COMMISSION FOR INSTRUMENTS 
AND 
METHODS OF OBSERVATION 

ABRIDGED FINAL REPORT 
OF THE 
SECOND SESSION 

Paris, 18th June - 6th July 1957 

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Corrigendum for Publication No. 64.RP.26
COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION
Abridged Final Report
of the
Second Session
Paris, 18 June - 6 July 1957

Page 15 - Paragraph 19, read:
(d) That CIMO suggests...
- Paragraph 20, sub-paragraph 2, last line, read:
... standard barometers...
- Paragraph 21, 3rd line, insert a comma between
"Guide" and "subject"

Page 16 - Paragraph 22, 4th sub-paragraph, 5th line, read:
The CIMO requests the president...

Page 18 - Paragraph 27 (continued), 2nd line, read:
... results of investigations...
- Paragraph 29, 2nd line, read:
... to the report, including...
- Second sub-paragraph, end of 2nd line, correct
to read: wet-bulb
- Paragraph 30, title, read:
Measurement of soil moisture
- 7th line, read:
A Working Group on evaporation measurement...

Page 25 - Paragraph 44 (continued), 3rd line, read:
Working Group on measurement of atmospheric electricity
- Paragraph 45, 2nd and 3rd lines, replace "radio-electricians" by "radio engineers"
- Paragraph 47, 2nd line, read:
... Mr. J. van der Mark...
-2-

**Page 26** - Paragraph 49, 3rd line, replace "require" by "requires"
- 6th line, replace "need" by "needs"
- Paragraph 50, 5th line, read:

(c) Measurement of radiation.
- 7th line, read:

**Instrument development**
- last line, read:

A recording leaf-wetness meter

**Page 27** - Paragraph 50 (continued), 6th line, read:

Tropical thunderstorms and radar
- 19th line, read:

Measurement of radiation
- 23rd line, insert hyphen between "ultra" and "violet"
- Paragraph 51, read:

**Acknowledgments**
# TABLE OF CONTENTS

1. List of representatives attending the session............................................. 1
2. Agenda of the session ................................................................................. 4
3. General summary of the work of the session ............................................. 9
4. Resolutions adopted by the session ......................................................... 28

<table>
<thead>
<tr>
<th>Final No.</th>
<th>Session No.</th>
<th>Working Group on hydrometeorological instruments</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B.3</td>
<td>Working Group on hydrometeorological instruments</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>B.5</td>
<td>Working Group on the uses of radar in meteorology</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>A.2</td>
<td>Working Group on automatic weather stations</td>
<td>29</td>
</tr>
<tr>
<td>4</td>
<td>B.2</td>
<td>Working Group on international comparison of precipitation gauges</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>B.4</td>
<td>Working Group on snow measurements</td>
<td>31</td>
</tr>
<tr>
<td>6</td>
<td>B.1</td>
<td>Working Group on meteorological instruments and methods of observation on aerodromes</td>
<td>32</td>
</tr>
<tr>
<td>7</td>
<td>B.7</td>
<td>Working Group on hygrometry</td>
<td>33</td>
</tr>
<tr>
<td>8</td>
<td>B.6</td>
<td>Working Group on evaporation measurement</td>
<td>34</td>
</tr>
<tr>
<td>9</td>
<td>M.4</td>
<td>Working Group on radiation measurement</td>
<td>35</td>
</tr>
<tr>
<td>10</td>
<td>M.5</td>
<td>Working Group on comparison of meteorological instruments</td>
<td>36</td>
</tr>
<tr>
<td>11</td>
<td>M.6</td>
<td>Working Group on measurement of atmospheric electricity</td>
<td>36</td>
</tr>
<tr>
<td>12</td>
<td>A.3</td>
<td>Revision of resolutions and recommendations adopted prior to its second session</td>
<td>37</td>
</tr>
</tbody>
</table>

5. Recommendations adopted by the session ............................................. 38

<table>
<thead>
<tr>
<th>Final No.</th>
<th>Session No.</th>
<th>Recommendation</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B.2</td>
<td>Interim international reference precipitation gauge</td>
<td>36</td>
</tr>
<tr>
<td>2</td>
<td>B.3</td>
<td>International comparison of barometers</td>
<td>39</td>
</tr>
<tr>
<td>3</td>
<td>B.1</td>
<td>Definition of meteorological optical range</td>
<td>40</td>
</tr>
</tbody>
</table>
## TABLE OF CONTENTS

### Recommendations (continued)

<table>
<thead>
<tr>
<th>Final No.</th>
<th>Session No.</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>B.4</td>
<td>41</td>
</tr>
<tr>
<td>5</td>
<td>M.4</td>
<td>42</td>
</tr>
<tr>
<td>6</td>
<td>M.5</td>
<td>42</td>
</tr>
<tr>
<td>7</td>
<td>M.10</td>
<td>43</td>
</tr>
<tr>
<td>8</td>
<td>M.11</td>
<td>43</td>
</tr>
<tr>
<td>9</td>
<td>M.12</td>
<td>44</td>
</tr>
<tr>
<td>10</td>
<td>M.15</td>
<td>44</td>
</tr>
<tr>
<td>11</td>
<td>M.3</td>
<td>44</td>
</tr>
<tr>
<td>12</td>
<td>M.18</td>
<td>45</td>
</tr>
<tr>
<td>13</td>
<td>M.1</td>
<td>45</td>
</tr>
<tr>
<td>14</td>
<td>M.2</td>
<td>46</td>
</tr>
<tr>
<td>15</td>
<td>A.3</td>
<td>46</td>
</tr>
<tr>
<td>16</td>
<td>A.1</td>
<td>47</td>
</tr>
<tr>
<td>17</td>
<td>A.2</td>
<td>48</td>
</tr>
<tr>
<td>18</td>
<td>M.14</td>
<td>49</td>
</tr>
</tbody>
</table>

### 6. Annexes

1. Conclusions concerning the future work of CIMO 51
2. Revised definition for annex to recommendation 15 (CIMO-I) 53
3. Recommendations adopted by correspondence between the first and second sessions of CIMO 54
<table>
<thead>
<tr>
<th></th>
<th>Table of Contents</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Annexes (continued)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>The establishment and operation of working groups</td>
<td>64</td>
</tr>
<tr>
<td>5</td>
<td>Specification of interim reference precipitation gauge (IRPG) (annex to Rec. 1 (CIMO-II))</td>
<td>65</td>
</tr>
<tr>
<td>6</td>
<td>Guidance for establishment of regional working groups on measurements of radiation (annex to Rec. 5 (CIMO-II))</td>
<td>67</td>
</tr>
<tr>
<td>7</td>
<td>Information concerning the World Comparisons of radiosondes (annex to Rec. 13 (CIMO-II))</td>
<td>68</td>
</tr>
<tr>
<td>8</td>
<td>Amendments to Technical Regulations in the field of CIMO (annex to Rec. 15 (CIMO-II))</td>
<td>72</td>
</tr>
<tr>
<td>7</td>
<td>List of documents distributed before and during the second session of CIMO</td>
<td>74</td>
</tr>
</tbody>
</table>
LIST OF REPRESENTATIVES
ATTENDING THE SECOND SESSION OF THE COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION

1. Officers of the session
   A. Perlat               president
   L.M. Malet              vice-president

2. Representatives of Members of WMO
   G. Weiss               principal delegate Austria
   N. Vander Elst         principal delegate Belgian Congo
   M.W. Schüpp            delegate
   L.M. Malet             principal delegate Belgium
   P. Slootmaekers        delegate
   L. Poncelet            expert
   G.D. Dupriez           expert
   J.L.V. Maldonado       principal delegate Brazil
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   Mrs. I.A. Pokrovskaja  principal delegate Byelorussian SSR
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   V. Váisälä             delegate
   V. Marc                principal delegate Finland
   H. Treussart           alternate
   G. Barbé               expert
   R. Beving              expert
   G. Boisseau            expert
   R. Johansen            expert
   P. Misme               expert
   R. Morin               expert
   M. Petit               expert
   R. Strutz              expert
   A. Valentin            expert
   R. Lhermitte           observer
   F. Borel               observer
   R. Eyraud              observer
<table>
<thead>
<tr>
<th>Country</th>
<th>Delegate/Expert/Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany, Federal Republic</td>
<td>M. Hinzpeter</td>
</tr>
<tr>
<td>Ghana</td>
<td>J. Grunow</td>
</tr>
<tr>
<td>Greece</td>
<td>H.O. Walker</td>
</tr>
<tr>
<td>Hungary</td>
<td>F.A.A. Acquah</td>
</tr>
<tr>
<td>India</td>
<td>Th. Findiklis</td>
</tr>
<tr>
<td>Ireland</td>
<td>F. Dési</td>
</tr>
<tr>
<td>Italy</td>
<td>S. Müll</td>
</tr>
<tr>
<td>Libya</td>
<td>S.P. Venkiteshwaran</td>
</tr>
<tr>
<td>Libya</td>
<td>S. McWilliams</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>G. Cena</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>C.A. Lea</td>
</tr>
<tr>
<td>Libya</td>
<td>J.P. Engels</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>A. Hauer</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>F.H. Schmidt</td>
</tr>
<tr>
<td>Norway</td>
<td>J. Knudsen</td>
</tr>
<tr>
<td>Perú</td>
<td>C. Moya Alvarado</td>
</tr>
<tr>
<td>Poland</td>
<td>W. Molga</td>
</tr>
<tr>
<td>Poland</td>
<td>T. Kopcewicz</td>
</tr>
<tr>
<td>Romania</td>
<td>S. Zakrent</td>
</tr>
<tr>
<td>Romania</td>
<td>S. Dumitrescu</td>
</tr>
<tr>
<td>Rome</td>
<td>N. Topor</td>
</tr>
<tr>
<td>Spain</td>
<td>J.A. Barasoain</td>
</tr>
<tr>
<td>Sweden</td>
<td>L.-O. Raab</td>
</tr>
<tr>
<td>Spain</td>
<td>A. Nyberg</td>
</tr>
<tr>
<td>Spain</td>
<td>J. Lugeon</td>
</tr>
<tr>
<td>Switzerland</td>
<td>P. Ackermann</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>W. Mørikofer</td>
</tr>
<tr>
<td>Thailand</td>
<td>Sanit Vesa-rajanan</td>
</tr>
<tr>
<td>Ukrainian SSR</td>
<td>A.Kh. Khrgian</td>
</tr>
<tr>
<td>Union of South Africa</td>
<td>A.J. Dreyer</td>
</tr>
<tr>
<td>United States of America</td>
<td>J.J. Taljaard</td>
</tr>
<tr>
<td>Union of Soviet Socialist Republics</td>
<td>L.Q. Hayward</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>K.T. Logvinov</td>
</tr>
<tr>
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<td>A.M. Kitaítsev</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>G.I. Golychev</td>
</tr>
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<td>D.N. Harrison</td>
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<td>R. Frith</td>
</tr>
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<td>N.E. Rider</td>
</tr>
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<td>J.A. Bell</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>L.T.H. Collis</td>
</tr>
<tr>
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<td>C. Harmantas</td>
</tr>
<tr>
<td>United States of America</td>
<td>D.M. Swingle</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>V.S. Hardin</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>V.D. Rockney</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>S.M. Sokić</td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>R. Vasić</td>
</tr>
<tr>
<td>Colombia</td>
<td>M.G. Cruz Duque</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>J. Fatjo Granados</td>
</tr>
</tbody>
</table>

3. **Representatives of countries non-Members of WMO**

<table>
<thead>
<tr>
<th>Country</th>
<th>Delegate/Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombia</td>
<td>M.G. Cruz Duque</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>J. Fatjo Granados</td>
</tr>
</tbody>
</table>
Representatives of countries non-Members of WMO (continued)

W. Phillips observer Liberia
A. Fantoli observer Somaliland (under Italian trusteeship)

4. Representatives of international organizations

O. Lönngvist observer ICAO
J. van der Mark observer ITU (CCIR)
J. Swarbrick observer UNESCO
R.C. Sutcliffe observer IUCG

5. Representatives of WMO Secretariat

K. Langlo chief, technical division
Miss U. Banister technical assistant

6. Secretariat of the session

P. Picq
R. Beaufils
<table>
<thead>
<tr>
<th>Agenda Items</th>
<th>Relevant documents*</th>
<th>Relevant decisions</th>
<th>General summary, para.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Organization of the session</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1.1</td>
<td>Opening of the session</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>1.2</td>
<td>Report on credentials</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>1.3</td>
<td>Adoption of the agenda</td>
<td>1 (2 add., 1 rev.), 2 (1 corr., 2 add.)</td>
<td>4</td>
</tr>
<tr>
<td>1.4</td>
<td>Establishment of committees</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Reports</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>2.1</td>
<td>Report by the president of the commission</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2.2</td>
<td>Reports by the chairmen of working groups</td>
<td>4,5,6,7,8, 9,10,11</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>International Geophysical Year</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Standardization of instruments and observations</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>4.1</td>
<td>Value of standardization of instruments for surface and upper-air measurements</td>
<td>13,51</td>
<td>10</td>
</tr>
<tr>
<td>4.2</td>
<td>Standardization of meteorological observations</td>
<td>14,16,32, 68</td>
<td>11</td>
</tr>
<tr>
<td>4.3</td>
<td>Hydrometeorological measurements</td>
<td>37,47,80</td>
<td>12</td>
</tr>
<tr>
<td>4.4</td>
<td>Specifications for weather radar</td>
<td>11,39,43, 82</td>
<td>13</td>
</tr>
<tr>
<td>4.5</td>
<td>Automatic weather stations</td>
<td>17,64</td>
<td>14</td>
</tr>
<tr>
<td>4.6</td>
<td>Continuous recording of cloud base</td>
<td>18,41,62</td>
<td>15</td>
</tr>
<tr>
<td>4.7</td>
<td>Measurement of illumination</td>
<td>2 (1 add., 52)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Measurement of precipitation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The underlined documents are those considered in plenary.
AGENDA

<table>
<thead>
<tr>
<th>Agenda Item</th>
<th>Relevant documents*</th>
<th>Relevant decisions</th>
<th>General summary, para.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Influence of wind and exposure on different types of rain-gauges and shields</td>
<td>4,37,69</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>5.2 Measurement of precipitation at sea</td>
<td>4,19,56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.3 Measurement of snow density</td>
<td>2 (1 add.), 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Barometry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.1 Reduction of pressure</td>
<td>9,53,77</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>6.2 International comparison of barometers</td>
<td>20,76</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>6.3 Correction of barometric errors</td>
<td>9,74</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>7 Visibility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.1 Definition of meteorological optical range</td>
<td>5,58</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>7.2 Estimation of visibility</td>
<td>5,57</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>7.3 Development of visibility instruments</td>
<td>21 (1 add.), 6</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>8 Measurement of wind</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.1 Measurement of gusts</td>
<td>22,61</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>8.2 Definition of period for measuring mean wind speed</td>
<td>23,40,60</td>
<td>15</td>
<td>27</td>
</tr>
<tr>
<td>9 Dew gauges</td>
<td>10,71</td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>10 Measurement of humidity</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.1 Measurement of air humidity</td>
<td>6,10,83</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>10.2 Measurement of soil moisture</td>
<td>10,84</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>11 Measurement of radiation</td>
<td>7,85</td>
<td>9</td>
<td>5,6, 6, 7,8, 3</td>
</tr>
<tr>
<td>12 Upper-air measurements</td>
<td>15,31,34, 59,63</td>
<td></td>
<td>11,12</td>
</tr>
</tbody>
</table>

