

WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION

**INTERNATIONAL ORGANIZING COMMITTEE (IOC) FOR
UPPER-AIR INSTRUMENTS INTERCOMPARISONS**
Fifth Session

Payerne, Switzerland

29-31 March 2011

FINAL REPORT



CONTENTS

	<u>Pages</u>
Agenda	ii
Executive summary	iii
General summary of the work of the meeting	p.1- p.5
Annexes:	
List of participants	ANNEX I, p.1 - p.5
Data Policy	ANNEX II p.1

AGENDA

1. ORGANIZATION OF THE SESSION

- 1.1 Opening of the Session
- 1.2 Adoption of the Agenda
- 1.3 Working Arrangements for the Session

2. REPORT OF THE CHAIRPERSON

3. 8TH WMO INTERCOMPARISON OF HIGH QUALITY RADIOSONDE SYSTEMS

- 3.1 Presentation of the Final Report
- 3.2 Review and Approval of the Final Report
- 3.3 Data Policy
- 3.4 Publication of the Final Report

4. RECOMMENDATIONS FOR FUTURE INTERCOMPARISONS

5. OTHER BUSINESS

6. DRAFT REPORT OF THE SESSION

7. CLOSURE OF THE SESSION

EXECUTIVE SUMMARY

This report provides a summary of the fifth session of the International Organizing Committee for Upper Air Instruments Intercomparisons (IOC).

The IOC reviewed the Draft Final Report of the 8th WMO Intercomparison of High Quality Radiosonde Systems held in Yangjiang, China, in July 2010. The methods used for the analysis were reviewed in details as well as the method and standards used for ranking the performances of the individual systems. The meeting agreed with the used methodology and results of the intercomparison. The Final Report provides factual information on the performance of the systems tested as well as a number of recommendations directed at Members providing advice on standard operations as well as for climate purposes, recommendations to manufacturers and recommendations for future similar activities. It is expected that the intercomparison results will significantly contribute to the overall performance of upper-air observing systems and lead to further improvements in radiosonde performances.

The IOC also reviewed the need for follow-up regional intercomparisons and made recommendations regarding the organization of future intercomparisons.

GENERAL SUMMARY

1. ORGANIZATION OF THE SESSION

1.1 Opening of the Session

1.1.1 The fifth session of the International Organizing Committee for Upper-Air Instruments Intercomparisons (IOC) was held in Payerne, Switzerland, 29-31 March 2011. Mr Tim Oakley, Chairperson of the IOC opened the session. The list of participants is given in Annex I.

1.1.2 Prof. Bertrand Calpini, President of CIMO, welcomed all the participants to the MeteoSwiss Aerological Station of Payerne. He stressed the remarkable work done by the project team in conducting the 8th WMO Intercomparison of High Quality Radiosonde Systems and preparing the draft final report. He recalled the role of CIMO to lead such intercomparisons and the high impact the results of such intercomparisons have on Members for the planning and renewal of their observing networks. A number of Members are waiting for the publication of the CIMO intercomparison reports to decide which instruments they will purchase for their networks and obtain from these reports information they would not be able to get alone.

1.1.3 Dr Wenjian Zhang, Director of the WMO Observing and Information Systems Department, welcomed the participants on behalf of WMO and thanked the host for their generous hospitality. He noted that this activity is one of the very important activities of CIMO as well as one of the largest one. He thanked the China Meteorological Administration (CMA) for having hosted the intercomparison in Yangjiang and all the manufacturers for having participated in and supported the intercomparison. He recalled that radiosondes are still the backbone of numerical weather predictions and that the contribution made by the manufacturers in developing high quality systems and the outcomes of this intercomparison were providing a very important contribution to the whole world, including for climate matters.

1.1.4 Mr Tim Oakley also welcomed the participants and wished everyone a fruitful and productive meeting.

1.2 Adoption of the Agenda

The IOC adopted the Agenda for the meeting, which is reproduced at the beginning of this report.

1.3 Working Arrangements for the Session

The working hours and tentative timetable for the meeting were agreed upon.

