

WORLD METEOROLOGICAL ORGANIZATION

**COMMISSION FOR AGRICULTURAL
METEOROLOGY**

TWELFTH SESSION

ACCRA, 18–26 FEBRUARY 1999

ABRIDGED FINAL REPORT WITH RESOLUTIONS AND RECOMMENDATIONS



WMO-No. 900

Secretariat of the World Meteorological Organization – Geneva – Switzerland

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REPORTS OF RECENT WMO SESSIONS

Congress and Executive Council

- 827 — **Twelfth World Meteorological Congress**. Geneva, 30 May–21 June 1995.
829 — **Executive Council**. Forty-seventh session, Geneva, 22–23 June 1995.
846 — **Executive Council**. Forty-eighth session, Geneva, 11–21 June 1996.
867 — **Executive Council**. Forty-ninth session, Geneva, 10–20 June 1997.
880 — **Twelfth World Meteorological Congress**. Proceedings, Geneva, 30 May–21 June 1995.
883 — **Executive Council**. Fiftieth session, Geneva, 16–26 June 1998.

Regional associations

- 851 — **Regional Association II** (Asia). Eleventh session, Ulaanbaatar, 24 September–3 October 1996.
868 — **Regional Association IV** (North and Central America). Twelfth session, Nassau, 12–21 May 1997.
874 — **Regional Association III** (South America). Twelfth session, Salvador, 17–26 September 1997.
882 — **Regional Association VI** (Europe). Twelfth session, Tel Aviv, 18–27 May 1998.
890 — **Regional Association V** (South–West Pacific). Twelfth session, Denpasar, 14–22 September 1998.
891 — **Regional Association I** (Africa). Twelfth session, Arusha, 14–23 October 1998.

Technical commissions

- 825 — **Commission for Agricultural Meteorology**. Eleventh session, Havana, 13–24 February 1995.
852 — **Commission for Hydrology**. Tenth session, Koblenz, 2–12 December 1996.
854 — **Commission for Basic Systems**. Eleventh session, Cairo, 28 October–7 November 1996.
860 — **Commission for Marine Meteorology**. Twelfth session, Havana, 10–20 March 1997.
870 — **Commission for Climatology**. Twelfth session, Geneva, 4–14 August 1997.
879 — **Commission for Atmospheric Sciences**. Twelfth session, Skopje, 23 February–4 March 1998.
881 — **Commission for Instruments and Methods of Observation**. Twelfth session, Casablanca, 4–12 May 1998.
893 — **Commission for Basic Systems**. Extraordinary session, Karlsruhe, 30 September–9 October 1998.
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GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING OF THE SESSION (agenda item 1)

1.1 The twelfth session of the Commission for Agricultural Meteorology (CAgM) was held in Accra, Ghana, from 18 to 26 February 1999. It was opened at 9.30 a.m. on 18 February 1999 by Mr C. J. Stigter (Netherlands), president of the Commission. He welcomed everyone to the session.

1.2 Mr B. C. Eghan, Chief Director, Ministry of Communications of the Government of Ghana, welcomed everyone to the opening ceremony. He referred to the just concluded International Workshop on Agrometeorology in the Twenty-first Century: Needs and Perspectives and to the fact that the participants found the facilities helpful in achieving the workshop objectives and in preparing and issuing the Workshop Declaration, which the press carried to audiences beyond the shores of Ghana.

1.3 Mr Eghan hoped that the delegates and observers attending the session of CAgM would find the facilities just as adequate, and be even more at home, than the participants of the Workshop. Mr Eghan then formally introduced Mr C. J. Stigter, president of the Commission and chairperson for the opening ceremony, and the remaining part of the meeting.

1.4 The Honourable Minister of Food and Agriculture of the Government of Ghana, Mr Owusu-Acheampong, welcomed the delegates. He stressed that the deliberations of the Commission over the next few days were important in efforts to ensure food security and that that was no mean task considering the very diverse agricultural systems and practices the world over.

1.5 He mentioned that agriculture was vital to the overall economic growth and development of Ghana and was one of the largest contributors to the GDP. It was generally believed that it was in the agricultural sector that Ghana's quest for food security and poverty alleviation through long term and sustainable economic growth and development would have to be won.

1.6 Mr Owusu-Acheampong emphasized that one objective of the Ministry of Food and Agriculture in performing its mission was ensuring the availability of timely, reliable and relevant data on agriculture for strategic planning purposes. In carrying out that objective, the agricultural statistics and census division of the Ministry collaborated with the Meteorological Services Department of Ghana on commodity/input forecast and early-warning system. It provided advance information on commodity production inputs and food supply to alert policy makers and agro-industries well in advance of any impending food shortages/surpluses so that timely and remedial action could be taken.

1.7 Another area of recommended collaboration with the Meteorological Services Department was the

development of a crop weather model for Ghana. Given the inadequate and variability of the rainfall in most parts of the country and in particular its impact on crop production, a simple model of water limited production might be developed for cereals to enhance the crop forecasting and early warning assessment activities of the Ministry and to serve as an advisory and practical tool for the improvement of cereal production.

1.8 Mr Owusu-Acheampong stressed that weather and climate knew no national boundaries. International cooperation at a global scale was therefore essential for the development of meteorology and operational hydrology. He expressed pleasure that WMO deliberations were taking place in Ghana and that they would definitely increase the awareness of what inputs needed to go into lucrative agricultural practices whether in forestry, fisheries or animal husbandry.

1.9 Professor G. O. P. Obasi, Secretary-General of WMO, expressed his personal appreciation and that of the Organization to the Government of Ghana for the kind invitation to host the present Commission session in Accra, along with the International Workshop on Agrometeorology, which was held over the previous three days. He pointed out that that was the first time that a session of CAgM was held on African soil, reflecting the increasing recognition by most countries of the continent of the strong link between agriculture-based economies and weather and climate. Holding the session in Accra was a further demonstration of Ghana's strong support of the ideals and Programmes of WMO. Indeed, Ghana was among the earlier groups of African countries to join WMO soon after becoming an independent nation in March 1957. Professor Obasi recalled with great pride, the excellent contributions of three former Directors of the Ghana Meteorological Services who had served as members of the WMO Executive Council in the past. For example, Mr F. Acquah, the first national Director and Permanent Representative of Ghana with WMO, served on the Council continuously from 1963 until his retirement in 1975, and also became the Third Vice-President of WMO in 1970. The collaboration between WMO and Ghana had continued to be further strengthened over the years. Professor Obasi thanked Mr N. B. Yelifari, Director of the Meteorological Services Department and Permanent Representative of Ghana with WMO, and his staff, as well as his other collaborators, for making all the necessary arrangements that helped ensure the success of the session.

1.10 The Secretary-General thanked the president and vice-president of the Commission, Messrs C. J. Stigter and M. J. Salinger, respectfully, for their able leadership in guiding the Commission over the past eight years. He also extended his sincere thanks to the chairpersons and members of various working groups,

and the rapporteurs and their coordinators, for their contribution during the inter-sessional period.

1.11 Professor Obasi stated that since the last session of the Commission in 1995, there had been many developments and initiatives that had significant implications for the activities of the Commission. Those included the coming into force in 1996 of UNCCD, which had so far been ratified or acceded to by 145 countries; the 1997 Special Session of the United Nations General Assembly on the implementation of UNCED's Agenda 21; the outcome of COP-3 and COP-4 to the UN/FCCC, the Convention on Biological Diversity, and the successful World Food Summit. The World Food Summit, in particular, was organized by FAO in 1996 to sensitize the global community to the serious food security situation in many parts of the world. The Summit noted that more than 800 million people throughout the world lacked food sufficiency and that sustainable agriculture, which included crops, livestock husbandry, forestry, and fisheries, was essential to attaining the required food security.

1.12 Professor Obasi emphasized that agriculture was the sector most sensitive to variability in weather and climate. Extreme weather events occurred in many parts of the world with a negative impact on agricultural production. There had been some alarming cases of floods, tropical cyclones, droughts and other climatic catastrophes over the last few years. The 1997-1998 *El Niño* event caused significant damages in agricultural production in different parts of the world. Professor Obasi referred to the hardship that the people of Ghana had had to endure due to the low level of the famous Volta Hydroelectric Dam at Akosombo during the 1997-1998 *El Niño* event.

1.13 The Secretary-General mentioned that among the many pressing long-term problems affecting food security in several parts of the world was that of desertification, with severe and prolonged drought being one of the major contributing factors. In Africa, for example, drought and desertification had been posing major problems over the last 20 to 30 years, with dramatic effects on the social and economic well-being of many countries. Agricultural lands were disappearing and rivers were drying up due to prolonged droughts. In addition to variations in climate and desertification, longer-term global warming would produce changes in climatic regimes around the world and could adversely impact agricultural production in some places. Changes in the chemical composition of the atmosphere might already be producing significant effects on agricultural and forestry ecosystems, while farming methods, which included the use of fertilizers and pesticides, were themselves sources of Earth-warming greenhouse gases. Those processes were of particular importance to the UN/FCCC and to the WMO/UNEP IPCC, a body that assessed the impact of climate change on the various economic sectors such as agriculture. He therefore urged the Commission to pay particular attention to the identification of regions most vulnerable to climate variability and change and how agrometeorological

management strategies could help to mitigate the adverse effects or take advantage of any improved agricultural conditions which might arise from climate change.

1.14 Professor Obasi stated that WMO had been addressing the issues relating to food security in several ways, particularly through its AgMP and other related activities. For example, through its CLIPS Project, WMO was collaborating with various national and international research programmes and institutions to improve further the prediction of climate variability, on the time-scale of weeks to seasons or even years. Such predictions would have a tremendous impact on the contribution of NMHSs to agricultural planning and production. He therefore urged the Commission to consider ways to promote further the use of climate forecasts in operational agriculture. In that light, he was pleased to note that a new project on that topic was already being proposed for implementation during the next WMO financial period.

1.15 WMO had continued to support the implementation of the UNCCD, as many articles of the Convention were of special relevance to the work of the Commission. He called upon the Commission to continue to examine the issues involved and to provide guidance on appropriate agrometeorological strategies and actions to minimize the rate of land degradation and to mitigate the effects of drought. In that regard, he also urged all Member countries to implement the Convention and to continue to support the operation, or to consider the establishment of regional centres in the climate-sensitive parts of the world.

1.16 The Secretary-General stressed the importance that WMO attached to enhance its cooperation in agrometeorology with various international and regional organizations. He mentioned, in particular, FAO where the cooperation was in the promotion of food production through the application of agrometeorological methods to improve land use, crop selection and management practices. WMO also collaborated with UNESCO, UNEP, the IARCs under CGIAR, START, ACMAD and AGRHYMET.

1.17 As the present session of the Commission was the last one of the century and since the Commission had the opportunity to address its concerns and proposals to the WMO Congress through the draft Fifth WMO Long-Term Plan to be approved by Congress in May 1999, the Secretary-General urged that the Commission take into account the recommendations of the just concluded International Workshop on Agrometeorology, which examined the needs and perspectives for agrometeorology and its applications to agriculture in the twenty-first century. The Secretary-General also urged that special attention be placed on other issues such as the impact of commercialization of NMHSs, on the provision of agrometeorological services, the terms of reference of the Commission and the future structure and priority areas of AgMP.

1.18 The Honourable Minister of Communications, Mr J. Mahama, expressed the happiness of the

Government of Ghana that the twelfth session of CAgM was taking place in Accra. As that was the first time a session of CAgM or any other Commission of WMO was being held in Ghana, he assured the Commission that the whole country was very anxious to know the outcome of its discussions over the next two weeks and to take advantage of any new grounds that would be broken to enhance their efforts in agriculture.

1.19 Mr J. Mahama stated that the world's climate and weather patterns were going through an unprecedented period of upheaval. Even the most sceptical were now recognizing the reality of global warming, manifesting itself both in erratic weather episodes ranging from drought to violent storms, and in worrying climatic trends. Governments around the world were endeavouring, often with inadequate urgency and determination, to ameliorate some of the causes of global warming by checking the emission of greenhouse gases and combating deforestation, among other measures. Meanwhile, the farmers of the world were facing the consequences of those events which impacted negatively on agricultural production. In Africa, where farming was predominantly rain-fed, and often carried out with simple technology on a relatively small-scale basis, agriculture was particularly vulnerable to those climate changes.

1.20 Mr J. Mahama emphasized that there was therefore a more urgent need than ever for the comprehensive collection and analysis of meteorological data to provide prompt, accurate and relevant short-, medium- and long-term forecasts on weather patterns.

1.21 Mr J. Mahama referred to the question of the dissemination of data and trends. While policy-making organizations, government departments and large commercial agricultural enterprises knew the value of meteorological information and how to access it, it was important to consider how one could be more effective in getting timely and relevant information to the small-scale farmers who made up the majority of agriculturalists in Ghana and who could least withstand crop losses caused by erratic weather. Mr J. Mahama highlighted the importance of the session as it would plan the activities of the agricultural meteorological programmes of WMO for the turn of the century. The deliberations of the session would therefore serve as the foundation stone for those activities for the twenty-first century.

1.22 As the Government of Ghana was concerned about the ever-increasing degradation of the environment due to human activities especially in agriculture and as it was one area which was posing problems to their efforts aimed at reducing poverty levels in Ghana, Mr J. Mahama highlighted the areas that would receive special attention in the forthcoming National Communications Policy of Ghana.

1.23 Mr J. Mahama was pleased to note that WMO had put in place the WWW Programme involving all NMSs in meteorological data collection to improve man's understanding of the atmosphere to find solutions to such problems. There were uncertainties in the predictions relating to the timing, magnitude and regional pattern of climate change as it affected

agriculture due to the current incomplete understanding of the various aspects of the complex process. None the less, the information available was sufficient to allow for certain actions to be taken to address concerns relating to global food security.

1.24 In his statement at the opening session, Mr C. J. Stigter, president of the Commission, mentioned that the technical commissions had generally come out of the discussions on restructuring of the Organization in a strengthened position, apart from CIMO, for which there remained hope, however. He highlighted three important developments:

- (a) That the flexibility of support of the Commission to the agrometeorological programme had increased, among other measures, by a more thorough regionalization;
- (b) That the focusing of the Commission's work had changed with the selection of some urgent new priorities and some more explicitly determined policies, while some older priorities had, of course, remained;
- (c) That the priorities could now be better connected to policies, globally, regionally and locally; that had been made explicit in the vision document "CAgM — Towards 2000 and Beyond". The vision document permitted organization at one level of aggregation below that set by the terms of reference of the Commission.

1.25 Mr Stigter emphasized that science and technology developments were highly needed but were also highly in need of very specific guidance by very well determined needs in which man and his production environment were central. That was fully in line with the outcome of the International Workshop on Agrometeorology which was held over the previous three days.

1.26 Mr Stigter expressed his delight that the last session of CAgM that he was chairing was taking place in Africa as he lived in Tanzania for close to nine years and had undertaken 40 missions to Africa since 1985. Ghana was the fifteenth African country he visited for work. He expressed the hope that Africa would profit from the advances that had been made in science and technology developments. The Commission had played and should continue to play a role in the exercise of fine tuning those developments to local, regional and continental needs.

1.27 The president thanked all the speakers for their stimulating words and encouraging remarks. He thanked the Government of Ghana for hosting the present session of the Commission.

1.28 There were 117 participants at the session, including representatives from 56 countries and nine international organizations. A complete list of participants is given in Appendix A to this report.

1.29 The Secretary-General's representative at the present session of the Commission was Mr M. Coughlan, Director of the World Climate Programme Department. He was assisted by Messrs M. V. K. Sivakumar and A. Yeves Ruiz, who acted as secretaries for the working committees, and by other staff of the Secretariat.

2. ORGANIZATION OF THE SESSION (agenda item 2)

2.1 CONSIDERATION OF THE REPORT ON CREDENTIALS (agenda item 2.1)

In accordance with WMO General Regulation 22, a list of participants and the capacities in which they were attending the session was prepared on the basis of an examination of the credentials. The list, prepared by the representative of the Secretary-General, was accepted unanimously as the report on credentials. Consequently, it was decided not to establish a Credentials Committee.

2.2 ADOPTION OF THE AGENDA (agenda item 2.2)

The Commission adopted the provisional agenda with some minor modifications. The agenda of the session, as approved by the Commission, is reproduced in Appendix B to this report.

2.3 ESTABLISHMENT OF COMMITTEES (agenda item 2.3)

2.3.1 In accordance with WMO General Regulation 24, the Commission established the following committees for the duration of the session:

WORKING COMMITTEES

2.3.2 Two working committees were established to examine in detail the various agenda items:

- (a) Committee A to examine agenda items 4 to 8 and 14 to 16. Mr Chan Ah Kee (Malaysia) and Ms V. Pérarnaud (France) were elected co-chairpersons of the committee;
- (b) Committee B to examine agenda items 9 to 13. Messrs R. P. Motha (United States) and L. E. Akeh (Nigeria) were elected co-chairpersons of the committee.

NOMINATION COMMITTEE

2.3.3 A Nomination Committee was established consisting of the following delegates:

- RA I Mr I. M. Musa (Ghana);
- RA II Mr B-L. Lee (Republic of Korea);
- RA III Mr J. Choquevilca Rocha (Bolivia);
- RA IV Mr R. Desjardins (Canada);
- RA V Mr R. K. Stringer (Australia);
- RA VI Mr P. V. Harker (United Kingdom).

Mr P. V. Harker was elected chairperson of the Nomination Committee.

COORDINATION COMMITTEE

2.3.4 In accordance with WMO General Regulation 28, a Coordination Committee was set up consisting of the president and vice-president of the Commission, the co-chairpersons of the working committees and the representative of the Secretary-General.

SPECIAL COMMITTEE FOR THE NOMINATION OF MEMBERS OF WORKING GROUPS AND RAPORTEURS

2.3.5 A Special Committee, consisting of:

- The president;
- The vice-president;
- Mr D. Rijks (Netherlands);

Ms Wang Shili (China);
Mr Chan Ah Kee (Malaysia);

Mr B. Diarra (Mali);

Mr B. O'Donnell (Canada);

Mr J. Choquevilca Rocha (Bolivia);

Mr O. D. Sirotenko (Russian Federation);

was established to formulate proposals for the nomination of members of working groups and rapporteurs. Mr B. O'Donnell was elected chairperson of that Committee.

2.4 OTHER ORGANIZATIONAL MATTERS (agenda item 2.4)

2.4.1 The working hours adopted were from 9.30 a.m. to 12.30 p.m. and from 2.30 p.m. to 5.30 p.m.

2.4.2 The Commission decided that, in accordance with WMO General Regulation 111 and in view of the technical and specific nature of its discussions, it was not necessary to prepare minutes of the plenary meetings of the current session. The list of documents presented at the session is given in Appendix B to this report.

3. REPORT BY THE PRESIDENT OF THE COMMISSION (agenda item 3)

3.1 The Commission noted with appreciation the report of the president, which reviewed the activities of the Commission since its eleventh session and contained guidance for future activities.

3.2 The Commission approved "to promote agrometeorology and agrometeorological applications for efficient, sustainable agriculture, silviculture and aquaculture for an increasing world population in rapidly changing environments" as the theme upon which to focus its activities during the next inter-sessional period, as proposed in the document mentioned in general summary paragraph 3.4.

3.3 The Commission endorsed the idea of Agrometeorological Advisers to presidents of regional associations on matters relating to the affairs of agrometeorology. The Adviser should also be in touch with all the CAgM members advising the Permanent Representatives of members of the Region.

3.4 The Commission complimented the Advisory Working Group for preparing the document "CAgM — Towards 2000 and Beyond" which offered the opportunity of refocusing priority areas and issues of AgMP. The Commission was pleased to note that it was guided by the twin principles of utility and efficiency in the provision of services to Members. The Commission endorsed the document for submission to Thirteenth Congress, after amendments had been made.

3.5 The Commission noted that some rapporteurs and members of the working groups had encountered serious problems in the preparation of their reports, caused by lack of necessary support, including financial provisions. The Commission agreed on the need to select good scientists who would be able to devote time within their schedules to the Commission. Agrometeorological Advisers to presidents of regional associations as well as

all CAgM members should assist in approaching Permanent Representatives to have their staff and other experts in the country contribute more to work for CAgM, while all involved should show better the connections that existed between the needs of NMHSs and the work in the AgMP projects. The Commission decided that the proposals made regarding experts in the Havana Report (general summary paragraph 3.6) would continue.

3.6 The Commission noted with appreciation the efforts of the WMO Secretariat in preparing the Guidelines for authors of WMO Technical Notes and reports of the Commission for Agricultural Meteorology. The Commission agreed that, in order to ensure the quality of the reports and their timely publication, it would be useful if all working groups and rapporteurs could prepare their reports following the Guidelines given, and it encouraged the working groups and rapporteurs to follow the instructions in the Guidelines while preparing their reports.

