of Management	
			1	Uganda	Makerere University, Kampala	
	Zambia	1		Zimbabwe	DMC	
		1		South Africa	Univ. of Johannesburg	
	II	Lao PDR	1		Romania	
			1		India	
		1		Thailand		
		2		Hong Kong, China		
		1		UK		
		3		China		
		1		Brunei Darism		
		2		Malaysia		
Mongolia			5	India	SAC, ISRO	
Untd Arab Em		5		Oman	Oman Meteorological Department	
		3		Bahrain	Bahrain Meteorological Dept.	
Viet Nam			3	Japan		
			1	Malaysia		
			1	Thailand	ADPC	
		1	Australia	ADF		
	2		Korea rep			

Region	Home country	Nr Fellows		Host country	Institutions/Organizations
		STF	LTF		
		1		Italy	ESA
		1		Germany	DFG
		1		China	
		4		Japan	
		1		Malaysia	MTCP
		3		Thailand	EANET
	Yemen		1	China	Nanjing University
III	Colombia		2	Spain	
	Ecuador		1	Spain	INM
		2		Spain	INM
		2		USA	NOAA
	Guyana		3	Barbados	Caribbean Institute of Meteorology and Hydrology
			1	UK	University of Reading
IV	Antigua and Barbuda		1	UK	University of Reading
			1	Barbados	University of the West Indies
			1	Barbados	Caribbean Institute of Meteorology
	Costa Rica		1	USA	State Univ. of Colorado
		1		USA	NCEP
		2		UK	Met Office College
	Dominican Rep		1	Spain	Universidad de Salamanca
	St.Lucia		1	Barbados	Caribbean Institute for Meteorology and Hydrology
V	Indonesia		1	Australia	Bureau of Meteorology
		1		Japan	JMA (via JICA)
		1		Korea Rep	KMA
	Malaysia	1		Australia	
		1		Brunei Darssm	
		1		Australia	
		1		Hong Kong, China	
		2		Germany	
	Philippines		1	Costa Rica	
			1	France	Meteo-France
			1	Switzerland	World Radiation Centre
			1	Hong Kong, China	
		3		Malaysia	Malaysia Met Service
		2		China	WMO-RTC Nanjing, China / Shanghai Met Bureau
		2		USA	National Hurricane Centre
		2		Macao, China	Macao geophysical and Met Bureau
	Samoa		1	Australia	Bureau of Meteorology
		5		USA	NOAA-Hawaii
		5		Fiji	Fiji Met Service
VI	Armenia	6		Russian Fed	Roshydromet
		2		France	Meteo-France
	Bosnia Herzg		4	Turkey	Turkish Meteorological Service
		3		China	RMTC CHINA

**ANNEX IV:  
QUESTIONNAIRE**

**ON MEMBERS TRAINING REQUIREMENTS, OPPORTUNITIES AND  
CAPABILITIES**

Current status (2003-2006) and planning (2006-2009)

PART A: METEOROLOGY

PART B: HYDROLOGY

PART C



**QUESTIONNAIRE  
ON MEMBERS TRAINING REQUIREMENTS, OPPORTUNITIES AND  
CAPABILITIES**

Current status (2003-2006) and planning (2006-2009)

Part A: Meteorology

Member country: \_\_\_\_\_

**I. Current status of national Education and Training PROGRAMMES in  
Meteorology**

*The aim of this section is to identify the job-entry-level requirements for Meteorologist and Meteorological Technician<sup>(#)</sup>; the programmes available for continuing education and training (CET); and factors which adversely may affect the education and training in meteorology.*

**I.1 What is the usual qualification for job-entry-level Meteorologists in the  
national Service responsible for meteorological activities?**

*Please tick the relevant box and  
specify duration of programme*

(e) First degree in meteorology;  .....

(f) Postgraduate Diploma/Master's degree in meteorology, for holders of a degree in a scientific/engineering/computational subject (e.g. physics, mathematics, chemistry, engineering, earth sciences);  .....

(g) Foundation training in meteorology, organized by the Service, possibly in partnership with other national institutions, for holders of a degree in a scientific/engineering/computational subject;  .....

(h) Another approach; *(please give details below, using an additional page if necessary):*  .....

.....  
.....  
.....  
.....  
.....  
.....  
.....