* The underlined documents are those considered in plenary.
### AGENDA

<table>
<thead>
<tr>
<th>Agenda items</th>
<th>Relevant documents*</th>
<th>Relevant decisions</th>
<th>General summary, para.</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 Radiosonde comparison and improvement</td>
<td>8, 15, 33, 42, 44, 45, 48, 52, 73</td>
<td>10 13, 3, 34, 35</td>
<td>14 7</td>
</tr>
<tr>
<td>14 Evaporation measurements</td>
<td>10, 46, 47, 84</td>
<td>8 3 36</td>
<td></td>
</tr>
<tr>
<td>15 Definition of length of day for meteorological purposes</td>
<td>24, 30, 72</td>
<td>24, 30, 72</td>
<td>37</td>
</tr>
<tr>
<td>16 Measurements of the radioactivity of air and precipitation</td>
<td>49</td>
<td>25 (1 add.), 38, 81</td>
<td>1 38</td>
</tr>
<tr>
<td>16.1 Standards for collecting rain water samples</td>
<td>25 (1 add.), 38, 81</td>
<td>25 (1 add.), 38, 81</td>
<td>26, 38, 81</td>
</tr>
<tr>
<td>16.2 Methods of obtaining snow samples</td>
<td>25 (1 add.), 38, 81</td>
<td>25 (1 add.), 38, 81</td>
<td>26, 38, 81</td>
</tr>
<tr>
<td>17 Review of the relevant parts of the Technical Regulations adopted by the Second Congress</td>
<td>27, 65</td>
<td>27, 65</td>
<td>27, 65</td>
</tr>
<tr>
<td>18 Revision of the Guide to international meteorological instrument and observing practice</td>
<td>28, 67</td>
<td>28, 67</td>
<td>28, 67</td>
</tr>
<tr>
<td>19 Examination of the resolutions and recommendations adopted at the first session of the commission</td>
<td>29 (1 add.), 66</td>
<td>29 (1 add.), 66</td>
<td>29 (1 add.), 66</td>
</tr>
<tr>
<td>20 Election of president and vice-president</td>
<td>6, 16, 17</td>
<td>6, 16, 17</td>
<td>6, 16, 17</td>
</tr>
<tr>
<td>21 Establishment of working groups</td>
<td>35, 36, 70</td>
<td>35, 36, 70</td>
<td>35, 36, 70</td>
</tr>
<tr>
<td>22 Measurement of the refractive index of the atmosphere</td>
<td>35, 36, 70</td>
<td>35, 36, 70</td>
<td>35, 36, 70</td>
</tr>
</tbody>
</table>

* The underlined documents are those considered in plenary.
<table>
<thead>
<tr>
<th>Agenda items</th>
<th>Relevant documents*</th>
<th>Relevant decisions</th>
<th>General summary, para.</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 Atmospheric electricity</td>
<td>50, 78</td>
<td>11</td>
<td>46</td>
</tr>
<tr>
<td>24 Local lightning flash counters</td>
<td>(CAe-II/35), 75</td>
<td></td>
<td>47</td>
</tr>
</tbody>
</table>

*The underlined documents are those considered in plenary.
Organization of the session (Agenda item 1)

1. The second session of the Commission for Instruments and Methods of Observation was held from 18 June to 6 July 1957 in the conference rooms of the Hotel du Palais d'Orsay, Paris, at the invitation of the Government of France.

The session was presided over by Mr. A. Perlat, president of CIMO, assisted by Mr. L.M. Malet, vice-president of CIMO. The WMO Secretariat was represented by Mr. K. Langlo, Chief of the Technical Division, assisted by Miss U.M. Banister. The complete list of delegates, experts and observers will be found on page 1.

The session was held simultaneously with the second session of the Commission for Aerology.

Opening of the session (Agenda item 1.1)

2. The President of WMO, Mr. A. Viaut, opened the session at 10.15 a.m. on 18 June 1957. This first formal plenary meeting was held jointly with the Commission for Aerology and in his speech of welcome Mr. Viaut expressed his appreciation that so many Members of the Organization had found it possible to send delegations to the second sessions of these two commissions. In total 36 Members were accredited to the CIMO session; and two Members, four non-Members and several international organizations had sent observers. Mr. Viaut also welcomed the delegates on behalf of the French Government. The Secretary-General of WMO, Mr. D.A. Davies, then expressed on behalf of the World Meteorological Organization his deep appreciation to the French Government for its hospitality. Finally, Mr. J. Van Mieghem, president of C Ae, speaking on behalf of both commissions, thanked the French Government and the French Meteorological Service for having organized the sessions in Paris.

After the completion of the opening formalities, Mr. Van Mieghem gave a talk on the "Conquest of the Third Dimension", illustrated by slides, and finally Mr. Perlat, president of CIMO, briefly described, by means of slides, the possibilities for observing clouds by aerial photographs taken regularly from aircraft flying at a height of 10 kilometres and from free balloons reaching 30 kilometres.

Report on credentials (Agenda item 1.2)

3. It was reported that the credentials of the participants had been examined and found to be in good order. The commission therefore decided not to establish a Credentials Committee.

Adoption of the agenda (Agenda item 1.3)

4. The provisional agenda submitted to the session was adopted with minor amendments only. Two new items:
23 Atmospheric electricity, and
24 Local lightning flash counters,
were added to the agenda which is reproduced in its final form on page 4 of
this report.

Establishment of committees (Agenda item 1.4)

5(a) Nominations Committee
The following delegates were appointed as members of the Nominations
Committee:
C. Harmantas (USA)
D.N. Harrison (UK)
M. Hinzpeter (Federal Republic of Germany)
A.M. Kitaitsev (USSR)
S. Mull (India)
Mr. Hinzpeter served as chairman.

5(b) Working committees
The commission established three working committees and allocated the
agenda items to these committees as follows:
Committee A (chairman : W.A. Grinsted)
Agenda items : 4.1, 4.2, 4.5, 4.6, 8.1, 8.2, 17, 18 and 19.
Committee B (chairman : A. Hauer)
Agenda items : 4.3, 4.4, 4.7, 5.1, 5.2, 5.3, 6.1, 6.2, 6.3, 7.1, 7.2,
7.3, 9, 10.1, 10.2, 14, 15, 16.1, 16.2 and 24.
Committee M (chairman : L.M. Malet)
Agenda items : 11, 12, 13, 22 and 23.
Committee M was a joint committee with CAe; its chairman was elected by
CIMO with the consent and in the presence of the president of CAe.

5(c) Other committees
As stated in paragraph 3 above, it was found unnecessary to set up a
Credentials Committee and since each working committee drafted its de-
cisions in their final form, no Drafting Committee was established. Each
working committee set up a number of ad-hoc sub-committees to report on
specific questions.

Report by the president of the commission (Agenda item 2.1)

6. The report by the president of the commission was discussed at two plen-
ary meetings. The commission noted with appreciation the work carried out
since its first session and requested the president to bring to the knowledge
of the Executive Committee the conclusions reached by the president in his re-
port with regard to the future structure of CIMO, with which the commission
was in full agreement. These conclusions are reproduced in annex 1 to this
report.
The reports of chairmen of the nine working groups were presented to
the commission at a plenary meeting and referred to the relevant working com-
mittees for consideration. The action taken on these reports will therefore
be found under the relevant agenda items.

International Geophysical Year (Agenda item 3)

This item was discussed at a plenary meeting on the basis of a document
prepared by the Secretariat. The commission noted with appreciation the urgent
action taken by the president of CIMO on certain recommendations which have
special reference to the International Geophysical Year (see annex 3). The
report of the Secretariat was adopted without comment.

Value of standardization of instruments for surface and upper-air measurement
(Agenda item 4.1)

Views were expressed by many members of the commission on the desirabi-

lity or otherwise of standardization, and the WMO observer at a recent meet-
ing of the International Organization for Standardization stated that in his
opinion the manufacturers of instruments would welcome any move towards stan-
ardization. The commission felt, however, that the time had not yet come to
lay down detailed standards for instrument construction and it was decided
that no further action be taken on this matter at present.

Standardization of meteorological observations (Agenda item 4.2)

The commission noted the material received from eleven countries by the
president of CIMO in response to his questionnaire on the desirable character-
istics of instrumental performance and methods of observation. It was agreed
that there was little prospect of obtaining such general agreement on these
characteristics as would permit the adoption of standards but that it was high-
ly desirable to lay down minimum acceptable standards of accuracy for observa-
tions which would be included in Technical Regulations.

The commission prepared proposals for such minimum acceptable standards
of accuracy for observations and included them in recommendation 15 (CIMO-II)
containing the proposed amendments to the WMO Technical Regulations (see agenda
item 17).

Note was taken of document CIMO-II/16 reporting the development of a
new small thermometer screen for agricultural purposes. The commission recog-
nised that there was a requirement for small portable screens for various pur-
poses and suggested that the information in document 16, with any other similar
information, should be distributed to Members by the WMO Secretariat.

The information contained in document CIMO-II/32 on the lag of meteoro-
logical instruments was noted with appreciation and the hope was expressed
that further work would be undertaken on this subject.
Hydrometeorological measurements (Agenda item 4.3)

11. There was general support for the view that information on hydrometeorological measurements should be included in the CIMO Guide and in particular there was a strongly felt need for guidance on methods of measuring snow cover and the water content of snow. Reference was also made to the difficulties experienced by WMO technical assistance experts because no guidance has been published by WMO on how to carry out hydrometeorological measurements.

In view of this situation and considering also the general policy of WMO in the field of water resources development and the recommendations of the Executive Committee panel of experts in this field, the commission agreed that a chapter on hydrometeorological measurements should be included in the CIMO Guide. A working group was set up to carry out this task (see resolution 1 (CIMO-II).

Reference is also made to the action taken on agenda item 5.3.

Specifications for weather radar (Agenda item 4.4)

12. The commission paid tribute to the work already carried out by the working group established by the president of CIMO to study this question and prepare a WMO Technical Note on "The use of ground-based radar in meteorology" (excluding wind measurements).

It was agreed to re-establish the working group with the same terms of reference and this decision is contained in resolution 2 (CIMO-II).

Automatic weather stations (Agenda item 4.5)

13. After considerable discussion at committee level of the requirements of the various users of automatic measuring and reporting devices, including consideration of the requirements for automatic climatological stations suggested by the Commission for Climatology and of the needs stated by the International Civil Aviation Organization, it was decided that a working group should be formed to collate existing information on automatic weather stations, to state the various requirements for such stations and to present the information in a form suitable for reproduction and circulation. It was felt that the Working Group on automatic weather stations should be strictly limited in number and that its terms of reference should include the assembly of existing information, including the listing of manufacturers and other pertinent data, and a statement of the various requirements for such stations.

Resolution 3 (CIMO-II) incorporates these decisions.

Continuous recording of cloud base (Agenda item 4.6)

14. The commission noted that pulsed or modulated light techniques had an advantage over strictly radar techniques using wavelengths of between 2 mm and 1.25 cm owing to the effect of even very light precipitation on the latter, and it was also felt that the development of continuous recorders of
direct utility in aviation work was of greater practical importance than that of indicators or recorders giving detailed cloud information of scientific interest to meteorologists.

It was felt that some difficulty arose in the formulation of a definition of cloud base which would meet the requirements of various uses, particularly aviation interests, although the definition included under section 2.4.1 of WMO publication No. 8 appeared to meet most meteorological requirements. It was therefore decided to confirm the definition of cloud base as given in WMO publication No. 8 for the present and to include problems related to cloud height measurements in the terms of reference of the Working Group on meteorological instruments and methods of observation on aerodromes (see resolution 6 (CIMO-II) and agenda item 7.3).

Measurement of illumination (Agenda item 4.7)

15. The commission noted the recommendation of the Commission for Climatology (Rec. 3 (CCl-II)) to have included in Technical Regulations para. 2.1.5 the provision that measurements of illumination be included in the programme of special meteorological stations.

Considering the necessity, from the viewpoints of biology, hygiene and medicine, architecture, plant physiology and agricultural climatology, as well as for such technical applications as the beginning and ending of twilight and the lighting of airports, the commission requested its president:

(a) To invite Members of the WMO to state their achievements, their plans and their possible instrumental requirements in this field, indicating the field of application in which they are specially interested, with particular reference to the spectral regions;

(b) To take the requisite action for encouraging the study of these problems.

Influence of wind and exposure on different types of raingauges and shields (Agenda item 5.1)

16. The discussion of this item was based upon the proposal by the Working Group on measurement of rainfall that an interim international reference precipitation gauge should be adopted by WMO.

This proposal was favourably received by the commission and in the selection of the precipitation gauge to be recommended as a reference gauge due account was taken of the length of record of permanent use of the three gauges recommended by the working group.

The commission agreed to recommend the British Snowdon gauge with an Alter shield as the interim reference gauge.

Detailed information on the specifications, exposure and provision of this reference gauge and on recording of the data is contained in recommendation 1 (CIMO-II). The commission also decided, in its resolution 4 (CIMO-II), to set up a working group to study the results of the international comparison of precipitation gauges.
**Measurement of precipitation at sea (Agenda item 5.2)**

17. In view of the recommendation (Rec. 6 (CMM-II)) already passed by the Commission for Maritime Meteorology on the subject, the commission decided to include the following statement in the minutes of plenary, in support of and amplifying the recommendation of CMM:

"The Commission for Instruments and Methods of Observation, realizing the importance of rainfall measurement at sea and the difficulties of such measurement, requests the president of CIMO to inform the Executive Committee:

(a) That the CIMO supports Rec. 6 (CMM-II);
(b) That it is not certain that a general method suitable for use on all types of ships can be found;
(c) That all Members concerned should be invited to continue their experiment and report their progress, even though their work may be applicable only to one type of ship".

**Measurement of snow density (Agenda item 5.3)**

18. This item was discussed together with item 4.3 under which it was decided to set up a Working Group on hydrometeorological instruments (see resolution 1 (CIMO-II)).

Since hydrometeorology is a very wide field of science the commission considered that in the coming four-year period it should concentrate its activity on some well defined problems in hydrometeorology and that another working group should be set up to study these problems.

Taking into account the request from the Commission for Climatology that questions relating to snow measurements should be urgently studied and considering further the importance of reliable information on the water content of snow cover for hydrometeorological applications, the commission decided that the techniques and methods of measuring snow and related problems should be studied first, and consequently adopted resolution 5 (CIMO-II) setting up a special Working Group on snow measurements.

**Reduction of pressure (Agenda item 6.1)**

19. In its recommendation 14 (CIMO-I) the commission recommended that the Executive Committee should appoint a panel of experts or a joint working group on barometry composed of experts from CIMO, CAe and CSM but this proposal was referred back to the president of CIMO suggesting that he should set up a working group and should invite presidents of other technical commissions to suggest members for the group.

The commission considered that the above procedure had not led to any generally acceptable method of reducing pressure to mean sea level and that on the other hand the chairman of the Working Group on barometry had developed
a new concept of treatment of pressure which needed to be carefully studied by synoptic meteorologists and by Members.

Finally, the commission decided to request its president to inform the Executive Committee:

(a) That the subject of pressure reduction has been under study for a number of years and by different working groups without appreciable progress being achieved;

(b) That other commissions of WMO are more directly concerned with questions of pressure reduction;

(c) That the report prepared by the chairman of the Working Group on barometry to the second session of CIMO needs to be carefully studied by an appropriate group of experts, due account being taken of the needs of the synoptic meteorologists and of other users of pressure data;

(d) That CIMO suggest that the whole concept of pressure reduction and alternative methods should be studied by the Commission for Synoptic Meteorology as a matter of urgency. The continued study should be based on the studies already made by working groups of CIMO and should have the object of achieving a higher degree of uniformity in the methods used.

International comparison of barometers (Agenda item 6.2)

It was generally agreed that the document prepared by the chairman of the Working Group on barometry (CIMO-II/Doc. 9, part I) contained very useful information and that it therefore should be included in the CIMO Guide subject to necessary editorial amendments.

The commission decided to request its president, in co-operation with the Secretary-General, to consider the inclusion of document CIMO-II/9, part I, in the CIMO Guide subject to the amendments suggested by Committee B and contained in the report of Committee B to plenary on agenda item 6.3 (document CIMO-II/74).
GENERAL SUMMARY

The commission further noted that some of the definitions contained in the annex to Rec. 15 (CIMO-I) need clarification in view of the experience gained during the last few years. The new definitions of barometers in categories "A", "Ar" and "B" are contained in annex 2 to this report. The commission decided that these definitions should be used when including the annex to Rec. 15 (CIMO-I) in the CIMO Guide.

Visibility (Agenda item 7)

22. This item covers some questions raised in the report of the Working Group on the measurement of visibility other than those handled under agenda items 7.1, 7.2 and 7.3.

With reference to conversion from night to equivalent daylight visibility, the commission noted with appreciation that a suitable nomogram had been prepared for inclusion in the Guide (WMO publication No. 8). The commission agreed that recommendation 22 (CIMO-I) should be considered as implemented when this nomogram has been included in the Guide.