3.7 The Commission congratulated the Advisory Working Group and the WMO Secretariat for their excellent efforts in organizing the International Workshop on Agrometeorology in the Twenty-first Century: Needs and Perspectives, which permitted increased participation of members from developing countries in the session. The Commission emphasized the need to consider carefully the conclusions and recommendations from the Workshop in developing future activities for the Commission.

3.8 The Commission noted with appreciation the progress made in the activities of the Commission, especially the publication of a large number of reports. The Commission complimented the Secretariat for the excellent support it had been providing to the Commission in carrying out its activities. The Commission decided that strict monitoring of progress of working groups and joint rapporteurs by the Secretariat would continue.

3.9 The Commission fully supported the steps taken by the Secretariat to enhance international cooperation, for example with START of IGBP, WCRP and IHDP. It encouraged WMO's continued participation in the activities of the START Committees.

3.10 The Commission noted with concern the insufficient number of good submissions for the NORBERT GERBIER-MUMM International Award and requested the Members to give wider coverage to the announcement regarding the submissions for the award to increase the number and quality of submissions.

3.11 The Commission emphasized the need for continuing strong collaboration with related WMO Programmes and Commissions in the implementation of AgMP and it noted with appreciation the participation of CAgM representatives in inter-programme and inter-commission activities. It encouraged the members to participate in such activities.

3.12 The Commission agreed on the need for links to be established between CAgM reports and existing agrometeorological information databases and for case studies on economically-valuable, or otherwise successful, agrometeorological applications and services.

3.13 The Commission endorsed the idea of a complete revision of the *Guide to Agricultural Meteorological Practices* (WMO-No. 134). The Commission proposed the establishment of a special Steering Committee and to discuss the plans detailed in a recent circular letter of the president under the appropriate agenda item.

3.14 The various other suggestions made in respect to the report of the president were considered further under the relevant agenda items.

4. NATIONAL PROGRESS REPORTS ON AGRICULTURAL METEOROLOGY (agenda item 4)

4.1 The Commission noted with appreciation the initiative taken by the WMO Secretariat in preparing and circulating a detailed questionnaire using the standard layout for the preparation of national reports on progress made by Members during 1995–1998 according to Recommendation 1 (CAgM-XI) — National reports on progress made in agricultural meteorology.

4.2 The Commission noted with satisfaction that 54 Members had provided national reports on progress made and that the WMO Secretariat had compiled a comprehensive list of the countries who provided responses. The Commission also noted that responses were received from nine Members after the deadline.

4.3 The Commission noted with appreciation the proposal of the WMO Secretariat to compile the information provided in the reports in a comprehensive database on the status of agrometeorological activities in Member countries. It noted with interest that Parts 1 to 4 of the responses received from the 54 Members had already been entered in the database.

4.4 The Commission reviewed the short analysis of those responses prepared by the WMO Secretariat and agreed that the analysis provided valuable information on the organization of agrometeorological units, on the status of agrometeorological observation networks, on the nature of agrometeorological and agroclimatological research undertaken, on the means and methods of agrometeorological services, and on publications.

4.5 The Commission noted with concern the disturbing trend of reducing the number of stations in the network of agrometeorological observations and that 13 of the 54 Members reported less number of stations in operation in 1998 as compared to 1995. The Commission urged the Members to take appropriate steps to arrest that decline and requested the donor countries to assist the developing countries in improving their network of agrometeorological stations to provide timely and efficient agrometeorological services to agriculture.

4.6 The Commission noted with interest the extensive range of publications brought out by the 54 Members during 1995–1998, and in some cases for a longer period, and encouraged the Members to continue placing emphasis on regularly publishing information generated by the agrometeorological services.

4.7 The Commission agreed with the proposal of the WMO Secretariat to compile the information provided in the reports in a comprehensive database.

Noting the importance of preparing such a database covering as many Members as possible, the Commission adopted Recommendation 1 (CAGM-XII).

5. REGIONAL ACTIVITIES IN AGROMETEOROLOGY (agenda item 5)

5.1 The Commission expressed its satisfaction with the establishment of working groups and rapporteurs on agricultural meteorology by the regional associations and noted that studies recommended by CAGM-XI were included in their terms of reference. The Commission reiterated that such studies were important as the agrometeorological situations differed greatly from region to region. Such studies complement those undertaken by CAGM.

5.2 The Commission encouraged WMO's participation at meetings of other organizations in different regions, within the available budgetary resources, to convince the national agencies and the user community of the importance and value of applying meteorological knowledge and information to increase sustainable agricultural production, to reduce losses due to pests and diseases and during storage and transport, and to minimize the pollution of the environment from agricultural practices.

5.3 The Commission agreed that responses to questionnaires circulated in the regions were in general poor and encouraged the members to provide prompt responses to questionnaires received from WMO.

REGIONAL ASSOCIATION FOR AFRICA (RA I)

5.4 The Commission noted the activities carried out by the Working Group on Agricultural Meteorology re-established by the eleventh session of RA I. The Commission expressed its satisfaction that the technical report of the RA I Working Group on Agricultural Meteorology would be published in the CAGM Report Series.

5.5 The Commission agreed with the observations of the Association (XII-RA I) that responses to questionnaires circulated in the region had been poor and that it affected the work of the members of the working group. The Commission appreciated the suggestion made by the association that the Directors of NMHSs should designate, from their agrometeorological departments, coordinators who would be responsible for preparing responses to questionnaires received from WMO. The Commission agreed with the suggestion made by the Association that working group members could also use other means of communication such as list servers, e-mail and World Wide Web as well as the agrometeorology discussion group on the Internet implemented by WMO and FAO.

5.6 The Commission noted that RA I, at its twelfth session, had appointed three rapporteurs to address the following agrometeorological issues of priority to Africa: agrometeorological methods and practices, meteorological factors in land and ecosystem degradation and data needs for agrometeorology.

REGIONAL ASSOCIATION FOR ASIA (RA II)

5.7 The Commission noted that the eleventh session of the Association had reestablished a Working Group on Agricultural Meteorology to study problems of particular interest to the Region and that a meeting of the group was being planned to be held in 1999.

5.8 The Commission complimented the India Meteorological Department for arranging to publish the Proceedings of the Training Seminar/Workshop on User Requirements for Agrometeorological Services, held in Pune, India from 10 to 14 November 1997. The Commission agreed that the Proceedings, which were circulated to all the Members, provided good visibility to the host country and would be of great use to agrometeorologists in all the regions. The Commission encouraged the members to undertake similar activities in their regions.

REGIONAL ASSOCIATION FOR SOUTH AMERICA (RA III)

5.9 The Commission noted with regret that the activities of the RA III Working Group on Agricultural Meteorology, established by the Association at its eleventh session, could not proceed as planned because of problems in identifying rapporteurs.

5.10 Noting that at the twelfth session of RA III, a resolution was adopted to appoint a rapporteur on agricultural meteorology with specific terms of reference and whose responsibility was assigned as a regular task to the Permanent Representative of Peru, the Commission urged the rapporteur to undertake work on the tasks assigned.

5.11 The Commission agreed with the views of the Association supporting the establishment of a joint project involving Costa Rica, Cuba, Mexico and Venezuela on the exchange of agrometeorological information and invited all members of RA III to consider their participation in it. The Commission also urged members to take actions in the implementation of UNCCD and to benefit from the support by the Global Environment Facility for projects in that area.

5.12 The Commission expressed its gratitude to the Secretary-General for his continued financial assistance to the Regional Bibliographic Centre for Agrometeorology in Lima, Peru, which had been assigned the responsibility for the publication and distribution of annotated bibliographies in meteorology, including agrometeorology, for use by members of RAs III and IV. The Commission requested the Secretary-General to seek the authorization of Congress to continue to provide support to the Centre during the next financial period.

5.13 The Commission noted with appreciation the publication and distribution by WMO of the FAO-WMO-UNESCO-UNEP Inter-agency report in Spanish entitled *Encuesta Agrometeorológica de las Tierras Bajas de los Trópicos Húmedos de América del Sur*. The Commission supported the steps taken by the Secretariat to provide publications in different languages.

REGIONAL ASSOCIATION FOR NORTH AND CENTRAL AMERICA (RA IV)

5.14 The Commission noted with regret that the activities of the RA IV Working Group on Agricultural Meteorology, established by the Association at its eleventh session, could not proceed as planned because of problems in identifying rapporteurs.

5.15 Noting that at its twelfth session, the Association decided that the working group would be re-established with renewed terms of reference, the Commission urged the group and the Secretariat to take active steps to ensure that the activities of the group were initiated promptly to address all the terms of reference assigned to the group.

5.16 The Commission noted with appreciation the cooperation extended by the USDA to the Secretariat in the preparation of the training manual for the Roving Seminar on Data Management for Applications to Agriculture and in conducting the seminar in Slovenia for 11 European countries with economies in transition in October 1998. It encouraged the Members to benefit from those courses.

REGIONAL ASSOCIATION FOR THE SOUTH-WEST PACIFIC (RA V)

5.17 The Commission noted with regret that the activities of the RA V Working Group on Agricultural Meteorology, established by the Association at its eleventh session, could not proceed as planned because of the demise of Mr M. B. Rozari (Indonesia), chairperson of the group, on 19 December 1997. The Commission acknowledged the valuable contributions made by Mr Rozari to its activities.

5.18 The Commission noted that the twelfth session of RA V, by Resolution 11 (XII-RA V) decided to appoint a Rapporteur on Agricultural Meteorology and that Mr Sutrisno (Indonesia) had been nominated rapporteur.

5.19 The Commission noted with appreciation that members of the Association continued to contribute to the activities of CAgM and that the publication *Climate Variability, Agriculture and Forestry: an Update* (Technical Note No. 199, WMO-No. 841), had been prepared and published under the chairpersonship of Mr M. J. Salinger (New Zealand).

REGIONAL ASSOCIATION FOR EUROPE (RA VI)

5.20 The Commission noted the activities carried out by the Working Group on Agricultural Meteorology, established by the eleventh session of RA VI. The Commission expressed its satisfaction that the technical report of the RA VI Working Group on Agricultural Meteorology would be published in the CAgM Report Series.

5.21 The Commission noted that RA VI, at its twelfth session, had re-established the Working Group on Agricultural Meteorology, with new terms of reference.

5.22 The Commission recorded its appreciation to the IATA in Florence, Italy for serving as a specialized centre for training in remote-sensing applications to agriculture. The Commission noted with satisfaction the

training courses organized by the Institute in cooperation with WMO. The Commission noted with appreciation the cooperation extended by the Institute to the Secretariat in preparing the training manual for the Roving Seminar on Automatic Weather Stations and in conducting the seminar in Bahrain in October/November 1998. It encouraged the Members to benefit from those courses.

RESOLUTION

5.23 Recognizing that there was a need to undertake a critical evaluation of the position of agrometeorology in NMHSs, the Commission adopted Resolution 1 (CAGM-XII).

6. FOURTH WMO LONG-TERM PLAN AND THE AGRICULTURAL METEOROLOGY PROGRAMME (agenda item 6)

6.1 The Commission noted with satisfaction the progress made in the implementation of AgMP during the inter-sessional period.

6.2 The Commission noted in particular the large number of training activities that had been organized during the inter-sessional period, including seven training seminars/workshops and 13 roving seminars. (For discussion on those activities, see agenda item 14.3).

6.3 The Commission was pleased with the large number of publications issued during the inter-sessional period, including four proceedings, three Technical Notes, two brochures, 18 CAgM Reports, one inter-agency report and five technical manuals. The Commission congratulated the Secretary-General on that achievement and recommended that the publications should be distributed to all members and, to the extent possible, the user community.

7. FIFTH WMO LONG-TERM PLAN AND THE AGRICULTURAL METEOROLOGY PROGRAMME (agenda item 7)

7.1 The Commission agreed with the two main long-term objectives of the AgMP of the draft Fifth WMO Long-term Plan and noted with satisfaction the seven projects formulated for the thirteenth financial period 2000–2003 (numbered from Project 42.0 to Project 42.6) to implement the Programme.

7.2 The Commission suggested that projects 42.4 and 42.6 be renamed as followed:

Project 42.4 — Communication of agrometeorological information;

Project 42.6 — Impact of management strategies in agriculture and forestry to mitigate greenhouse gas emissions and to adapt to climate variability and climate change.

7.3 The Commission agreed that the description of the Programme related to data management should be more comprehensive and should include reference to an integrated dataset including climate, weather and agronomic data.

7.4 The Commission noted the working groups and rapporteurs recommended by the Advisory Working

Group for the next inter-sessional period (see agenda item 8). The Commission reiterated the importance of the role of an advisory body to assist the president on matters relating to agricultural meteorology and adopted Resolution 2 (CAGM-XII) re-appointing the Advisory Working Group of CAGM, with renewed terms of reference.

8. REVIEW OF THE TECHNICAL REGULATIONS AND OF THE *GUIDE TO AGRICULTURAL METEOROLOGICAL PRACTICES* (WMO-No. 134) (agenda item 8)

8.1 REPORT OF THE ADVISORY WORKING GROUP (agenda item 8.1)

8.1.1 The Commission noted with appreciation the work accomplished by the Advisory Working Group during the inter-sessional period and complimented the Advisory Working Group for proposing a balanced agenda for CAGM-XII and for its recommendations on the terms of reference of working groups and rapporteurs for the inter-sessional period. It noted with regret the sudden demise of Mr F. A. Muminov (Uzbekistan), who had been nominated as a member of the Advisory Working Group.

8.1.2 The Commission congratulated the Advisory Working Group and the Secretariat for their initiative to organize the International Workshop on Agrometeorology in the Twenty-first Century: Needs and Perspectives. That event helped promote the attendance by CAGM members from developing countries at the session. The Commission proposed that a similar event be organized in conjunction with the thirteenth session of CAGM.

8.1.3 The Commission expressed its appreciation to Mr W. Baier (Canada) for his report on WMO/CAGM related achievements in agricultural meteorology. The Commission noted that the report summarized submissions from 16 Member countries and stressed the importance of reflecting fully the real impact of the work of the Commission at the global level as outlined in that report. The Commission requested the Advisory Working Group to take steps to have the report reviewed accordingly and requested the Secretariat to arrange subsequent publication of the report in the CAGM Report Series. The Commission also recommended that suitable extracts be taken from the report and used, in due course in the preparation of a popular brochure on agrometeorology for sustainable agriculture. For that brochure, case studies should also be collected on economically-beneficial agrometeorological applications and services and on other success stories in agrometeorology for policy matters. The Commission proposed the establishment of a special coordinator for those collections, with the following experts: Messrs V. Antonenko (Ukraine), W. Baier (Canada), M. Carvajal Ortiz (Ecuador), G. Munthali (Malawi), Nguyen Thi (Viet Nam), S. Shen (China), D. Tohio (Benin), V. Usmanov (Uzbekistan), P. Zorba (Albania), R. N. Whitaker (Australia), Ms L. Lebed (Kazakhstan), Ms P. Ustinova (Russian Federation) and Ms V. Pérarnaud (France). The Commission requested Mr W. Baier (Canada) to serve as the coordinator.

8.2 *GUIDE TO AGRICULTURAL METEOROLOGICAL PRACTICES* (WMO-No. 134) (agenda item 8.2)

The Commission agreed with the proposal of the Advisory Working Group that the new *Guide to Agricultural Meteorological Practices* should become more operational. The Commission recorded its appreciation to the ad hoc working group of the Advisory Working Group for their proposal to undertake a thorough revision of the *Guide*. It agreed with the ad hoc group's observation that the examples given in the current *Guide* expressed well the agrometeorology of the 1970s and 1980s and that technologies, methodologies and applications had been developed further since then and new issues had emerged. The Commission noted the additions/amendments made at the session on the proposal from the ad hoc group and authorized the president to take such actions as might be required on the proposed revision. The Commission appointed the following experts to assist the president in revising the *Guide*: Messrs A. K. Abdullaev (Uzbekistan), W. Baier (Canada), M. M. Eissa (Egypt), P. Kozhakhmetov (Kazakhstan), E. Mukhala (Zambia), Si Giai Ngo (Viet Nam), C. J. Stigter (Netherlands) and an expert from South America (to be named). The Commission requested Mr C. J. Stigter to serve as the coordinator.

8.3 TECHNICAL REGULATIONS (agenda item 8.3)

8.3.1 The Commission noted the following proposals from the Advisory Working Group for specific amendments to the Technical Regulations:

- (a) In many developing countries, urbanization had seriously affected the environment around meteorological stations. It was necessary to distinguish climate warning and urban heat-island effects. Otherwise, the effects of the former might be enlarged. Therefore it was important to ensure that the environment of stations was properly maintained;
- (b) The heights of measuring air temperature were sometimes different. In some countries, it was 1.5 m while in others it was 2.0 m. There was a necessity to maintain uniformity in that regard;
- (c) Forecasts of dates of crop sowing, transplanting or harvest were also important and useful. Those could be included in agrometeorological forecasts;
- (d) "Degree day" or "accumulated temperature" was often used in the literature. Mr Monteith called it "thermal time", but the units used in papers were different, some used "°c.d.", while others used "c". A clear definition of those units was necessary. "°c.d." looked more reasonable from the standpoint of physical principles.

8.3.2 The Commission decided that there was a need to make amendments to the Technical Regulations to reflect the above proposals.

9. REQUIREMENTS FOR AGROMETEOROLOGICAL INFORMATION (agenda item 9)

9.0.1 The Commission noted the work accomplished by the Working Group on Validation of

Information Requirements on Agricultural Crops summarized by its chairperson, Mr P. D. Jamieson (New Zealand). The Commission considered that the final report contained useful information. It requested its president to have the report suitably edited and published as a CAgM report.

9.0.2 The Commission acknowledged that although a lot of knowledge on the information requirements of agricultural crops existed, it was difficult to find all the information in one place. The Commission recommended that WMO and FAO, along with other relevant organizations, should undertake the preparation of a compendium on that subject.

9.1 CEREAL CROPS (agenda item 9.1)

9.1.1 The Commission emphasized the availability of information technology to diffuse information at the farmer level in developing countries. Noting that knowledge and databases existed, especially in FAO, the Commission recommended that those could be used to analyse management effects on crop production, modify farmer management practices and improve crop production.

9.1.2 The Commission recommended, where possible, the establishment by Members of core stations for the collection of integrated datasets on climate, soils, crops, pests and disease, using an interdisciplinary approach and, where possible, automatic weather stations.

9.1.3 The Commission recommended that further case studies should be made on validation of information requirements for agricultural crops, taking full account of the environment and sustainable development. In that connection, information on application of remote sensing techniques and GIS should be widely disseminated for practical applications.

9.1.4 The Commission urged the Organization, in conjunction with FAO and IARCs, to organize training programmes for trainers, development agencies, NGOs and the end users in the identification of information requirements, and to facilitate the rapid diffusion of that information.

9.2 TUBER AND PULSE CROPS (agenda item 9.2)

9.3 COMMERCIAL TREE CROPS (agenda item 9.3)

9.4 FIELD AND BUSH CROPS (agenda item 9.4)

9.5 VEGETABLE CROPS (agenda item 9.5)

The Commission noted that there was no specific report on those aspects. However, the Commission was of the opinion that given the socio-economic and nutritional importance of those crops, members should be encouraged to compile such information in the future.

9.6 IRRIGATED SOILS AND CROPS (agenda item 9.6)

9.6.1 The Commission complimented Mr R. P. Samui (India), coordinator of the Joint Rapporteurs on Validation of Information Requirements on Irrigated Soils and Crops for his report. It noted with appreciation that Mr A. K. Abdullaev (Uzbekistan) also submitted a brief report on the estimation of cotton yield using agrometeorological information. The Commission

expressed its regret that other rapporteurs did not submit any report. The Commission recommended that the reports already submitted should be suitably edited and published as CAgM reports.

9.6.2 The Commission noted that a number of revolving seminars had been organized jointly by WMO and FAO on Application of Meteorological Data for Effective Planning and Management of Water for Sustainable Irrigated Crop Production in 18 countries during 1992–1997. The Commission noted with pleasure that there was a lot of ongoing research on water requirements of crops under various types of soil and meteorological conditions and for various types of crops. The Commission requested the Secretary-General to consider organizing regional symposia on the subject, particularly in Africa, Asia and South America in the near future in order to exchange and review current knowledge and technology in the field of irrigation scheduling and its environmental impact.

9.6.3 The Commission noted the recommendation of the joint rapporteurs on the need to assess the two components of the total evapotranspiration, i.e. soil evaporation and transpiration, and to consider the interaction between them. In order to develop more effective soil and crop management strategies, especially in arid and semi-arid areas, that information was crucial. The Commission encouraged the members to pay more attention to those aspects.

9.6.4 The Commission urged members to continue to study the inter-relationships among the soil-water-plant-atmosphere continuum in order to determine the optimum conditions for irrigation scheduling, particularly during periods of adverse weather. Efforts should be made to promote system design and management in such a way as to balance the often conflicting needs of maintaining high yields without causing environmental degradation either on-site or off-site, using dynamic simulation models.