2. REPORT OF THE CHAIRPERSON

2.1 Mr Tim Oakley, the chairperson of the IOC, recalled that the planning of the intercomparison had started three years ago. At that time, the IOC would never have expected the intercomparison to have such an extent, including 11 operational systems as well as scientific sounding instruments.

2.2 He noted that the magnitude of the intercomparison had had significant implications on the analysis of the data and on the time needed to carry out the analysis. He expressed his gratitude to Dr John Nash, the radiosonde test expert, who took over most of the analysis work and drafting of the final report. He stressed that the amount of work needed to evaluate the data could almost not be done by an expert beside his normal work in a metservice.

2.3 A draft version of the final report of the intercomparison had been distributed to all participating manufacturers with a request to provide questions and comments prior to the meeting. Most of these comments were already taken into account and incorporated in the report at the beginning of the meeting, while some other would need to be addressed during the meeting.

2.4 As a result of the distribution of the draft final report, several manufacturers provided examples of errors in metadata and/or algorithms that they used during the intercomparison. In view of the time and resources that would be needed to reprocess the data and to produce new plots, the IOC decided not to reprocess the corrected data but to allow for statements of clarification alongside the relevant results in the final report. The meeting would have to agree on the exact wording of these statements. Reprocessing of the data would also significantly delay the publication of the final report.

2.5 Mr Oakley mentioned the major achievements of the intercomparison campaign. He recalled that the site had been selected to provide a challenging environment for testing the participating instruments, which was particularly the case for humidity measurements. He noted the significant contribution from the China Meteorological Administration (CMA) for the logistics, the preparation of the launches and providing remote-sensing instruments. He stressed that it was exceptional that none of the 72 launches carried out during the intercomparison failed

2.6 He recalled the main objectives of the intercomparison that were to advise Members on the performance of operational systems and to advise GCOS on the suitability of instruments for use within GRUAN.

3. 8TH WMO INTERCOMPARISON OF HIGH QUALITY RADIOSONDE SYSTEMS

3.1 Presentation of the Final Report

3.1.1 Dr Nash presented the analysis of the Quality Radiosonde Systems, including a detailed description of the method used to link the results of the two groups that were flown separately. The proposed method was accepted by the meeting.

3.1.2 He emphasized that the availability of the remote-sensing instruments had enabled him to make informed decisions on the conditions in which the flights took place and had been of significant help for the understanding of the measurements and the data analysis. In addition, having data from the LMS multithermistor sonde for every night flight would have brought a lot of additional information on the cloud structure, which could not always be properly assessed from the cloud radar measurements.

3.1.3 The detailed analysis of the data showed that most manufacturers were applying some corrections to the raw data, consisting, for example, in treating time constant effects. As the project team had no information on which kind of corrections were applied, this significantly complicated the data analysis. The meeting recommended that manufacturers should provide both the raw and the processed data to the users and inform them on the type of corrections applied, so that they could decide on the data set best suitable to meet their needs. The meeting agreed that examples of the effects of the applied corrections be included in the report. The manufacturers were also requested and agreed to provide information on the corrections they were applying to their data for inclusion in the final report of the intercomparison.

3.1.4 WMO Members who are using the outcome of the intercomparison for the selection of radiosondes for their observing networks have to be able to identify which radiosondes can meet their requirements, that they be for standard operation, for climate monitoring use, or even for use with GRUAN. In order to enable them to make best benefit from the results, the meeting agreed that the participating QRS needed to be rated in the final report. That rating should be transparent and done against a standard that ensures radiosondes can meet user requirements.

3.1.5 Dr Holger Vömel, the data processing expert for the scientific sounding instruments (SSI) recalled the general aims and principles of GRUAN. He presented the analysis of the SSI payload. The meeting made a number of recommendations to clarify the analysis presented and to ensure proper linkage to the QRS part of the report.

3.1.6 The meeting noted that the intercomparison report included a recommendation on the water vapor pressure equations to be used at temperatures below -50°C . It recommended that WMO undertake follow-up activities to ensure that all WMO documents (in particular the CIMO Guide and the WMO Technical Regulations) recommend the same formula. It was emphasized that consensus on the formula to be used was needed and that sufficient lead time was needed for Members to adapt their national practices.