It was further agreed that a note be inserted in the CIMO Guide recommending that where no "Gold" visibility meter or similar device is used, the candlepower of light used for visibility observations should be measured from time to time in the direction of observation.

The opinions of the members of the working group were divided with regard to the usefulness of beamed light for runway visual range observations and the commission therefore decided that the following statement be included in the minutes of plenary:

"The CHAO request the President of CIMO to forward annex 13, document CIMO-II/5, to the president of the Commission for Aeronautical Meteorology for any use the CAeM may think fit. Attention of the president of the CAeM should be drawn to the doubt expressed by experts in this field to the advisability of using the beamed light from runway lights for the measurements of runway visual range unless the observer is in the beam of the lights."

Definition of meteorological optical range (Agenda item 7.1)

23. The commission noted that Rec. 21 (CIMO-I) was referred back to CIMO by the Executive Committee.

The definition of meteorological optical range which the commission is now proposing is essentially the same as that proposed in recommendation 21 (CIMO-I) but with the additional provision that the extinction to be measured shall be that of the luminous flux from a filament lamp at a colour temperature of 2,700°K; and that the luminous flux shall be defined by means of the photopic function of the International Commission on Illumination (CIE), (see recommendation 3' (CIMO-II)).

The commission also agreed that the note concerning "photopic" appearing in recommendation 3 (CIMO-II) should be inserted in the Guide.
Estimation of visibility (Agenda item 7.2)

24. The commission agreed that Rec. 23 (CIMO-I) could now be cancelled but wished to place on record that further research was desirable to determine the optical properties of the atmosphere, using both a detection criterion and a recognition criterion.

Development of visibility instruments (Agenda item 7.3)

25. During the discussion of this item it was brought to light that a number of problems relating to the most suitable instruments and their exposure at aerodromes remain to be investigated.

In addition to visibility measurements, mention was made of measurements of cloud base, runway temperatures and remote recording of meteorological elements at airports.

The commission agreed to set up a working group to study this problem and its conclusions are incorporated in resolution 6 (CIMO-II) which also contains the action taken by the commission on agenda item 4.6 "Continuous recording of cloud base".

Measurement of gusts (Agenda item 8.1)

26. The commission examined the position in the light of the document presented to the session and agreed that no further action be taken by CIMO on this question until aeronautical requirements have been expressed.

Definition of period for measuring mean wind speed (Agenda item 8.2)

27. Results of investigations carried out in France, the Federal Republic of Germany, India and the United Kingdom were available in working documents for the session.

An account was also given of experiments carried out in the Netherlands using anemometers of various time lags, which indicated that to give a representative mean wind a period of between eight and fifteen minutes was desirable. Experience in the USSR also supported a period of between six and ten minutes. The investigations carried out in Europe thus gave support to the use of a period of about ten minutes for synoptic purposes where the effect of surface induced turbulence is not wanted, but the experiments carried out in India did not support the necessity for such a long period and it was agreed that investigations in other parts of the world were most desirable.

It also appeared that much shorter periods than 10 minutes were used for non-instrumental observations and for special purposes such as aviation reports.

As a period of about ten minutes is laid down in volume B of WMO publication No. 9, it was agreed to include this period in the proposed amendments to the Technical Regulations (see annex to Rec. 15 (CIMO-II)), as a recommended practice in respect of synoptic observations only.
It was further decided to request the president of CIMO to invite the attention of the other interested commissions to the results on investigations into the period for measuring mean wind speed reported to CIMO in documents CIMO-II/23 and 40 and to the records of the discussion on this subject at the second session.

**Dew gauges (Agenda item 9)**

28. The importance of dew measurements, particularly for arid and semi-arid regions, was stressed during the discussion at committee level but it was generally recognized that CIMO was not in a position yet to make any recommendations on the most suitable instrument for such measurements.

The hope was expressed that further investigations on the lines suggested in "RECOMMENDS (2)" of Rec. 29 (CIMO-I) would be carried out but the commission did not feel it necessary to re-affirm this part of the recommendation.

In conclusion the commission agreed that no further action be taken at present on Rec. 29 (CIMO-I) which should be considered as redundant.

**Measurement of air humidity (Agenda item 10.1)**

29. The commission complimented the Working Group on hygrometry on its work and agreed that the surveys prepared as appendices to the report and including an extensive bibliography, should be published by WMO as a technical note, excluding annex B to document CIMO-II/6 which should be further studied by a new working group.

In regard to the adoption of a psychrometric formula it was generally agreed that this should be based on the concept of the thermodynamic wet bulb temperature but it was felt that further work must be carried out on the calibration of different types of psychrometers before the appropriate thermodynamic formula was accepted as the universal psychrometric formula. It was therefore agreed that the Working Group on hygrometry be continued with the same membership but with more restricted terms of reference and resolution 7 (CIMO-II) to this effect was adopted.

The commission further adopted recommendation 4 (CIMO-II) on master psychrometric tables and agreed to request the president of CIMO to investigate the possibilities of having these tables prepared by WMO.

**Measurements of soil moisture (Agenda item 10.2)**

30. This item was considered in conjunction with item 14 "Evaporation measurements".

The commission agreed that the title of the report submitted by the Working Group on the measurement of soil moisture did not correspond to the actual scope of the report and recommended that this valuable report should be published as a WMO technical note under a suitable new title.

A Working Group on evaporation measurements was established by resolution 8 (CIMO-II), (see also item 14).
Measurement of radiation (Agenda item 11)

31. The main discussion on this item at committee level was based on the resolutions and recommendations of the two International Radiation Conferences held in Rome 1954 and in Davos 1956.

Considering that reliability and comparability of radiation measurements necessitate a close contact between the different radiation stations, the commission recommended the creation of national radiation centres and of regional working groups for radiation. Recommendation 5 (CIMO-II) was adopted to this effect.

The commission also considered the need for comparisons between the various primary pyrheliometric sub-standards and between primary and national sub-standards, and incorporated its conclusions in recommendation 6 (CIMO-II). In this connexion the commission requested its president to contact the appropriate authorities of WMO in order to obtain the necessary funds to cover the costs of inter-comparison of the primary sub-standards.

Considerable attention was given to the development of simple radiation instruments which would combine easy handling with acceptable accuracy at a moderate price. Recommendation 7 (CIMO-II) covers this point.

The commission noted the importance of the orientation of the receiving surfaces of instruments for measurement of radiation and recommendation 8 (CIMO-II) invites the attention of Members to this question.

Recommendation 9 (CIMO-II) deals with the possibilities of making use of available data of mean cloudiness when calculating the total radiation of sun and sky, since it will scarcely be possible to create a sufficiently dense network of appropriate instruments.

The commission further considered the need for comparisons of Campbell-Stokes sunshine recorders in view of the differences in construction, cards and methods of analysis employed. Recommendation 10 (CIMO-II) invites Members to study this question in accordance with instructions prepared by the CIMO Working Group on radiation measurement.

32. During the discussion of this item in plenary the commission decided that certain instructions concerning:

(a) Apertures of pyrheliometric instruments,
(b) Recording of the diffuse sky radiation, and
(c) Actinometric determination of turbidity parameters,
should be included in the appropriate chapter of the CIMO Guide.

The commission considered the need for continuing the work carried out by the Working Group on radiation measurement and included in its terms of reference that it should assist in keeping up to date the international instructions in this field (notably chapter 9 of WMO publication No. 8).

The detailed terms of reference of the working group are given in resolution 9 (CIMO-II).
Upper-air measurements (Agenda item 12)

33. This item was considered together with item 13 and no clear distinction was made between the two items during the discussion.

The commission considered that the accuracy of instruments used for measuring upper winds had been studied in a number of countries but that the details of the results are not sufficiently known.

Recommendation 11 (CIMO-II) requests, among other things, that the detailed results of such studies should be published by WMO.

Some attention was paid under this item to problems related to the specifications for meteorological instruments in general. Recommendation 12 (CIMO-II) invites Members to consider the need for ease of use and maintenance, robustness and cheapness of the instrument, when preparing such specifications.

Radiosonde comparison and improvement (Agenda item 13)

34. The results of the World Comparison of Radiosondes at Payerne in 1956 and of other comparisons were discussed at great length at the committee level and the main decisions of the commission are summarized below.

Considering the clearly expressed need that the results of such comparisons should receive wide publicity, the commission prepared two tables for general distribution to all Members and recommended that these tables be given a trial by synopticians in order to determine their usefulness. Recommendation 13 (CIMO-II) incorporates the decision of the commission on the subject.

In the opinion of the commission the results of the Payerne comparisons show the necessity for improving the accuracy of pressure measurements. The attention of meteorological services is called to this important point in recommendation 14 (CIMO-II).

With regard to the humidity measurements the commission agreed that the following statement should be included in the Guide:

"The present inaccuracy of relative humidity measurements obtained by means of radiosondes may, in certain cases, lend to serious random errors in the evaluation of altitudes of standard surfaces, this being especially the case with regard to the equatorial zone."

As a general comment on the Payerne comparisons, the commission stated that:

"The Payerne comparisons have shown that considerable progress has been achieved with regard to the comparability of the data supplied by certain types of sonde; this progress shows that it is possible to obtain a homogeneous aerological network in spite of the diversity of types of sonde used."

35. The commission further commented upon Rec. 39 (56-CIMO) - Information for the Special Committee on the International Geophysical Year - which had
been adopted by the President of WMO on behalf of the Executive Committee. The president of CIMO was requested to ensure that the words "at high solar elevations" be deleted from the two passages in which they occur, when this recommendation is being confirmed by the Executive Committee.

Finally, the commission decided to set up a Working Group on comparison of aerological instruments with the terms of reference contained in resolution 10 (CIMO-II).

**Evaporation measurements (Agenda item 14)**

36. This item was discussed mainly on the basis of the report of the Working Group on the measurement of soil moisture (see item 10.2).

The commission noted that WMO had adopted recommendation 42 (56-CIMO) (see annex 3) i.e., that the class "A" evaporation pan, described in the annex to that recommendation should be adopted as the standard of reference for evaporation measurements made during the International Geophysical Year.

The need for a reference evaporation pan was stressed and it was agreed that this question should be studied and that the study should be based upon the experience gained during the IGY with the use of the class "A" pan as a reference pan.

In view of the importance of the evaporation term in the water budget equation the commission agreed that questions of evaporation measurements should be studied by a suitable working group. Taking into account that no evaporation pan measures a well defined meteorological quantity the commission agreed that this fact should be reflected in the terms of reference of the group established in resolution 8 (CIMO-II).

**Definition of length of day for meteorological purposes (Agenda item 15)**

37. The commission noted that the Commission for Climatology at its second session had decided that for climatological purposes the length of day should be defined in accordance with current astronomical practice as "the interval between the moments when the sun's upper limb contacts the apparent horizon."

The commission agreed without discussion to authorize its president to inform the president of CCI and, if required, the Executive Committee that CIMO supports the definition of "length of day" as recommended by the Commission for Climatology.

**Standards for collecting rain water samples (Agenda item 16.1)**

38. This item was discussed in conjunction with item 16.2 and gave rise to considerable discussion at committee level.

It was explained that the United Nations Scientific Committee on the Effects of Atomic Radiation had requested advice from WMO as to suitable standards for collecting samples of monthly precipitation. The commission
felt that it would also be desirable to record its opinion on the best way of obtaining internationally comparable values of daily precipitation, since such measurements may be of some interest for meteorological purposes.

In view of the decisions reached by the commission under its consideration of agenda item 5.1, i.e. the recommendation that an interim reference precipitation gauge should be adopted by WMO, the commission agreed that the following statement be included in the minutes of plenary as the preliminary comments of CIMO on the questions put to WMO under agenda item 16.1 and 16.2:

"The CIMO asks the president of CIMO to draw the attention of the Executive Committee Panel on atomic energy to Rec. 1 (CIMO-II), and in particular to the annex, in which a specification is given for an interim international reference precipitation gauge. The commission suggests that this gauge, but made of a more suitable material and provided, if necessary, with a deeper container, might be suitable for adoption as an international standard sampling gauge for monthly measurements.

It is understood, however, that sampling gauges used for daily measurements need to have a large collecting funnel, or collecting area, in order to collect a sufficient quantity of precipitation for analysis. The commission does not consider that it can recommend a design for a unique standard sampling gauge for daily measurements and would suggest, rather, that precise international comparability of measurements could be achieved (insofar as the amount of precipitation is concerned) by installing an interim international reference gauge near every daily sampling gauge.

The commission endorses the advice already given by the WMO that advice on the exposure of these gauges, and of the reference gauges, should be sought from the national meteorological services."

Methods of obtaining snow samples (Agenda item 16.2)

39. Reference is made to the action taken on agenda item 16.1 and 5.3.

Review of relevant parts of the Technical Regulations adopted by Second Congress (Agenda item 17)

40. The commission agreed that in principle the Technical Regulations should not specify any particular type of instrument for obtaining meteorological information but simply the minimum standards of accuracy with which such information was required. The amendments required by such a principle and the minimum acceptable standards of accuracy referred to in the report on agenda item 4.2 are included in recommendation 15 (CIMO-II).

Revision of the Guide to International Meteorological Instrument and Observing Practice (Agenda item 18)

41. Noting that the Executive Committee had authorized amendments to pub-
lication No. 8 TP. 3 (Guide to International Meteorological Instrument and Observing Practice) being made by the Secretary-General in consultation with the president of CIMO, the commission did not consider purely editorial amendments but confined itself to matters involving principle. It noted the outstanding recommendations and proposals for further revision of the Guide, and decided to record that such further amendments should be made to the Guide as were necessary to bring it into conformity with the decisions of CIMO.

The commission discussed the estimation of cloud height and agreed that in the revision of chapter 2, the last sentence of paragraph 2.4.6 should be omitted and in paragraph 2.4.5 the statement should be included that, in general, the height of clouds above 3,000 metres cannot be satisfactorily estimated unless a very recent instrumental or aircraft observation of the cloud has been made.

A number of other decisions concerning amendments to the CIMO Guide were made during the discussion of other items of the agenda.

Examination of the resolutions and recommendations adopted at the first session of the commission (Agenda item 19)

42. In regard to the relationship of publication No. 8 and the Manual of Meteorological Observing in Aircraft, referred to in Res. 1 (CIMO-I), it was decided to ask the president of CIMO to inquire from the president of the Commission for Aeronautical Meteorology when the Manual of Meteorological Observing in Aircraft would be ready for publication and to consider what action, if any, was necessary in respect of instruments for use in vertical aircraft ascents after he had been able to examine the manual.

It was noted that funds for international comparison of instruments had been allocated by Second Congress and that part of these funds had been used for the comparison of radiosondes, but little guidance had been given in Res. 3 (CIMO-I) as to what projects for comparison were considered necessary by CIMO. It was therefore decided that the president of CIMO should request the Executive Committee to consider the granting of $1,500 in 1958 and $800 in 1959 to meet the cost of inter-comparison of primary sub-standard pyrheliometers (see recommendation 6 (CIMO-II)).

It was also decided to recommend that further funds be allocated with a somewhat wider scope in view, for the third financial period. This decision is included in Rec. 16 (CIMO-II).

The president of the Commission for Synoptic Meteorology had asked the president of CIMO for an interpretation of instructions given in the annex to Rec. 8 (CIMO-I) in respect of the height of a station. The correct interpretation is that given by the president of CSM as his alternative A (document CIMO-II/29, addendum 1).

Rec. 18 (CIMO-I) had been referred to the Commission for Maritime Meteorology, which passed its Rec. 4 (CMM-II) on the measurement of sea-surface temperature. This recommendation is not in conflict with Rec. 18 (CIMO-I), which has been reaffirmed in Rec. 17 (CIMO-II).
Further to Rec. 37 (56-CIMO) on the disposal of the resolutions of the International Meteorological Organization, the Executive Committee in its Res. 26 (EC-VIII) had referred Res. 130 (CD Washington, 1947) to CIMO for reconsideration. In view of the progress which has taken place since 1947 in this matter it was decided that it was not necessary to reaffirm the resolution.

Finally the commission adopted resolution 12 (CIMO-II) incorporating its decision arising from the review of the resolutions and recommendations adopted by CIMO prior to its second session. Recommendations 37, 38, 39, 40, 41, 42 (56-CIMO) are contained in annex 3 to this report.