9.6.5 Over-irrigation and improper drainage were leading to problems of increasing salinization which was taking much of the productive lands out of production. The Commission expressed its concern regarding the impact of growing salinization on the sustainability of irrigated cropping systems in most developing countries. The Commission emphasized the need for interdisciplinary cooperation between agrometeorologists, soil scientists and irrigation specialists to devise appropriate irrigation management techniques to tackle that growing menace.

9.7 FOREST MANAGEMENT AND EXPLOITATION (agenda item 9.7)

There was no specific report on that subject.

9.8 LIVESTOCK AND PASTURE PRODUCTION (agenda item 9.8)

9.8.1 The Commission noted with appreciation that Mr O. L. Babushkin, Rapporteur on the Utilization of Meteorological Information Required for Pasture and Livestock Production in Arid and Semi-arid Climates and that Ms L. V. Lebed, Rapporteur on the Use of Direct

and Remote Sensing Methods to Provide Information for Livestock and Pasture Production in Arid Climatic Zones, had completed their work and submitted their final reports. The Commission recommended that their reports be published in the CAgM Report Series.

9.8.2 The Commission agreed that effective operation of the livestock sector depended on the provision of up-to-date hydrometeorological information.

9.8.3 The Commission noted that many countries had interesting methods/models for evaluating grazing conditions and pasture productivity using both direct and remotely- (airborne and spaceborne) sensed information. The Commission agreed that applications of satellite-derived data to assess pasture conditions and production in the arid and semi-arid zones should be promoted. The Commission also encouraged the development of yield models using such data.

9.8.4 The Commission noted that the usefulness of pasture ecosystem models was bound to increase with their inclusion in current GISs, both general and specialized, operating at the regional and local levels.

9.8.5 The Commission agreed that it was important to evaluate the potential effect of climate change and climate variability on the productivity of rangelands in arid zones.

9.8.6 The Commission noted that the Rapporteurs for Temperate, Cold Climate, Tropical and Subtropical Humid and Tropical and Subtropical Sub-humid-Zones, had not submitted their final reports.

10. WEATHER AND CLIMATE RELATED TO AGRICULTURAL PRODUCTION (agenda item 10)

The Commission noted with appreciation the contents of the final report of the Working Group on Weather and Climate Related to Agricultural Production. The Commission complimented the chairperson, Ms V. Pérarnaud (France), and the other members of the group who made an effort in preparing the various chapters. The Commission requested its president to finalize the report for publication as a CAgM report.

10.1 EFFECTS OF CLIMATE VARIABILITY AND CLIMATE CHANGE ON AGRICULTURE AND FORESTRY — AGROMETEOROLOGICAL ASPECTS OF MANAGEMENT STRATEGIES AND IMPROVEMENT OF SUSTAINABILITY (agenda item 10.1)

10.1.1 The Commission noted with appreciation the work accomplished by the Joint Rapporteurs on the Effects of Climate Variability and Climate Change on Agriculture and Forestry — Agrometeorological Aspects of Management Strategies and Improvement of Sustainability. The Commission recommended that the report be published with the least possible delay as a WMO Technical Note as a further expansion to the earlier material contained in *Climate Variability, Agriculture and Forestry* (Technical Note No. 196, WMO-No. 802) and the 1997 *Climate Variability, Agriculture and Forestry: An Update* (Technical Note No. 199, WMO-No. 841).

10.1.2 Accordingly, the Commission recommended that emphasis be placed by Members on research on

improved weather and climate prediction especially in the subtropical and tropical areas, including identification of climate/crop and climate/forest sensitivities as well as crop/climate and forest/climate models.

10.1.3 In that connection, the Commission also recommended close coordination and cooperation with IPCC and relevant international scientific programmes, such as IGBP, WCRP, and especially with CLIPS.

10.1.4 The Commission requests the Secretary-General to organize, in collaboration with relevant international organizations, an international seminar/symposium on increasing the adaptability of agriculture and forestry to climate variability through the application of seasonal climate forecasting, plant breeding programmes and matching appropriate crops and crop operations to both current and forecast climate variability.

10.1.5 The Commission also requested the Secretary-General to organize roving seminars to disseminate the results of the symposium and the WMO publications on that matter to agrometeorologists, particularly those in developing countries.

10.1.6 The Commission noted the conclusions of the report of the joint rapporteurs that human activities had been modifying the global atmosphere, whose changing components such as increased carbon dioxide concentration and ultraviolet-B radiation could have potential effects on agriculture and forestry. However, agriculture and forestry themselves could be important sources of greenhouse gases. Increases in anthropogenic greenhouse gases were viewed by the 1995 IPCC Second Assessment Report on Climate Change to be the most probable cause of recently observed increases in global surface temperatures of about 0.5°C. According to some global climate models, it was predicted that those emissions might result in an increase in mean surface temperature of 1–3°C by the year 2100.

10.1.7 The Commission noted that knowledge of the relation of regional climate with the crop under cultivation was required to reduce the impacts of climate variability on tropical agriculture. The Commission therefore encouraged strong cooperation between organizations involved with crop production in conjunction with monthly and seasonal climate projections, since interactions among climate, agricultural processes and greenhouse emissions were extremely complex. NMSs were therefore urged to cooperate with relevant national institutions involved in the study of those interactions.

10.1.8 In consideration of the IPCC Second Assessment Report on Climate Change, and noting that there was a clear requirement to identify the priority agricultural meteorology adaptation strategies, the Commission adopted Resolution 3 (CAgM-XII).

10.2 METEOROLOGICAL FACTORS AND SUSTAINABLE AGRICULTURAL PRODUCTION (agenda item 10.2)

10.2.1 The Commission noted the summary of developments in agrometeorology, described in the report, which might contribute to further application of basic knowledge on the relationships between

meteorological factors and sustainable agricultural production and protection of agricultural resource base and on output for tuber and pulse crops, commercial tree crops, field and bush crops and vegetables.

10.2.2 The Commission noted that statistical and simulation models had been developed for yield prediction for some commercial tree crops.

10.2.3 The Commission also noted that for various reasons, including expanding populations and increasing economic activity, agriculture was being pushed into climatically-marginal areas especially in developing countries. Therefore the Commission urged members to develop environmentally-friendly policies in order to reduce land and soil degradation.

10.2.4 The Commission endorsed the concept of crop-specific research institutes to assist in the transfer of knowledge and expertise between scientists in developed and developing countries.

10.2.5 The Commission noted that it would be useful to evaluate the impacts of agrometeorological applications for sustainable agricultural management and appointed, by adopting Resolution 4 (CAGM-XII), a Working Group on Impacts of Agrometeorological Applications for Sustainable Management of Farming Systems, Forestry and Livestock. The terms of reference are given in that resolution.

10.2.6 The Commission noted that agriculture had recently evolved in urban areas while some agricultural production had been carried out in indoor environments. There were also farming techniques such as organic agriculture and precision farming, which were becoming important in food and vegetable production for households. The Commission discussed the implications of those techniques for agrometeorology and agreed that the agrometeorological aspects needed to be properly determined in order to ensure an appropriate response. Accordingly, the Commission adopted Resolution 5 (CAGM-XII).

10.3 FARMING SYSTEM ADAPTATION TO CLIMATE CHANGE AND VARIABILITY (agenda item 10.3)

The Commission noted the excellent summary prepared by the Rapporteur on Farming Systems Adaptation to Climate Change and Variability, which was based on the IPCC Working Group II (IPCC, 1995) report. In that connection, the Commission recalled that, in the past, Mr J. Salinger (New Zealand) had been providing reviews of progress on that matter by the IPCC and that his reviews had been made available to Members by the president of the Commission through his circular letters. The Commission, noting that the rapporteur was a member of IPCC Working Group II, decided to request him to collaborate with Mr J. Salinger in order to keep the Commission informed of the activities of IPCC Working Group II on that matter.

10.4 OPERATIONAL AGROMETEOROLOGICAL TECHNIQUES (agenda item 10.4)

10.4.1 The Commission noted that various operational tools — such as satellite technology, radar and

automatic networks, numerical prediction models, modern systems of transmission of weather information to farmers, GIS, supercomputers and the Internet — were becoming available for use in agrometeorology. Improved reliability of forecasts up to a range of five days were proving useful to farmers and those forecasts covered the typical time taken for most tasks in agriculture. Those tasks included harvesting, silage making, soil preparation, fertilizer application and disease prevention. It was however appreciated that the forecasts should be spatially adapted and refined to provide local forecasts of sensitive weather parameters. Such adaptation called for knowledge of local conditions including climate and geographical features, crops grown, their phenology and sensitivity to weather. The Commission urged members to take advantage of the most appropriate tools in order to improve agrometeorological services to agriculture.

10.4.2 The Commission recognized the value of long-range forecasts to farmers, particularly, seasonal to annual climate forecasts. In that connection, it adopted Resolution 6 (CAGM-XII).

10.4.3 The Commission agreed that long-term planning of agricultural activities required at least some knowledge of regional climate. To enable that knowledge to be used effectively, some spatial extrapolation was necessary, taking into account the cost/quality ratio of the methods used. Considerable progress had been made in agrometeorological modelling and that required comprehensive data coverage as well as suitable database management systems, such as the CLICOM system. However, the Commission noted that a CCI initiative was under way to provide users a more advanced climate database management system than the current CLICOM system. It would take advantage of new advances in computer science.

10.5 TRANSFORMATION OF BASIC KNOWLEDGE INTO OPERATIONAL TECHNIQUES (agenda item 10.5)

The Commission further noted that there were several different types of plant growth models available, depending on the extent to which they detailed the mechanisms of plant growth and development. Adaptation would be necessary to allow them to be used in other regions. The Commission advised members that, when those models were used to help decision making, their application should be performed by agricultural technicians with a fair understanding of their limitations and merits. The Commission also considered it useful to prepare a summary of the various models that were becoming available for use in agrometeorology and appointed Joint Rapporteurs on the Status of Modelling in Agroclimatology for that purpose. In that connection, it adopted Resolution 7 (CAGM-XII). The terms of reference are given in that resolution.

10.6 ADAPTED FARMING SYSTEMS AS STRATEGY TO COMBAT DESERTIFICATION (agenda item 10.6)

The Commission noted with regret that no report was submitted on that item. The Commission

acknowledged that agrometeorological aspects on desertification and drought were covered under agenda item 13.7.

10.7 WEATHER AND CLIMATE RELATED TO FORESTRY AND (NON-FOREST) TREE PRODUCTION (agenda item 10.7)

10.7.1 The Commission thanked Mr X. Lee (United States) for his report on weather and climate related to forestry and (non-forest) tree production in the temperate regions. The Commission noted with regret that rapporteurs could not be designated for the arid, semi-arid and dry sub-humid regions and humid tropical regions.

10.7.2 The Commission recognized the importance of a good understanding of forest microclimates especially wind patterns, radiation regimes, temperature and humidity, and carbon dioxide patterns for studies of natural regeneration. The Commission emphasized the importance of such studies on climate for (non-forest) tree production, as trees supported a range of functions important for various sectors of our society including run-off and erosion control, landscaping, protection of wildlife habitats, use as windbreaks to enlarge crop productivity, amelioration of urban environments, and the combating of desertification.

10.8 WEATHER AND CLIMATE RELATED TO LIVESTOCK AND PASTURE PRODUCTION (agenda item 10.8)

10.8.1 The Commission, through Resolution 9 (CAGM-XI), had appointed Joint Rapporteurs on Weather and Climate Related to Livestock and Pasture Production. It noted with appreciation the report submitted by Mr D. Dagvadorj (Mongolia). The Commission agreed that the report contained useful information on livestock and pasture development and production in Mongolia and recommended that the report should be suitably edited and published as a CAGM report. The Commission regretted that other joint rapporteurs had not submitted reports.

10.8.2 The Commission noted that water availability was the dominant factor determining pasture development and livestock production in dry marginal areas. It also noted that the main problems associated with livestock and pasture production in those areas were the variability of the climate, soil salinity arising from wrong irrigation practices, soil erosion and destruction of the grasslands due to overgrazing. The Commission strongly recommended that Members in such areas should keep in mind the need to avoid actions such as overgrazing and deforestation that tended to create situations leading to desertification and other adverse environmental impacts.

10.8.3 The Commission agreed that the use of satellite information, including the normalized difference vegetation index and other related indices, were useful tools for monitoring growth. Their use would also enhance attempts to improve pasture management and livestock production in arid and semi-arid areas.

10.8.4 The Commission agreed that in future reports on that topic it would be useful to also include a section on fire regimes and fire ecology.

11. AGROMETEOROLOGICAL DATA MANAGEMENT (agenda item 11)

The Commission noted with appreciation the work accomplished by the CAGM-XI Working Group on Agrometeorological Data Management and complimented the chairperson, Mr R. P. Motha (United States) and the members of the group for the final technical report. The Commission also acknowledged the contribution made by Mr A. Kleschenko (Russian Federation), the invited expert on remote sensing.

11.1 GROUND-BASED AND REMOTELY-SENSED OBSERVATIONS DEVELOPMENTS (agenda item 11.1)

11.1.1 The Commission noted the new technologies in automated weather observing and processing presented in the report as well as other necessary data that improved the density of the data observations. Those included derived estimates from radar and satellite technologies. It was proposed that the management of those observed and derived data from emerging and expanding technologies should be standardized to ensure effective applications. Agronomic data and phenological information that were necessary for statistical and dynamic modelling must be properly coded for merging with meteorological data.

11.1.2 The Commission also noted with pleasure the increasing use of automatic weather stations in many countries. That would increase the efficiency of data collection. Real-time data could be made readily available for weather forecasting and daily decision making. The Commission therefore recommended that guidelines, consistent with those already laid down by CBS, should be developed for automatic weather stations in agrometeorological settings. Such guidelines should be developed to maintain data quality and continuity, with particular attention being paid to regular maintenance and calibration of sensors. The record of such details, sometimes referred to as metadata, should then be included in the data history as an integral part of the database holdings.

11.1.3 The Commission noted the activities of the CBS Working Group on Satellites and that preliminary results had been published in the publication *A Description of a Standard Small Satellite Groundstation for Use by WMO Members* (WMO Satellite Reports No. 13, WMO/TD-No. 660). It also noted the activities of other centres such as the satellite active archive managed by the Office of Satellite Data Processing and Distribution which was a component of NESDIS. In addition, the Commission was aware of significant developments under way within GCOS and more particularly GTOS for broadening the scope of land surface databases and improving both *in situ* and remote-sensing technologies.

11.1.4 The Commission requested its president, together with the president of CBS, and in collaboration with other relevant organizations, to continue to

monitor regularly the use of satellite information for agrometeorological purposes. That should consist of:

- (a) Distribution of standard questionnaires in order to:
 - (i) Assess the accessibility to information by surveying the availability of the receiving equipment and assessing the existing methods of data dissemination;
 - (ii) Assess the level of usage of satellite information for various applications;
 - (iii) Assess the level of data processing to obtain the values of different parameters;
- (b) The processing and analysis of responses in order to formulate proposals for training in, and further use of, satellite information.

11.1.5 Considering the need for updating the requirements for satellite and other remote sensing data, including automatic weather stations information for use in agriculture, the Commission adopted Resolution 8 (CAGM-XII). The rapporteur should review techniques for integrating satellite information of different resolutions within a GIS framework, using agrometeorological models and prepare guidelines for monitoring data quality.

11.1.6 The Commission requested that, under AgMP, an active participation be sought in feasibility studies on the economic benefits of the use of radar data for the quantitative estimation of precipitation, and perhaps other parameters, as compared with the cost of other methods to collect such observations.

11.2 COMPUTER-BASED MANAGEMENT SYSTEMS (agenda item 11.2)

The Commission noted that super computers and simple personal computers had become useful tools for processing remote sensing images in order to prepare products used by agrometeorologists and other users in agriculture. It noted that high quality derived products were now available on a regular basis in appropriate formats at large well-equipped centres such as AGRHYMET, CNES NESDIS, etc. Although such products were expensive for developing countries, attempts were being made to design and develop inexpensive equipment for receiving and processing those remotely sensed data.

11.3 SUITABLE SOFTWARE PACKAGES AND TRAINING REQUIREMENTS (agenda item 11.3)

11.3.1 The Commission observed that the CLICOM data management system and the related software package INSTAT continued to be, within limitations, good tools for operational activities.

11.3.2 The Commission noted with pleasure that many multiprocess models and modelling systems were now being supported by interdisciplinary teams of researchers and were being continually upgraded based on theoretical developments and on test results in a number of countries. It requested that, to the extent possible, the adaptation and training in the use of those tools for staff of countries that did not yet have access to them, should be included in the AgMP.

11.3.3 The Commission urged its members to ensure that all technological innovations, including computerized data collection and electronic communication systems and expertise, were responsive to specific user needs in order to justify their implementation. In addition, the Commission urged its members to interact closely with other committees and working groups representing climatology, satellite technology and basic services in order to ensure common standards and efficient utilization of data management technologies.

11.3.4 The Commission urged the Secretary-General to strengthen the Organization's training programme in the field of the application of satellite information within CAGM and CBS. The use of available operational agrometeorological models could be included in such programmes.

11.3.5 The Commission requested its president, in conjunction with the president of CCI, to include agricultural meteorology applications in future versions of the CLICOM project software. Accordingly, the Commission recommended that a CAGM member be nominated to represent CAGM on the proposed CCI Task Group on a Future Climate Database Management System.

11.4 DATA AND PRODUCTS FOR CURRENT AND FUTURE REQUIREMENTS (agenda item 11.4)

11.4.1 The Commission requested its president to consult the president of CCI with regard to the possible publication of the report on the case study in the United States on unified climate access network, as guidance material.

11.4.2 The Commission acknowledged a greater role for the Working Group on Agrometeorological Data Management in identifying trends in new technologies for data products and services. The Commission agreed that it was important to continue activities in that field as recommended by the Advisory Working Group and the Working Group on Agrometeorological Data Management. It, therefore, established the Joint Rapporteurs on Agrometeorological Data Management. The terms of reference of that group, as adopted by the Commission, are given in Resolution 9 (CAGM-XII).

12. APPLICATIONS OF AGROMETEOROLOGY (agenda item 12)

12.1 APPLICATION OF AGROMETEOROLOGICAL INFORMATION (agenda item 12.1)

12.1.1 The Commission noted with appreciation the report submitted by Mr B. Diarra (Mali), coordinator of the Joint Rapporteurs on Application of Agrometeorological Information. It noted that the report contained case studies on the organization of national Agrometeorological Services in China, India, Malaysia, Mali and the Netherlands, including evaluation of socio-economic and environmental benefits of the application of agrometeorological data and information.

12.1.2 The Commission was pleased to note that 65 Members provided responses to the questionnaire prepared by the joint rapporteurs on the subject of agrometeorological information.

12.1.3 The Commission noted that, although many member countries had established national Agrometeorological Services, agrometeorological activities in some countries were not well-structured and in some cases no activities existed. The Commission however noted that agrometeorological observations were being made in other institutions such as agricultural universities and agricultural research institutions. It urged Members to promote cooperation and coordination with and among those institutions in order to avoid duplication of effort and to reduce dispersal of resources.

12.1.4 In that connection, the Commission encouraged the establishment of interdisciplinary committees comprising the representatives of relevant services involved in agriculture and related activities. It was hoped that that would promote the use of agrometeorological information for food and agricultural production.

12.1.5 Weather and climate would continue to influence agriculture and food production, in particular under rainfall dependent agricultural systems. The Commission agreed that, in the light of the food security and food availability situation worldwide, improvement in the delivery and application of meteorological data and information to farmers and other agriculturists could be of immense benefit. Agrometeorologists should therefore continue to be involved, through interaction with relevant agricultural advisors, researchers and extension officers in the best application of those data and information to improve agricultural productivity.

12.1.6 The Commission noted that agrometeorological information contributions were very varied and were directed to agriculture in the broadest sense of the word. That included not only farming but also agricultural planning, pasture and animal husbandry, forests, fisheries, agricultural water use, farm buildings and structures and agro-ecology. The Commission urged members to promote improvement of the provision of agrometeorological services including provision of local short-range weather forecasts, medium-range bulletins and seasonal climate outlooks in areas where they were of acceptable quality, and information on forest, rangeland and bush fires and incidence of pest and diseases. The Commission decided that further work should be done in that regard. In that connection, the Commission adopted Resolutions 10, 11, 12 and 13 (CAGM-XII).

12.1.7 The Commission agreed that the best use of the information could be achieved through the education and training of both agrometeorologists and the users of the information, including the media, in order to encourage transfer of knowledge and technology.

12.2 AGROMETEOROLOGICAL ASPECTS OF MARINE FISHERIES (agenda item 12.2)

12.2.1 The Commission thanked Mr Fang Weimo (China) for his report on agrometeorological aspects of marine fisheries.

12.2.2 The Commission recognized the need for an improved understanding of air-sea interaction

mechanisms in order to improve the safety of fishing boat crews and to develop fishing and aquaculture production while, at the same time, protecting the marine natural resources. The Commission emphasized the importance of studies linking marine meteorology and fishery sciences as well as the need to enhance accurate and wide dissemination of marine meteorology forecasts.