<sup>(#)</sup> Please note that the new WMO scheme for classification of personnel in meteorology and hydrology is being used throughout this Questionnaire; see the definitions for 'Meteorologist' and 'Meteorological Technician' under Chapter 1 of WMO-No. 258, Vol. I - Meteorology; fourth edition 2002.

**I.2 What is the usual qualification for job-entry-level Meteorological Technicians in the national Service responsible for meteorological activities?**

*Please tick the relevant box and*

*specify duration of programme*

- (a) Meteorological training at a technical/vocational secondary school;  .....
- (b) Meteorological training at a post-secondary school institution;  .....
- (c) Meteorological training organized by the Service, possibly in partnership with other national institutions;  .....
- (d) Another approach; *(please give details below, using an additional page if necessary):*  .....

.....  
 .....

**I.3 Have you already completed the transition to the new classification of personnel as stated in WMO-No. 258 Vol. I, Edition 4? .....**

*If No, please answer the following questions.*

- (c) Do you anticipate completing the transition by 1 January 2007?.....
- (d) If No, please outline the main issues preventing you from completing the transition

.....  
 .....

**I.4 What are the main activities in continuing education and training in meteorology presently undertaken by the Service, and their frequency?**

*Please specify the frequency: every "n" years; tick where relevant*

- |  | <i>n/a</i>               | <i>1</i>                 | <i>2</i>                 | <i>other</i>             |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| (a) Periodic refresher training for Meteorologists;  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (b) Periodic refresher training for Meteorological Technicians;                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) Specialised training for Meteorologists, organized by the Service as required;             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) Specialised training for Meteorological Technicians, organized by the Service as required; | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



## Questionnaire on Members' Training Requirements, Opportunities and Capabilities

Current status (2003-2006) and planning (2006-2009) - Part A: Meteorology

- (e) Other activities in support of continuing professional development such as stimulating employees for self-study, promoting the lifelong learning culture, etc.;  
(please give details below, using an additional page if necessary):

.....  
.....

- (f) Does your Service use Information and Communication Technology (ICT) in continuing education and training activities? (Yes / No)

If Yes, which tools are employed to undertake these activities

- Video conferencing system       Electronic media  
 Web site       Others

### I.5 If the overall performance of the meteorological education and training undertaken in your country is not fully satisfactory, what are the principal weaknesses?

- |  | Tick relevant<br>box(es) |
|--|--------------------------|
| (e) Low visibility of Meteorology at national level: lack of teaching staff and/or teaching facilities;  | <input type="checkbox"/> |
| (f) Insufficient meteorological and/or teaching expertise: outdated documentation for specialised training in meteorology; lack of staff development programmes for meteorological instructors;                    | <input type="checkbox"/> |
| (g) Limited co-operation between institutions giving meteorological education: ambiguous objectives; unpractical institutional fragmentation;  | <input type="checkbox"/> |
| (h) Inflexible accreditation arrangements for previously acquired competencies; rigid access to meteorological qualifications and progression routes, including the bridging routes in between different pathways; | <input type="checkbox"/> |
| (f) Other constraints; (please give details below, using an additional page if necessary):   | <input type="checkbox"/> |

.....  
.....

## II. Human Resources Development (HRD) - Assessment and Plans

The aim of this section is to identify the current and projected staffing requirements, and the factors that have impact on staff numbers and the development of human resources; another aim is to identify the amount of external support received and/or provided for training.

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**  
 Current status (2003-2006) and planning (2006-2009) - Part A: Meteorology

**II.1 What is the staffing of the Service from 2003 to 2006, and what is the projection for 2009.** (If you cannot provide exact figures, please give your best estimate in blank cells):

Category of personnel by qualification/gender	2003		2006		2009 (estimate)	
	men	women	men	women	men	women
Graduate Meteorologists (former WMO Class I)						
Meteorological Technicians (former WMO Class II, III, IV)						

**II.2 When making plans for human resources development during the period 2006-2009, what are the main issues that have to be considered by your Service?**

Please specify the priority order by entering a number 1 – 6 in each box

- (a) Expertise required for new tasks/services;.....
  - (b) Introduction of new equipment;.....
  - (c) Re-deployment of staff to other jobs;.....
  - (d) Increased recruitment (e.g. caused by an aging or expansion of workforce); .....
  - (e) Lack of expertise in meteorology and/or management;.....
  - (f) Other factors (please give details below, using an additional page if necessary):.....
- .....
- .....