**Election of president and vice-president (Agenda item 20)**

43. At its last plenary meeting Mr. A. Perlat, Ingénieur en chef, (France) was unanimously re-elected president and Mr. L.M. Malet (Belgium) was re-elected vice-president of the commission.

**Establishment of working groups (Agenda item 21)**

44. The commission agreed to set up in all 11 working groups based on the proposals put forward by the various committees. References to the resolutions establishing these working groups are found under the relevant agenda items. In connexion with the terms of reference of these working groups the commission agreed that they should all report to the president of CIMO not later than six months before the third session of the commission unless other dates were specified in the resolutions.

The commission further authorized the president to fill any gaps in the membership of the groups caused by the inability of any of the persons nominated to accept the invitation.

The commission also examined some procedural questions in connexion with invitations to experts to participate in the work of a working group and agreed that the president should bring the considerations in annex 4 to this report to the attention of the Executive Committee.

The working groups established by the commission are as follows:

- Working Group on hydrometeorological instruments
- Working Group on the uses of radar in meteorology
- Working Group on automatic weather stations
- Working Group on international comparison of precipitation gauges
- Working Group on snow measurements
- Working Group on meteorological instruments and methods of observation on aerodromes
- Working Group on hygrometry
- Working Group on evaporation measurement
Working Group on radiation measurement
Working Group on comparison of aerological instruments
Working Group on measurements of atmospheric electricity.

**Measurement of the refractive index of the atmosphere (Agenda item 22)**

45. The commission considered that it would be possible, by means of the present network of aerological stations, to give certain data to radio-electricians and other users in response to their requests.

To this effect recommendation 18 (CIMO-II) was adopted.

**Atmospheric electricity (Agenda item 23)**

46. It was noted that measurements of atmospheric electricity have been carried out for several years either sporadically or systematically in certain countries. During the IGY these measurements will be extended and made more systematic.

The commission considered that the different techniques used for the measurement of atmospheric electricity need to be carefully studied and established by resolution 11 (CIMO-II) a working group to carry out these studies.

**Local lightning flash counters (Agenda item 24)**

47. This question was presented by the representative of the International Radio Consultative Committee (CCIR), Mr. van der Mark, who recalled that the problem of developing a suitable local lightning flash counter had been under study by CCIR since 1948 and that the instrument now proposed is the result of tests carried out by a special commission set up in London in 1953. The following administrations took part in the work of this commission: United States, France, India, Japan, United Kingdom, Union of South Africa, while WMO also participated. Mr. van der Mark suggested that WMO might recommend that the lightning flash counter described in document CAe-II/35 be used at meteorological stations of Members of WMO.

The commission agreed that, according to the information available, data obtained with the proposed instrument would seem in certain cases to be better than those obtained by an observer. It was recommended that an article on the instrument developed by CCIR should be published in the WMO Bulletin and that the detailed specification of the instrument should be distributed to all Members for information.

It was noted that a CAe Working Group on atmospherics will study the need for establishing a world network of stations equipped for measuring local lightning flashes.
Closure of session

48. In all there were seven plenary meetings during the session. The minutes of the three first meetings were adopted at the session and the commission authorized its president to approve the remaining four minutes.

The president was also authorized to make any necessary editorial amendments to the 12 resolutions and 18 recommendations which had been adopted.

The session closed at 12.40 p.m. on 6 July 1957.

Action to be taken on the decisions of the session

49. In accordance with resolution 6 (EC-III), the recommendations adopted at the session have been classified as follows:

(a) None of the recommendations require urgent consideration by the President of the Organization;

(b) Recommendation 15 (CIMO-II) - Amendments to the Technical Regulations in the field of CIMO - need to be considered by all regional associations and by other technical commissions before being submitted to the Executive Committee;

(c) All remaining recommendations and the resolutions are being submitted direct to the Executive Committee.

A number of decisions on technical matters have been recorded in the minutes of the session and these decisions have all been included in the preceding paragraphs of this general summary.

Action on these decisions will be taken as indicated in each case.

Scientific lectures

50. In the course of the session scientific lectures and discussions on the following main subjects were arranged:

(a) Instrument development;

(b) Use of radar in meteorology;

(c) Measurements of radiation.

The authors and titles of these lectures are given below:

**Instruments development**

S.P. Venkiteshwaran : Development of instruments in India

H.H. Bindon : The new Canadian radiosonde - A new absolute standard barometer

R. Frith : A recording leaf wetness meter
GENERAL SUMMARY

A. Hauer : On wind measurement
V. Väisälä : A mixing hygrostat for calibrating radiosonde hygrometers.

Use of Radar in Meteorology

R. Lhermitte : Use of radar in meteorology
S. Mull : Tropical thunderstorm and radar
V.D. Rockney : Study of tornados by radar
G. Barbé : Practical estimation of the errors involved in radar-wind measurement
R. Eyraud : Rapid procedure for determining the wind by radar
R.T.H. Collis : Wind measurements by radar
L.M. Malet : Corrections for earth's curvature and refraction in upper wind measurements
A. Perlat and P. Misme: : Correction for refraction in radar measurements
G. Barbé : Numerical data on the jet stream and the circulation in the layer 15-30 km over the Paris region.

Measurements of Radiation

M.W. Schüepp : Bellani-Davos spherical pyranometer
F. Borrel : New integrating actinometer
M.W. Schüepp : Influence of atmospheric turbidity on total radiation, diffuse sky radiation and ultra violet radiation from the sun.

Acknowledgements

51. The president wished especially to thank the conference secretariat and the interpreters for their help. He also thanked Mr. Langlo and his colleagues, on behalf of all members of CIMO, for their valuable assistance during the session. Stating the pleasure which collaboration with all the participants had given him, the president stressed the important rôle of Messrs. Grinsted, Hauer and Malet as chairmen of the working committees.
Res. 1 (CIMO-II) - WORKING GROUP ON HYDROMETEOROLOGICAL INSTRUMENTS

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING,

(1) Resolution 24 (Cg-II);

(2) The recommendations of the Organization's Panel of experts on water resource development;

CONSIDERING the clearly expressed need for having a chapter on hydrometeorological measurements included in the Guide to international meteorological instrument and observing practice;

DECIDES,

(1) To set up a Working Group on hydrometeorological instruments with the following terms of reference:

(a) To draft a chapter on instruments and methods of observation at present used in hydrometeorology for inclusion in the above-mentioned Guide, incorporating the material received from the Working Group on snow measurements;

(b) To submit the draft chapter to the president of the commission not later than 1 January 1959;

(2) To invite the following individuals to serve on the working group:

L.O. Raab (chairman)
W. Friedrich
W. Kohler
A. Serra
A member nominated by the USSR;

REQUESTS the president of the commission,

(1) To give the necessary guidance to the working group on the scope of the chapter, in agreement with the competent authorities of the Organization;

(2) To invite, through the Secretary-General, a representative of the International Association of Scientific Hydrology of the International Union of Geodesy and Geophysics to participate in the work of the working group.
Res. 2 (CIMO-II) - WORKING GROUP ON THE USES OF RADAR IN METEOROLOGY

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING the report of the Working Group on the uses of radar in meteorology presented to the second session of the commission;

CONSIDERING the need for completing the work already carried out by the group;

DECIDES,

(1) To re-establish the Working Group on the uses of radar in meteorology with the following terms of reference:
   (a) To prepare a technical note on the use of ground-based radar in meteorology (excluding upper wind measurements);
   (b) To submit the draft of the technical note to the president of the commission if possible before 1 January 1958;

(2) To invite the following individuals to serve on the working group:

   R.F. Jones (chairman)
   J.P. Henderson
   R. Lhermitte
   H. Mitra
   A. Perlat
   V.D. Rockney
   N.P. Sellick.

Res. 3 (CIMO-II) - WORKING GROUP ON AUTOMATIC WEATHER STATIONS

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING,

(1) The statement submitted by the Commission for Climatology on this subject;

(2) The action taken by the Executive Committee on recommendation 7 (CIMO-I); and

(3) The relevant recommendations of the regional associations, the Commission for Aeronautical Meteorology and the International Civil Aviation Organization;
CONSIDERING the developing requirement for automatic stations which will record meteorological data and transmit such data to another location;

DECIDES,

(1) To set up a Working Group on automatic weather stations with the following terms of reference:

(a) To consider information relating to instruments and equipment for the recording and transmission of meteorological data and, in particular, to such equipment as will report most of the information required for a meteorological report but not excluding equipment which will only record data;

(b) To make a summary of equipment available;

(c) To make a summary of stated requirements for automatic weather stations as described in the statement referred to in (1) under NOTING;

(d) To report on the available and possible future means of including in automatic weather stations equipment which will give information on those sky and other conditions referred to as "present weather";

(e) To present the information under (a) - (d) above in a form suitable for publication by the World Meteorological Organization;

(f) To report to the president of the commission not later than six months before the third session of the commission;

(2) To invite the following individuals to serve on the working group:

H. Treussart (chairman)
A member nominated by Japan
A member nominated by India
A member nominated by the United States of America.

Res. 4 (CIMO-II) - WORKING GROUP ON INTERNATIONAL COMPARISON OF PRECIPITATION GAUGES

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING recommendation 1 (CIMO-II),

CONSIDERING,

(1) That the results of the international comparison of precipitation gauges, requested in the above recommendation, should be studied by a group of experts;
(2) That the result of this study should be made generally available to Members;

DECIDES,

(1) To set up a Working Group on international comparison of precipitation gauges with the following terms of reference:
(a) To collect and study the results of the international comparisons of precipitation gauges;
(b) To prepare a report on the result of this study for distribution to Members;
(c) To present this report to the president of the commission - not later than six months before the third session of the commission;

(2) To invite the following individuals to serve on the working group:

L. Poncelet (chairman)
S.P. Venkiteshwaran
H.H. Bindon.

Res. 5 (CIMO-II) - WORKING GROUP ON SNOW MEASUREMENTS

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING,

(1) The request from the Commission for Climatology that questions relating to snow measurements should be urgently studied;

(2) The lack of uniformity in the methods used for snow measurements;

CONSIDERING the importance of reliable information on the water content of snow cover for hydrometeorological applications;

DECIDES,

(1) To set up a Working Group on snow measurements with the following terms of reference:
(a) To study as a matter of urgency the present methods of measuring snow accumulation, snow density and water content of snow cover;
(b) To make recommendations on possible standardization of the methods and instruments used for the above purposes, including the necessary changes and additions to the Guide to international meteorological instruments and observing practice;
(c) To report to the president of the commission on the above matters as early as possible and not later than 1 July 1958;
(d) To study other instrumental problems related to snow measurements such as temperatures in snow and radiation within the snow layer and to and from snow surfaces;

(e) To report on the study referred to in paragraph (d) above not later than 6 months before the third session of the commission;

(2) To invite the following individuals to serve on the working group:

M. de Quervain (chairman)
L.O. Raab
J. van de Erve
J. Grunow.

**Res. 6 (CIMO-II) - WORKING GROUP ON METEOROLOGICAL INSTRUMENTS AND METHODS OF OBSERVATION ON AERODROMES**

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION, NOTING,

(1) The increasing demand for specialized meteorological observations at aerodromes, made with suitable instruments exposed in the proper way;

(2) The great number of problems related to the choice of meteorological instruments and the methods of observation at aerodromes;

CONSIDERING,

(1) The need for a consolidated study of the problems involved;

(2) The particular need for relating the definition of cloud base (WMO publication No. 8, paragraph 2.4.1) to the information required by air navigators and other users;

DECIDES,

(1) To set up a Working Group on meteorological instruments and methods of observation on aerodromes, with the following terms of reference:

(a) To collect information on the present types of instruments and their exposure at aerodromes;

(b) To study this information and to make recommendations, as appropriate, on the most suitable types of instruments, on their exposure and on methods of observation, especially to meet the demands of aviation;
(c) To review the present definition of cloud base and to relate it to the information needed by air navigators and other users, taking into account the views expressed by the Commission for Synoptic Meteorology and for Aeronautical Meteorology;

(d) To report to the president of the commission not later than six months before the third session of the commission;

(2) To invite the following individuals to serve on the working group:

  A. Hauer (chairman)  
  R. Frith  
  D. Harris  
  A. Perlat  
  Mrs. E. Poljakova.

Res. 7 (CIMO-II) - WORKING GROUP ON HYGROMETRY

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING the report and annexes submitted by the chairman of the Working Group on hygrometry established in accordance with resolution 5 (CIMO-I); and

CONSIDERING,

(i) That all psychrometric tables should be computed from the formulae defining the thermodynamic wet bulb and the thermodynamic ice bulb temperatures, the tables being adjusted as necessary to take account of differences in design or operation of the various instruments;

(ii) That no adequate psychrometric technique is yet available for measuring humidity under dry conditions;

DECIDES,

(1) To re-establish the Working Group on hygrometry with the following terms of reference:

(a) To investigate the relationship between the thermodynamic wet-bulb temperature and the wet bulb temperature obtained from the usual types of psychrometers, especially in extreme conditions;

(b) To propose:

(i) Designs of hygrometers, including psychrometers, to yield results within various tolerances;

(ii) Means of achieving improved measurements of humidity under a wide range of conditions in routine observations; and
RESOLUTION 8

To report its findings to the president of the commission at least six months before the third session of the commission;

(2) To invite the following individuals to continue to serve on the working group:

- H.H. Bindon (chairman)
- R. Eyraud
- S. Gratch
- A.W. Brewer
- L.P. Harrison
- R.A. Wylie

Res. 8 (CIMO-II) - WORKING GROUP ON EVAPORATION MEASUREMENT

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING,

1) The importance of the evaporation term in the water budget equation;
2) The dependence of economic development in many parts of the world on the availability of water;

DECIDES,

(1) To set up a Working Group on evaporation measurement with the following terms of reference:

(a) To consider the rôle of evaporation pans in the study of (i) evaporation and (ii) potential evaporation;
(b) To advise on the specification of an international reference evaporation pan;
(c) To consider and advise whether the evaporation pan might be superseded by the measurement of definable meteorological elements;
(d) To report to the president of the commission not later than six months before the third session of the commission;

(2) To invite the following individuals to serve on the working group:

- H.O. Walker (chairman)
- N.E. Rider
- M. Kohler
Res. 9 (CIMO-II) - WORKING GROUP ON RADIATION MEASUREMENT

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING the interest shown in the achievement of the Working Group on radiation set up at the first session of the commission;

CONSIDERING that the research in radiation, now in full development, requires further international co-operation;

DECIDES,

(1) To establish a Working Group on radiation measurement with the following terms of reference:

(a) To recommend appropriate equipment for the measurement of all components of the radiation balance (including ultra-violet, infra-red and illumination);

(b) To give particular attention to the development and study of simple instruments combining acceptable accuracy with a modest price;

(c) To co-ordinate the comparisons of standard instruments;

(d) To encourage research into the requirements of instruments destined for use on a wide scale;

(e) To develop as a matter of priority a terminology of radiation fluxes and instruments in collaboration with the Radiation Commission of the International Association of Meteorology;

(f) To study methods which enable information to be obtained on radiation components from radiation observations with simple instruments and from observations of other meteorological elements;

(g) To assist in keeping up to date the international instructions (notably chapter 9 of WMO publication No. 8) relative to the use of instruments and the evaluation of their records;

(h) To report to the president of the commission not later than six months before the third session of the commission;

(2) To invite the following individuals to serve on the working group:

W. Mörikofer (chairman)
P. de Brichambaut
R. Dogniaux
S. Fritz
J. Janichevsky
H.G. Müller
G.D. Robinson
F. Sauberer
W. Schüepp
R. Schulze.
Res. 10 (CIMO-II) - WORKING GROUP ON COMPARISON OF AEROLOGICAL INSTRUMENTS

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING recommendation 9 of the report of the third meeting of the Working Group for comparison of radiosondes set up at the first session of the commission;

DECREASES,

(1) To set up a Working Group on comparison of aerological instruments with the following terms of reference:

(a) To co-ordinate studies for improving methods and instruments for aerological measurements;

(b) To inaugurate an international programme of experimental collaboration for these studies;

(c) To report to the president of the commission not later than six months before the third session of the commission;

(2) To invite the following individuals to serve on the working group:

M. Hinzpeter (chairman)
G.I. Golychev
C. Harmantas
D.N. Harrison
A. Hauer
J. Lugeon
L.M. Malet
A. Valentin
S.P. Venkiteshwaran.