12.2.3 The Commission reiterated the importance of evaluating the use of meteorological and climatological data on inland fisheries and aquaculture and agreed with the recommendation made by the president that the work on the subject should be continued. It therefore adopted Resolution 14 (CAGM-XII).

12.3 COMMERCIALIZATION AND THE EXCHANGE OF AGROMETEOROLOGICAL DATA AND PRODUCTS (agenda item 12.3)

12.3.1 The Commission thanked Mr G. Goroza (Côte d'Ivoire), coordinator of the Joint Rapporteurs on Commercialization and the Exchange of Agrometeorological Data and Products, for his preliminary report on the commercialization and exchange of data and products. It noted that 55 NMHSs had responded to the questionnaire prepared by the joint rapporteurs and that the preliminary report was based on 36 of the 55 responses reviewed. The Commission encouraged the joint rapporteurs to take into account the translations, which were provided by the Secretariat to the coordinator, of the 19 responses in Spanish and Russian and to prepare a final report as soon as possible. The Commission also suggested that the analysis of responses could be repeated by dividing the responses into various groups based on the number of years the Members had been engaged in commercialization. The Commission also noted the success achieved by some NMHSs in the commercialization of their activities.

12.3.2 The Commission noted that since its last session, Resolution 40 (Cg-XII) — WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities, had come into being. That provided a framework and terminology for the international exchange of data and products and included guidelines on relationships in commercial meteorological activities. The Commission also noted that the publication *Exchanging Meteorological Data. Guidelines on Relationships in Commercial Meteorological Activities — WMO Policy and Practice* (WMO-No. 837) provided the text of Resolution 40 (Cg-XII) together with a concise and informative history and discussion of the matter and decided to enclose a copy of that publication with the final report of the joint rapporteurs when it was distributed to Members.

12.3.3 The Commission further noted that the WMO Executive Council was actively monitoring the implementation of Resolution 40 (Cg-XII) through its Advisory Group on the Exchange of Meteorological and Related Data and Products and encouraged members to contribute to the implementation of Resolution 40 (Cg-XII).

12.3.4 The Commission thanked Mr M. Boulahya, Director General of ACMAD, for his presentation on the contribution of regional institutions of development such as ACMAD in the exchange of agrometeorological data and products. The Commission expressed its appreciation for the proposal of ACMAD to examine the decisions and recommendations of the current session and to propose appropriate ways in which ACMAD could contribute to the work of the Commission. In that context, the Commission noted with appreciation the proposal of ACMAD to publish, in French, jointly with WMO and *Météo-France*, the proceedings of the International Workshop on Agrometeorology in the Twenty-first Century: Needs and Perspective which preceded the Commission session.

13. AGROMETEOROLOGY RELATED TO EXTREME EVENTS (agenda item 13)

13.0.1 The Commission noted with appreciation the work accomplished by the Working Group on Agrometeorology Related to Extreme Events. The Commission complimented the chairperson, Mr H. P. Das (India), and the other members of the group for their contributions to the various chapters of the final report. The Commission recommended that the report should be suitably edited and published as a Technical Note.

13.0.2 The Commission accepted the view that extreme environmental conditions eventually lead to extreme agrometeorological events and disasters only if they interacted with a vulnerable agricultural system and that any non-agrometeorological events such as floods and fires caused by earthquakes might lead to situations very similar to those falling within the domain of agrometeorology. Extremes of many meteorological elements such as temperature, rainfall or lack of it, radiation and wind, would directly harm agricultural crops by their instantaneous intensity or through longer-term exposure. By that definition, tropical cyclones, storm surges and high winds became agrometeorological extremes in so far as they affected agriculture and agricultural systems and facilities.

13.1 INFORMATION NEEDED TO COPE WITH EXTREME EVENTS (agenda item 13.1)

13.1.1 The Commission agreed that past and current information on almost all meteorological elements as well as hydrological and climatological information and derived data and products that would affect agriculture were required in order to cope with extreme events. There was therefore the need to maintain a viable network of observing stations including automatic stations, satellites and radar networks in order to depict extreme events adequately and their impact on agriculture. Other information of a geophysical nature relating to eruption of volcanoes, earthquakes and avalanches as well as meteorological phenomena such as lightning, cyclones and tropical storms, storm surges, tornadoes and sand and dust storms could be of immense use to evaluate situations which might lead to

agricultural disasters resulting from damage to agriculture and agricultural facilities.

13.1.2 The Commission further agreed that, in order to cope adequately with the situation, an early meteorological warning service charged with disaster prevention, preparedness and mitigation would also be useful. In that regard, agricultural and other economic information would also be necessary. Agricultural information included evidence of epidemics of insects and other pests, bacteria and virus.

13.1.3 The Commission suggested that in addition to tropics, there was a need to compile information on agrometeorology related to extreme events in middle and high-latitude regions.

13.2 GUIDANCE ON OPERATIONAL USE OF THE INFORMATION (agenda item 13.2)

The Commission noted with interest the use of the BIPODE soil water balance model developed by the *Département des cultures annuelles du Centre de coopération internationale en recherche agronomique pour le développement* (CIRAD-CA) in France to demonstrate operational use of information on extreme weather conditions in crop production in Romania. Members were urged to develop methods to use information available on many extreme events, such as the case study of the early warning services of India, and to disseminate the methodology to other countries to assist them in providing services of prevention, awareness, preparedness and mitigation.

13.3 EXTREME METEOROLOGICAL EVENTS DATABASE (agenda item 13.3)

The Commission agreed that a database of extreme agrometeorological events should include descriptions of direct and indirect impacts of extreme weather events on agriculture taken in the broadest sense to include crop production, livestock husbandry, fisheries and forestry.

13.4 REQUIREMENTS FOR INSTRUMENTATION (agenda item 13.4)

The Commission noted that the report of the CAgM-XI working group did not adequately cover the requirements of instrumentation for continuous observation of extreme events, both during and after the event. It noted that a working group of CIMO had not adequately responded to the request of the Commission for development of instruments for measuring extreme agrometeorological events. The Commission requested its president to reformulate suitable questions on the matter for consideration by CIMO, as requested.

13.5 METHODS FOR ASSESSING ECONOMIC IMPACTS (agenda item 13.5)

The Commission noted the various methods available for assessing economic impacts in a field such as meteorology and complimented the rapporteur on the contribution. It noted that many types of impacts could

be identified from all the events — positive and negative, direct and indirect, tangible and intangible or social costs — and that that should be the first step towards assessing the impacts of those hazards on agriculture.

13.6 ASPECTS OF THE IMPLEMENTATION OF THE UNCCD (agenda item 13.6)

13.6.1 Mr A. Cissoko, representative of the Interim Secretariat of the UNCCD, stated that it was a great honour for his Secretariat to participate in the twelfth session of the Commission. He mentioned that WMO, right from the beginning, had taken an active role in the negotiation of the UNCCD and later in the implementation of the Convention. Mr Cissoko referred with gratitude to the support provided by WMO to the Secretariat and to WMO's engagement in all the activities concerning desertification and mitigation of the effects of drought. The fruitful collaboration established between WMO and the UNCCD Secretariat had resulted in:

- (a) The publication of an important document entitled *Water resources and desertification, problems and challenges*;
- (b) The publication of a book entitled *Interactions of Desertification and Climate*;
- (c) The preparation and organization of some seminars, such as the International Symposium on *El Niño* and *La Niña* Events and their Relationship with Drought and Desertification, to be held in Chile in September/October 1999.

Mr Cissoko also mentioned that WMO's Agricultural Meteorology Division contributed its expertise and wide experience both in the work relating to the definition and development of benchmarks and in the work relating to the definition and development of benchmarks and indicators, as well as the impacts of desertification. All the members of the special group and of the informal ad hoc group had recognized WMO's contributions in that field.

13.6.2 The Commission expressed its support for the continuing fruitful collaboration between WMO and the Interim Secretariat of the UNCCD and requested the Secretary-General to continue to support implementation activities in support of the Convention.

13.6.3 The Commission expressed its appreciation to the Secretary-General for his wide-ranging actions in support of UNCCD within the programmes and activities of WMO. In particular, the Commission noted with satisfaction the actions taken by the Secretary-General to ensure the active participation of WMO in both the negotiating process leading to the Convention and at COP-1 and COP-2. The Commission expressed its appreciation for the special brochures prepared by WMO for COP-1. The Commission appreciated the initiative taken by the Secretary-General to inform the Members of the major decisions taken at COP-1 and COP-2.

13.6.4 The Commission stressed the necessity to enhance climate monitoring networks in the fight against desertification and reiterated WMO's strong commitment to assist UNCCD. The Commission

emphasized the need to draw the attention of the donors to the inadequacy of the present networks for climate and desertification monitoring due to the lack of appropriate financial support.

13.6.5 The fight against desertification and drought received a high priority in WMO's Long-term Plans, and the Commission emphasized the need to provide strong support to the relevant activities in the AgMP, so that WMO could adequately respond to relevant articles of UNCCD.

13.6.6 The Commission expressed its satisfaction with the different activities undertaken by WMO in support of the Convention such as the Workshop on Drought and Desertification, which was held in Bet Dagan, Israel, in May 1997.

13.6.7 The Commission emphasized the need for training in the fields of desertification and drought, taking advantage of the funding facilities available under the Convention. The Commission noted with appreciation the initiative taken by WMO to organize Roving Seminars on the Application of Climatic Data for Drought Preparedness and Management for Sustainable Agriculture, in collaboration with FAO, UNEP, the Interim Secretariat of the UNCCD and the USDA using extrabudgetary resources. The Commission expressed its appreciation to the National Oceanic and Atmospheric Administration for providing some funds for that purpose and encouraged other donors to support such activities.

13.6.8 The Commission strongly urged Members to continue to strengthen and expand their activities relating to research, training and capacity building, observation data collection and exchange on matters relating to drought, early warning, preparedness and public environmental awareness for meteorological disasters.

13.6.9 The Commission considered that studies undertaken by the Commission relating to drought and desertification, in particular on their impacts, should be continued. The Commission should also provide advice, within its terms of reference, on matters relating to drought and to the agrometeorological aspects of the implementation of the UNCCD. In that connection, the Commission adopted Resolution 15 (CAGM-XII).

13.7 AGROMETEOROLOGICAL ASPECTS OF DESERTIFICATION AND DROUGHT (agenda item 13.7)

DESERTIFICATION

13.7.1 The Commission emphasized the role of climate in the process of land degradation and desertification, especially in marginal agricultural lands. It noted that major deterioration of vegetative cover might occur during periods of extended droughts with substantial recovery in between. But human and livestock pressure might combine together to accelerate deterioration. Global surveillance of both the climate and the status of dryland ecosystems could be achieved through ground truth sampling and remote sensing using satellite technology.

13.7.2 The Commission urged members to take actions that could help to reduce the growth rate of extension of desertification. Those included, among others: improvement of the efficiency of use of fuel (wood) in desert-prone areas; adaptation of livestock grazing pressure on pastures; protection of natural vegetation cover by protecting the recovery of deteriorated lands; creation of protective belts to stabilize sand dune surfaces and to fight wind and sand erosion; and arid horticulture.

DROUGHT

13.7.3 The Commission reminded members of the importance of a system for continuous monitoring, detection and reporting of the incidence of drought and for the development of contingency plans to deal with it, if it occurred. The system should include networks of surface-based instruments, automatic weather stations and satellite imagery. The severity, duration and areal extent of drought were particularly crucial in agriculture. The Commission noted with interest the useful information contained in the case studies of responses of countries concerned with drought.

13.8 DELINEATION OF DRYLANDS AND IMPACTS OF CLIMATIC FACTORS (agenda item 13.8)

The Commission noted that there was no specific report on that subject.

14. TRAINING AND EDUCATION MATTERS (agenda item 14)

14.1 REPORT OF THE JOINT RAPPORTEURS ON IMPACT OF TRAINING IN AGROMETEOROLOGY (agenda item 14.1)

14.1.1 The Commission noted with satisfaction the work accomplished by the Joint Rapporteurs on Impact of Training in Agrometeorology. The Commission complimented the chairperson, Mr J. Lomas (Israel), and the other rapporteurs for the final report. The Commission requested the Secretary-General to review the report and publish it in the CAgM Report series.

14.1.2 The Commission agreed that farming was a weather-sensitive occupation and that the agricultural industry in particular was sensitive to the variability of the weather and climate from planting stage to marketing. The Commission expressed concern for the lack of dialogue between the agricultural extension officers and the meteorological personnel. The Commission expressed its view that that was due to lack of information on that subject given to the user community including farmers and the farming advisory service and, in particular, the extension services. The Commission urged Members to take steps to promote cooperation between national agrometeorological institutions and those responsible for the transfer of agrometeorological information and advisories.

14.1.3 The Commission noted that the food insecurity situation worldwide, especially in the rainfed agricultural systems, had been significantly influenced by the weather and climate and that sufficient economic

justification existed for the application of agrometeorological advisories. It had been noted that a large proportion of interannual variability in crop yields, even in developed countries, could be attributed to climatic variations and that climate influenced crop response to planting dates, fertilizer application, and pest and disease control.

14.1.4 In view of the above, the Commission urged Members to promote training programmes jointly organized by WMO/FAO/UNESCO for both agrometeorologists and the user community, including agriculturists and national decision makers. That would enable the user community to acquire sufficient understanding of agrometeorological information in order to make use of the information provided by the Agrometeorological Services. In that connection, the Commission requested the Secretary-General to investigate the possibility of organizing, in collaboration with other relevant international organizations, regional workshops on the application of agrometeorology to agricultural planning and operations.

14.1.5 The Commission suggested that future education and training plans could be structured at four different levels:

- (a) For researchers: on new methodologies and advanced techniques including development of new instrumentation;
- (b) For agrometeorologists at the regional level: on strategic applications of agrometeorology;
- (c) For agrometeorologists at the local level: on tactical applications of agrometeorology;
- (d) For extension agencies, farming communities and NGOs: on basic agrometeorology.

14.1.6 The Commission recommended that a glossary of agrometeorological terms should be prepared in four languages to fill communication gaps between the agrometeorologists in different countries.

14.1.7 The Commission noted that there were few suitable training programmes in the field of agrometeorology at the undergraduate level. The Commission urged Members to give priority consideration to the introduction of appropriate courses in agrometeorology at the undergraduate level in universities and agricultural colleges, with emphasis on the application of meteorology to agriculture.

14.1.8 The Commission stressed that training and education in agricultural meteorology should continue to be a matter of great importance to Members, particularly in developing countries and, therefore, should be given a high priority consideration. The Commission noted that evaluation of existing training education and capacity building programmes in agrometeorology could help develop improved programmes for the benefit of all the Members. The Commission, therefore, adopted Resolution 16 (CAgM-XII).

14.2 WMO ACTIVITIES ON TRAINING IN AGRICULTURAL METEOROLOGY (agenda item 14.2)

14.2.1 The Commission reviewed the ETRP activities of relevance to CAgM which had taken place during the

inter-sessional period. The Commission agreed that, in general, the activities undertaken in that field had been particularly successful, especially with regard to the workshops and training seminars, which were considered of great value in stimulating and assisting in the further development of agricultural meteorological services in developing countries.

14.2.2 The Commission noted that the draft Fifth WMO Long-term Plan (2000–2009) had been circulated to Members and that the comments received were reviewed by the Executive Council for submission to Thirteenth Congress. The Commission urged its Members to carry out the roles, which were defined for their implementation and execution under the various ETRP's activities and projects of the Plan.

14.2.3 The Commission reaffirmed the importance of the human resources development programme in assisting NMHSs, particularly in developing countries, to plan and mobilize the financial and other resources to meet Members' training needs. In that respect, the Commission noted with appreciation that the WMO Secretariat had undertaken, during 1998, the fourth worldwide survey on current and future training requirements of Members. The Commission felt that the results of the survey would constitute a useful source of information on training requirements in new subject areas and technologies for a number of users and would be a basis for improvements in the ETRP. It accordingly requested the Secretariat to provide the results of the survey to relevant WMO bodies and, on request, to interested WMO Member countries.

14.2.4 The Commission noted the views and recommendations of the Executive Council Panel of Experts on Education and Training on the activities of WMO technical commissions in education and training, and recommended that the terms of reference of relevant working groups or rapporteurs dealing with education and training matters should adhere to the guidelines endorsed by the forty-eighth session of the Executive Council (Geneva, June 1996).

14.2.5 The Commission expressed its gratitude to those of its Members which had made their training facilities available for the training in agrometeorology. The Commission expressed the hope that its Members would continue such support, in particular by hosting training events, by financially supporting the participation of their accepted candidates and by providing lecturers or instructors to training events organized by WMO.

14.2.6 With particular reference to the WMO RMTCs, the Commission expressed its appreciation that the training facilities of IATA in Florence had been recognized by the forty-ninth session of the Executive Council (Geneva, June 1997) as an additional component of the WMO RMTc in Italy for the training of meteorologists in computer and remote-sensing applications in agrometeorology, among other things.

14.2.7 The Commission expressed the hope that ways and means would continue to be found to support agrometeorological training at RMTCs with more emphasis to be placed by RMTCs on specialized courses

in various subject areas. The Commission encouraged its Members to take advantage of training programmes offered in RMTCs, as well as those in other countries, with a view to meet their training needs.

14.2.8 In that connection, the Commission noted that the *Compendium of Training Facilities for Meteorology and Operational Hydrology* (WMO-No. 240) had been revised and that a new loose-leaf edition of the publication was issued and distributed to Members in 1997. It also noted that the information contained in that publication was computerized and that the database was available on diskette. Members were accordingly urged to take advantage of that publication and to submit new information on their training programmes to the WMO Secretariat so that, the *Compendium* could be kept up-to-date.

14.2.9 The Commission noted with satisfaction the training publications that had been prepared and issued by the Secretariat since its last session. In particular, the Commission noted that the *Lecture Notes for Training Class II and Class III Agricultural Meteorological Personnel* (WMO-No. 551) had been revised and updated by Mr J. Wieringa (Netherlands) with the assistance of Mr J. Lomas (Israel) and that it would be issued soon. Taking into account the limited budgetary provisions for that purpose, the Commission urged its Members to continue to support those activities.

14.2.10 The Commission noted that, since its last session, the training material available in the WMO Training Library had been increased and that the Training Library was acting as an exchange forum for audiovisual and computer-aided learning material. It was also pleased to note that a WMO virtual Training Library page was now available through the Internet. The Commission invited Members that produced training material in agricultural meteorology and related fields to provide the WMO Training Library with copies, which might be of use in the training activities of other Members of the Organization.

14.2.11 The Commission noted that a new *Catalogue of the WMO Training Library* (WMO/TD-No. 791) was distributed to Members in 1997. In urging Members to make use, in their training programmes, of the WMO Training Library holdings, the Commission also requested them to provide the Training Library with relevant training material for the benefit of all other WMO Members.

14.2.12 The Commission noted with satisfaction that, in accordance with the decision of Twelfth Congress and following subsequent recommendations of the Executive Council, the fiftieth session of the Executive Council (Geneva, June 1998) had approved a new classification of personnel common to both meteorology and operational hydrology. The Commission also noted that the *Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology* (WMO-No. 258) would be revised to reflect the new approach to classification and related curricula.

14.2.13 The Commission noted in the new classification that two broad categories of personnel should be identified as followed:

FOR METEOROLOGICAL PERSONNEL

- (a) Meteorologist — a person who held a university degree or equivalent, had acquired an appropriate level of knowledge of mathematics, physics and chemistry, and had completed the Basic Instruction Package in Meteorology (BIP-M);
- (b) Meteorological Technician — a person who had successfully completed the Basic Instruction Package for Meteorological Technicians (BIP-MT).

FOR HYDROLOGICAL PERSONNEL

- (a) Hydrologist — a person who held a university degree or equivalent and had completed the Basic Instruction Package in Hydrology (BIP-H);
- (b) Hydrological Technician — a person who had successfully completed the Basic Instruction Package for Hydrological Technicians (BIP-HT).

14.2.14 The Commission also noted that the new classification would be effective from 1 January 2001 and that the actual implementation should be gradual with a transition period not exceeding four years.

14.2.15 The Commission noted with appreciation that WMO had continued to award fellowships in various fields to assist Members in the development and strengthening of trained human resources of their respective NMHSs.

14.2.16 The Commission noted that there had been a considerable increase in the number of requests for post-graduate and specialized studies in the field of agrometeorology, as a result of the scientific and technical development in that field. It regretted that with the dwindling of WMO's financial resources, coupled with donor fatigue and reduction in UNDP support, there was a wider gap between the number of requests for fellowships and the total number actually implemented in respect of agrometeorology, since the last inter-sessional period of the Commission.