**II.3 What external support for training has your Service received from agencies other than WMO from 2003 to 2006.** (please provide information about the donors, using an additional page if necessary):

- (a) Countries: .....
- (b) International organizations/institutions: .....
- (c) Private sector companies: .....
- (d) Other donors: .....

**II.4 What external support for training has been provided by your Service to other countries from 2003 to 2006?** (please indicate the nature of the support and the beneficiaries, using an additional page if necessary):

.....

.....

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**  
 Current status (2003-2006) and planning (2006-2009) - Part A: Meteorology

**III. Assessment of WMO Training Activities**

*The aim of this section is to assess the use and effectiveness of WMO training activities. If no personnel from your Service benefited from WMO support for training (e.g. Blue Series publication, audio-visual aids, participation in training events; fellowships or other financial support), please go to Section IV.*

**III.1 What use is made by your Service of WMO Training Materials?**

- |   |                          |                          |                           |                              |
|---|--------------------------|--------------------------|---------------------------|------------------------------|
|   | <i>n/a</i>               | <i>low</i>               | <i>med.</i>               | <i>high</i>                  |
| (d) Extent of use of the WMO Training Publications:                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/>     |
| (e) Extent of the use of the WMO Virtual Training Library:                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/>     |
| (f) Extent of use of the WMO Training Library Services:                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/>     |
|   | <i>slide</i>             | <i>video</i>             | <i>CAL<sup>(**)</sup></i> | <i>other<sup>(***)</sup></i> |
| (g) Types of training materials used at present:                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/>     |
| (h) Types of training materials likely to be needed for future training activities: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/>     |

*(\*\*) CAL - Computer-aided learning module; (\*\*\*) other - please specify (e.g. multimedia).*

- (f) Comment upon the range and quality of these services. *(please give details below, using an additional page if necessary):*

.....  
 .....

**III.2 What use has been made by your Service of training events under WMO Major Programmes from 2003 to 2006?**

- |   |                          |                          |                          |                          |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
|   | <i>n/a</i>               | <i>1-3</i>               | <i>4-9</i>               | <i>&gt;9</i>             |
| (i) Number of events attended by the staff in your Service: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (j) Number of participants co-sponsored by WMO:             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (k) Number of participants financed by other sources:       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
|   | <i>n/a</i>               | <i>low</i>               | <i>med.</i>              | <i>high</i>              |
| (l) Adequacy of the attended training events:               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

- (e) Comments upon the quality and range of these training events. *(please give details below, using an additional page if necessary)*

.....  
 .....

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**  
 Current status (2003-2006) and planning (2006-2009) - Part A: Meteorology

**III.3 What use has your Service made of the WMO Regional Meteorological Training Centres (RMTCs) from 2003 to 2006?** *(please do not consider the events organized by WMO at RMTCs; see question III.2 above)*

(g) Number of staff in your Service trained at RMTCs during the last 4 years: n/a    1-3    4-9    >9  
           

(h) Number of participants co-sponsored by WMO: n/a    1-3    4-9    >9  
           

(i) Value of the RMTCs' training to the development of your Service: n/a    low    med.    high  
           

(a) Comment upon the quality and range of training provided by RMTCs. *(please give details below, using an additional page if necessary).*

.....  
 .....

**III.4 Are there any ways in which the present interaction/collaboration between RMTCs and national Services could be improved or expanded?** *(please give details below, using an additional page if necessary).*

.....  
 .....

**III.5 What use has your Service made of the WMO Fellowships Programme from 2003 to 2006?** *(please do not count the trainees reported under item (b) in questions III.2 and III.3 above)*

(b) The number of fellowships awarded to staff in your Service and the host countries and their institutions/organizations where the awarded fellowships were implemented.

Fellowship Type	Nr. of fellows	Host countries	Institutions/organizations
Short-term (≤ 6 months)			
Long-term (> 6 months)			

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**  
 Current status (2003-2006) and planning (2006-2009) - Part A: Meteorology

- |  |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
|  | <i>n/a</i>               | <i>low</i>               | <i>med.</i>              | <i>high</i>              |
| (b) Improvement in knowledge and skills of your fellows:                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (c) Relevance of training to current work of your fellows:                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (d) Impact of fellows on promoting new applications, operations or services: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

(b) Other comments: *(please give details below, using an additional page if necessary).*

.....  
 .....