Res. 11 (CIMO-II) - WORKING GROUP ON MEASUREMENT OF ATMOSPHERIC ELECTRICITY

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING,

(1) Recommendation 10 (CAe-I);

(2) That several countries will make measurements of atmospheric electricity during the International Geophysical Year;

DECREASES,

(1) To set up a Working Group on measurement of atmospheric electricity with the following terms of reference:
(a) To study and compare the different techniques used for the measurement of potential gradient, conductivity of air and charge of raindrops;

(b) To report to the president of the commission not later than six months before the third session of the commission;

(2) To invite the following individuals to serve on the working group:

L. Koenigsfeld (chairman)
H. Israel
P. Ackermann
S.P. Venkiteshwaran
A member nominated by the United States of America.

Res. 12 (CIMO-II) - REVISION OF RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION ADOPTED PRIOR TO ITS SECOND SESSION

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

CONSIDERING that resolutions 1, 2, 3, 4, 5, 6 and 7 of the first session of the commission have now become obsolete;

HAVING EXAMINED the action taken on the recommendations adopted at its first session and by correspondence;

DECIDES,

(1) To cancel resolutions 1, 2, 3, 4, 5, 6 and 7 (CIMO-I);

(2) To maintain in force recommendations 38, 39, 40, 41 and 42 (56-CIMO) and to incorporate these recommendations in the report of the second session;*

(3) To note the action taken by the competent bodies on recommendations 1 to 36 inclusive (CIMO-I) and on recommendation 37 (56-CIMO)* which therefore need no longer be kept in force.

* See annex 3.
Rec. 1 (CIMO-II) - INTERIM INTERNATIONAL REFERENCE PRECIPITATION GAUGE

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

CONSIDERING,

(1) That the appreciable differences in design between the national standard raingauges now in use and the different standard methods of exposure are capable of resulting in significant systematic differences in the amounts of precipitation measured;

(2) That attempts to draw isohyets across national boundaries have in fact shown such systematic differences;

(3) That it is desirable that all national precipitation data should be reduced to a common international standard for the preparation of international precipitation charts;

(4) That it is not possible to recommend a design of raingauge for adoption as a permanent international reference gauge until further investigations have been completed;

(5) That this matter is of some urgency in view of the International Geophysical Year and the proposed World Climatic Atlas;

RECOMMENDS,

(1) That an interim international reference precipitation gauge should be adopted as specified in the annex to the present recommendation;*

(2) That in order to ensure complete uniformity the gauges should preferably be made by a single manufacturer;

(3) That one of these gauges should be installed at one or more of the main precipitation observatories in each country with a view to determining reduction factors to bring the national precipitation records to a uniform international standard;

(4) That these reference gauges shall be exposed and measurements made as specified in the annex.*

* See annex 5.
Rec. 2 (CIMO-II) - INTERNATIONAL COMPARISON OF BAROMETERS

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING,

(1) Recommendation 15 (CIMO-I);

(2) The action taken by the various regional associations to promote comparison of national standard barometers with the appropriate regional standard barometers;

CONSIDERING,

(1) That a number of national standard barometers have not yet been compared with a regional standard barometer;

(2) That there is a need for urgent comparison of these barometers, particularly in view of the International Geophysical Year;

(3) That the results of these comparisons should be made available to all interested as soon as possible;

RECOMMENDS,

(1) That Members who have not yet compared their national standard barometer with an agreed regional standard barometer should make every effort to have this done as soon as possible and not later than 1 January 1959;

(2) That the Secretary-General should be requested to distribute to all Members an up-to-date list of regional standard barometers (category "A_r") which are now available for such comparisons;

(3) That Members should be reminded of Technical Regulation 3.4.4.6 which states that presidents of regional associations shall be informed of the results of comparisons of national and regional standard barometers for communication to the Secretariat.

Rec. 3 (CIMO-II) - DEFINITION OF METEOROLOGICAL OPTICAL RANGE

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING that the present definition of "visibility" is subjective;

and

CONSIDERING,

(1) That a definition is required of a suitable objective quantity;
(2) That the definition should preferably be such that the measure of the quantity is expressed as a distance roughly equivalent to the "day-light visibility" with which meteorologists are familiar; and

(3) The need to distinguish carefully between an objective quantity and the actual visual range of objects or lights under any given conditions;

RECOMMENDS,

(1) That a new measure of the optical state of the atmosphere, with a distinctive name, be adopted;

(2) That this measure be called the meteorological optical range (M.O.R.);

(3) That the meteorological optical range be defined as follows:

"The meteorological optical range is the length of path in the atmosphere required to reduce the luminous flux in a collimated beam from an incandescent lamp at a colour temperature of 2,700°K to 0.05 of its original value, the luminous flux being evaluated by means of the C.I.E. (International Commission on Illumination) photopic luminosity function";

(4) That a note be inserted in the Guide explaining that the M.O.R. is, for practical purposes, the same as the "meteorological visibility" as at present defined; that is to say, it is practically the same as the distance at which a black object of suitable dimensions can be seen and recognized against the horizon sky.

NOTE:

"Photopic" refers to the state of the eye when adapted to light at a level of luminance typical of ordinary backgrounds during the daytime. When dealing with the photopic state in the technical sense, one is concerned with the visual response of a normally sighted observer to the stimulus of light incident on the fovea centralis, the sensitive area of the retina by means of which fine details and colours are distinguished under such conditions of adaptation to light. The photopic luminosity function is a relative index of the visual response in the photopic state of the eye as a function of incident wave-length of light, where the standard of reference for the index is taken as the visual response at the wave-length for which the sensitivity of foveal vision is a maximum, namely at 555 millimicrons. Thus, the maximum value of the photopic luminosity function is unity, at this wave-length. Luminous flux owing to a given radiant flux within a narrow spectral wave-length interval centered at a given wave-length under photopic conditions is proportional to the product of the radiant flux, the photopic luminosity function at the given wave-length, and the width of the wave-length interval.
The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING that a master psychrometric table should be in a form that is readily adjustable for use at different pressures or for use with psychrometric constants that differ from the standard value;

CONSIDERING that a uniform format for tables required for the calculation of the dew point from wet-and dry-bulb observations is desirable;

RECOMMENDS,

(1) That a master table be prepared, having as its major parameters the wet-bulb (or ice-bulb) temperature and the depression;

(2) That the values of the dew point, which should appear on the body of the table, shall in all cases be with respect to liquid water and the values should be computed from the formulae defining the thermodynamic wet bulb and the thermodynamic ice-bulb temperatures;

(3) That the format of the table should be similar to that illustrated by the appended skeleton table, with the following additions:

(a) A companion table should be provided with temperatures expressed in degrees Fahrenheit;

(b) The depressions (T-T_w) should be given for every 0.1°C or every 0.2°F;

(c) The wet-bulb (or ice-bulb) temperatures should be given for every 0.5°C or every 1°F;

(d) For temperatures below 0°C the table should provide for both liquid water and ice on the wet bulb.

SKELETON PSYCHROMETRIC TABLE
(Pressure = 1.000 mb)

<table>
<thead>
<tr>
<th>Wet-bulb temperature (T_w) °C</th>
<th>Dew-point temperature °C (liquid water on the bulb)</th>
<th>Depression (T - T_w) °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>----</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>-20</td>
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Rec. 5 (CIMO-II) - CREATION OF NATIONAL RADIATION CENTRES AND OF REGIONAL WORKING GROUPS ON RADIATION

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING the fruitful results of the activity of the radiation centres existing in many countries and of the working groups on radiation created recently in some regions; and

CONSIDERING that reliability and comparability of radiation measurements necessitate a close contact between the different radiation stations;

RECOMMENDS,

(1) That Members without a radiation centre should consider the creation or designation of a centre of this kind to provide all necessary facilities to ensure the comparability of the radiation measurements in the country; especially the technical co-ordination of the measurements, their analyses and publication, as well as regular checking and recalibration of the instruments;

(2) That regional associations which have not yet done so should consider the creation of a Working Group on measurement of radiation taking into account the guidance given in the annex to this recommendation.*

Rec. 6 (CIMO-II) - RECALIBRATION OF PYRHELIOMETRIC SUB-STANDARDS

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING the importance of comparability of pyrheliometric observations;

CONSIDERING that comparisons between the various primary sub-standards and between primary and national sub-standards is the only way to ensure this;

RECOMMENDS,

(1) That the radiation observatories at Stockholm, Washington, Davos, Hamburg, Leopoldville, Potsdam, Pretoria and Uccle, which possess acknowledged sub-standards and facilities for comparison should be designated for the present time as primary sub-standard radiation observatories;

(2) That primary sub-standard radiation observatories should be established also in other regions;

* See annex 6.
(3) That recalibrations between the primary sub-standards should be undertaken as soon as possible and also immediately after the end of the International Geophysical Year, and should be continued in the future;

(4) That Members should arrange for recalibrations of their national sub-standard pyrheliometers with one of the primary sub-standards. If arrangements for comparison of this nature are not covered by regional agreement, Members should arrange recalibrations with one of the observatories designated in paragraph (1) above.

Reco. 7 (CIMO-II) - DEVELOPMENT OF SIMPLE RADIATION INSTRUMENTS

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING the requirements of meteorology and climatology for more detailed knowledge of the different radiation components and their regional distribution;

CONSIDERING that the majority of existing reliable radiometers are difficult to handle and evaluate and are at the same time expensive;

RECOMMENDS that Members be invited to pay more attention to the development and critical study of radiation measuring instruments which combine easy handling with acceptable accuracy at a moderate price.

Reco. 8 (CIMO-II) - IMPORTANCE OF THE ORIENTATION OF RECEIVER SURFACES OF INSTRUMENTS FOR MEASUREMENT OF RADIATION

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING the importance of the orientation of the receiver surfaces of instruments for measurement of radiation;

CONSIDERING,

(1) That a plane horizontal receiver surface is generally considered appropriate for purposes of pure meteorology and geophysics;

(2) That radiation data valid for other forms and orientation of the receiver may be required for purposes of agricultural meteorology, bioclimatology and architecture;

RECOMMENDS that the attention of Members be invited to the fact that measurements made by instruments of different form and orientation are not directly comparable.
Rec. 9 (CIMO-II) - FORMULAE FOR CALCULATION OF TOTAL RADIATION

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING that there are now a large number of long-period means of cloudiness in existence;

CONSIDERING,

(1) The desirability, for the purposes of meteorology and for its different applications, of having a more detailed knowledge of the regional distribution of the incoming radiation of sun and sky;

(2) That it will scarcely be possible to create a sufficiently dense network of appropriate instruments;

RECOMMENDS,

(1) That more attention be paid to the possibilities of calculating the total radiation of sun and sky;

(2) That it would be highly desirable to study for the different climatic regions the relation between cloudiness and duration of sunshine on the one hand, and between duration of sunshine and incoming total radiation on the other, making use of available data of mean cloudiness.

Rec. 10 (CIMO-II) - COMPARISONS OF CAMPBELL-STOKES SUNSHINE RECORDERS

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

CONSIDERING that differences in construction, cards and methods of analysis employed cause difficulties in the comparison of observations from different countries;

RECOMMENDS that Members should be invited to study, for different climatic regions, and in accordance with instructions prepared by the commission's Working Group on measurement of radiation, the differences in results obtained with Campbell-Stokes Sunshine Recorders arising from construction, variation in cards and methods of analysis.

Rec. 11 (CIMO-II) - ACCURACY OF UPPER WIND MEASURING EQUIPMENT

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

CONSIDERING,

(1) That the accuracy of instruments used for measuring upper winds has been studied in a number of countries;
(2) That the details of the results are not sufficiently known;

RECOMMENDS,

(1) That the detailed results of such studies, including descriptions of the equipment and methods of comparison, should be published by the World Meteorological Organization;

(2) That meteorological services with the necessary facilities should continue to carry out, by themselves or in collaboration, comparisons of different types of upper wind instruments;

(3) That the methods used and the results obtained should be circulated to all countries through the Secretariat;

(4) That the comparisons should be made under the greatest possible variety of conditions and that an account of the conditions should be included in the reports.

Rec. 12 (CIMO-II) - SPECIFICATIONS FOR METEOROLOGICAL INSTRUMENTS

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

CONSIDERING that the quality of meteorological instruments is generally no better than called for in procurement specifications;

REALISING that such specifications are prepared by meteorological services for specific purposes;

RECOMMENDS that Members be invited to consider, in addition to the usual requirements for precision, the need for ease of use and maintenance, robustness and cheapness.

Rec. 13 (CIMO-II) - INFORMATION CONCERNING THE WORLD COMPARISON OF RADIOSONDIES (Payerne, 1956)

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING,

(1) The results obtained from various experimental comparisons of radiosondes, and more particularly those carried out at Payerne in 1956, where fourteen different types of sondes were compared;

(2) The good agreement between the reports of various authors who have studied these results;
CONSIDERING the repeated requests from many meteorological services that the results of such comparisons should receive wide publicity;

RECOMMENDS,

(1) That the numerical tables appended in the annex to the present recommendation* be circulated to Members of the Organization;

(2) That, in consideration of the introductory note to the annex, a trial be made in the use of these tables by the synopticians so as to determine whether they contribute to the achievement of uniformity in aerological work throughout the world;

(3) That at the end of a given period (e.g., at the end of 1958) Members inform the Secretariat of the results of the trials;

(4) That the Secretariat transmit to the president of the commission the results thus obtained in order that he may ask the Working Group for the comparison of aerological instruments to draft a final report on the question well in advance of the next session of the commission;

(5) That any meteorological service that makes any modification in the sonde used by it which might invalidate part of the tables* should inform Members of such modification through the medium of the Secretariat.

Rec. 14 (CIMO-II) - ACCURACY OF PRESSURE MEASUREMENTS BY RADIOSONDES

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

CONSIDERING that the results of the Payerne comparison show the necessity for improving the accuracy of pressure measurements;

RECOMMENDS that the attention of meteorological services should be called to the importance of investigations which may lead to reducing the errors in pressure measurements. The thermal and other factors which influence the aneroid, its support and the transmission system should be included in these investigations.

Rec. 15 (CIMO-II) - AMENDMENTS TO TECHNICAL REGULATIONS IN THE FIELD OF CIMO

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

CONSIDERING,

(1) That Technical Regulations should, wherever possible, specify the accuracy requirements for instrumental and for non-instrumental observations;

* See annex 7.
(2) That advice on how to achieve this accuracy is, in general, more appropriate to the "Guide" than to Technical Regulations; and

REALISING that the minimum accuracy requirements specified in Technical Regulations must be consistent with what can readily be achieved using existing instruments and techniques;

RECOMMENDS,

(1) That Technical Regulations should not stipulate the use of particular instruments or observing techniques unless it is considered that this is the only way of securing a satisfactory degree of intercomparability of observations (e.g. in evaporation measurements);

(2) That Technical Regulations be amended as indicated in the annex to this Recommendation;

(3) That the Secretariat be instructed to make any necessary amendments to the Guide to International Meteorological Instrument and Observing Practice.

Rec. 16 (CIMO-II) - FUNDS FOR FACILITATING INTERNATIONAL ACTIVITY IN THE FIELD OF INSTRUMENTS AND METHODS OF OBSERVATION

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING,

(1) Articles 2 (c) and 2 (e) of the Convention of the World Meteorological Organization;

(2) The modest sum included in the budget of the Organization for the second financial period for comparison of instruments;

CONSIDERING,

(1) That in addition to comparison of instruments there are other related projects which need to be materially assisted and encouraged by the Organization;

(2) That it is difficult to obtain funds from other sources for such international activities;

RECOMMENDS that third Congress give favourable consideration to the inclusion in the budget of the Organization for the third financial period of appropriate provisions for the following:

* See annex 6.
RECOMMENDATION 17

(a) Arranging of international symposia on subjects related to the activity of the commission, particularly a symposium on the utilization and development of automatic devices;

(b) Covering the expenses (travel and subsistence allowance) of necessary meetings of working groups of the commission;

(c) Assisting investigations into the improvement and development of meteorological instruments for international use in fields where present instruments are lacking or inadequate;

(d) Comparison of radiosondes;

(e) Inter-regional comparison of standard barometers;

(f) Inter-regional comparison of standard pyrheliometers;

(g) Comparison of instruments for measuring meteorological optical range, of ceilometers and of such other instruments and methods, as may be necessary from time to time.