14.2.17 The Commission noted that the Government of Belgium, which used to provide each year, through the Belgium Trust Fund, fellowships for studies in agrometeorology at the *Fondation universitaire luxembourgeoise* had discontinued its financial assistance. It then called on the Government of Belgium to consider the possibility of resuming the provision of fellowships through the Trust Fund for studies in the fields of agrometeorology at the *Fondation universitaire luxembourgeoise*.

14.2.18 The Commission also called on other donor Member countries to contribute funds to the Voluntary Cooperation Programme of WMO, to be specifically earmarked for training of fellows in agrometeorology, in their respective countries. The Commission supported the recommendations of the Executive Council Panel of Experts on Education and Training and the Executive Council, in its last sessions, for an increase within the overall budgetary limit, in the WMO regular budget allocations for fellowships for the thirteenth financial period, to alleviate the problems being currently experienced in the programme.

14.3 SYMPOSIA, SEMINARS AND WORKSHOPS IN AGRICULTURAL METEOROLOGY (agenda item 14.3)

14.3.1 The Commission noted, with appreciation, the large number of training events, including seven training seminars/workshops and 13 roving seminars, on a wide range of topics related to agricultural meteorology organized by WMO. It noted in particular, the holding of:

- (a) Two Workshops/Training Seminars on Drought Preparedness and Management were conducted. The first, was organized, jointly with the United Nations Office to Combat Desertification and Drought (UNDP/UNSO), for the Member countries of the Economic Community of West African States (ECOWAS) in Banjul, Gambia, from 4 to 9 September 1995. The second was organized for the North African countries in Casablanca, Morocco, from 24 to 28 June 1996;
- (b) A Workshop on Drought and Desertification in Bet Dagan, Israel, from 26 to 30 May 1997;
- (c) A Regional Workshop/Expert Meeting on Agrometeorological Techniques in Operational Agriculture in Latin America in Paipa, Colombia, from 17 to 21 March 1997;
- (d) A Training Seminar/Workshop on User Requirements for Agrometeorological Services in Pune, India, from 10 to 14 November 1997;
- (e) A Regional Workshop on Agrometeorological Data Management and Application in Agricultural Services in Bamako, Mali, from 24 to 28 November 1997;
- (f) An RA II Regional Training Workshop on Dissemination of Agrometeorological Information in Doha, Qatar, from 18 to 22 October 1998;
- (g) Six joint WMO/FAO/UNEP Roving Seminars on the Use of Data for Effective Planning and Management of Water for Sustainable Irrigated Crop Production in Antananarivo, Madagascar, from 10 to 21 July 1995; in Maputo, Mozambique, from 27 September to 13 October 1995; in Dakar, Senegal, from 3 to 7 June 1996; in Beijing, China, from 3 to 14 June 1996; in Kathmandu, Nepal, from 3 to 14 February 1997, and in Tashkent, Uzbekistan, from 24 November to 5 December 1997;
- (h) Three Roving Seminars on Agrometeorology Related to Extreme Events in Pune, India, from 28 April to 10 May 1997; in Addis Ababa, Ethiopia, from 9 to 21 April 1998, and in San José, Costa Rica, from 24 August to 4 September 1998;
- (i) Two Roving Seminars, in cooperation with FAO, on Crop-Yield Weather Modelling in Dar-es-Salaam, United Republic of Tanzania from 14 to 25 September 1998 and in Seoul, Republic of Korea, from 12 to 23 October 1998;
- (j) A Roving Seminar on Data Management for Applications to Agriculture in Ljubljana, Slovenia, from 12 to 23 October 1998;
- (k) A Roving Seminar on Automatic Weather Stations in Bahrain, from 24 October to 4 November 1998.

14.3.2 The Commission recorded its appreciation for the participation and collaboration of several international,

regional and national organizations in WMO activities related to training in agricultural meteorology, in particular USDA, IATA in Italy, the India Meteorological Department and FAO. The Commission requested the Secretary-General to continue to seek co-sponsorship for the organization of such events.

14.3.3 The Commission, in particular, was pleased with the initiative taken in the development of the contents for four new roving seminar series in the inter-sessional period, the preparation of training manuals for each of them and the organization of those roving seminars in different locations in RAs I, II, III and VI. The Commission strongly recommended the continued organization of those roving seminars in the next financial period. The Commission also suggested that the training manuals prepared for those roving seminars should be made available to the Members on the World Wide Web.

14.3.4 The Commission expressed its appreciation to WMO and the co-sponsors, including CTA, FMA, LaMMA, ICARDA, IITA, JRC, KNMI, SANREM, CRSP, and USDA, for organizing the International Workshop on Agrometeorology in the Twenty-first Century: Needs and Perspectives, which permitted increased participation of members from developing countries in the session. The Commission requested the Secretary-General to continue to seek co-sponsorship for the organization of such events in conjunction with future sessions of the Commission.

14.3.5 The Commission noted the symposia, seminars and workshops held during the inter-sessional period. The Commission requested the Secretary-General to continue to provide full support for the organization of such events. The Commission proposed the following topics of current interest for the organization of such events within the available financial resources.

Symposia/workshops:

- (a) Use of GIS and remote sensing in agrometeorological application;
- (b) Agrometeorological impact assessment and adaptation to climate change and climate variability;
- (c) Carbon sequestration potential in agriculture and forestry;
- (d) Communication technologies for agrometeorological information;
- (e) Dissemination of agrometeorological information (for RA I).

Training events:

- (a) Automatic weather stations maintenance (for RA III Members);
- (b) Education and training of agrometeorologists;
- (c) Operational use of seasonal forecasts in Africa;
- (d) Planning and effective management of water resources.

15. UNCED FOLLOW-UP (agenda item 15)

15.0.1 The Commission noted with appreciation the comprehensive report submitted by the Joint Rapporteurs on UNCED Follow-up and complimented the coordinator, Mr W. Baier (Canada), and the other

rapporteurs on the preparation of the report. The Commission requested the president of the Commission to have the report suitably reviewed and published as a CAgM report. The Commission also recommended that the report be widely disseminated to its members.

15.0.2 The Commission recalled the guidelines prepared by the Executive Council Working Group on Follow-up of UNCED including Capacity Building (May 1993). The Commission agreed that the broad nature of the comprehensive UNCED documents and related instruments permitted only very few specific references to agrometeorology and that several linkages to the subject and work of the Commission existed. In that connection, the Commission was of the view that UNCED documents and instruments should be made more accessible to its members so as to facilitate identification of new areas of activities within the programme of the Commission and to follow up UNCED decisions and recommendations.

15.0.3 The Commission adopted the annex to this report, which contained a summary of proposals for new areas of CAgM activities in response to UNCED documents bearing in mind that climate change had an effect on climate variability. The Commission urged its members to adopt it as a basis for their activities in response to challenges posed in UNCED documents. Those activities were also incorporated in the proposed programmes for the AgMP of the Fifth WMO Long-term Plan.

15.0.4 The Commission noted that, although the Rio Declaration was directed at "States, key sectors of societies and people", there were many principles mentioned in the Declaration that WMO Members should keep in mind as background information when planning CAgM activities. Those principles referred to, *inter alia*, strengthening of endogenous capacity building for sustainable development by improving scientific understanding, environmental impact assessment for proposed activities that were likely to have a significant impact on the environment, and natural disasters or other emergencies that were likely to produce sudden harmful effects on the environment.

15.0.5 The Commission also observed that many chapters in UNCED Agenda 21 contained references to activities covered under the terms of reference of the Commission, in particular, in Chapter 12 where the role of agrometeorology in support of combating desertification and drought was mentioned.

15.0.6 The Commission considered other activities that could be undertaken in response to Agenda 21 and made the following proposals:

- (a) Encourage Members to strengthen/improve their drought early warning and monitoring systems by continuous calibration/validation of the local indices being used and to improve the methodologies being used in their seasonal forecasting in order to arrive at more accurate input for food security strategies;
- (b) Develop courses of action (cropping strategies, water harvesting techniques, etc.) for each degree of severity of drought events;

- (c) Encourage participation in the WMO CLIPS programme;
- (d) Develop climate risk assessment methodologies in agricultural investment planning;
- (e) Design indigenous farming technologies;
- (f) Conduct research on the impacts of climate variability on rice/corn production using different scenarios, including those that took into consideration different agricultural practices and technology options;
- (g) Conduct research on how to minimize pollution effects and impacts of pesticide residues on health and on environment — including increased use of user-friendly technologies in pest management;
- (h) Strengthen existing networks on agriculture research and development;
- (i) Design programmes to improve access to information;
- (j) Study the influence of the changing atmospheric environment on agro-ecosystems as well as forest-ecosystems. Of particular interest were the increasing concentrations of carbon dioxide, other greenhouse gases and tropospheric ozone levels. The influence of ultraviolet-B on crops/vegetation also needed to be addressed under different regional conditions;
- (k) Develop integrated packages of sustainable agrometeorological practices for different regions.

15.0.7 The Commission considered the important role of farmers in influencing agricultural policy decisions and recommended more direct participation of farmers in agrometeorological field studies and in designing appropriate strategies for the provision of agrometeorological information to the users. The Commission also urged its members to involve NGOs and farmers in agrometeorological studies.

15.1 UN/FCCC (agenda item 15.1)

The Commission noted that a number of articles in UN/FCCC such as Articles 2, 4, 5 and 6 and various proposals in the Climate Agenda were of interest to CAgM. In particular, Article 2 referred to the need to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent anthropogenic interference, through some agricultural practices, with the climate system.

15.2 CONVENTION ON BIOLOGICAL DIVERSITY (agenda item 15.2)

The Commission also noted that a number of activities in the Convention on Biological Diversity were of interest to the work of the Commission and that there were major interactions between climate and biological diversity. The Commission therefore adopted Resolution 17 (CAgM-XII).

15.3 UNCCD (agenda item 15.3)

15.3.1 The Commission noted that UNCCD, called for in Chapter 12 of Agenda 21, had entered into force on 26 December 1996 and that COP-1 had been held in

the FAO Headquarters in Rome, from 29 September to 10 October 1997. It noted with satisfaction that the Secretary-General had attended and addressed the conference and that special brochures were prepared by WMO to highlight important agrometeorological issues at COP-1.

15.3.2 The Commission urged members to keep in mind the guidelines issued by WMO for strategies regarding the implementation of Agenda 21, Chapter 12 on desertification and drought. The Commission also urged the Members to note the articles in UNCCD that required their attention and to be more actively involved in developing strategies relating to the implementation of the Convention. The Commission noted that availability of information was a key element in drought early warning and management and recommended the creation in WMO of a drought information system with access to international communication networks. That system could be further strengthened through the creation of regional networks of drought research and monitoring stations to facilitate the collection of information specific to a region.

15.4 STATEMENT OF FOREST PRINCIPLES (agenda item 15.4)

15.4.1 The Commission noted that paragraph 12 of the Statement on Forest Principles had some relevance to its mandate. It noted the role and importance of meteorology in the following areas: predicting forest fires, their spread and subsequent control; the control and combat of pests and diseases in forests; and the management and conservation of forests and other resources to protect watersheds against erosion.

15.4.2 The Commission urged members to include the application of meteorological, hydrological and climatological information both to protect forests and to increase forestry production as a topic in the curricula of training for forestry officials. That would, in turn, promote research on the use of agrometeorological information for efficient, rational and sustainable development of all types of forests and forest-based resources, forestlands and other related activities such as wildlife conservation.

16. COLLABORATION WITH INTERNATIONAL ORGANIZATIONS (agenda item 16)

The Commission expressed its appreciation for the initiative taken by the Secretariat in establishing collaborative activities with a number of international organizations in implementing the AgMP.

16.1 UNEP AND IPCC (agenda item 16.1)

16.1.1 The Commission noted with appreciation the collaboration that existed between WMO and UNEP on matters relating to drought and desertification. The Commission supported the continuation of the collaborative activities between the two agencies for the implementation of UNCCD.

16.1.2 The Commission noted the process established by the WMO/UNEP IPCC for the Third

Assessment Report which was expected to be completed in 2000/2001. The Commission noted with interest the roles for the three working groups set up to prepare the Third Assessment Report. In that connection, the Commission agreed that increased attention should be given to the assessment and research on a regional basis, particularly as regarded the impacts of the 1997-1998 *El Niño* and *La Niña*, which significantly impacted a number of sectors including agriculture, fisheries, livestock, health, etc.

16.1.3 The Commission considered that the Advisory Working Group should continue to have one of its members designated to review the activities of IPCC of interest to CAgM and to inform the Members on the progress of activities of IPCC accordingly. It thanked Mr M. J. Salinger for providing the necessary link with IPCC and for submitting appropriate periodic reviews on its activities, which were included in the circular letters of the president to members of CAgM.

16.2 FAO (agenda item 16.2)

16.2.1 The Commission commended both WMO and FAO for the many fruitful collaborative activities undertaken during the inter-sessional period, in particular, the participation at technical meetings of mutual interest, including meetings of working groups of CAgM and IACCA, training programmes and data exchange. The Commission further noted that the Roving Seminars on the Use of Data for Effective Planning and Management of Water for Sustainable Irrigated Crop Production were held in several countries during the inter-sessional period.

16.2.2 The Commission also noted with interest the new initiative taken by WMO, FAO, UNEP and the UNCCD Secretariat to organize Roving Seminars on Drought Preparedness and Management of Sustainable Agriculture in support of UNCCD. The Commission commended the USDA for its support in preparing several chapters for the training manual for those roving seminars. The Commission supported the plans of the Secretariat to organize several of those seminars in different countries during the next financial period. The Commission encouraged the members to take advantage of the roving seminars to create better awareness and interest with the user services at the national level.

16.2.3 The Commission noted with appreciation that the report of the FAO/WMO/UNESCO/UNEP Inter-agency Group on Agricultural Biometeorology on Agrometeorological Survey of Lowlands of the Humid Tropics of South America was published in Spanish by WMO.

16.3 CGIAR INSTITUTES (agenda item 16.3)

The Commission placed on record its appreciation for the contribution to the activities of the Commission made by other national and international agencies and agricultural research institutes, in particular ICARDA, ICRISAT, IITA and ICRAF. Every effort would be made to strengthen those and other similar activities.

16.4 ACMAD AND AGRHYMET (agenda item 16.4)

The Commission noted the collaborative activities of WMO with ACMAD and AGRHYMET, both located in Niger. Recognizing the importance of agrometeorological applications to promote sustainable agricultural production in Africa, the Commission supported the continued participation of WMO in the Scientific Advisory Committee of ACMAD and in the activities of ACMAD and AGRHYMET.

16.5 IGBP/START (agenda item 16.5)

The Commission fully supported the steps taken by the Secretariat to enhance collaboration with START of IGBP, IHDP and WCRP. It noted with appreciation WMO's participation in the newly established Task Force on Climate Prediction and Agricultural Production of START and the collaboration between START and WMO to organize the International Workshop on Climate Prediction and Agricultural Production at WMO in June 1999. Noting that the primary goals of START were to promote regional global change science and to enhance the capacity of individuals, institutions and developing regions to undertake such research, the Commission encouraged WMO's continued participation in the activities of START Committees.

16.6 OTHER ORGANIZATIONS (agenda item 16.6)

16.6.1 The Commission noted with appreciation that many international organizations had come forward to co-sponsor the International Workshop on Agrometeorology in the Twenty-first Century: Needs and Perspective, held in conjunction with the session, which had greatly helped in the participation of members from many developing countries in the workshop as well as the session.

16.6.2 The Commission noted the activities that were proposed to be undertaken by ICID and expressed its appreciation for the offer of ICID to enhance its collaboration with the Commission.

16.6.3 The Commission recommended that collaborative activities with international organizations should be actively pursued during the next financial period.

17. REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND OF RELEVANT EXECUTIVE COUNCIL RESOLUTIONS (agenda item 17)

The Commission examined the resolutions and recommendations adopted at its previous sessions that were still in force at the time of the twelfth session. It also examined those Executive Council resolutions based on previous recommendations of the Commission that were still in force. The decisions of the session were incorporated in Resolution 18 (CAgM-XII) and Recommendation 2 (CAgM-XII).

18. AWARDS FOR OUTSTANDING AND/OR EXCEPTIONALLY LONG-TERM SERVICES TO CAgM (agenda item 18)

18.1 In accordance with the guidelines reviewed and approved by CAgM-XI, the Advisory Working Group proposed candidates for the award for outstanding contributions and/or exceptionally long-term service to CAgM. The Commission conferred the second awards to Messrs L. P. Smith (United Kingdom), W. Baier (Canada) and J. Lomas (Israel). The president, in conferring the award, referred to the outstanding contributions made by Messrs Smith, Baier and Lomas to agrometeorology in general and to CAgM in particular.

18.2 The Commission noted the criteria agreed at the Meeting of the Presidents of Technical Commissions, held in Geneva from 26 to 28 October 1998 for the nomination and award of certificates presented by technical commissions for outstanding service. The Commission agreed that those criteria should be used for the awards to be made at the subsequent sessions of the Commission.

19. ENCOURAGEMENT OF EQUAL OPPORTUNITIES FOR ACTIVE PARTICIPATION OF MEN AND WOMEN IN THE FIELD OF AGRICULTURAL METEOROLOGY (agenda item 19)

The Commission noted that WMO had organized a meeting of International Experts on the Participation of Women in Meteorology and Hydrology in Bangkok, Thailand, in December 1997, and that many important recommendations had resulted from that meeting. It noted that importance of diversity in the workforce extended beyond gender. It also noted that the inadequate education in sciences for women was, in some cases, a barrier to achieving equal opportunity in the participation of men and women in the field of agricultural meteorology. The Commission noted the potential contribution of women in the field of agricultural meteorology and accordingly adopted Resolution 19 (CAgM-XII).

20. ELECTION OF OFFICERS (agenda item 20)

20.1 The quorum of 37 Members with voting rights, as required under General Regulation 192, was not reached. With the agreement of the session, elections were conducted by invoking General Regulation 193, with votes cast by 34 representatives who had credentials and voting rights and who were present at the meeting. The session agreed to Mr R. P. Motha (United States) as president and to Mr L. E. Akeh (Nigeria) as vice-president.

20.2 The session noted that under General Regulation 193, its decision would be considered a decision of the Commission only when it had been approved by a majority of votes cast for and against within 90 days after it had been sent to the Permanent Representatives of Members of WMO which had designated experts to represent them permanently in the Commission.

20.3 Subsequently, the representative of the Secretary-General advised the session that the application

of General Regulation 193 might not apply to the election of the president and vice-president of the Commission during the session, since action to be taken after the session for processing the implementation of General Regulation 193 would have to be by secret ballot.

20.4 The session noted that under General Regulation 2(f), any question or dispute regarding the interpretation or application of a Regulation which occurred between sessions of Congress within the other constituent bodies should be submitted to the Executive Council for decision. In view of the fact that Thirteenth Congress would take place two months after the close of the present session of the Commission, the session agreed that the application of General Regulation 193 in that particular case should be referred to Congress for decision.

20.5 The session noted that pending the decision of Congress, General Regulation 16(b) allowed the President of WMO to assume responsibility as acting president of the Commission.

20.6 Thirteenth Congress, after lengthy debates and extensive consultation among delegations, agreed that in that instance only, and without prejudice to any future decision, the results of the election process at CAgM-XII should be transmitted for decision to Permanent Representatives of Members of WMO who had designated experts to represent them permanently in the Commission and that such decision should be considered a decision of the Commission only when it had been approved by a majority of votes. Accordingly, Messrs R. P. Motha (United States) and L. E. Akeh (Nigeria) were confirmed as president and vice-president, respectively, of CAgM.