**III.6 Are there any ways in which the present WMO training activities, services and materials could be improved or expanded?** *(please give details below, using an additional page if necessary).*

.....  
 .....

**IV. Future Education and Training REQUIREMENTS, OPPORTUNITIES AND CAPABILITIES IN METEOROLOGY**

*The aim of this section is to assess the national priorities for training and development, identify the national capability for providing external assistance for education and training activities; and suggest possible new requirements for specific WMO activities, services or materials that would be of value to your Service.*

**IV.1 What short-term professional development training in meteorology has the highest priority for your Service?** *Please identify the major training requirements of your Service that cannot be satisfied at a national level (such training could be undertaken abroad, or delivered in the country/region by external experts). (please give details below, using an additional page if necessary).*

Fields of specialisation <sup>(1)</sup>	Brief justification of the required specialised training in terms of actual operational needs	Nr. of candidates	Teaching <sup>(2)</sup> language

(1) *You may spell out specific topics within fields of specialisation such as those identified in Chapters 3 and 4 of the publication WMO-No. 258, Vol. I - Meteorology, fourth edition, 2000/2002.*

(2) *Arabic, Chinese, English, French, Russian, Spanish, others.*

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**  
 Current status (2003-2006) and planning (2006-2009) - Part A: Meteorology

**IV.2 What are the expected future requirements for fellowship for your Service?**

*Please indicate the number of potential candidates from your Service who require meteorological education or training abroad, irrespective of the funding source. This information will be used to estimate the likely demand for fellowships but will not be used as a request for fellowships. (please give details below, using an additional page if necessary).*

Fellowship		Foundation Training		Advanced-specialised Training	
Type	Period	Nr. of Meteorologists	Nr. of Met Technicians	Fields of Specialization	Nr. of Candidates
STF (≤ 6 months)	2007				
	2008-2009				
LTF (> 6 months)	2007				
	2008-2009				

**IV.3 What is the national capability for providing external assistance for education and training in meteorology?**

- |  |                          |                          |
|--|--------------------------|--------------------------|
|  | Yes                      | No                       |
| (e) Offering education and training to foreign students:<br>(e.g. access to training programmes, full/partial funding, waiving tuition fees, IT support, local training materials) | <input type="checkbox"/> | <input type="checkbox"/> |
| (f) Assisting in the preparation of WMO training publications:<br>(e.g. outsourcing support with printing, translation, contributing authors/reviewers on emerging)                | <input type="checkbox"/> | <input type="checkbox"/> |
| (e) Supporting WMO training events:<br>(e.g. hosting the events, provision of experts, co-sponsorship of participants, production of proceedings)                                  | <input type="checkbox"/> | <input type="checkbox"/> |
| (f) Supplying training materials to the WMO Training Library:<br>(e.g. supplying samples of recent publications, CAL modules, slides, videos)                                      | <input type="checkbox"/> | <input type="checkbox"/> |

(m) Others: (please give details below, using an additional page if necessary).

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....







**QUESTIONNAIRE  
ON MEMBERS TRAINING REQUIREMENTS, OPPORTUNITIES AND  
CAPABILITIES**

Current status (2003-2006) and planning (2006-2009)

**PART B: HDYROLOGY**

Member country: \_\_\_\_\_

**V. Current status of national Education and Training PROGRAMMES in Hydrology**

*The aim of this section is to identify the job-entry-level requirements for Hydrologist and Hydrological Technician<sup>(#)</sup>; the programmes available for continuing education and training (CET); and factors which adversely may affect the education and training in Hydrology.*

**I.1 What is the usual qualification for job-entry-level Hydrologists in the national Service responsible for Hydrological activities?**

*Please tick the relevant box and specify duration of programme*

(i) First degree in Hydrology;  .....

(j) Postgraduate Diploma/Master's degree in Hydrology, for holders of a degree in a scientific/engineering/computational subject (e.g. physics, mathematics, chemistry, engineering, earth sciences);  .....

(k) Foundation training in Hydrology, organized by the Service, possibly in partnership with other national institutions, for holders of a degree in a scientific/engineering/computational subject;  .....

(l) Another approach; *(please give details below, using an additional page if necessary)*:  .....