3.2 Review and Approval of the Final Report

3.2.1 The meeting reviewed the final report, the proposed standards used for the rating of the instrument and the final rating of the participating systems. A number of suggestions were made and incorporated in the report in particular to account for the problem that appeared during the analysis and that were sometimes specific to the observations carried out during the campaign, like the influence of wrong metadata.

3.2.2 Carrying out an intercomparison of this magnitude implies significant efforts, costs and resources, both financially as well as in terms of man-power that is not well-known by Members. These significant contributions were provided by the host country, the manufacturers, the experts of the project team as well as WMO. The meeting felt that it would be beneficial to provide an overview of the needed investments to carry out such an intercomparison to Members, so that the contributions of all are recognized at their proper value, as well as the high interest and commitment of all groups involved in the intercomparison. Therefore, the meeting decided to compile a table of the costs that were related to this intercomparison and recommended to include it in the final report of the intercomparison.

3.2.3 The meeting agreed that the final report of the intercomparison showed unprecedented performances of the tested systems and was of very high value for Members in selecting systems for their applications, as well as for manufacturers to further improve their products. As for past intercomparisons, it is expected that it will lead to further improvements in radiosonde performances/developments in the coming years.

3.2.4 The meeting commended the project team for the efforts made to carry out the intercomparison, the analysis and the excellent report.

3.3 Data Policy

3.3.1 The meeting reviewed the data policy of the intercomparison and recognized that the data set would have the potential for further scientific studies. As the CIMO structure has changed and there is now only one CIMO expert team addressing both surface and upper-air instrument intercomparisons, it was felt that some small adjustments and clarifications had to be made to the data policy and agreed on the version provided in Annex II.

3.3.2 Discussions held during the meeting showed that there were different interpretations of the data policy. For the analysis, some adjustments had to be made to the processed data that had been provided by the manufacturers to account for small time differences, flagging of invalid data, etc... The value of the dataset clearly relies on keeping this information together. In view of the fact that providing full access to the processed data, including all the adjustments, would require a significant amount of work, the IOC agreed on the following:

- The data manager will provide an encrypted version of the dataset to the WMO Secretariat and participating manufacturers that include a viewing mechanism of the data and would allow reproducing most of the results of the analysis, but that would not allow extracting the

data. This dataset will consist of the data that were used for the final analysis and would be sufficient for most applications.

- In view of the time and resources needed to provide an ascii version of this dataset, including a proper description of the data, the IOC recommended that the WMO Secretariat request a quotation from the data manager to carry out this work and consider financing it, if possible.

3.3.3 The remote-sensing data were also considered as being part of the dataset. Their use by anyone will require proper quotation of the copyright statement provided by CMA "The remote-sensing campaign carried out during the 8th WMO Intercomparison of High Quality Radiosonde Systems held in Yangjiang, China, in July 2010, and associated data set was organized by the China Meteorological Administration(CMA) as well as the campaign financial support."

3.3.4 Upon request to the WMO Secretariat, other parties would be allowed access to the encrypted dataset, or possibly to the ascii version if available, provided they submit a request to the WMO Secretariat stating their plans for use of the dataset. The meeting requested that the WMO Secretariat keeps a list of the individuals to which the dataset was provided and inform them on the data policy.

3.3.5 Discussions during the meeting showed that there were different interpretations of the data policy. Therefore the meeting felt that it would be beneficial if CIMO had a generic data policy for all CIMO intercomparisons and recommended that the CIMO Management Group addresses this issue at its next meeting.

3.4 Publication of the Final Report

3.4.1 The comments presented by IOC members, project team members and participating manufacturers were discussed and incorporated in the Final Report.

3.4.2 The IOC and manufacturers agreed on the text of the Final Report that was shared among the participants of the meeting at the end of the session. It was agreed that additional clarifications on the analysis could be incorporated in the final report by the project leader and radiosonde test expert and that additional editorial modifications could be done as long as they did not change the results. The meeting agreed that an annex showing limitations encountered by specific systems should be included in the Final Report.