Rec. 17 (CIMO-II) - MEASUREMENT OF SEA-SURFACE WATER TEMPERATURE

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING,

(1) Recommendation 18 (CIMO-I), which was referred to the Commission for Maritime Meteorology for consideration;

(2) Recommendation 4 (CMM-II);

(3) WMO publication No 8, chapter 10;

CONSIDERING,

(1) That investigations conducted by Canada, France, the United Kingdom and the United States of America have revealed important information regarding the vertical gradient of temperature in the surface waters to a depth of about 10 metres in the North Atlantic and North Pacific Oceans;

(2) That 296 sets of observations were made with bathythermograph, reversing thermometer, and thermister over the oceans from latitudes 45° to 59°, during the season from April to July, when solar radiation is intense;

(3) That of the total number of observations, only 1 to 3 per cent showed a difference of as much as 0.5°F between the surface and 5 or 10 metres depth, and only 1 per cent showed a difference of as much as 1°F between the same levels;
RECOMMENDATION 18

(4) That all investigators have found that there is rarely a difference of as much as $0.5^\circ F$ between the specified levels when the wind force is greater than Beaufort 3 at any latitude or season;

(5) That differences of as much as $2^\circ F$ in higher latitudes and $4^\circ F$ in the tropics do occur in quiet sunny weather, and with a frequency that cannot be neglected in the less windy portions of the lower latitudes;

(6) That bucket measurements are often unsatisfactory in windy weather; and also

(7) That intake measurements of water temperature suffer from lack of proper location of the thermometer, from unsatisfactory thermometers, and from crudeness of reading or timing;

RECOMMENDS,

(1) Consideration and tests of the use of resistance thermometers in the intake to measure the water temperature, with provision for reading the instrument at a distance on the bridge;

(2) That until installation and successful use of resistance thermometers are realized, an effort be made to improve existing intake temperature arrangements by installing fixed precision thermometers in the flow of newly intaken sea water at a convenient reading height, and by accepting for synoptic reports only those readings made at the times that they are requested by the officer on the bridge;

(3) That where improved arrangements are made for intake temperature readings, these readings be given preference over those made by means of bucket measurements in latitudes above $45^\circ$, and that bucket measurements be made in quiet, sunny weather at lower latitudes;

(4) That requirements for precision of reading of sea thermometers be $1^\circ F$ or $0.5^\circ C$, instead of $0.2^\circ F$ or $0.1^\circ C$.

Rec. 18 (CIMO-II) - COMPUTATION OF THE REFRACTIVE INDEX OF THE ATMOSPHERE

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING the need of radioengineers and other users for more detailed and accurate observations of pressure, temperature and humidity from the lower layer of the atmosphere up to 700 mb to enable the refractive index one unit of $N$ to be computed with sufficient accuracy;

CONSIDERING that the pressure, temperature and humidity data obtained by routine meteorological radiosoundings are not sufficiently detailed for this purpose;
RECOMMENDS that Members be advised that more suitable data for computation of the refractive index of the atmosphere may be obtained either by appropriate modifications of the existing instruments or by reducing the rate of ascent in the lower layers.
CONCLUSIONS CONCERNING THE FUTURE WORK OF CIMO

1. I feel that it is the duty of the president of the commission to reach a conclusion on its efficiency and on the part which it has played. This question is all the more important, because a working group of the Executive Committee is studying the modifications which might have to be made in the present system of technical commissions.

2. A glance at the agendas of the first and second sessions of CIMO shows the very wide field of activity of a commission such as ours. The diversity of the questions dealt with makes it essential to allot the tasks to the various working groups. It should be pointed out here that the effective work of CIMO, i.e. the preparation of recommendations and texts for inclusion in the Guide, has been done by these working groups, and we owe our gratitude to the chairmen and members for the considerable amount of work accomplished between the first and second sessions.

3. The formation of these working groups is generally a fairly complicated matter and this throws into relief one of the difficulties of a technical commission such as CIMO. Experience has shown that it is impossible to find within the commission all the elements necessary to form these groups. For example, the eight working groups formed between the first two sessions of CIMO were composed of:

- 22 members of CIMO
- 35 non-members of CIMO.

Instrumental problems are only studied by this commission in compliance with wishes expressed by other commissions and, more generally, by research bodies or other users.

CIMO experts are not responsible for solving problems related to the construction of instruments, but rather for establishing specifications with which standardized instruments can be produced, even if made by different manufacturers. That is why, when forming a working group, an effort is made to find not only specialists in the taking of measurements, but also experts on problems for the solution of which the measurements are required.

An example of this need for collaboration between instrument experts and users is given by the joint meetings foreseen during the second session, between the members of CAe and those of CIMO. Mention might also be made of the work of the Working Group on radiation, which, in practice, has always been carried out in liaison with radiation specialists.

4. That is why, having followed the work of this commission since my election as president, I feel that CIMO's work is accomplished entirely through its working groups, which do not consist merely of instrument experts but,
in reality, constitute panels of specialists on specific meteorological questions.

It therefore seems to me that the creation of permanent or temporary commissions responsible for the complete study of problems relating to a specific branch of meteorology would prove more effective and more efficient than the practice of referring matters from one commission to another in the form of recommendations, with all the delays inherent in this procedure.

5. We might envisage for example a commission responsible for the study of problems relating to the upper atmosphere which included experts on physical and synoptic meteorology; similar commissions could deal with radiation and radio-electric problems in meteorology. Such a subdivision of responsibilities, which would provide for direct discussion between the experts, would lead to a much more rapid solution of certain problems and to finding the compromise which is always necessary between the idealized requirements of science and technology and the limitations imposed by instruments and operational needs.

6. On the other hand, in special cases, it is still necessary to form temporary groups to carry out special investigations - for example an international comparison of radiosondes or instruments for the measurement of radiation - or to deal with a specific point. The terms of reference of these groups should be quite clearly defined, however, and membership should be limited to a maximum of 2 or 3 experts.

7. As a technical commission only meets once every four years, the normal procedure for setting up these groups and studying the results of their work is long and is sometimes complicated by the exchanges of correspondence necessary between the presidents of the commissions who must also consult the members of their commissions.

I therefore think that temporary groups should be formed by the Secretary-General of the Organization, at the request of the Executive Committee, and should report direct to the President of the Executive Committee.

8. Finally, there is sometimes a delicate problem to be faced in connexion with instrumental problems, that of finding a constructionally acceptable instrument. It is very difficult for a commission to select such instruments, because of national commercial considerations. I think that the problem could be solved if any constructor could ask WMO for a certificate testifying that his instruments comply with the standards adopted by the Organization. A certificate of this type could be given by the Secretariat after examination of the instrument in one or more laboratories recognized by WMO for this purpose, or after an ad hoc Commission including a member of the Secretariat had made inquiries of the constructor.
ANNEX 2

REVISED DEFINITIONS FOR ANNEX TO REC. 15 (CIMO-I)

A An absolute standard barometer capable of independent determination of pressure to an accuracy of at least ± 0.05 millibars.

A' A barometer of category "A" which has been selected by regional agreement as a reference standard for barometers of that region.

B A working standard barometer of a national meteorological service of a design suitable for routine pressure comparisons and with known errors which have been established by comparison with a regional standard.

Note:
ANNEX 3
Annex to resolution 12 (CIMO-II)
RECOMMENDATIONS ADOPTED BY CORRESPONDENCE BETWEEN THE FIRST
AND SECOND SESSIONS OF THE COMMISSION

Rec. 37 (56-CIMO) - DISPOSAL OF IMO RESOLUTIONS PERTAINING TO THE FIELD OF THE
COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,
NOTING resolution 21 (Cg-II);
RECOMMENDS that the action indicated in the annex be taken on cer-
tain resolutions of the International Meteorological Organization pertaining
to the field of the commission.

ANNEX

<table>
<thead>
<tr>
<th>IMO resolution</th>
<th>Reference IMO Publication</th>
<th>Proposals for action to be recommended by CIMO to the Executive Committee</th>
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<tr>
<td>CD Washington 1947, No. 130</td>
<td>No. 71 p. 151</td>
<td>Contents not to be included in WMO publications for the moment</td>
</tr>
<tr>
<td>CD Warsaw 1935, No. 76</td>
<td>No. 50 p. 265</td>
<td>This resolution will be completely implemented in the course of the coming International Geophysical Year. Contents not to be included in WMO publications for the moment</td>
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<td>Remaining resolutions in field of CIMO, listed in Doc. Cg-II/92, annex I</td>
<td></td>
<td>Considered obsolete or replaced for the reasons shown in each case in Doc. Cg-II/92, annex I. Contents not to be included in WMO publications for the moment</td>
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Rec. 38 (56-CIMO) - IMPROVEMENT IN RADIOSONDE TECHNIQUES

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,
CONSIDERING,

1) That for the successful accomplishment of the programme of
the International Geophysical Year it is essential to have accurate radio­sonde data to the greatest possible heights;

(2) That the results of the second world comparisons of radio­sondes indicate that in certain cases an improvement in accuracy can be achieved by the application of radiation corrections to the readings of temperature;

(3) That in some cases it may be possible to reduce the radiation errors by relatively simple modifications to the radiosondes;

RECOMMENDS,

(1) That all meteorological services in which radiation corrections are not yet applied should undertake, as a matter of urgency, investigations to determine the radiation corrections if any which should be used for their radiosondes;

(2) That all meteorological services which at present apply radiation corrections should examine the Payerne results with a view to determining if these corrections are adequate;

(3) That those responsible for the design of radiosondes should endeavour to modify the instruments to reduce the radiation errors;

(4) That every effort should be made to complete the above studies before 1 July 1957 with a view to applying radiation corrections, wherever necessary, to radiosonde results during the International Geophysical Year.

Rec. 39 (56-CIMO) - INFORMATION FOR THE SPECIAL COMMITTEE FOR THE INTERNATIONAL GEOPHYSICAL YEAR

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

RECOGNIZING,

(1) That it is possible by the use of special balloons to carry out ascents to the levels of 50 mb and 20 mb, and even 10 mb;

(2) That for most types of radiosondes the errors in pressure and temperature at the 50 mb level are large and that they increase rapidly at higher levels, especially during the day;

(3) That in most cases the upper winds can be measured by radar or radiotheodolite up to the 50 mb level;

RECOMMENDS that the Special Committee for the International Geophysical Year should be informed that:
(1) For most types of radiosondes the errors in pressure and temperature at the 50 mb level are large and that they increase rapidly at higher levels, especially during the day;

(2) It was not possible to study the problem of measuring the winds at high altitude during the Payerne comparisons, but it is well-known that in most cases it is possible to do this up to about the 50 mb level by radar or by certain types of radiotheodolites.

Rec. 40 (56-CIMO) - RADIOSONDE BALLOONS

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

CONSIDERING,

(1) That during the International Geophysical Year and especially on world days, it has been recommended by the Special Committee for the International Geophysical Year that balloons carrying radiosondes should regularly reach the 50 mb level and preferably even greater heights;

(2) That a recent inquiry by the WMO Secretariat has shown that in many countries it is at present not possible to attain even the 90 mb level regularly;

RECOMMENDS,

(1) That all meteorological services should use the best quality balloons at their radiosonde stations during the International Geophysical Year, especially on world days;

(2) That the Secretariat of the Organization should carry out an immediate inquiry with a view to supplying to all meteorological services information about suitable balloons and about techniques which may be used to ensure the best possible performance of the balloons.

Rec. 41 (56-CIMO) - INTERNATIONAL PYRHELIOMETRIC SCALE

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING recommendation 1 adopted at the International Radiation Conference (Davos, September 1956), Recommendation 31 (CIMO-1) and Resolution 49 (EC-IV); and

CONSIDERING,

(1) The arguments set out in the annex to this recommendation;
(2) The urgent need for a unique international scale for expressing measurements of solar radiation, especially during the International Geophysical Year;

RECOMMENDS that the Technical Regulations of the Organization, paragraph 3.4.9.1, be changed to read as follows:

3.4.9.1 Pyrheliometric measurement shall be expressed in the International Pyrheliometric Scale (1956)

Note: (1) The above paragraph will come into force on 1 July 1957;

(2) To express pyrheliometric observations in the International Pyrheliometric Scale (1956) the following procedure is to be observed:

Measurements made according to the original uncorrected Ångström scale shall be increased by 1.5 per cent;

Measurements made according to the Smithsonian Scale (1913) shall be decreased by 2.0 per cent.

ANNEX 3

1. Pyrheliometric scales in current use

In meteorological services and institutes, radiation measurements are normally standardized by one of the two types of instrument, the Abbot silver disc pyrheliometer and the Ångström compensation pyrheliometer. The silver disc instrument is calibrated by reference to a calorimeter maintained by the Smithsonian Institution, the sun being always used as source. Two main types of Ångström instrument are in use, the original type was calibrated at Upsala, and is now calibrated in Stockholm, by reference to a standard Ångström instrument, used absolutely, always with the sun as source. The other one is calibrated by the Smithsonian Institution, the ultimate reference being the calorimeter, with the sun as source.

In some countries certain measurements of solar radiation are made using radiometers standardized, by reference to other absolute radiometers, on laboratory radiation sources.

2. The Smithsonian pyrheliometric scale

The history of the Smithsonian scale of radiation may be studied in the publications of the Smithsonian Institution. For the present purpose it is important to note that in 1932, following the introduction of an improved calorimeter, the Institution announced that the scale of 1913 was in error, measurements in this scale being high by 2.5 per cent; this
has been confirmed in 1934, 1947 and 1952. Nevertheless the Smithsonian Institution has continued to standardize instruments in terms of the scale of 1913, to preserve continuity in series of measurements, and particularly in the publication of their solar constant determinations. The correction of - 2.5 per cent has, as far as we know, not been applied in meteorological practice; measurements have always been referred to the scale of 1913.

3. The Ångström pyrheliometric scale

The Ångström scale is based on the compensation pyrheliometer introduced by K. Ångström, which was recommended in 1905 by the International Meteorological Organization for meteorological radiation measurements. The scale is, and has been, embodied in a small group of specimen instruments, other instruments being sub-standards not used absolutely. When the Ångström instrument is used absolutely, it is necessary to apply certain corrections to the readings, mainly on account of the so-called "edge effect." These corrections have been investigated from time to time during the past 40 years. The present estimate, following recent measurements in Stockholm, of the magnitude of the required correction is 2 per cent, measurements on the uncorrected scale being low. This correction has never been applied when sub-standard instruments have been calibrated in Sweden; in meteorological practice measurements have always been referred to the original Ångström scale.

4. Comparisons of the existing pyrheliometric scales

The ultimate standards of the Ångström and Smithsonian scales have never been compared with each other, nor with any other absolute radiometer. There have been frequent inter-comparisons of the Ångström and Smithsonian 1913 scales through sub-standard instruments representing either scale with absolute radiometers of other types. Many comparisons of sub-standard instruments have been made with the sun as source. The difficulty of such comparisons is that different areas of circumsolar sky are covered by the different instruments, and the intensity of radiation therefrom is widely variable with time and place, so that the silver disc and Ångström instruments are not strictly comparable if the sun is used as source. A few laboratory comparisons have been reported. The difficulty introduced by the circumsolar sky radiation is eliminated in principle in the case of the laboratory comparisons, but other difficulties are introduced, chiefly in dealing with the silver disc instrument, e.g. it is not easy to maintain an even distribution of radiation of sufficient intensity over the comparatively large sensitive surface. One laboratory comparison of a sub-standard instrument with another type of absolute radiometer has been reported.

5. Summary of results of the comparisons

The generally accepted mean difference between measurements of solar radiation by instruments standardized by the Smithsonian Institution on the 1913 scale and by instruments standardized on the uncorrected
Ångström scale is 3.5 per cent, measurements on the Ångström scale being the lower; individual determinations show however considerable scatter. The mean of laboratory determinations of this difference is 2.8 per cent. A single laboratory determination of the difference between the (British) National Physical Laboratory (NPL) standard scale of radiation and a sub-standard representing the uncorrected Ångström scale shows readings on the latter scale to be the lower by 0.5 per cent. A series of inter-comparisons at Davos (1934) between sub-standard Ångström instruments and the Potsdam absolute pyrheliometer (a calorimeter), using the sun as source, shows readings on the uncorrected Ångström scale to be the lower by 1 per cent.