21. NOMINATION OF MEMBERS OF WORKING GROUPS AND RAPORTEURS (agenda item 21)

21.1 The Working Groups listed below were established to carry out the work of the Commission between the twelfth and thirteenth sessions. Their terms of reference are contained in the respective resolutions:

- (a) Advisory Working Group of the Commission for Agricultural Meteorology (Resolution 2 (CAgM-XII));
- (b) Working Group on the Impact of Management Strategies in Agriculture and Forestry to Mitigate Greenhouse Gas Emissions and to Adapt to Climate Variability and Climate Change (Resolution 3 (CAgM-XII));
- (c) Working Group on the Impacts of Agrometeorological Applications for Sustainable Management of Farming Systems, Forestry and Livestock (Resolution 4 (CAgM-XII));
- (d) Working Group on the Use of Seasonal Forecasts and Climate Prediction in Operational Agriculture (Resolution 6 (CAgM-XII));
- (e) Working Group on the Communication of Agrometeorological Information (Resolution 10 (CAgM-XII));
- (f) Working Group on the Impacts of Desertification and of Drought and other Extreme Meteorological Events (Resolution 15 (CAgM-XII));

21.2 In addition, the following rapporteurs were appointed:

- (a) Joint Rapporteurs on the Past, Present and Future Position of Agrometeorology in the National Meteorological and Hydrological Services in the Regional Associations (Resolution 1 (CAGM-XII));
- (b) Joint Rapporteurs on Agrometeorological Aspects of Organic Agriculture, Urban Agriculture, Indoor Agriculture and Precision Farming (Resolution 5 (CAGM-XII));
- (c) Joint Rapporteurs on the Status of Modelling in Agroclimatology (Resolution 7 (CAGM-XII));
- (d) Joint Rapporteurs on User Requirements for Satellite and other Remote-sensing Information in the Field of Agricultural Meteorology (Resolution 8 (CAGM-XII));
- (e) Joint Rapporteurs on Agrometeorological Data Management (Resolution 9 (CAGM-XII));
- (f) Joint Rapporteurs on the Impact of Agrometeorological Information on Rangeland and Pasture Ecology and Management (Resolution 11 (CAGM-XII));
- (g) Joint Rapporteurs on the Impact of Agrometeorological Advisories and Information on Operational Aspects of Forestry Planning, with Emphasis on Wildland Fire Ecology, including the Use of Prescribed Fire in Rangelands and Forests and Preventing and Combating Wildfires in Forests and Rangelands (Resolution 12 (CAGM-XII));
- (h) Joint Rapporteurs on Designing Pilot Surveys to Assess CAGM Products and to Evaluate their Relevance to User Requirements (Resolution 13 (CAGM-XII));
- (i) Joint Rapporteurs on the Impact of the Use of Meteorological and Climatological Data on Fisheries and Aquaculture (Resolution 14 (CAGM-XII));
- (j) Joint Rapporteurs on Evaluation of Training, Education and Capacity Building Projects/Programmes in Agrometeorology, including Textbooks, Information on the World Wide Web and other Published Training Materials (Resolution 16 (CAGM-XII));
- (k) Joint Rapporteurs on the Interactions Between Climate and Biological Diversity (Resolution 17 (CAGM-XII));

22. **OPEN FORUM** (agenda item 22)

22.1 Two sessions of the open forum were held on 24 and 25 February 1999, which gave an opportunity to participants to share their experiences with others. The forum also provided an opportunity to inform the Commission on problems of a specific nature in a country or in a region.

22.2 The following topics were presented at the open forum:

- (a) Developments in agrometeorology in Regional Association I (Mr T. Hyera, United Republic of Tanzania);
- (b) Summary and recommendations of the International Workshop on Agrometeorology in the Twenty-first Century: Needs and Perspectives (Mr C. J. Stigter, president of CAGM);
- (c) Agrometeorology and food security of China in the twenty-first century (Ms Wang Shili, China);
- (d) FAO-WMO Agrometeorology Internet Conference (Mr R. Gommès, FAO);
- (e) Review of the impact of the 1997-1998 *El Niño/La Niña* episodes (Mr M. J. Salinger, Discussion Leader).

22.3 Publications in agrometeorology of WMO were exhibited.

23. **DATE AND PLACE OF THE THIRTEENTH SESSION** (agenda item 23)

23.1 The Commission was informed that the thirteenth session of the Commission was scheduled to be held in 2003. Offers were received from Slovenia and Bolivia to host that session.

23.2 The Commission recorded its appreciation to Slovenia and Bolivia for their offers to host that session.

23.3 The actual date and place would be announced at a later date.

24. **CLOSURE OF THE SESSION** (agenda item 24)

The twelfth session of CAGM closed at 6:20 p.m. on 25 February 1999.

RESOLUTIONS ADOPTED BY THE SESSION

RESOLUTION 1 (CAgM-XII)

JOINT RAPPORTEURS ON THE PAST, PRESENT AND FUTURE POSITION OF AGROMETEOROLOGY IN THE NATIONAL METEOROLOGICAL AND HYDROLOGICAL SERVICES IN THE REGIONAL ASSOCIATIONS

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The recommendations of the Advisory Working Group on the establishment of working groups and appointment of rapporteurs,
- (2) The report of the Working Group on Weather and Climate Related to Agricultural Production,
- (3) The report of the Joint Rapporteurs on Application of Agrometeorological Information,

CONSIDERING that agrometeorological applications hold considerable promise for increasing and sustaining agricultural production in the Member countries, in particular the developing countries,

RECOGNIZING that there is a need to undertake a critical evaluation of the position of agrometeorology in national Meteorological and Hydrological Services (NMHSs),

DECIDES:

- (1) To appoint Joint Rapporteurs on the Past, Present and Future Position of Agrometeorology in the National Meteorological and Hydrological Services in the Regional Associations with the following terms of reference:
 - (a) To survey and review for each Regional Association, through questionnaires, the present position of agrometeorology in NMHSs as seen by the Permanent Representatives of Members;
 - (b) To do the same for members of the Commission;

- (c) To survey and review for each Regional Association how different the present position of agrometeorology in NMHSs is relative to its status about 10 years ago, as well as the points of view on the future of agrometeorology in NMHSs, again as seen by the Permanent Representatives and by members of the Commission, independently;
 - (d) To elicit opinions from the same groups as to whether the new measures on regional strengthening of the Commission are sufficient or additional measures are required to pay adequate attention to region-specific issues;
 - (e) To submit mid-term information on the progress of activities of the joint rapporteurs and a final report to the president of the Commission, not later than six months prior to the next session of the Commission;
- (2) To invite the following experts to serve jointly as rapporteurs:
Mr A. K. Abdullaev (Uzbekistan);
Mr Chan Ah Kee (Malaysia);
Mr M. Lukando (United Republic of Tanzania);
Mr M. Molendijk (Netherlands);
Mr P. Nejedlik (Slovakia);
An expert to be designated from Bolivia;
An expert to be designated from Cuba;
 - (3) To invite Mr Chan Ah Kee (Malaysia) to act as coordinator of the joint rapporteurs.

RESOLUTION 2 (CAgM-XII)

ADVISORY WORKING GROUP OF THE COMMISSION FOR AGRICULTURAL METEOROLOGY

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,

NOTING:

- (1) The useful work accomplished by the Advisory Working Group established at the eleventh session,
- (2) The views of Congress on the retention of the system of advisory bodies to provide advice to the presidents of the technical commissions,

CONSIDERING:

- (1) The value of contributions on a wide variety of topics of interest to the Commission from a group of experts who are available for consultation by the president as and when required,
- (2) That the Commission provides advice on the planning of the Agricultural Meteorology Programme including input to the WMO Long-term Plans,

DECIDES:

- (1) To re-establish an Advisory Working Group of the Commission for Agricultural Meteorology with the following terms of reference:
 - (a) To provide general assistance to the president in the performance of his duties as president of the Commission;
 - (b) To assist the president in his responsibility, through establishing and maintaining contact with the rapporteurs and the chairperson of working groups on agricultural meteorology of regional associations and to assist them in the study of specific problems in agricultural meteorology that are of interest to their Members;
 - (c) To advise the president on cooperation with other technical commissions;
 - (d) To recommend any necessary amendments to the relevant sections of the WMO Technical Regulations taking into account the developments in agricultural meteorology;
 - (e) To provide advice on, and assist in, the planning of the programme of the Commission for the thirteenth financial period;
 - (f) To assist the president in the preparations for, and the organization of, the thirteenth session of the Commission;
 - (g) To assist the president in preparing, for inclusion in his circular letters to members of the Commission, brief reports on the progress of activities within the various WMO Regions by providing contributions related to the terms of reference of the working groups and rapporteurs of the Commission in the Regions;
- (2) To invite the following experts to serve on the working group:
 - (.....) president of the Commission (chairperson);
 - (.....) vice-president of the Commission (vice-chairperson);
 - Mr C. J. Stigter (Netherlands) immediate past president of the Commission;
 - Mr W. Baier (Canada);
 - Ms Z. Gat (Israel);
 - Mr G. Maracchi (Italy);
 - Mr M. J. Salinger (New Zealand);
 - Mr J. A. Sanchez Garcia (Paraguay);
 - Mr R. K. Stringer (Australia);
 - Ms Wang Shili (China);
 - An expert to be nominated from Regional Association I.

RESOLUTION 3 (CAgM-XII)

WORKING GROUP ON THE IMPACT OF MANAGEMENT STRATEGIES IN AGRICULTURE AND FORESTRY TO MITIGATE GREENHOUSE GAS EMISSIONS AND TO ADAPT TO CLIMATE VARIABILITY AND CLIMATE CHANGE

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The recommendations of the Advisory Working Group on the establishment of working groups and appointment of rapporteurs,
- (2) The report and recommendations of the CAgM-XI Joint Rapporteurs on the Effects of Climate Variability and Climate Change on Agriculture and Forestry — Agrometeorological Aspects of Management Strategies and Improvement of Sustainability,
- (3) The 1995 Second Assessment Report on Climate Change of the Intergovernmental Panel on Climate Change (IPCC),

CONSIDERING that there is a clear requirement to identify the priorities of agrometeorological adaptation strategies,
RECOGNIZING:

- (1) That the interactions between agricultural processes, climate and greenhouse gas emissions are extremely complex and require detailed analysis,

- (2) That certain greenhouse gas emissions and mitigation measures may have unforeseeable and undesirable consequences,
- (3) That mitigation measures are very likely to be insufficient to stabilize greenhouse gas emission concentrations in the atmosphere and that it is essential to develop adaptation strategies to climate variability and climate change,

DECIDES:

- (1) To establish a Working Group on the Impact of Management Strategies in Agriculture and Forestry to Mitigate Greenhouse Gas Emissions and to Adapt to Climate Variability and Climate Change, with the following terms of reference:
 - (a) To update and present a report on the science of climate change from the latest IPCC assessment and to identify those regions most vulnerable to current climate variability and

- projected climate change where significant changes in the next few decades are likely to disrupt food and fibre production;
- (b) To survey and present examples of impacts of adaptation strategies required for reducing vulnerability of agriculture and forestry to climate variability and climate change;
- (c) To recommend appropriate adaptation strategies required to reduce vulnerability of agriculture and forestry to climate change, climate variability and climate extremes;
- (d) To study the impact of the conversion of forests into crop and rangelands due to human and livestock population pressure on the sources and sinks of carbon and global warming;
- (e) To provide examples of the impact of management strategies to mitigate greenhouse gas emissions from agroecosystems;
- (f) To study the impact of climate change on greenhouse gas emissions from agriculture and forestry;
- (g) To submit mid-term information on the progress of activities and a final report to the president of the Commission not later than six months prior to the next session of the Commission;
- (2) To invite the following experts to serve on the working group:
 Mr H. P. Das (India);
 Mr R. Desjardins (Canada);
 Mr B. Diarra (Mali);
 Mr M. J. Salinger (New Zealand);
 Mr O. D. Sirotenko (Russian Federation);
 Mr Y. Zhang (China);
 An expert from FAO;
 An expert from the Climate Impact Strategies Programme from the United Nations Environment Programme;
- (3) To invite Mr H. P. Das (India) to act as chairperson.

RESOLUTION 4 (CAgM-XII)

WORKING GROUP ON THE IMPACTS OF AGROMETEOROLOGICAL APPLICATIONS FOR SUSTAINABLE MANAGEMENT OF FARMING SYSTEMS, FORESTRY AND LIVESTOCK

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
 NOTING:

- (1) The recommendations of the Advisory Working Group on the establishment of working groups and appointment of rapporteurs,
- (2) The value of agrometeorological applications for increased and sustainable agricultural production,

CONSIDERING that the evaluation of impacts of agrometeorological applications would be useful,

RECOGNIZING:

- (1) That the potential benefits of agrometeorological applications such as response farming are considerable,
- (2) That the potential impacts of modern techniques such as geographical information system (GIS) and agroecological zoning need to be quickly evaluated to promote their adoption by members,

DECIDES:

- (1) To establish a Working Group on the Impacts of Agrometeorological Applications for Sustainable Management of Farming Systems, Forestry and Livestock with the following terms of reference:
- (a) To review and summarize the impacts of proven agrometeorological applications for sustainable management of farming systems, forestry and livestock, giving specific examples from both developed and developing countries;

- (b) To report on the potential impacts of applications of response farming in developing countries, using examples from case studies and suggest ways and means of promoting field applications;
- (c) To report on the potential impacts of the applications of GIS and agroecological zoning in operational agrometeorology using examples from case studies in selected countries and suggest appropriate procedures for their efficient adoption in the Member countries;
- (d) To submit mid-term information on the progress of activities and a final report to the president of the Commission not later than six months prior to the next session of the Commission;
- (2) To invite the following experts to serve on the working group:
 Mr M. M. Eissa (Egypt);
 Ms L. Grom (Uzbekistan);
 Mr A. D. Kleschenko (Russian Federation);
 Mr A. Ly (Senegal);
 Mr R. Nelson (Australia);
 Mr A. Simard (Canada);
- (3) To invite Mr A. D. Kleschenko (Russian Federation) to act as chairperson.

RESOLUTION 5 (CAgM-XII)

JOINT RAPPORTEURS ON AGROMETEOROLOGICAL ASPECTS OF ORGANIC AGRICULTURE, URBAN AGRICULTURE, INDOOR AGRICULTURE AND PRECISION FARMING

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The recommendations of the Advisory Working Group on the establishment of working groups and appointment of rapporteurs,
- (2) Increasing food production in urban and indoor environments,

CONSIDERING that more and more farmers are interested in switching to organic and precision farming,

RECOGNIZING the potential benefits that will accrue to urban dwellers and farmers from the use of these techniques,

DECIDES:

- (1) To appoint Joint Rapporteurs on Agrometeorological Aspects of Organic Agriculture, Urban Agriculture, Indoor Agriculture and Precision Farming with the following terms of reference:
 - (a) To define properly the mentioned fields of agricultural production;
 - (b) To determine the most important agrometeorological and agroclimatological aspects of the mentioned fields of agricultural production;

- (c) To determine the most important management aspects in the mentioned fields of agricultural production that have agrometeorological and/or agroclimatological components;

- (d) To review conditions and measures to optimize agricultural production in the mentioned fields where agrometeorology can play an important role;

- (e) To submit mid-term information on the progress of activities of the joint rapporteurs and a final report to the president of the Commission not later than six months prior to the next session of the Commission;

- (2) To invite the following experts to serve jointly as rapporteurs:

Mr N. J. Bello (Nigeria);

Mr M. Carvajal Ortiz (Ecuador);

Mr N. Holden (Ireland);

Mr P. Zorba (Albania);

- (3) To invite Mr N. Holden (Ireland) to act as coordinator of the joint rapporteurs.

RESOLUTION 6 (CAgM-XII)

WORKING GROUP ON THE USE OF SEASONAL FORECASTS AND CLIMATE PREDICTION IN OPERATIONAL AGRICULTURE

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The recommendations of the Advisory Working Group on the establishment of working groups and appointment of rapporteurs,
- (2) The report of the CAgM-XI Working Group on Weather and Climate Related to Agricultural Production,
- (3) The definition of meteorological forecasting ranges (Appendix I.4, *Manual on the Global Data-processing System* (WMO-No. 485)),

CONSIDERING that various operational tools have recently become available including the results of seasonal forecasts and climate prediction models and modern systems of transmission of weather information to farmers, RECOGNIZING that seasonal forecasts and climate prediction could be of much benefit to agriculturalists,

DECIDES:

- (1) To establish a Working Group on the Use of Seasonal Forecasts and Climate Prediction in Operational Agriculture with the following terms of reference:
 - (a) In liaison with the Climate Information and Prediction Services (CLIPS) project, review

and summarize the current advances in seasonal forecasts and climate prediction and the products and services relevant to agriculture that are becoming available based on these forecasts;

- (b) To survey and summarize, using appropriate case studies, the current applications and possible impacts of seasonal forecasts and climate prediction in agriculture, forestry and livestock management;

- (c) To review and recommend ways to use and disseminate optimally the seasonal forecasts and climate prediction in operational agriculture with emphasis on user needs especially in the tropical and subtropical zones;

- (d) To propose applications for use of seasonal forecasts and climate prediction for early warning of extreme climatic events;

- (e) To submit mid-term information on the progress of activities and a final report to the president of the Commission not later than six months prior to the next session of the Commission;

- (2) To invite the following experts to serve on the working group:
 Mr V. Dmitrenko (Ukraine);
 Mr G. E. Hugo Ogaz (Chile);
 Ms C. Mullen (Australia);

- Mr I. Tarakidzwa (Zimbabwe);
 An expert to be designated from the African Centre of Meteorological Applications for Development;
 (3) To invite Mr V. Dmitrenko (Ukraine) to act as chairperson.

RESOLUTION 7 (CAgM-XII)

JOINT RAPORTEURS ON THE STATUS OF MODELLING IN AGROCLIMATOLOGY

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
 NOTING:

- (1) The recommendations of the Advisory Working Group on the establishment of working groups and appointment of rapporteurs,
 (2) The report of the CAgM-XI Working Group on Weather and Climate Related to Agricultural Production,

CONSIDERING:

- (1) The rapid developments in the use of computer technology in agrometeorology and the need to keep abreast with these developments,
 (2) The various types of models that are becoming available,
 (3) That such models can often be adapted for use in regions other than those for which they were developed and tested,

RECOGNIZING that computer-based agrometeorological techniques are increasingly used in many countries,

DECIDES:

- (1) To appoint Joint Rapporteurs on the Status of Modelling in Agroclimatology with the following terms of reference:
 (a) To review and classify the different types of modelling approaches applied in agroclimatology and summarize available software;
 (b) To summarize the progress made in each of these fields of modelling as far as agroclimatology is concerned;

- (c) To indicate the most promising fields of modelling in operational agroclimatology as to the expected progress in the immediate future;

- (d) To review those fields of modelling in operational agroclimatology that may be most successfully used for actual management purposes in agricultural production, mainly in the developing countries;

- (e) To assess critically existing models and determine their range of applicability in particular regarding input data needs, availability of crop and required soil parameters, sensitivity to errors in inputs and spatial scale of validity;

- (f) To submit mid-term information on the progress of activities of the joint rapporteurs and a final report to the president of the Commission not later than six months prior to the next session of the Commission;

- (2) To invite the following experts to serve jointly as rapporteurs on the subject:

Ms I. Donet (France);

Mr V. Zhukov (Russian Federation);

Mr G. Zipoli (Italy);

An expert to be designated from the Netherlands;

An expert to be designated from the United States;

- (3) To invite Mr G. Zipoli (Italy) to act as coordinator of the joint rapporteurs.

RESOLUTION 8 (CAgM-XII)

JOINT RAPORTEURS ON USER REQUIREMENTS FOR SATELLITE AND OTHER REMOTE-SENSING INFORMATION IN THE FIELD OF AGRICULTURAL METEOROLOGY

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
 NOTING:

- (1) The report and recommendations of the CAgM-XI Working Group on Agrometeorological Data Management,
 (2) The report of the CAgM-X Working Group on Agrometeorological Data Management,

CONSIDERING:

- (1) The importance of integrating satellite information using operational agrometeorological models,

- (2) The need for updating the requirements for satellite and other remote-sensing data and information including automated weather station data for use in agriculture,

- (3) The need to assess the extent to which the capabilities of satellite systems meet the user requirements,
 RECOGNIZING the increasing use of computers and PCs for processing remote-sensing images to prepare products used by agrometeorologists and other users in agriculture,

DECIDES:

- (1) To appoint Joint Rapporteurs on User Requirements for Satellite and other Remote-sensing Information in the Field of Agricultural Meteorology with the following terms of reference:
 - (a) To provide an overview on the development and an update of requirements for satellite and other remote-sensing information;
 - (b) To assess the extent to which the capabilities of the satellite systems meet the user requirements in the field of agriculture using an appropriate pilot study;
 - (c) To collect and collate information on experience on the implementation, operation and dissemination of low-cost satellite-receiving stations in the field of agrometeorology;
 - (d) To review techniques for integration of information coming from different satellite sensors with ground-based meteorological and agronomic data using geographical information system technology for inclusion in agrometeorological models;
- (e) To prepare guidelines for monitoring data quality;
- (f) To compile an up-to-date inventory of satellite information available for agrometeorological applications including technical specifications, approximate costs and examples of applications;
- (g) To submit mid-term information on the progress of activities and a final report to the president of the Commission not later than six months prior to the next session of the Commission;
- (2) To invite the following experts to serve jointly as rapporteurs:

Mr G. B. Diagne (Senegal);
 Mr P. Doraiswamy (United States);
 Mr M. Labo (Niger);
 Mr S. K. Shaha (India);
 Mr O. Virchenko (Russian Federation);
 One expert to be designated from South America;
- (3) To invite Mr P. Doraiswamy (United States) to act as coordinator of the joint rapporteurs.