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

<sup>(#)</sup> Please note that the new WMO scheme for classification of personnel in meteorology and hydrology is being used throughout this Questionnaire; see the definitions for 'Hydrologist' and 'Hydrological Technician' under Chapter 1 of WMO-No. 258, Vol. II - Hydrology; fourth edition 2003.

**I.2 What is the usual qualification for job-entry-level Hydrological Technicians in the national Service responsible for Hydrological activities?**

*Please tick the relevant box and*

*specify duration of programme*

- (e) Hydrological training at a technical/vocational secondary school;  .....
- (f) Hydrological training at a post-secondary school institution;  .....
- (g) Hydrological training organized by the Service, possibly in partnership with other national institutions;  .....
- (h) Another approach; *(please give details below, using an additional page if necessary):*  .....

.....  
 .....

**I.3 Have you already completed the transition to the new classification of personnel as stated in WMO-No. 258 Vol. I, Edition 4? .....**

*If No, please answer the following questions.*

- (e) Do you anticipate completing the transition by 1 January 2007?.....
- (f) If No, please outline the main issues preventing you from completing the transition

.....  
 .....

**I.4 What are the main activities in continuing education and training in Hydrology presently undertaken by the Service, and their frequency?**

*Please specify the frequency:  
 every "n" years; tick where relevant*

- |   | <i>n/a</i>               | <i>1</i>                 | <i>2</i>                 | <i>other</i>             |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| (g) Periodic refresher training for Hydrologists;   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (h) Periodic refresher training for Hydrological Technicians;   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (i) Specialised training for Hydrologists, organized by the Service as required;  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (j) Specialised training for Hydrological Technicians, organized by the Service as required;  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (k) Other activities in support of continuing professional development such as stimulating employees for self-study, promoting the lifelong learning culture, etc.;<br><i>(please give details below, using an additional page if necessary):</i> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

.....  
 .....

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**

Current status (2003-2006) and planning (2006-2009) - Part B: Hydrology

- (l) Does your Service use Information and Communication Technology (ICT) in continuing education and training activities? (Yes / No)

If Yes, which tools are employed to undertake these activities

- Video conferencing system       Electronic media  
 Web site       Others

**I.5 If the overall performance of the Hydrological education and training undertaken in your country is not fully satisfactory, what are the principal weaknesses?**

- |  |                              |
|--|------------------------------|
|  | <b>Tick relevant box(es)</b> |
| (i) Low visibility of Hydrology at national level: lack of teaching staff and/or teaching facilities;  | <input type="checkbox"/>     |
| (j) Insufficient Hydrological and/or teaching expertise: outdated documentation for specialised training in Hydrology; lack of staff development programmes for Hydrological instructors;                        | <input type="checkbox"/>     |
| (k) Limited co-operation between institutions giving Hydrological education: ambiguous objectives; unpractical institutional fragmentation;  | <input type="checkbox"/>     |
| (l) Inflexible accreditation arrangements for previously acquired competencies; rigid access to Hydrological qualifications and progression routes, including the bridging routes in between different pathways; | <input type="checkbox"/>     |
| (g) Other constraints; <i>(please give details below, using an additional page if necessary):</i>  | <input type="checkbox"/>     |

.....

**VI. Human Resources Development (HRD) - Assessment and Plans**

The aim of this section is to identify the current and projected staffing requirements, and the factors that have impact on staff numbers and the development of human resources; another aim is to identify the amount of external support received and/or provided for training.

**II.1 What is the staffing of the Service from 2003 to 2006, and what is the projection for 2009.** *(If you cannot provide exact figures, please give your best estimate in blank cells):*

Category of personnel by qualification/gender	2003		2006		2009 (estimate)	
	men	women	men	women	men	women
Graduate Hydrologists (former WMO Class I)						
Hydrological Technicians (former WMO Class II, III, IV)						

**II.2 When making plans for human resources development during the period 2006-2009, what are the main issues that have to be considered by your Service?**

*Please specify the priority order by entering a number 1 – 6 in each box*

- (g) Expertise required for new tasks/services; .....
- (h) Introduction of new equipment; .....
- (i) Re-deployment of staff to other jobs; .....
- (j) Increased recruitment (e.g. caused by an aging or expansion of workforce); .....
- (k) Lack of expertise in Hydrology and/or management; .....
- (l) Other factors (please give details below, using an additional page if necessary): .....