The Smithsonian Institution considers the 1913 scale to be in error by +2.5 per cent. Let us designate the Smithsonian scale 1913 less 2.5 per cent the "corrected Smithsonian scale". On the other hand, the Stockholm Institute considers that a correction of +2 per cent should be made to the Ångström scale. Let us designate the uncorrected Ångström scale plus 2 per cent the Ångström corrected scale. The comparison of sub-standard instruments using the sun as source suggests that readings on the Ångström corrected scale are in the mean 1 per cent higher than on the Smithsonian corrected scale. Comparison on laboratory sources suggests that this figure is 1.7 per cent. The single comparison of Guild suggests that measurements on the Ångström corrected scale are 1.5 per cent higher than measurements on the National Physical Laboratory scale. The Potsdam comparisons show that measurements on the Ångström corrected scale are 1 per cent higher than those referred to the old absolute pyrheliometer. The mean difference of 0.7 per cent between comparisons using the sun and those using laboratory sources is of the magnitude to be expected from considerations of the apertures of standard and sub-standard instruments and an average distribution of circumsolar radiation. The computations of Pastiels have thus shown that the amount of circumsolar sky radiation, which enters through the aperture of the pyrheliometers at measurements of the solar radiation, is about 2 - 3 per cent in the silver disc and the original Ångström instruments and that the difference between the Ångström and the Smithsonian instruments on account of sky radiation and aperture conditions amounts to about 0.45 per cent.

The various comparisons are summarized in the following diagram.

Diagram illustrating the relation of various scales

Smithsonian 1913

2.5%

Corrected
Smithsonian

Uncorrected
Ångström

3.5

2.8

Potsdam

NPL

0.5

Corrected
Ångström

2%
6. Conclusions

Measurements on the uncorrected Ångström scale increased by 1.5 per cent will almost certainly be within ± 1 per cent and may be within ± 0.5 per cent of the best realization which can at present be made of the true absolute scale of radiation.

This uncertainty is quite acceptable for meteorological purposes, and is in conformity with the present accuracy of meteorological radiation observations.

Rec. 42 (56-CIMO) - EVAPORATION MEASUREMENTS DURING THE INTERNATIONAL GEO-PHYSICAL YEAR

The COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION,

NOTING resolution 11 (EC-VIII); and

CONSIDERING,

(1) That the plans for the International Geophysical Year in some countries include the installation at additional stations of equipment to measure evaporation;

(2) That it is desirable that all evaporation measurements made during the International Geophysical Year should be capable of being reduced to a standard reference;

(3) That the evaporation pan to be used as a standard of reference should be:

(a) A non-insulated pan exposed above the ground;

(b) A pan which is widely used and whose performance and characteristics have been investigated in detail;

RECOMMENDS,

(1) That the class "A" evaporation pan, as described in the annex to this resolution should be adopted as the standard of reference for evaporation measurements made during the International Geophysical Year;
(2) That meteorological services which install new evaporation pans for the International Geophysical Year should employ the class "A" pan;

(3) That meteorological services which already have a network of evaporation stations employing some other type of pan should install a class "A" pan alongside the existing pan at a few stations which differ as much as possible in latitude, elevation and other relevant factors.

ANNEX

CONSIDERATIONS REGARDING THE CHOICE OF A STANDARD EVAPORATION TANK FOR USE IN THE IGY PROGRAMME, TOGETHER WITH A BRIEF SPECIFICATION OF THE INSTRUMENT RECOMMENDED AND INSTRUCTIONS FOR ITS USE

1. Choice of type of tank or pan

The evaporation tanks or pans in use may be divided into two types according to whether they are exposed with the whole of the tank and the evaporation surface at some small height above the ground or whether the main body of the tank is sunk below ground level, the evaporating water surface being at or near the level of the undisturbed ground surface. The instrument at present recommended in the Guide to International Meteorological Instrument and Observing Practice is of the second type, but in spite of this it appears that the majority of free water evaporimeters in use throughout the world have an above ground exposure. Insulated tanks have been employed from time to time but have never been in wide-spread use. The working group has come to the conclusion that a non-insulated tank employing an above ground exposure is desirable for the following main reasons:

(a) It is cheap to make and install;

(b) Any leakage which develops after installation is relatively easy to detect and rectify;

(c) It stays cleaner than a sunken tank as dirt does not splash or blow into the water from the surroundings to any large extent. Further when cleaning becomes necessary, it is more easily accomplished than is the case for a sunken tank;

(d) Results from a number of sites using tanks with above ground exposures are more likely to be comparable as the influence of differences in heat exchange with the surrounding soil and of small differences in surrounding soil cover (for example in grass length) will not influence the performance of the instruments to the same extent as would be so in a network of sunken tanks.

We have had in mind the one disadvantage of an above ground exposure, namely that heat transfer through such a tank is greater than that
through a sunken tank of the same size. However, since this can be elimi-
nated from the final results when an above ground exposure is used, pro-
vided that air and water temperatures, dew point and wind are also ob-
served, and these observations with the exception of water temperature
are likely to be made on the same site, we consider that the operational
and economic advantages of the above ground exposure outweigh this ob-
jection. Moreover it must be remembered that it is nearly always impos-
sible to make a similar correction for a sunken tank since this requires
a knowledge of the soil temperature and moisture profiles which are very
much more difficult to obtain than the measurements in the air and water
which have already been mentioned.

2. Choice of the particular tank or pan

Having once decided the type of tank or pan which should be recom-
mended, it was obvious to us that there were overwhelming advantages in
specifying an evaporimeter which had been in use for some time and which
had had its performance and characteristics investigated in some detail.
We have decided to recommend the adoption of the American class "A" pan
since its performance has been extensively studied under a range of cli-
matic conditions within quite wide limits of latitude and elevation. In
particular it must be noted that more reliable equations are available
for the conversion of the class "A" pan observations to lake evaporation
than is so for any other type of evaporimeter in use. Further it is pos-
sible to arrive at good estimates of water loss from this evaporimeter
from the climatic data, a consideration which is of some importance when,
for example, records are lost or freezing temperatures persist for a con-
siderable period of the year. Reference should be made to Research Paper
No. 38 "Evaporation from Pans and Lakes" by Kohler, Nordenson and Fox,
US Weather Bureau, 1955, for detailed information on these aspects.

The working group does not recommend the wholesale replacement of
existing evaporation tanks and pans by the class "A" pan. Rather it is
suggested that at stations where a new installation is to be made this
evaporimeter should be employed and that in existing networks class "A"
panes should be set up alongside the existing evaporimeters at a few sta-
tions which differ as much as possible in latitude, elevation, etc.

3. Specification for the class "A" evaporation pan and brief instructions
for its installation and use

This section is based on information contained in chapter 4 of
"Instructions for Climatological Observers", Circular B, tenth edition,
issued by the US Weather Bureau, which should be consulted for detailed
information and in particular for relevant drawings and figures.

The pan is of cylindrical design, 10 inches (25.4 cm) deep and
47½ inches (120.65 cm) in diameter (inside dimensions). It is constructed
of galvanized iron or an alloy similar to monel metal, preferably the
latter in areas where the water contains large amounts of corrosive sub-
stances. The seams of the pan should be carefully made to prevent buck-
ling of the bottom. The support should be made of 2 x 4 inches (5 x 10 cm)
timber arranged in an open framework with seven lengths of wood covering the diameter of the pan one way and 4 lengths the other way. If it is intended to use a hook gauge for measuring the water level (see below), two white lines painted on the inside of the pan, 2 inches (5 cm) and 3 inches (7.5 cm) below the rim, help in maintaining the correct water level. The pan should be installed on a fairly level site which is, as far as possible, free from obstruction. If an obstruction such as a tree is present, it should not be closer to the instrument than twice the height of the obstructions above the pan. The ground surface cover must be cut sufficiently frequently to keep grass, weeds, etc. below the level of the pan rim. The exposure of the pan must be such that no shadow of any obstruction falls across it. Close proximity to small areas of water should be avoided. On installation the ground should be filled sufficiently to level the support and keep the bottom of the pan above the level of surface water in rainy weather. The top of the earth fill should be 1 to 2 inches (2.5 to 5 cm) below the top of the wood supporting frame so that air may circulate under the pan and the base of the pan may be inspected without difficulty. Inspection should be carried out at least once a month, particular attention being paid to the detection of any leaks. The pan should be cleaned out as often as necessary to keep it free from litter, sediment, scum and oil films.

If it is intended to use a hook gauge for measuring the water level, it will be necessary to provide a still well with means for levelling. The still well may be made of brass or other non-corrosive material. The use of a fixed point gauge is to be preferred to a hook gauge, both from the point of view of cost and the maintenance of a consistent level of water in the pan. If a hook gauge is used, the water level should be maintained between the two white lines mentioned previously. The fixed point gauge consists of a circular brass plate about 8 inches (20 cm) in diameter to which is attached a brass cylinder of 4 inches (10 cm) diameter, the cylinder being drilled radially with 3 holes 120° apart near the end which is attached to the plate. A brass rod with a pointed end is fitted to the centre of the plate along the axis of the cylinder, so that its point is 7.5 inches (19 cm) from the base of the plate. This gauge is rested on the bottom of the pan and the water level is adjusted initially to coincide with the top of the pointed rod. It will be found convenient to use in conjunction with gauge a measuring cylinder having a cross-sectional area one hundredth of that of the pan so that, for example, the addition of one inch of water from such a measuring cylinder to the pan will raise the water level in the pan by 0.01 inch. When such a measuring cylinder is not available, an ordinary laboratory measuring cylinder may be used. With the fixed point gauge it is only necessary to add or remove water with the aid of such a graduated cylinder at each time of observation to bring the water level in the pan back to its original level, as indicated by the height of the top of the pointed rod.
ANNEX 4

THE ESTABLISHMENT AND OPERATION OF WORKING GROUPS

The establishment of working groups of a technical commission and their smooth working between two sessions of that commission, are of particular interest to CIMO in view of the large number of working groups set up by it. The administrative aspect of this question is not within the competence of a technical commission, but it is nevertheless felt to be worth while to transmit the opinion of CIMO to the Executive Committee for its consideration should it agree to facilitate the work of the chairmen of the working groups by adopting special procedures in the matter.

1. The commission notes the following paragraphs from the minutes of the 10th plenary meeting of the second session of Regional Association I (Las Palmas):

"When the members of a working group have been designated by name, or in any other manner, by the association or by its president, the Secretary-General shall inform the governments concerned accordingly and shall submit to them for approval those decisions which concern them. In his letter, the Secretary-General shall also indicate:

(a) the reasons for the appointment of the working group and the reasons underlying the choice of the persons or countries mentioned;

(b) the obligations which result from this appointment for the members of the group and, particularly, the need to attend meetings, the probable duration and frequency of such meetings and the need to inform the chairman of the working group at least four months in advance of their attendance or non-attendance at a forthcoming meeting."

2. The commission notes, moreover, that certain Members experience administrative difficulties either because their permanent representative is not empowered to deal with questions relating to the appointment of persons to subsidiary bodies of the WMO, or because those Members do not attend all the meetings of the various technical commissions. This means that the permanent representatives are not always in the best position to put before their government the advisability of authorising the appointment of an expert to a given working group. It is felt that some special procedure, such, for example, as that proposed by the Regional Association I is worth considering.

The essential feature of this procedure would be that the WMO should ask each Member concerned (through its permanent representative) to confirm its agreement to the attendance of its expert or experts.
**ANNEX 5**

Annex to recommendation 1 (CIMO-II)

INTERIM REFERENCE PRECIPITATION GAUGE

Specification of Interim Reference Precipitation Gauge (IRPG)

The IRPG will consist of the British Snowdon gauge with an Alter shield, exposed at a height of one metre above the surface.

The rain gauge

The Snowdon gauge will be made of copper with a turned brass rim made to the British Meteorological Office specification.*

The inner collecting bottle will be made of plastic and will be supplied with the gauge.

The Alter shield

The Alter shield will be made in accordance with the US Weather Bureau specifications* but will be provided with a suitable support so that it may be fastened to the support that holds the rain gauge.

The support

The mouth of the gauge will be at a height of one metre above the ground. A support will be supplied suitable for fixing into a foundation on the ground. The foundation will normally extend to a height of 10 cm above the ground, but meteorological services should ensure that where necessary provision is made to raise the gauge to a height of about one metre above the prevailing snow surface.

The measure

Two glass measures reading in mm and made to the British Meteorological Office Specification will be supplied with each gauge. A suitable identification mark will be engraved on each measure.

Snow

The Snowdon gauge is not suitable for use where snowfalls of more than about 10 cm are likely between observations. For use in such circumstances snow gauges will be available. These will be simple cylindrical containers with the same external dimensions as the Snowdon gauge; stations requiring these will be supplied with two. The method of attachment to the support will be such that one container can be readily removed and replaced by the second. The snowfall will be measured by melting and by pouring into the rain measure.

* Specifications to be published separately.
Exposure of the reference gauges

Meteorological services shall select precipitation observatories for this trial which in their view have a good exposure and are representative of the characteristic rainfall regime. The national gauges shall be installed in accordance with national instructions. The IRPG shall be installed not more than 15 metres and not less than 5 metres from the national gauge. An attempt should be made to secure an exposure equivalent to that of the national gauge. Services are encouraged to carry out these trials in various rainfall regimes in their territories.

Provision of gauges

The basic gauge is a British Snowdon gauge and the British Meteorological Office has agreed to arrange the provisioning of the complete instrument.

The WMO Secretariat shall carry out a survey at the earliest possible date to determine the number of gauges required by each Member so that the British Meteorological Office can proceed with the procurement. The information required will include:

(a) number of rain gauges
(b) number of snow gauges.

(The cost cannot be at present exactly estimated but certainly will not exceed £ 50).

Recording of data

The total precipitation for 24 hours of the IRPG and the national rain gauge shall be entered on a form which will be supplied by the WMO Secretariat and the completed forms shall be sent at the end of each calendar month to the chairman of the Working Group on international comparison of precipitation gauges.
ANNEX 6
Annex to recommendation 5 (CIMO-II)
GUIDANCE FOR ESTABLISHMENT OF REGIONAL WORKING GROUPS ON MEASUREMENT OF RADIATION

1. General

The working group should be composed of the main radiation specialists of the Region. The terms of reference for these working groups should cover the development of a common working programme, the co-ordination of equipment, of analysis and publication, the organization of frequent comparisons and recalibrations of national standard instruments as well as general encouragement of radiation research. The activity of these working groups should be guided by the recommendations of the Commission for Instruments and Methods of Observation and by the recent publications of the CIMO Working Group on radiation and the Radiation Commission of IAM listed below.

2. References

(a) Inquiry into the actinometric activity throughout the world (available in mimeographed form from WMO);

(b) The minutes, with recommendations, of the two International Radiation Conferences: Rome 1954 (see IUGG News Letter No. 11) and Davos 1956 (under preparation);

(c) Recommendations and Programme for Radiation Measurements during the IGY (mimeographed; available from the Davos Observatory);

(d) Bericht I and II Über die Vergleichsversuche an Strahlungsmessgeräten beim Meteorologischen Observatorium Hamburg, September 1955 and May 1956 (contains the detailed reports on the comparisons of radiation balance-meters and other instruments for measuring long-wave radiation). These reports can be obtained from Professor F. Möller, Secretary of the Radiation Commission of IAM (Meteorologisch - Geophysikalisches Institut der Universität, Mainz, Germany). An abstract of the results of these comparisons will appear in 1957 in the Bulletin of WMO;

(e) P. Courvoisier: Contributions to Standard Pyrheliometry (will appear in 1957 in the Communications of the Swedish Meteorological and Hydrological Institute);

ANNEX 7

Annex to recommendation 13 (CIMO-II)

INFORMATION CONCERNING THE WORLD COMPARISONS OF RADIOSONDES
(Payerne 1956)

The results of the radiosonde comparisons carried out at Payerne in 1956 are included in the final report of the Working Group for the comparison of radiosondes (Zurich 22-27 October 1956). That report also contains summaries of special studies made by some of the participants.