3.4.3 The meeting agreed that the project team finalize the report as discussed during the meeting. It would then be provided to the participating manufacturers and IOC members for a final check by end of April 2011.

3.4.4 The Final Report will be published by WMO as an IOM Report, and it will be distributed to WMO Members and participating manufacturers. It is expected that the report will be available in electronic form on the WMO website (<http://www.wmo.int/pages/prog/www/IMOP/publications-IOM-series.html>) by the beginning of the Sixteenth WMO Congress.

4. RECOMMENDATIONS FOR FUTURE INTERCOMPARISONS

4.1 The meeting recognized that a mechanism was needed within CIMO to test new designs of radiosondes before they are put into operation between two CIMO global radiosonde intercomparisons. That could be done through recognized CIMO Lead Centres and/or a procedure would need to be developed providing guidance on how to test the systems, including aspects such as number of needed flights, requirements for the publication of the test results, etc. The meeting recommended that the CIMO Management Group address this topic at its next meeting.

4.2 The meeting also recommended that during future intercomparisons, the project team verifies the metadata of the manufacturers, such as launch and antenna coordinates prior to the

start of the launches. This would help reducing the need for reprocessing of data at a later stage of the analysis.

4.3 Manufacturers from Russian Federation and India had expressed the desire to participate in the Yangjiang intercomparison. It had not been possible to accommodate their participation, among other because of interferences with some of the participating systems. The meeting therefore recommended that these systems be tested in national or regional intercomparisons.

4.4 The use of observations from remote-sensing instrument proved to be very valuable for the analysis of the intercomparison data. However, more valuable information could also be gained on the performance of these systems and their relative performance against the radiosondes if suitable experts could take a more active role in the planning, running and evaluation of the remote-sensing component of the intercomparison. The meeting therefore recommended that CIMO considers putting a stronger emphasis on the combined intercomparison with other remote-sensing instruments in future intercomparisons. Manufacturers expressed the wish that CIMO develop guidance material on what could be achieved from the various remote-sensing systems and on how they could be used to test radiosondes.

4.5 The next global intercomparison should also be organized at a place where the environmental conditions are challenging for the participating instruments to enable proper testing of their performances. Furthermore, the site could also be chosen at a place where a number of remote-sensing instruments are readily available so that they would not need to be transported to the intercomparison site, thus simplifying the organization, but also ensuring that the remote-sensing systems are properly installed and working prior to the test.

4.6 The meeting also decided to compile a list of lessons learned from the organization of this intercomparison from the view of the manufacturers. At the time of finalization of the report the collection of this information was still going on.

5. OTHER BUSINESS

The meeting thanked MeteoSwiss for the great hospitality and facilities provided for the meeting.

6. DRAFT REPORT OF THE SESSION

The meeting decided to adopt the final report of the session by correspondence.

7. CLOSURE OF THE SESSION

The session was closed on 31 March 2011 at 17h50.

List of participants

<p>Mr Tim OAKLEY <i>IOC Chair</i> <i>Project Leader</i></p>	<p>Met Office FitzRoy Road EXETER Devon EX1 3PB United Kingdom</p> <p>Tel.: +44 1392 88 55 11 Fax: +44 1392 88 56 81 tim.oakley@metoffice.gov.uk</p>
<p>Dr John NASH <i>Radiosonde Test Expert</i></p>	<p>20 St Mary's Park OTTERY ST MARY EX11 1JA United Kingdom</p> <p>Tel.: +44 1404 811 092 john.nash.114@gmail.com</p>
<p>Dr Holger VOEMEL <i>IOC Member</i> <i>Data Processing Expert for</i> <i>Scientific Sounding Instruments</i></p>	<p>DWD-MOL Am Observatorium 12 15848 LINDENBERG Germany</p> <p>Tel.: +49 33677 60244 Fax: +49 33677 60280 holger.voemel@dwd.de</p>
<p>Mr LI Wei <i>IOC Member</i> <i>China Focal Point</i></p>	<p>China Meteorological Administration Meteorological Observation Center No. 46 Zhongguancun, Nandajie BEIJING 100081 China</p> <p>Tel.: +86 10 6840 0918 Fax: +86 10 6840 0936 LW1024@263.net</p>
<p>Mr Sergey KURNOSENKO <i>Data Manager</i></p>	<p>Sergey Kurnosenko Scientific Software Consultant WASHINGTON DC United States of America</p> <p>Tel.: +1 703 591 1696 skurnosenko@cox.net skurnosenko@gmail.com</p>