.....  
 .....

**II.3 What external support for training has your Service received from agencies other than WMO from 2003 to 2006.** (please provide information about the donors, using an additional page if necessary):

- (c) Countries: .....
- (d) International organizations/institutions: .....
- (e) Private sector companies: .....
- (f) Other donors: .....

**II.4 What external support for training has been provided by your Service to other countries from 2003 to 2006?** (please indicate the nature of the support and the beneficiaries, using an additional page if necessary):

.....  
 .....

**VII. Assessment of WMO Training Activities**

*The aim of this section is to assess the use and effectiveness of WMO training activities. If no personnel from your Service benefited from WMO support for training (e.g. Blue Series publication, audio-visual aids, participation in training events; fellowships or other financial support), please go to Section IV.*

**III.1 What use is made by your Service of WMO Training Materials?**

- |  | <i>n/a</i>               | <i>low</i>               | <i>med.</i>              | <i>high</i>              |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
| (i) Extent of use of the WMO Training Publications:        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (j) Extent of the use of the WMO Virtual Training Library: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**

Current status (2003-2006) and planning (2006-2009) - Part B: Hydrology

(k) Extent of use of the WMO Training Library Services:      
*slide* *video* *CAL<sup>(\*\*)</sup>* *other<sup>(\*\*\*)</sup>*

(l) Types of training materials used at present:

(m) Types of training materials likely to be needed for future training activities:

<sup>(\*\*)</sup> CAL - Computer-aided learning module; <sup>(\*\*\*)</sup> other - please specify (e.g. multimedia).

(g) Comment upon the range and quality of these services. (please give details below, using an additional page if necessary):

.....  
 .....

**III.2 What use has been made by your Service of training events under WMO Major Programmes from 2003 to 2006?**

(n) Number of events attended by the staff in your Service: *n/a* *1-3* *4-9* *>9*

(o) Number of participants co-sponsored by WMO:

(p) Number of participants financed by other sources:

(q) Adequacy of the attended training events: *n/a* *low* *med.* *high*

(f) Comments upon the quality and range of these training events. (please give details below, using an additional page if necessary)

.....  
 .....

**III.3 What use has your Service made of the WMO Regional Hydrological Training Centres (RMTCs) from 2003 to 2006? (please do not consider the events organized by WMO at RMTCs; see question III.2 above)**

(j) Number of staff in your Service trained at RMTCs during the last 4 years: *n/a* *1-3* *4-9* *>9*

(k) Number of participants co-sponsored by WMO:

(l) Value of the RMTCs' training to the development of your Service: *n/a* *low* *med.* *high*

(c) Comment upon the quality and range of training provided by RMTCs. (please give details below, using an additional page if necessary).

.....  
 .....

**III.4 Are there any ways in which the present interaction/collaboration between RMTCs and national Services could be improved or expanded?** *(please give details below, using an additional page if necessary).*

.....  
 .....

**III.5 What use has your Service made of the WMO Fellowships Programme from 2003 to 2006?** *(please do not count the trainees reported under item (b) in questions III.2 and III.3 above)*

(c) The number of fellowships awarded to staff in your Service and the host countries and their institutions/organizations where the awarded fellowships were implemented.

Fellowship Type	Nr. of fellows	Host countries	Institutions/organizations
Short-term (≤ 6 months)			
Long-term (> 6 months)			

- |  |                          |                          |                          |                          |
|--|--------------------------|--------------------------|--------------------------|--------------------------|
|  | <i>n/a</i>               | <i>low</i>               | <i>med.</i>              | <i>high</i>              |
| (e) Improvement in knowledge and skills of your fellows:                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (f) Relevance of training to current work of your fellows:                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| (g) Impact of fellows on promoting new applications, operations or services: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

(d) Other comments: *(please give details below, using an additional page if necessary).*

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**III.6 Are there any ways in which the present WMO training activities, services and materials could be improved or expanded?** *(please give details below, using an additional page if necessary).*

.....  
 .....