RESOLUTION 9 (CAgM-XII)

JOINT RAPPORTEURS ON AGROMETEOROLOGICAL DATA MANAGEMENT

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The recommendations of the CAgM-XI Advisory Working Group on the establishment of working groups,
- (2) The report and recommendations of the CAgM-XI Working Group on Agrometeorological Data Management,
- (3) The report of the CAgM-X Working Group on Agrometeorological Data Management,

CONSIDERING:

- (1) The need to continue the activities in the field of data management,
- (2) That there is a greater role for Commission experts in identifying trends in new technologies for agrometeorological data/products and services,

RECOGNIZING the increasing use of innovative technology in agrometeorological data management such as computerized data collection and electronic communication systems,

DECIDES:

- (1) To establish Joint Rapporteurs on Agrometeorological Data Management with the following terms of reference:
 - (a) To survey and summarize information on impacts of the trends in new technologies on the management of agrometeorological data/products and the possibilities for improving management procedures and techniques;
 - (b) To provide information on methods for standardization, utilization and management of agrometeorological data from automated weather stations, including derived data from radar and satellites;
- (c) To collate information on effective agrometeorological database management strategies and tools which enable response to the demands of agricultural productivity, natural resource sustainability and food security;
- (d) To survey and review existing crop requirements and other agrometeorological information databases and to link information in the Commission reports with such databases;
- (e) To compile a list of available agrometeorological applications for future possible upgrading of climate computing (CLICOM);
- (f) To submit mid-term, information on the progress of activities and a final report to the president of the Commission not later than six months prior to the next session of the Commission;
- (2) To invite the following experts to serve jointly as rapporteurs:

Ms I. Donet (France);
 Mr P. Doraiswamy (United States);
 Ms B. Lozada-García (Venezuela);
 Mr J. M. V. Ratovoharison (Madagascar);
 Mr S. Crimp (Australia);
 An expert to be designated from the Food and Agriculture Organization of the United Nations;
- (3) To invite Ms I. Donet (France) to act as coordinator of the joint rapporteurs.

RESOLUTION 10 (CAgM-XII)

WORKING GROUP ON THE COMMUNICATION OF AGROMETEOROLOGICAL INFORMATION

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The report and recommendations of the CAgM-XI Working Group on Weather and Climate Related to Agricultural Production,
- (2) The report of the CAgM-XI Joint Rapporteurs on Application of Agrometeorological Information,
- (3) The report of the CAgM-X Working Group on Relationships between Weather/Climate and Sustainable Agricultural Production and Protection,
- (4) The Fifth WMO Long-term Plan on the Agricultural Meteorology Programme,
- (5) *Agrometeorological Aspects of Operational Crop Protection* (WMO-No. 687), Technical Note No. 192,

CONSIDERING:

- (1) The need to improve agrometeorological services to improve agricultural production and conserve the environment,
- (2) The importance of timely provision of agrometeorological data, information and advice in a user-oriented format,

RECOGNIZING that methodologies exist for preparing and providing such information using computer-based techniques,

DECIDES:

- (1) To establish a Working Group on the Communication of Agrometeorological Information with the following terms of reference:
 - (a) To review and summarize the experience and information on operational agrometeorological services in national Meteorological Services, Ministries of Agriculture and other institutions in Member countries and evaluate the extent to which they are meeting the user needs;

- (b) To evaluate the current methods and approaches being used in different Member countries for the communication of agrometeorological information to users and assess their impact through involvement of users in such studies;
- (c) To survey and summarize the advances being made in information technology, e.g., audio-video media, fax, computer-to-computer links, Internet, etc., for the communication of information and suggest through appropriate case studies, ways and means by which agrometeorological information and products could be disseminated more efficiently and rapidly to the users;
- (d) To make recommendations on the methods to cope with problems in the provision and accessibility of operational services and their improvement;
- (e) To submit mid-term information on the progress of activities and a final report to the president of the Commission not later than six months prior to the next session of the Commission;

- (2) To invite the following experts to serve as members of the working group:
 - Mr A. Bootsma (Canada);
 - Mr J. Choquevilca Rocha (Bolivia);
 - Mr P. Isabirye (Uganda);
 - Mr B.-L. Lee (Republic of Korea);
 - Ms V. Pérarnaud (France);
- (3) To invite Ms V. Pérarnaud (France) to act as chairperson.

RESOLUTION 11 (CAgM-XII)

JOINT RAPPORTEURS ON THE IMPACT OF AGROMETEOROLOGICAL INFORMATION ON RANGELAND AND PASTURE ECOLOGY AND MANAGEMENT

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The recommendation of the CAgM-XI Advisory Working Group on the establishment of working groups and appointment of rapporteurs,
- (2) The report of the Joint Rapporteurs on Application of Agrometeorological Information,
- (3) *Definition of Agrometeorological Information Required for Pasture and Livestock Production in Cold Climate Regions* (WMO/TD-No. 751), CAgM Report No. 69,

- (4) *Agrometeorology of Grass and Grasslands for Middle Latitudes* (WMO-No. 839), Technical Note No. 197,

CONSIDERING the importance of agrometeorological information in increasing and stabilizing the livestock and pasture production in different regions of the world,
RECOGNIZING the need to continue activities in this field,

DECIDES:

- (1) To appoint Joint Rapporteurs on the Impact of Agrometeorological Information on Rangeland and

Pasture Ecology and Management with the following terms of reference:

- (a) To survey and summarize the existing agrometeorological information for rangeland and pasture management, including information on meteorological driving factors for forage production and pasture erosion management;
- (b) To survey and summarize the existing agrometeorological information on rangeland and pasture disturbance ecology including competition from wildlife, drought and other severe weather events including short-term shifts;
- (c) To describe, using case studies from Member countries, the impacts of such information;

- (d) To suggest ways and means to improve further such agrometeorological information for applications in livestock and pasture production;
 - (e) To submit mid-term information on the progress of activities of the joint rapporteurs and a final report to the president of the Commission not later than six months prior to the next session of the Commission;
- (2) To invite the following experts to serve jointly as rapporteurs:
Mr P. Gibba (Gambia);
Mr Y. Gandega (Mauritania);
Ms L. Lebed (Kazakhstan);
Mr D. Rijks (Netherlands);
 - (3) To invite Ms L. Lebed (Kazakhstan) to act as coordinator of the joint rapporteurs.

RESOLUTION 12 (CAgM-XII)

JOINT RAPPORTEURS ON THE IMPACT OF AGROMETEOROLOGICAL ADVISORIES AND INFORMATION ON OPERATIONAL ASPECTS OF FORESTRY PLANNING, WITH EMPHASIS ON WILDLAND FIRE ECOLOGY, INCLUDING THE USE OF PRESCRIBED FIRE IN RANGELANDS AND FORESTS AND PREVENTING AND COMBATING WILDFIRES IN FORESTS AND RANGELANDS

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The recommendation of the CAgM-XI Advisory Working Group on the establishment of working groups and appointment of rapporteurs,
- (2) The report of the Joint Rapporteurs on Application of Agrometeorological Information,
- (3) The report of the Joint Rapporteurs on Weather and Climate Related to Forestry and (Non-Forest) Tree Production,
- (4) *Meteorological Information Required for Managing Forests in Arid and Semi-Arid Regions* (WMO/TD-No. 728), Part III, CAgM Report No. 64,

CONSIDERING the importance of agrometeorological advisories and information on the prevention of wildland fires for the protection of the environment,

RECOGNIZING the need to continue activities in this field,

DECIDES:

- (1) To appoint Joint Rapporteurs on the Impact of Agrometeorological Advisories and Information on Operational Aspects of Forestry Planning, with Emphasis on Wildland Fire Ecology, Including the Use of Prescribed Fire in Rangelands and Forests and Preventing and Combating Wildfires in Forests and Rangelands with the following terms of reference:

- (a) To survey and summarize the existing agrometeorological advisories and information managing forests and rangelands (wildlands) particularly with respect to fire and on the potential effects of changing climate;
 - (b) To describe, using case studies from Member countries, the impacts of such advisories and information;
 - (c) To suggest ways and means to improve further the quality of such agrometeorological advisories and information for applications in forestry;
 - (d) To submit mid-term information on the progress of activities of the joint rapporteurs and a final report to the president of the Commission not later than six months prior to the next session of the Commission;
- (2) To invite the following experts to serve jointly as rapporteurs:
Mr A. Riebau (United States);
Mr P. Zorba (Albania);
One expert to be designated from South America;
 - (3) To invite Mr A. Riebau (United States) to act as coordinator of the joint rapporteurs.

RESOLUTION 13 (CAgM-XII)

JOINT RAPPORTEURS ON DESIGNING PILOT SURVEYS TO ASSESS CAgM PRODUCTS AND TO EVALUATE THEIR RELEVANCE TO USER REQUIREMENTS

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The recommendation of the CAgM-XI Advisory Working Group on the establishment of working groups and appointment of rapporteurs,
- (2) The report of the Joint Rapporteurs on the Application of Agrometeorological Information,

CONSIDERING the importance of developing appropriate CAgM products that would be useful to the farming community in making operational farm management decisions, RECOGNIZING the need to evaluate the relevance of CAgM products to the user requirements,

DECIDES:

- (1) To appoint Joint Rapporteurs on Designing Pilot Surveys to Assess CAgM Products and to Evaluate their Relevance to User Requirements with the following terms of reference:

- (a) To assess the consequences of the outcome of the "Sequeira" survey for certain CAgM products;
- (b) In line with the adopted CAgM vision document, to define all the CAgM products and to classify them, by survey or otherwise, in order of importance (absolute priority; important; of less importance; unnecessary) for each regional association separately;

- (c) To design pilot surveys to assess fully absolute priority and important CAgM products in the respective regional associations and propose efficient ways to conduct such pilot surveys;

- (d) To do the same with respect to the evaluation of the relevance to user requirements of such absolute priority and important CAgM products in the respective regional associations;

- (e) To submit mid-term information on the progress of activities of the joint rapporteurs and a final report to the president of the Commission not later than six months prior to the next session of the Commission;

- (2) To invite the following experts to serve jointly as rapporteurs:

Mr Y. Bangoura (Guinea);
Mr J. Choquevilca Rocha (Bolivia);
Mr T. Luu Dang (Viet Nam);
Mr G. Munthali (Malawi);
Mr A. Propopenko (Ukraine);
Mr N. F. Ouattara (Burkina Faso);
Mr R. N. Whitaker (Australia);

- (3) To invite Mr J. Choquevilca Rocha (Bolivia) to act as coordinator of the joint rapporteurs.

RESOLUTION 14 (CAgM-XII)

JOINT RAPPORTEURS ON THE IMPACT OF THE USE OF METEOROLOGICAL AND CLIMATOLOGICAL DATA ON FISHERIES AND AQUACULTURE

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The FAO *Review of the State of World Fishery Resources: Marine Fisheries* (1997),
- (2) The FAO *Review of the State of World Aquaculture* (1997),
- (3) The report of the CAgM-XI Joint Rapporteurs on Agrometeorological Aspects of Marine Fisheries,

CONSIDERING the need to continue to work on the subject,

DECIDES:

- (1) To appoint Joint Rapporteurs on the Impact of the Use of Meteorological and Climatological Data on Fisheries and Aquaculture with the following terms of reference:

- (a) To survey and summarize the existing uses of meteorological and climatological data on fisheries and aquaculture;

- (b) To describe, using case studies from Member countries, the impacts of such information;

- (c) To suggest ways and means to improve further agrometeorological information for applications in fisheries and aquaculture;

- (d) To submit mid-term information on the progress of activities of the joint rapporteurs and a final report to the president of the Commission not later than six months prior to the next session of the Commission;

- (2) To invite the following experts to serve jointly as rapporteurs:

Mr M. M. Eissa (Egypt);
Mr S. G. Ngo (Viet Nam);
One expert to be designated from New Zealand;

- (3) To invite Mr S. G. Ngo (Viet Nam) to act as coordinator of the joint rapporteurs.

RESOLUTION 15 (CAGM-XII)

WORKING GROUP ON THE IMPACTS OF DESERTIFICATION AND OF DROUGHT AND OTHER EXTREME METEOROLOGICAL EVENTS

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) The report of the CAGM-XI Working Group on Agrometeorology Related to Extreme Events,
- (2) *Extreme Agrometeorological Events* (WMO/TD-No. 836), CAGM Report No. 73,
- (3) *Estimation of Maximum Floods* (WMO-No. 233), Technical Note No. 98,
- (4) *Climate Variability, Agriculture and Forestry* (WMO-No. 802), Technical Note No. 196,
- (5) *Protection of Plants Against Adverse Weather* (WMO-No. 281), Technical Note No. 118,

CONSIDERING:

- (1) That the frequency of occurrence of some extreme meteorological events is increasing worldwide with negative impact on agricultural production, natural resources and the environment,
- (2) The need to establish an expert system on extreme meteorological events that impact on agriculture, forestry and fisheries,

RECOGNIZING that continuous observations, both during and after the occurrence of an extreme event, are required for modelling the impact, including socio-economic impact, of extreme events on agriculture,

DECIDES:

- (1) To appoint a Working Group on the Impacts of Desertification and of Drought and other Extreme Meteorological Events with the following terms of reference:
 - (a) To provide advice, within the terms of reference of the Commission, on matters relating to the implementation of the United Nations Convention to Combat Desertification and Mitigate the Effects of Drought;

- (b) To survey, update and summarize existing knowledge and information on assessing different aspects of desertification, drought and other extreme meteorological events such as high temperatures, hail, floods, frosts, etc.;
- (c) To identify and list the actions that could be taken by the national Meteorological and Hydrological Services to increase the benefits from the implementation of the United Nations Convention to Combat Desertification and Mitigate the Effects of Drought;
- (d) To develop a structure for an expert system on extreme meteorological events including the timing and duration of their long-term socio-economic effects and the meteorological information that can be provided to issue early warning and alleviate the effects of these events;
- (e) To submit mid-term information on the progress of activities and a final report to the president of the Commission not later than six months prior to the next session of the Commission;

- (2) To invite the following experts to serve as members of the working group:
 - Mr S. T. Gathara (Kenya);
 - Mr I. G. Gringof (Russian Federation);
 - Mr E. Mersha (Ethiopia);
 - Mr K. C. Sinha Ray (India);
 - Mr P. Spasov (Yugoslavia);
 - An expert to be designated from the Food and Agriculture Organization of the United Nations;
- (3) To invite Mr S. T. Gathara (Kenya) to act as chairperson.

RESOLUTION 16 (CAGM-XII)

JOINT RAPPORTEURS ON EVALUATION OF TRAINING, EDUCATION AND CAPACITY BUILDING PROJECTS/PROGRAMMES IN AGROMETEOROLOGY, INCLUDING TEXTBOOKS, INFORMATION ON THE WORLD WIDE WEB AND OTHER PUBLISHED TRAINING MATERIALS

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) Resolution 16 (CAGM-XI) — Joint Rapporteurs on Impact of Training in Agrometeorology,
- (2) The recommendation of the Advisory Working Group on the establishment of working groups and appointment of rapporteurs,

CONSIDERING:

- (1) That education and training in agricultural meteorology continues to be of utmost importance for the

practical application of agrometeorological data and information,

- (2) The need to assess the impact of education and training on the development of operational agrometeorological services,
- (3) That evaluation of existing training, education and capacity building programmes in agrometeorology could help develop improved programmes of education and training in agrometeorology,

RECOGNIZING the need to have joint rapporteurs advise the president of the Commission on matters relating to education and training in agricultural meteorology,

DECIDES:

- (1) To appoint Joint Rapporteurs on Evaluation of Training, Education and Capacity Building Projects/ Programmes in Agrometeorology, Including Textbooks, Information on the World Wide Web and Other Published Training Materials with the following terms of reference:
 - (a) To monitor the activities and developments in training, education and capacity building projects/programmes in agrometeorology, including textbooks and other published training materials;
 - (b) To survey and summarize methodologies for the evaluation of training, education and capacity building in agrometeorology;
 - (c) To collect and compare curriculum and syllabus information from different training centres and universities in order to establish appropriate emphasis on different subjects in the training programmes;
 - (d) Using the above, to evaluate the training in agrometeorology imparted through various

training programmes and to make recommendations for improvement, particularly for developing countries;

- (e) To analyse and report on issues related to the education of women in agrometeorology and to make recommendations for improvement;
- (f) To submit mid-term information on the progress of activities of the joint rapporteurs and a final report to the president of the Commission not later than six months prior to the next session of the Commission;
- (2) To invite the following experts to serve jointly as rapporteurs:
 - Mr G. E. Hugo Ogaz (Chile);
 - Mr F. Huard (France);
 - Mr J. Lomas (Israel);
 - Mr E. Mukhala (Zambia);
 - Ms M. A. Ogunwale (Nigeria);
 - Mr S. Shen (China);
 - Ms S. Walker (South Africa);
 One expert to be designated from the Food and Agriculture Organization of the United Nations;
- (3) To invite Ms S. Walker (South Africa) to act as coordinator of the joint rapporteurs.

RESOLUTION 17 (CAgM-XII)

JOINT RAPPORTEURS ON THE INTERACTIONS BETWEEN CLIMATE AND BIOLOGICAL DIVERSITY

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,

NOTING:

- (1) The Declaration of the United Nations Conference on Environment and Development (UNCED) and its Agenda 21,
- (2) The Convention on Biological Diversity,
- (3) The report of the Joint Rapporteurs on UNCED Follow-up,

CONSIDERING:

- (1) That there are major interactions between climate and biological diversity,
- (2) That deforestation is proceeding at an alarming rate in humid tropical regions and can greatly disturb the dynamic coupling between forests and atmosphere that once sustained a unique regional climate and biological diversity,

RECOGNIZING that the biological diversity at any location depends, among other factors, on climate,

DECIDES:

- (1) To appoint Joint Rapporteurs on the Interactions Between Climate and Biological Diversity with the following terms of reference:
 - (a) To provide an overview of the major interactions between climate and biological diversity;

(b) To review the effects of deforestation on climate change in a given region and their impacts on biological diversity;

(c) To examine the influence of projected global change on carbon sequestration by the forests and agricultural soils;

(d) To review sustainable agricultural practices which would contribute directly or indirectly to conservation of biological diversity;

(e) To submit mid-term information on the progress of activities of the joint rapporteurs and a final report to the president of the Commission not later than six months prior to the next session of the Commission;

- (2) To invite the following experts to serve jointly as rapporteurs:

Mr M. P. Bah (Gambia);

Ms V. Grigoran (Armenia);

Mr O. Hendrickson (Canada);

Ms S. T. Korskova (Ukraine);

One expert to be designated from the Food and Agriculture Organization of the United Nations;

- (3) To invite Mr M. P. Bah (Gambia) to act as coordinator of the joint rapporteurs.

RESOLUTION 18 (CAgM-XII)

REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION FOR AGRICULTURAL METEOROLOGY

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) That all its previous resolutions are now obsolete,
- (2) That the substance of some of its previous recommendations have been included in recommendations of the twelfth session,

DECIDES:

- (1) Not to keep in force any of its resolutions adopted prior to its twelfth session;
- (2) To note with satisfaction the action taken by the competent bodies on the recommendations of its previous sessions, which are now redundant.

RESOLUTION 19 (CAgM-XII)

ENCOURAGEMENT OF EQUAL OPPORTUNITIES FOR PARTICIPATION OF MEN AND WOMEN IN THE FIELD OF AGRICULTURAL METEOROLOGY

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,

NOTING:

- (1) The appeals made in Chapter 24 of Agenda 21: Programme of Action for Sustainable Development (Rio de Janeiro, 1992) on "Global action for women towards sustainable and equitable development",
- (2) The United Nations Conference on Women (Beijing, 1995) and its recognition of the importance of women and their contribution to science,
- (3) That several WMO technical commissions had passed recommendations encouraging the increased participation by women in the work of those commissions,
- (4) The recommendations of the International Expert Meeting on the Participation of Women in Meteorology and Hydrology (Bangkok, December 1997),
- (5) That the fiftieth session of the Executive Council (Geneva, 1998) requested Members to encourage the advancement of women in meteorology and operational hydrology,

CONSIDERING:

- (1) The need for trained professionals in the work of the Commission,
- (2) That in some countries, to ensure a good balance of men and women in science and technology, more emphasis may be needed to encourage women's education,

WELCOMING the active participation of women delegates at this session,

RECOMMENDS that Members:

- (1) Review the recommendations of the WMO International Expert Meeting on the Participation of Women in Meteorology and Hydrology, held in Bangkok, Thailand in December 1997 and, where appropriate, to take these recommendations into consideration in the work of their national Meteorological and Hydrological Service;
- (2) Provide active encouragement and support for equal opportunity for the participation of suitably qualified men and women:
 - (a) In agrometeorology and related fields;
 - (b) In training and promotion to decision-making levels;
 - (c) To participate in the work of the Commission including meetings and workshops;

RECOMMENDS that the Commission actively encourages equal opportunity for men and women in its work;

DECIDES to add a task to the work of the Joint Rapporteurs on Evaluation of Training, Education and Capacity Building Projects/Programmes in Agrometeorology, Including Textbooks, Information on the World Wide Web and Other Published Training Materials, specifically to analyse and report on issues related to the education of women in agrometeorology and make recommendations on the results.