In order to give synopticians some idea of the wide differences between results obtained with different types of radiosondes, tables have been prepared showing the mean differences recorded in temperature and height by the various sondes at standard levels up to 100 mb. These tables also give an assessment of the root mean square deviations affecting these mean differences. Most of the studies of the results of the Payerne comparison deal with the instrumental aspect of the question, but the figures in these tables have been so established as to be useful to synopticians. It must, however, be emphasized that these figures are not very accurate and that they must in no case be considered as corrections. Those using them must consider them simply as a rough working idea of the mean differences between the various types of radiosonde. The individual differences between sondes are such that the mean differences mentioned cannot be used without caution. The analyst can, however, use them as a guide when examining altitude charts.

It is also important to note that these tables have been drawn up from data obtained from comparisons made under special conditions (height of sun, ventilation, grouped launchings, etc.), which may not be representative of the normal conditions of the network concerned.
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### TABLE 2 / TABLE 2

**Écart moyens d'altitude (2 - x) et écarts types affectant ces écarts moyens**

**en mètres géopotentielles**

Mean differences in height (2 - x) and standard deviations affecting those mean differences

(in geopotential metres)

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Key
(a) $X = 1$ Belgian sonde
2 German Graw H50 sonde (Federal Republic of Germany)
3 German sonde (German Democratic Republic)
4 United States sonde (AN/AMT 4 B)
5 Finnish sonde
6 French sonde
7 Japanese sonde
8 Indian sonde (chronometric)
9 British sonde (Kew Mark II B)
10 Netherlands sonde
11 Swiss sonde
12 USSR sonde
13 Indian sonde (fan type)
14 Polish sonde

NOTE: It has not been possible to give figures for sonde No. 10 because the heights have not been calculated for that sonde.

(b) Upper figure = mean difference
Lower figure = approximate standard deviation

NOTE:
(1) To simplify the calculations, radiosonde No. 2 has been used as an arbitrary reference. This had no effect on the relative differences between the radiosondes.

(2) In accordance with recommendation 5 of the Working Group for radiosonde comparison, which has already been adopted by CIMO (by correspondence)* and by the President of the WMO as recommendation 38 (56-CIMO), certain countries have already taken or are about to take steps to reduce the errors in the radiosoundings made at their stations. Among these are France and Belgium. The figures given in the tables for these two countries' sondes therefore no longer apply.

(3) With regard to radiosonde No. 12 (USSR), corrections in radiation have now been made and are allowed for in the tables.

* See annex 3, recommendation 38 (56-CIMO).
ANNEX 8

Annex to recommendation 15 (CIMO-II)

AMENDMENTS TO TECHNICAL REGULATIONS IN THE FIELD OF CIMO

NOTE: When figures are given as regards accuracy of measurements, the specified accuracy should be achieved 95 per cent of the time.

3.4.2 Clouds - Add:

3.4.2.3 Estimates of cloud amount should be accurate to within 1 okta, or better.

3.4.2.4 Measurements of the height of cloud base for synoptic purposes should be accurate to within at least 45 metres if the base is 300 metres or below and to within 15 per cent if the base is above 300 metres.

3.4.4 Atmospheric pressure

Amend 3.4.4.1 to read:

3.4.4.1 At basic land stations and fixed ship stations the atmospheric pressure should be measured to an accuracy of at least 0.5 mb and the pressure tendency (over 3 hours) to at least 1.0 mb.

Amend 3.4.4.2 to read:

3.4.4.2 At mobile ship stations pressure should be measured to an accuracy of at least 2.0 mb.

3.4.5 Air temperature

Delete 3.4.5.1

Renumber 3.4.5.2 as 3.4.5.1 and add at the end of paragraph the following text:

Measurements of air temperatures should have accuracies of the following, or better: Maximum .... 1°C (thermometer should have time lag of about 5 minutes at a ventilation rate of 5 metres per second).

Minimum .... 1°C (thermometer should have a time lag of about 5 minutes at a ventilation rate of 5 metres per second).

Ordinary .... 0.6°C (Thermometer should have a time lag of 1 to 2 minutes at a ventilation rate of 5 metres per second).

3.4.6 Humidity

Amend 3.4.6.1 to read:

3.4.6.1 Humidity measurements should be taken at a height of 1.25 to 2.0 m above ground level.

Amend 3.4.6.2 to read:

3.4.6.2 Measurement of relative humidity should be to within 10 per cent but it is especially important that at high relative humidities measurements be made as accurately as possible.
3.4.7 Wind

Add new clause:

3.4.7.1 Measurements of wind for synoptic purposes should refer to a height of 10 metres in an open situation and should consist of mean values taken over a period of about ten minutes.

Renumber other clauses as necessary.

Add:

3.4.7.3 Measurements of wind speed should be within 5 per cent or 3 knots, whichever is the greater. Measurements of wind direction should be within 20° or better.

3.4.8 Precipitation

Amend 3.4.8.3 to read:

3.4.8.3 Measurement of precipitation should be within 2 per cent of the total or 0.2 mm (0.01 inch), whichever is the greater.

3.4.10 Sea temperature

Amend 3.4.10.1 to read:

3.4.10.1 Measurements of sea temperature should have an accuracy of 0.6°C, or better. The method of measurement shall be entered in the relevant meteorological log.
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<td>Explanatory memorandum (2 add.)</td>
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<td>3</td>
<td>Report of the president of the commission</td>
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<td>4</td>
<td>Report of the Working Group on the measurement of rainfall</td>
<td>2.2</td>
<td>Chairman of the working group</td>
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<td>Report of the Working Group on hygrometry</td>
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<td>Report of the Working Group on barometry</td>
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<td>Report of the Working Group on the measurement of soil moisture</td>
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</tr>
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<td>11</td>
<td>Report of the Working Group on the uses of radar in meteorology</td>
<td>2.2</td>
<td>Chairman of the working group</td>
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<tr>
<td>12</td>
<td>International Geophysical Year</td>
<td>3</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>13</td>
<td>Value of standardization of instruments for surface and upper-air measurements</td>
<td>4.1</td>
<td>President of CIMO</td>
</tr>
<tr>
<td>14</td>
<td>Standardization of meteorological observations</td>
<td>4.2</td>
<td>President of CIMO</td>
</tr>
<tr>
<td>15</td>
<td>Comparison of instruments for the measurement of upper winds</td>
<td>12, 13</td>
<td>Belgium</td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
<td>Agenda Item</td>
<td>Submitted by</td>
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</tr>
<tr>
<td>16</td>
<td>Standardization of meteorological observations</td>
<td>4.2</td>
<td>Israel</td>
</tr>
<tr>
<td>17</td>
<td>Automatic weather stations</td>
<td>4.5</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>18</td>
<td>Continuous recording of cloud base</td>
<td>4.6</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>19</td>
<td>Measurement of precipitation at sea</td>
<td>5.2</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>20</td>
<td>International comparison of barometers</td>
<td>6.2</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>21</td>
<td>Development of visibility instruments (1 add.)</td>
<td>7.3</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>22</td>
<td>Measurement of gusts</td>
<td>8.1</td>
<td>President of CIMO</td>
</tr>
<tr>
<td>23</td>
<td>Results of investigations to find a value of the wind speed which is representative on time when the mean value is based on periods equal to or less than 10 minutes</td>
<td>8.2</td>
<td>President of CIMO</td>
</tr>
<tr>
<td>24</td>
<td>Definition of length of day for meteorological purposes</td>
<td>15</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>25</td>
<td>Measurement of the radioactivity of air and precipitation - Standards for collecting rain water samples (1 add.)</td>
<td>16.1</td>
<td>Secretary-General</td>
</tr>
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<td>Measurement of the radioactivity of air and precipitation - Methods of obtaining snow samples</td>
<td>16.2</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>27</td>
<td>Review of relevant parts of the Technical Regulations adopted by Second Congress</td>
<td>17</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>28</td>
<td>Revision of the Guide to international meteorological instrument and observing practice</td>
<td>18</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>29</td>
<td>Examination of the resolutions and recommendations adopted at the first session of the commission (1 add.)</td>
<td>19</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>30</td>
<td>Definition of length of day for meteorological purposes</td>
<td>15</td>
<td>United Kingdom</td>
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<tr>
<td>No.</td>
<td>Title</td>
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</tr>
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<td>31</td>
<td>Studies made to determine the accuracy of upper-wind measuring equipment</td>
<td>12</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>32</td>
<td>Influence of lag in meteorological instruments</td>
<td>4,2</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>33</td>
<td>Report on the application of radiation corrections to temperature measurements from radiosondes</td>
<td>13</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>34</td>
<td>Thicknesses of the air layers used to calculate mean upper winds</td>
<td>12</td>
<td>President of CAe</td>
</tr>
<tr>
<td>35</td>
<td>Measurement of the refractive index of the atmosphere</td>
<td>22</td>
<td>Secretary-General</td>
</tr>
<tr>
<td>36</td>
<td>Adaptation of a normal radiosonde for the measurement of the radioelectric refractive index of the air</td>
<td>22</td>
<td>France</td>
</tr>
<tr>
<td>37</td>
<td>Use of small orifice raingauges for hydro-meteorological and agrometeorological requirements</td>
<td>4,3, 5,1</td>
<td>Israel</td>
</tr>
<tr>
<td>38</td>
<td>Measurements of the radioactivity of precipitation, surface waters and air-borne dust carried out in Belgium</td>
<td>16.1, 16.2</td>
<td>Belgium</td>
</tr>
<tr>
<td>39</td>
<td>Specification of weather radar</td>
<td>4,4</td>
<td>India</td>
</tr>
<tr>
<td>40</td>
<td>Definition of a period for measuring mean wind speed</td>
<td>8,2</td>
<td>India</td>
</tr>
<tr>
<td>41</td>
<td>Continuous recording of cloud base</td>
<td>4,6</td>
<td>India</td>
</tr>
<tr>
<td>42</td>
<td>Radiosonde comparisons and improvements</td>
<td>13</td>
<td>India</td>
</tr>
<tr>
<td>43</td>
<td>Translating device for intense echoes</td>
<td>4,4</td>
<td>France</td>
</tr>
<tr>
<td>44</td>
<td>Radiation errors of Indian radiosonde</td>
<td>13</td>
<td>India</td>
</tr>
<tr>
<td>45</td>
<td>An analysis of the radiosonde comparisons made at Payerne with 14 sondes, May-June 1956</td>
<td>13</td>
<td>India</td>
</tr>
<tr>
<td>46</td>
<td>Evaporation measurements</td>
<td>14</td>
<td>India</td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
<td>(128,492),(853,958)</td>
<td>Agenda Item</td>
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<td>47</td>
<td>Hydrometeorological measurements</td>
<td>4.3</td>
<td>India</td>
</tr>
<tr>
<td>48</td>
<td>Dispersion of values of pressure and temperature readings of Indian radiosondes</td>
<td>13</td>
<td>India</td>
</tr>
<tr>
<td>49</td>
<td>Measurement of the radioactivity of air and precipitation</td>
<td>16</td>
<td>India</td>
</tr>
<tr>
<td>50</td>
<td>Measurement of atmospheric electricity</td>
<td>23</td>
<td>India</td>
</tr>
<tr>
<td>51</td>
<td>Value of standardization of instruments for surface and upper-air measurements</td>
<td>4.1</td>
<td>Committee A</td>
</tr>
<tr>
<td>52</td>
<td>Measurement of illumination</td>
<td>4.7</td>
<td>Committee B</td>
</tr>
<tr>
<td>53</td>
<td>Measurements of the reduction of atmospheric pressure to sea level observed in San Salvador</td>
<td>6.1</td>
<td>El Salvador</td>
</tr>
<tr>
<td>54</td>
<td>Development of visibility instruments</td>
<td>7.3</td>
<td>Committee B</td>
</tr>
<tr>
<td>55</td>
<td>Visibility</td>
<td>7</td>
<td>Committee B</td>
</tr>
<tr>
<td>56</td>
<td>Measurement of precipitation at sea</td>
<td>5.2</td>
<td>Committee B</td>
</tr>
<tr>
<td>57</td>
<td>Estimation of visibility</td>
<td>7.2</td>
<td>Committee B</td>
</tr>
<tr>
<td>58</td>
<td>Definition of meteorological optical range</td>
<td>7.1</td>
<td>Committee B</td>
</tr>
<tr>
<td>59</td>
<td>Upper-air measurements and radiosonde comparison and improvement</td>
<td>12, 13</td>
<td>Committee M</td>
</tr>
<tr>
<td>60</td>
<td>Definition of period for measuring mean wind speed</td>
<td>8.2</td>
<td>Committee A</td>
</tr>
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<td>61</td>
<td>Measurement of gusts</td>
<td>8.1</td>
<td>Committee A</td>
</tr>
<tr>
<td>62</td>
<td>Continuous recording of cloud base</td>
<td>4.6</td>
<td>Committee A</td>
</tr>
<tr>
<td>63</td>
<td>Upper-air measurements</td>
<td>12</td>
<td>Committee M</td>
</tr>
<tr>
<td>64</td>
<td>Automatic weather stations</td>
<td>4.5</td>
<td>Committee A</td>
</tr>
<tr>
<td>65</td>
<td>Review of relevant parts of Technical Regulations adopted by the Second Congress</td>
<td>17</td>
<td>Committee A</td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
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<td>Submitted by</td>
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<td>Examination of resolutions and recommendations adopted by the first session of CIMO</td>
<td>19</td>
<td>Committee A</td>
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<tr>
<td>67</td>
<td>Revision of the Guide to international meteorological instrument and observing practice</td>
<td>18</td>
<td>Committee A</td>
</tr>
<tr>
<td>68</td>
<td>Standardization of meteorological observations</td>
<td>4,2</td>
<td>Committee A</td>
</tr>
<tr>
<td>69</td>
<td>Influence of wind and exposure on different types of raingauges and shields (1 add.)</td>
<td>5,1</td>
<td>Committee B</td>
</tr>
<tr>
<td>70</td>
<td>Measurement of the refractive index of the atmosphere (1 rev.)</td>
<td>22</td>
<td>Committee M</td>
</tr>
<tr>
<td>71</td>
<td>Dew gauges</td>
<td>9</td>
<td>Committee B</td>
</tr>
<tr>
<td>72</td>
<td>Definition of the length of day for meteorological purposes</td>
<td>15</td>
<td>Committee B</td>
</tr>
<tr>
<td>73</td>
<td>Radiosonde comparison and improvement</td>
<td>13</td>
<td>Committee M</td>
</tr>
<tr>
<td>74</td>
<td>Corrections of barometric errors</td>
<td>6,3</td>
<td>Committee B</td>
</tr>
<tr>
<td>75</td>
<td>Local lightning flash counters</td>
<td>24</td>
<td>Committee B</td>
</tr>
<tr>
<td>76</td>
<td>International comparison of barometers</td>
<td>6,2</td>
<td>Committee B</td>
</tr>
<tr>
<td>77</td>
<td>Reduction of pressure</td>
<td>6,1</td>
<td>Committee B</td>
</tr>
<tr>
<td>78</td>
<td>Atmospheric electricity</td>
<td>23</td>
<td>Committee M</td>
</tr>
<tr>
<td>79</td>
<td>Establishment of working groups</td>
<td>21</td>
<td>Committee M</td>
</tr>
<tr>
<td>80</td>
<td>Measurement of snow density</td>
<td>4,3, 5,3</td>
<td>Committee B</td>
</tr>
<tr>
<td>81</td>
<td>Standards for collecting rain-water samples and methods for obtaining snow samples</td>
<td>16,1, 16,2</td>
<td>Committee B</td>
</tr>
<tr>
<td>82</td>
<td>Specifications for weather radar</td>
<td>4,4</td>
<td>Committee B</td>
</tr>
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<td>83</td>
<td>Measurement of air humidity</td>
<td>10,1</td>
<td>Committee B</td>
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<tr>
<td>No.</td>
<td>Title</td>
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</tr>
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<td>84</td>
<td>Measurement of soil moisture and evaporation measurements</td>
<td>10, 2, 14</td>
<td>Committee B</td>
</tr>
<tr>
<td>85</td>
<td>Measurement of radiation</td>
<td>11</td>
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