**VIII. Future Education and Training REQUIREMENTS, OPPORTUNITIES AND CAPABILITIES IN HYDROLOGY**

*The aim of this section is to assess the national priorities for training and development, identify the national capability for providing external assistance for education and training activities; and suggest possible new requirements for specific WMO activities, services or materials that would be of value to your Service.*

**IV.1 What short-term professional development training in Hydrology has the highest priority for your Service?** *Please identify the major training requirements of your Service that cannot be satisfied at a national level (such training could be undertaken abroad, or delivered in the country/region by external experts). (please give details below, using an additional page if necessary).*

Fields of specialisation <sup>(1)</sup>	Brief justification of the required specialised training in terms of actual operational needs	Nr. of candidates	Teaching <sup>(2)</sup> language

(3) *You may spell out specific topics within fields of specialisation such as those identified in Chapters 3 and 4 of the publication WMO-No. 258, Vol. I - Hydrology, fourth edition, 2000/2002.*

(4) *Arabic, Chinese, English, French, Russian, Spanish, others.*

**IV.2 What are the expected future requirements for fellowship for your Service?** *Please indicate the number of potential candidates from your Service who require Hydrological education or training abroad, irrespective of the funding source. This information will be used to estimate the likely demand for fellowships but will not be used as a request for fellowships. (please give details below, using an additional page if necessary).*

Fellowship		Foundation Training		Advanced-specialised Training	
Type	Period	Nr. of Hydrologists	Nr. of Met Technicians	Fields of Specialization	Nr. of Candidates
STF (≤ 6 months)	2007				
	2008-2009				
LTF (> 6 months)	2007				
	2008-2009				

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**  
Current status (2003-2006) and planning (2006-2009) - Part B: Hydrology

*IV.3 What is the national capability for providing external assistance for education and training in Hydrology?*

- |  | Yes                      | No                       |
|--|--------------------------|--------------------------|
| (h) Offering education and training to foreign students:<br>(e.g. access to training programmes, full/partial funding, waiving tuition fees, IT support, local training materials) | <input type="checkbox"/> | <input type="checkbox"/> |
| (i) Assisting in the preparation of WMO training publications:<br>(e.g. outsourcing support with printing, translation, contributing authors/reviewers on emerging)                | <input type="checkbox"/> | <input type="checkbox"/> |
| (f) Supporting WMO training events:<br>(e.g. hosting the events, provision of experts, co-sponsorship of participants, production of proceedings)                                  | <input type="checkbox"/> | <input type="checkbox"/> |
| (g) Supplying training materials to the WMO Training Library:<br>(e.g. supplying samples of recent publications, CAL modules, slides, videos)                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| (r) Others: <i>(please give details below, using an additional page if necessary).</i>   |                          |                          |

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**IV.4 Are there any comments you would like to make about your training requirements, opportunities and capabilities that have not been covered elsewhere?** *(Please give details below, using an additional page if necessary).*

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**QUESTIONNAIRE  
ON MEMBERS TRAINING REQUIREMENTS, OPPORTUNITIES AND  
CAPABILITIES**

Current status (2003-2006) and planning (2006-2009)

Part C

**I. EDUCATION AND TRAINING OF AERONAUTICAL METEOROLOGICAL PERSONNEL**

1. What is the minimum qualification for personnel who are to be trained as aeronautical forecasters *(Please tick appropriate box)*

	Certificate/Diploma	BSc in Meteorology	Batchelor or higher degree in appropriate scientific subject	Other approach (please specify below)
Forecasters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other approach: .....

2. What is the minimum entry level qualification for personnel who are to be trained as Aeronautical observers *(Please tick appropriate box)*

	Lower than secondary school level	Certificate/Diploma	Vocational training in Meteorology at secondary or post-secondary level	Other approach (please specify below)
Observers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other approach: .....

3. *What is the duration of basic training*

	Theoretical training	'On-the-job' training	Is the 'On-the-job' training assessed
Forecasters	( weeks/months)	( weeks/months)	(Yes / No)
Observers	( weeks/months)	( weeks/months)	(Yes / No)

4. After personnel have taken up operational appointments, do your personnel participate in a Continuous Professional Development (CPD) programme? *(Please tick the appropriate boxes)*

	<33%	33% – 66%	>66%
Forecasters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Observers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**  
Current status (2003-2006) and planning (2006-2009) - Part C

**II. PUBLIC EDUCATION AND OUTREACH**

Part of the strategy of WMO is to encourage and facilitate the production, distribution and use of public education material in cooperation with others as appropriate. This section deals with the extent to which NMHSs have public education and outreach.