RECOMMENDATIONS ADOPTED BY THE SESSION

RECOMMENDATION 1 (CAgM-XII)

NATIONAL PROGRESS REPORTS ON PROGRESS MADE IN AGRICULTURAL METEOROLOGY

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,
NOTING:

- (1) Recommendation 1 (CAgM-XI) — National reports on progress made in agricultural meteorology,
- (2) The responses received so far from the Members to the questionnaire on the national reports on progress made during 1995–1998,
- (3) The proposal of the WMO Secretariat to create a comprehensive database on the status of agrometeorological activities in Member countries based on the information provided in the reports from the Members,

RECOMMENDS:

- (1) That Members:
 - (a) Who have not so far submitted their responses to the current questionnaire, do so as soon as possible, so that a comprehensive database on agricultural meteorology can be compiled by the WMO Secretariat before 31 December 1999;

- (b) Submit, six months prior to the next session of the Commission, their responses to the questionnaire on progress which has taken place in agrometeorology since the preparation of the previous national report;
- (2) That the Secretary-General:
 - (a) Circulate the list of Members who have sent their reports to all other Members with a note asking them to submit their reports by 31 May 1999;
 - (b) Arrange for the compilation of a comprehensive database on agrometeorology based on the responses provided by the Members before 31 December 1999;
 - (c) Publish brief summaries of progress in agricultural meteorology for information of Members, before the next session of the Commission.

RECOMMENDATION 2 (CAgM-XII)

REVIEW OF RESOLUTIONS OF THE EXECUTIVE COUNCIL BASED ON PREVIOUS RECOMMENDATIONS OF THE COMMISSION FOR AGRICULTURAL METEOROLOGY

THE COMMISSION FOR AGRICULTURAL METEOROLOGY,

NOTING with satisfaction the action taken on its previous recommendations by the Executive Council,

RECOMMENDS:

- (1) That the following Executive Council resolutions be maintained in force:

- 17 (EC-XXX); 5 (EC-XLIV); 8 (EC-XLV); and 5 (EC-XLVII);
- (2) That Resolution 5 (EC-XLVII) — Report of the eleventh session of the Commission for Agricultural Meteorology, be replaced by a new resolution relating to the report of the twelfth session of the Commission.

ANNEX

ANNEX

Annex to paragraph 15.3 of the general summary

SUMMARY OF PROPOSALS FOR NEW AREAS OF CAgM ACTIVITIES IN RESPONSE TO UNCED DOCUMENTS

<i>UNCED document</i>		<i>Proposals for new areas of CAgM activities</i>	
A.	United Nations Convention to Combat Desertification	A.1	CAgM recommendation of a drought information system with access to international networks.
		A.2	Seasonal forecasting for drought mitigation.
		A.3	Survey traditional technologies to cope with dryland climate variability.
		A.4	Planning of agricultural activities appropriate for dryland climates.
B.	United Nations Framework Convention on Climate Change	B.1	Strengthen research in the area of climate prediction and services to agriculture: <ul style="list-style-type: none"> (a) Improve methods for monitoring occurrences of drought and heavy rainfall; (b) Develop a methodology for assessing socio-economic effects of weather/climate variability on food production; (c) Study interactions between climate, drought and desertification, agricultural technology and resource management; (d) Develop climatic indicators to be used in research on minimizing adverse impacts in countries with extreme climate variability; (e) Develop a comprehensive model for predicting changes in greenhouse gas emissions associated with different management practices in agricultural and forestry systems.
		B.2	Facilitate capacity building: <ul style="list-style-type: none"> (a) Develop capabilities of climate prediction with emphasis on rainfall; (b) Facilitate in-country training seminars.
		B.3	Enhance management and exchange of information and networking: <ul style="list-style-type: none"> (a) Maximum use of available CLIPS products; (b) Develop computer-based information packages on resource management alternatives and application of weather/climate information for agricultural activities; (c) Enhance information management through regional network focal points and/or regional centres; (d) Faster exchange of information among Members on methodology, vulnerability, impact and adaptation.
C.	United Nations Convention on Biological Diversity	C.1	Maintenance of land productivity through the adoption and use of sustainable agricultural farming systems.
		C.2	Provision of support services and post-harvest facilities.
		C.3	Management and conservation including rehabilitation of critical resources through an "ecosystem approach".
		C.4	Efficient use of agricultural lands through the promotion of research and development on the utilization of indigenous materials in pest control.
		C.5	Maintenance of optimum level of land dedicated to agricultural use.

<i>UNCED document</i>	<i>Proposals for new areas of CAgM activities</i>
D. Statement of Principles on Forests	D.1 Encourage the provision of information on proper resource management. D.2 Develop a network for exchange of information. D.3 Encourage Members to promote rapid reforestation and proper management to arrest further erosion, especially near water reservoirs. D.4 Develop capacities for planning assessment and systematic observation of forests. D.5 Develop basic information related to area and type of forests and the existing potential and volume of harvest. D.6 Conduct research on use of agrometeorological information in efficient, rational and sustainable development and utilization of forests and forest-based resources and on activities that are non-degrading and enhance the value of forests such as wildlife conservation.

APPENDIX A

LIST OF PERSONS ATTENDING THE SESSION

A. OFFICERS OF THE SESSION

C. J. Stigter	President
M. J. Salinger	Vice-president

B. REPRESENTATIVES OF WMO MEMBERS

<i>Member</i>	<i>Name</i>	<i>Capacity</i>
Australia	R. K. Stringer	Principal delegate
Belgium	E. De Dycker	Principal delegate
Belize	R. Frutos	Principal delegate
Benin	D. Tohio	Principal delegate
Bolivia	J. Choquevilca Rocha	Principal delegate
Botswana	D. D. Dambe	Principal delegate
Burkina Faso	N. F. Ouattara	Principal delegate
Cameroon	E. G. Ondoua	Principal delegate
Canada	B. O'Donnell R. Desjardins W. Baier	Principal delegate Alternate Delegate
China	Shen Guoquan Wang Shili (Ms) Ying Ning Zheng Dawei	Principal delegate Delegate Delegate Delegate
Congo	B. Bitsoumani	Principal delegate
Côte d'Ivoire	G. Goroza K. Souleymane	Principal delegate Delegate
Cuba	O. Solano Ojeda	Principal delegate
Denmark	L. Wester- Andersen (Ms)	Principal delegate
Ecuador	M. Carvajal	Principal delegate
Egypt	M. M. Eissa	Principal delegate
France	V. Pérarnaud (Ms) P. Frayssinet F. Huard	Principal delegate Delegate Delegate
Germany	H. Dommermuth R. Krüger	Principal delegate Delegate
Ghana	N. B. Yelifari Y. Osei-Brimpong (Ms) Z. Minia I. Yahaya A. Y. Nkansah A. Mensah J. Wellens-Mensah L. Otoo (Ms) I. M. Musa J. B. Dankwa B. P. Acquaaah E. Acquaaah (Ms) F. Abbey G. A. Wilson	Principal delegate Alternate Delegate Delegate Delegate Delegate Delegate Delegate Observer Observer Observer Observer Observer Observer

<i>Member</i>	<i>Name</i>	<i>Capacity</i>
Ghana (Cont.)	K. Wurodu C. Kasei F. P. Mote S. E. Tandoh M. A. Odonkor E. Ofori-Sarpong N. K. Quartey R. A. Monney N. Gbeckor-Kove	Observer Observer Observer Observer Observer Observer Observer Observer Observer
Guinea	Y. Bangoura	Principal delegate
Iran, Islamic Republic of	G. A. Kamali B. Behyar	Principal delegate Delegate
Israel	Z. Gat (Ms)	Principal delegate
Italy	G. Maracchi G. Zipoli	Principal delegate Alternate
Jordan	F. Y. Abdo	Principal delegate
Kazakhstan	L. V. Lebed (Ms)	Principal delegate
Kenya	E. A. Mukolwe J. Mwikya	Principal delegate Alternate
Madagascar	D. Randriaroro	Principal delegate
Malaysia	Chan Ah Kee	Principal delegate
Mali	B. Diarra	Principal delegate
Mauritania	G. Yelli	Principal delegate
Mongolia	D. Dagvadorj	Principal delegate
Namibia	F. Uirab	Principal delegate
Netherlands	C. J. Stigter D. Rijks M. Molendijk	Principal delegate Delegate Delegate
New Zealand	M. J. Salinger	Principal delegate
Niger	M. Labo	Principal delegate
Nigeria	L. E. Akeh M. A. Ogunwale (Ms) A. A. Lawal S. S. Bala D. E. Eniaiyaju	Principal delegate Delegate Observer Observer Observer
Pakistan	M. Rafique Chaudhry	Principal delegate
Paraguay	J. A. Sanchez Garcia	Principal delegate
Poland	P. Kowalczak	Principal delegate
Portugal	R. Guerreiro (Ms)	Principal delegate
Republic of Korea	B.-L. Lee	Principal delegate
Russian Federation	O. D. Sirotenko	Principal delegate
Rwanda	D. Disi	Principal delegate
Senegal	F. Diallo	Observer

<i>Member</i>	<i>Name</i>	<i>Capacity</i>	<i>Organization</i>	<i>Name</i>		
Slovakia	P. Nejedlik	Principal delegate	Consultative Group on International Agricultural Research (CGIAR)	K. Dashiell		
South Africa	S. Walker (Ms)	Principal delegate		Economic Community of West African States (ECOWAS)	S. Traore	
Spain	A. Mestre	Principal delegate			International Commission on Irrigation and Drainage (ICID)	I. K. Musa Y. Aboki G. E. Oteze B. E. Lawson
Sudan	H. A. Abdalla	Principal delegate		International Institute for Tropical Agriculture (IITA)		K. Dashiell
Uganda	P. Isabirye	Principal delegate				International Union of Soil Sciences (IUSS)
United Kingdom of Great Britain and Northern Ireland	P. V. Harker I. Barrie	Principal delegate Alternate		E. LOCAL SECRETARIAT		
United Republic of Tanzania	T. M. Hyera	Principal delegate		G. K. Anaglate	J. K. Amelorku	
United States of America	R. Motha	Principal delegate		S. K. Xatse	D. Akpaloo	
	A. R. Riebau	Delegate		E. K. Afari	I. A. Aryee (Ms)	
	P. C. Doraiswamy	Delegate		A. Juati	C. Letsu (Ms)	
	G. Hoogenboom	Observer	G. V. Y. Addo	H. Cofie (Ms)		
	E. T. Kanemasu	Observer	J. A. Kanto	N. Appiah		
Uzbekistan	V. O. Usmanov	Principal delegate	M. Dwira (Ms)	S. K. Awudza		
Viet Nam	Nguyen Van Viet	Principal delegate	E. Churchill (Ms)	P. N. Clegg		
Zambia	E. Mukhala	Principal delegate	K. Quashiga	E. Akuffo		
Zimbabwe	I. Tarakidzwa	Principal delegate	J. A. Oduro	S. K. Opoku		
	J. Milford	Delegate	K. A. Kovey	B. Ayim (Ms)		
C. INVITED EXPERT						
M. S. Mhita	President of RA I		B. Assam (Ms)	E. Lawson (Ms)		
D. REPRESENTATIVES OF INTERNATIONAL ORGANIZATIONS						
			V. Okusu (Ms)	G. Nunco (Ms)		
			E. O. Martin	H. Boadu		
			A. A. Ayitey	D. Osika		
			C. M. Adams	E. Uzor (Ms)		
			F. WMO SECRETARIAT			
			G. O. P. Obasi	Secretary-General		
			M. J. Coughlan	Director, World Climate Programme Department and representative of the Secretary-General		
			M. V. K. Sivakumar	Chief, Division of Agricultural Meteorology		
			A. Yeves-Ruiz	Scientific Officer, Division of Agricultural Meteorology		
			F. Hayes	Director, Languages, Publications and Conferences Department (Conference Officer)		
<i>Organization</i>						
United Nations Economic Commission for Africa (UN/ECA)	D. Oben					
Food and Agriculture Organization of the United Nations (FAO)	R. A. Gommès					
United Nations Convention to Combat Desertification (UNCCD)	A. S. Cissoko					
African Centre of Meteorological Applications for Development (ACMAD)	M. S. Boulahya Y. Djellouli (Ms)					

APPENDIX B

AGENDA

<i>Agenda item</i>	<i>Document Nos.</i>	<i>PINK Nos. and person submitting</i>	<i>Resolutions and recommendations adopted</i>
1. OPENING OF THE SESSION		1, president of CAgM	
2. ORGANIZATION OF THE SESSION		2, president of CAgM	
2.1 Consideration of the report on credentials			
2.2 Adoption of the agenda	2-2(1); 2-2(2)		
2.3 Establishment of committees			
2.4 Other organizational matters			
3. REPORT BY THE PRESIDENT OF THE COMMISSION	3(1)	3, president of CAgM	
4. NATIONAL PROGRESS REPORTS ON AGRICULTURAL METEOROLOGY	4(1)	4, Chairperson, Committee A	Rec. 1
5. REGIONAL ACTIVITIES IN AGROMETEOROLOGY	5(1)	5, Chairperson, Committee A	Res. 1
6. FOURTH WMO LONG-TERM PLAN AND THE AGRICULTURAL METEOROLOGY PROGRAMME	6(1)	6, Chairperson, Committee A	
7. FIFTH WMO LONG-TERM PLAN AND THE AGRICULTURAL METEOROLOGY PROGRAMME	7(1)	7, Co-chairperson, Committee A	Res. 2
8. REVIEW OF THE TECHNICAL REGULATIONS AND OF THE <i>GUIDE TO AGRICULTURAL METEOROLOGICAL PRACTICES</i> (WMO-No. 134)	8(1)	8, Co-chairperson, Committee A	
8.1 Report of the Advisory Working Group			
8.2 <i>Guide to Agricultural Meteorological Practices</i> (WMO-No. 134)			
8.3 Technical Regulations			
9. REQUIREMENTS FOR AGROMETEOROLOGICAL INFORMATION		9, Chairperson, Committee B	
9.1 Cereal crops	9(1)		
9.2 Tuber and pulse crops	9(1)		
9.3 Commercial tree crops	9(1)		
9.4 Field and bush crops	9(1)		
9.5 Vegetable crops			
9.6 Irrigated soils and crops	9-6(1)		
9.7 Forest management and exploitation			
9.8 Livestock and pasture production	9-8(1)		
10. WEATHER AND CLIMATE RELATED TO AGRICULTURAL PRODUCTION		10, Co-chairperson, Committee B	
10.1 Effects of climate variability and climate change on agriculture and forestry — agrometeorological aspects of management strategies and improvement of sustainability	10(1)		Res. 3
10.2 Meteorological factors and sustainable agricultural production	10-2 to 10-6(2)		Res. 4; 5

<i>Agenda item</i>	<i>Document Nos.</i>	<i>PINK Nos. and person submitting</i>	<i>Resolutions and recommendations adopted</i>
10.3 Farming system adaptation to climate change and variability			
10.4 Operational agrometeorological techniques			Res. 6
10.5 Transformation of basic knowledge into operational techniques			Res. 7
10.6 Adapted farming systems as strategy to combat desertification			
10.7 Weather and climate related to forestry and (non forest) tree production	10-7(1)		
10.8 Weather and climate related to livestock and pasture production	10-8(1)		
11. AGROMETEOROLOGICAL DATA MANAGEMENT	11(1)	11, Co-chairperson, Committee B	
11.1 Ground-based and remotely-sensed observations developments			Res. 8
11.2 Computer-based management systems			
11.3 Suitable software packages and training requirements			
11.4 Data and products for current and future requirements			Res. 9
12. APPLICATIONS OF AGROMETEOROLOGY		12, Chairperson, Committee B	
12.1 Application of agrometeorological information	12-1(1)		Res. 10; 11; 12; 13
12.2 Agrometeorological aspects of marine fisheries	12-2(1)		Res. 14
12.3 Commercialization and the exchange of agrometeorological data and products	12-3(1)		
13. AGROMETEOROLOGY RELATED TO EXTREME EVENTS	13(1); ADD.1(13(1))	13, Chairperson, Committee B	
13.1 Information needed to cope with extreme events			
13.2 Guidance on operational use of the information			
13.3 Extreme meteorological events database			
13.4 Requirements for instrumentation			
13.5 Methods for assessing economic impacts			
13.6 Aspects of the implementation of UNCCD			Res. 15
13.7 Agrometeorological aspects on desertification and drought			
13.8 Delineation of drylands and impacts of climatic factors			
14. TRAINING AND EDUCATION MATTERS		14, Chairperson, Committee A	
14.1 Report of the Joint Rapporteurs on Impact of Training in Agrometeorology	14-1(1)		Res. 16
14.2 WMO activities on training in agricultural meteorology	14-2(1)		
14.3 Symposia, seminars and workshops in agricultural meteorology	14-3(1)		
15. UNCED FOLLOW-UP	15(1)	15, Chairperson, Committee B	Res. 17
15.1 UN/FCCC			
15.2 Convention on Biological Diversity			

<i>Agenda item</i>	<i>Document Nos.</i>	<i>PINK Nos. and person submitting</i>	<i>Resolutions and recommendations adopted</i>
15.3 UNCCD			
15.4 Statement of Forest Principles			
16. COLLABORATION WITH INTERNATIONAL ORGANIZATIONS	16(1)	16, Co-chairperson, Committee B	
16.1 UNEP and IPCC			
16.2 FAO			
16.3 CGIAR Institutes			
16.4 ACMAD and AGRHYMET			
16.5 IGBP/START			
16.6 Other organizations			
17. REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND OF RELEVANT EXECUTIVE COUNCIL RESOLUTIONS	17(1); REV.1(17(1))	17, president of CAgM	Res. 18 Rec. 2
18. AWARDS FOR OUTSTANDING AND/OR EXCEPTIONALLY LONG-TERM SERVICES TO CAgM	18(1)	18, president of CAgM	
19. ENCOURAGEMENT OF EQUAL OPPORTUNITIES FOR ACTIVE PARTICIPATION OF MEN AND WOMEN IN THE FIELD OF AGRICULTURAL METEOROLOGY		19, president of CAgM	Res. 19
20. ELECTION OF OFFICERS		20, president of CAgM	
21. NOMINATION OF MEMBERS OF WORKING GROUPS AND RAPORTEURS		21, president of CAgM	
22. OPEN FORUM		22, vice-president of CAgM	
23. DATE AND PLACE OF THE THIRTEENTH SESSION		23, president of CAgM	
24. CLOSURE OF THE SESSION		24, president of CAgM	

APPENDIX C

LIST OF ABBREVIATIONS

ACMAD	African Centre of Meteorological Applications for Development
AgMP	Agricultural Meteorology Programme
AGRHYMET	Regional Training Centre for Agrometeorology and Operational Hydrology and their Applications
BIP-H	Basic Instruction Package in Hydrology
BIP-HT	Basic Instruction Package for Hydrological Technicians
BIP-M	Basic Instruction Package in Meteorology
BIP-MT	Basic Instruction Package for Meteorological Technicians
CagM	Commission for Agricultural Meteorology
CBS	Commission for Basic Systems
CCI	Commission for Climatology
CGIAR	Consultative Group on International Agricultural Research
CIMO	Commission for Instruments and Methods of Observation
CIRAD-CA	Département des cultures annuelles du Centre de coopération internationale en recherche agronomique pour le développement
CLICOM	Climate Computing
CLIPS	Climate Information and Prediction Services
CNES	Centre national d'études spatiales
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
CRSP	Collaborative Research Support Program
CTA	Technical Centre for Agricultural and Rural Cooperation
ECOWAS	Economic Community of West African States
ETRP	Education and Training Programme
FAO	Food and Agriculture Organization of the United Nations
FMA	Applied Meteorology Foundation
GCOS	Global Climate Observing System
GDP	Gross Domestic Product
GIS	Geographical Information System
GTOS	Global Terrestrial Observing System
IACCA	Inter-agency Committee on the Climate Agenda
IARC	International Agricultural Research Centre
IATA	Institute of Agrometeorology and Environmental Analysis for Agriculture
ICARDA	International Center for Agricultural Research in Dry Areas
ICID	International Commission on Irrigation and Drainage
ICRAF	International Council for Research in Agroforestry
ICRISAT	International Crop Research Institute for the Semi-arid Tropics
IGBP	International Geosphere-Biosphere Programme
IHDP	International Human Dimensions Programme on Global Environmental Change
IITA	International Institute for Tropical Agriculture
INSTAT	Interactive Statistic
IPCC	Intergovernmental Panel on Climate Change
JRC	Joint Research Centre
KNMI	Royal Netherlands Meteorological Institute
LaMMA	Laboratory for Meteorology and Environmental Modelling

NESDIS	National Environmental Satellite, Data and Information Service
NGO	Non-governmental Organization
NMHS	National Meteorological and Hydrological Service
NMS	National Meteorological Service
RA	Regional Association
RMTC	Regional Meteorological Training Centre
SANREM	Sustainable Agriculture and Natural Resource Management
START	System for Analysis, Research and Training
UN/FCCC	United Nations Framework Convention on Climate Change
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNDP/UNSO	United Nations Office to Combat Desertification and Drought
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USDA	United States Department of Agriculture
WCRP	World Climate Research Programme
WMO	World Meteorological Organization
WWW	World Weather Watch