<p>Mr Carl BOWER <i>IOC Member</i></p>	<p>National Weather Service (NOAA/NWS) Observing Systems Branch 1325 East, West Highway # 4358 SILVER SPRING, MD 20910 United States of America</p> <p>Tel.: +1 301 713 2093, Ext. 115 carl.bower@noaa.gov</p>
<p>Prof. Bertrand CALPINI <i>President of CIMO</i></p>	<p>MeteoSwiss Head, Aerological Station Payerne Chemin de l'Aérologie CH-1530 PAYERNE Switzerland</p> <p>tel.: +41 26 662 62 28 fax: +41 26 662 62 12 bertrand.calpini@meteoswiss.ch</p>
<p>Dr Emanuele VUERICH <i>Chair, CIMO Expert Team on Instruments Intercomparisons</i></p>	<p>Italian Meteorological Service Centre of Meteorological Experimentations Via Braccianese Claudia, km 20,100 00062 Vigna di Valle (ROME) Italy</p> <p>Tel.: +39 06 9980 1013 Fax: +39 06 99 87 297 vuerich@meteoam.it</p>
<p style="text-align: center;">REPRESENTATIVES FROM THE MANUFACTURERS</p>	
<p>CHANGFENG Mr PENG Wenwu Mr HUANG Xiaojie</p>	<p>Beijing Changfeng Surface Acoustic Wave Co. P.O.BOX 142-85 No.50, Yongding Road Haidian District BEIJING 100854 China</p> <p>Tel: +86 10 683 853 33 Fax: +86 10 683 880 19 cfsaw@263.net, laughduck@163.com</p>
<p>DAQIAO Mr YANG Lerong</p>	<p>Nanjing Daqiao Machine Co. Ltd NO.61, Shuanglong Road Zhonghuamenwai NANJING 211101 China</p> <p>Tel.: +86 25 5210 6188, /5241 4817 Fax: +86 25 5210 2048 njdaqiao@public1.ptt.js.cn</p>

GRAW Mr Florian SCHMIDMER	GRAW Radiosondes GmbH & Co. KG Muggenhofer Str. 95 90429 NUERNBERG Germany Tel.: +49 911 320 1100 Fax: +49 911 320 1150 fschmidmer@graw.de
HUAYUN Mr YANG Jiachun	China National Huayun Technology Development Corporation No.46, South Street, Zhongguancun, Beijing 100081 China Tel.: +86 150 1146 8215 yangjiachun@cnhyc.com
INTERMET Mr Christo LE ROUX	INTERMET AFRICA 33 Estmil Road Diep River Cape Town South Africa 7800 Tel.: +27 21 715 1120 Fax: +27 21 715 1123 E-mail: christo@diel.co.za
JINYANG Mr Tae-Gyu AHN Mr Eon-Soo SHIN	Jinyang Industrial Co. Ltd Korea Overseas Department 896-4, Bangcho-Ri iLJuk-Myeon, Ansong-City Gyeonggi-Do Republic of Korea <i>Mr Ahn:</i> Tel.: +82-31-691-7740 (ex 134) Fax; +82-31-691-7751 E-mail: taekyu@jinyangimd.com <i>Mr Shin:</i> Tel.: +82-31-671-7740 (Ext. 251) Fax: +82-31-671-7751 esshin10@naver.com sales@jinyangind.com http://www.jinyangind.com
LOCKEED MARTIN SIPPICAN Mr Tom CURRAN	Lockheed Martin Sippican, Inc. 7 Barnabas Road MARION, Massachusetts 02738 United States of America Tel.: +1 610 354 7681 Fax: +1 610 354 3508 thomas.curran@lmco.com