1. For the various groups of people, what is the extent of the public education and outreach programmes? *(Please tick appropriate box)*

	No activities or materials	Few activities or materials	Some activities or materials but could be more	Many activities or materials
Primary school children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Secondary school children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Higher education students	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General public	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Users other than general public	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Policy and decision makers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other groups: .....

2. What types of materials and approaches are used for the public education and outreach programmes? *(Please tick appropriate box)*

	Leaflets, poster and other documents not available via the web	Leaflets, poster and other documents available via the web	Announcements, features and other material using the media including radio, television and newspapers	Seminar, coursed, visits, and other "person to person" contacts
Primary school children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Secondary school children	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Higher education students	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General public	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Users other than general public	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Policy and decision makers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other material and approaches: .....

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**  
 Current status (2003-2006) and planning (2006-2009) - Part C

3. How would you describe the level of collaboration and coordination with your National Education Service? *(Please tick appropriate box)*

	No links	Few links	Some links but could be more	Many links
Primary education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Secondary education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Higher education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other comments: .....

.....

4. For a recent public education and outreach campaign,

- Which was considered to be successful? .....
- .....
- Who was the campaign aimed at? .....
- .....
- What were the main elements of the campaign? .....
- .....
- What collaboration occurred at a governmental level? .....
- .....
- Why was the campaign successful? .....
- .....

5. Indicate which factors act as a constraint on instituting or extending a programme of public education and outreach. *(Please tick appropriate box(es))*

- Lack of resource
- Lack of expertise
- Lack of guidance and/or sample material
- Lack of an effective distribution network
- Lack of partners
- Lack of top-level support
- Other factors (please specify: .....) )

**Questionnaire on Members' Training Requirements, Opportunities and Capabilities**  
Current status (2003-2006) and planning (2006-2009) - Part C

6. What support would you wish to have provided by WMO to assist in initiating or extending public education and outreach activities?

.....  
.....

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## ANNEX V: BREIF OVERVIEW OF WMO-NO. 258

The fourth edition of the traditional publication *Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology* (WMO-No. 258, Vol. I - Meteorology) was issued in December 2001, with the aim of:

- Assisting educators, particularly from developing countries, in designing professional education and specialized training programmes in meteorology; and
- Facilitating common understanding and a degree of uniformity and stability in an international context, whilst fostering innovation and adaptation to national/local circumstances.

Users of these Guidelines should be aware that they depart considerably from the previous editions, both in structure and content, and moreover in the spirit of its implementation. The new structure is as follows:

**Chapter 1.** The new classification system is described along with an explanation of why the system has been changed and the implications of the changes.

**Chapter 2.** Four main meteorological disciplines are delineated, and principal competency requirements for common meteorological jobs are outlined; this is a first step in establishing training requirements in terms of knowledge and skills.

**Chapter 3.** Curricula for the initial education of Meteorologists are described – this is the Basic Instruction Package for Meteorologists (BIP-M)

**Chapter 4.** Curricula for the initial education of Meteorological Technicians are described – this is the Basic Instruction Package for Meteorological Technicians (BIP-MT).

**Chapter 5.** Several methods and strategies for CET are presented in relation with common needs of a NMHS. The concepts of the learning organization, continuing professional development and lifelong learning are emphasized.

**Chapter 6.** Four examples of BIPs: one complete and one condensed BIP-M, and one complete and one condensed BIP-MT.

**Chapter 7.** Nine examples of job-competency requirements at the current operation level in some National Meteorological Services

The core topics outlined in chapters 3 and 4 broadly indicate the syllabus required under the various disciplines. It is stressed that these BIP-topics are not prescriptive curricula - they simply provide an initial/generic framework for the subsequent development of curricula that account for the educational needs and job competency requirements of individual National Meteorological Services, as well as of the broader meteorological community of countries concerned. Accordingly, the content of the BIPs may be changed, either by deepening the study of certain topics, or by broadening the interdisciplinary treatment within the earth system science.

These Guidelines are complemented by a WMO departmental publication containing Detailed Syllabus Examples for each discipline under BIP-M and BIP-MT; see the first issue under the new Series CET-MH, 2001. A periodically updated version of this paper will be maintained on a dedicated web page under the WMO Internet address.