MEISEI Mr Kensaku SHIMIZUK	MEISEI ELECTRIC CO., LTD 2-5-7 Koishikawa Bunkyo-ku TOKYO 112-8511 Japan Tel.: +81 3 3814 5129 Fax: +81 3 3815 0761 E-mail: shimizuk@meisei.co.jp
METEOLABOR Mr Rolf MAAG	METEOLABOR AG Hofstrasse 92 CH-8620 WETZIKON Switzerland Tel.: +41 44 934 4040 Fax: +41 44 934 4099 rolf.maag@meteolabor.ch
MODEM Mr Rémy PEPIN	MODEM Rue de Bessonville 77760 URY France Tel.: +33 1 6074 7460 Fax: +33 1 6074 7419 rpepin@meteomodem.com
VAISALA Mr Hannu JAUHAINEN	VAISALA OYJ P.O. Box 26 FIN-00421 HELSINKI Finland Tel.: +358 40 770 8979 hannu.jauhainen@vaisala.com
Mr Bruce SUMNER <i>HMEI Executive Summary</i>	c/- WMO 7bis Avenue de la Paix Case Postale 2300 CH 1211 Geneva 2 Switzerland Tel.: +41 22 730 8334 Fax: +41 22 730 8340 hmei@wmo.int

OBSERVER	
KOMOLINE Mr Sanjay ATTARA	Mr Sanjay Attara, Director KOMOLINE ELECTRONICS PVT. LTD 110, Om Towers Satellite Road AHMEDABAD Gujarat 380015 India Tel.: +91 79 2 675 3712 Fax: +97 79 2 674 6324 attara@hotmail.com info@komoline.com
METEOSWISS Aerological Station CH-1530 PAYERNE Switzerland	
Mr Gilbert LEVRAT	gilbert.levrat@meteoswiss.ch
Mr Gonzague ROMANENS	gonzague.romanens@meteoswiss.ch
Dr Rolf PHILIPONA	rolf.philipona@meteoswiss.ch
WMO SECRETARIAT 7 bis, avenue de la Paix Case postale 2300 CH 1211 Geneva 2 Switzerland	Tel. WMO: +(41 22) 730 8111 Fax WMO: +(41 22) 730 8181 Fax IMOP: +(41 22) 730 8021 E-mail WMO: wmo@wmo.int
Dr Wenjian ZHANG	Director, WMO Observations and Information Systems Department (OBS) WZhang@wmo.int
Dr Miroslav ONDRAS	Chief, WMO Observation Systems Division (OBS/OSD) MOndras@wmo.int
Dr Isabelle RUEDI	Head, WMO Instruments and Methods of Observation Unit (OBS/OSD/IMO) IRuedi@wmo.int
http://www.wmo.int/pages/prog/www/IMOP/IMOP-home.html	

Data Policy

The following are the guidance principles for data policy of the intercomparison agreed by the IOC:

- The complete intercomparison dataset (1-s processed radiosonde plus Remote Sensing files/images) is kept by the WMO Secretariat, the IOC Chair, the Project Leader and Site Manager. WMO may, if requested, export whole or part of the comparison dataset on the CIMO/IMOP website, or other website controlled by the IOC members, as soon as the Final Report is published.
- After the Intercomparison, every participant could get a copy of the comparison dataset. Raw data obtained during the tests would not be circulated to other participants.
- The WMO authorizes the Project Leader (in collaboration with local Focal Point and data-processing experts), with the agreement of the ET/IOC Chair (following an IOC members consensus), to publish full results in a Final Report of the intercomparison on behalf of the ET/IOC.
- The ET/IOC members may publish their partial scientific results if demanded by the scientific community before the end of the intercomparison, provided the publication was authorized by the Project Leader and that the participating instruments remain anonymous in that publication.
- Prior to the publication of the full results, the comparison dataset may be provided to other parties for the purpose of scientific studies on the subject. This requires the approval of the ET/IOC Chair.
- The QRS participants are only allowed to publish data from their own instrument. In doing so, they will avoid qualitative assessment of their instruments in comparison with other participating instruments.
- Third parties may publish their own studies after the publication of the final report with the agreement of the data providers.