W O R L D M E T E O R O L O G I C A L O R G A N I Z A T I O N

COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION

OPAG ON UPPER-AIR OBSERVATION TECHNOLOGY

JOINT

CIMO EXPERT TEAM ON
UPPER-AIR SYSTEMS INTERCOMPARISONS (ET-UASI)
Fourth Session

and

INTERNATIONAL ORGANIZING COMMITTEE (IOC) ON
UPPER-AIR SYSTEMS INTERCOMPARISONS
Fourth Session

Yangjiang, China
31 August – 4 September 2009

FINAL REPORT

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AGENDA

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EXECUTIVE SUMMARY

This report provides a summary of the joint fourth session of the Expert Team on Upper-Air Systems Intercomparisons (ET) and International Organizing Committee on Upper-Air Systems Intercomparisons (IOC) that was held at the Yangjiang Meteorological Bureau, Yangjiang, China, 31 August – 4 September 2009.

The main goals of the meeting were to evaluate and review the proposed local arrangements for holding the 8th WMO Intercomparison of Radiosonde Systems and continue the planning for the WMO 8th Intercomparison of Radiosonde Systems. The local facilities and capabilities of the local staff were found to be fully suitable for hosting the Intercomparison. The local arrangements for participants in the intercomparison were also reviewed as well as the need for support to the local staff. The meeting could consequently agree on the place and duration of the intercomparison: it will be held in Yangjiang, China, from 12 to 31 July 2010.

The import and export procedures for consumable and non-consumable equipment that would be needed for the intercomparison were reviewed. As all radio-transmitting instruments need prior approval before being shipped to China, advanced notification of the planned shipments would be needed 4 months prior to the start of the intercomparison to ensure that all authorization can be obtained in due time.

The tentative list of participants was reviewed and a tentative planning for the intercomparison was developed taking into account the plans of manufacturers to participate in it. A draft grouping of the radiosondes was proposed as well as a preliminary launch schedule for which CMA needs to obtain approval from the China Air Traffic Control authority.

The meeting also addressed the issue of additional remote-sensing instruments to support the intercomparison that would need to be addressed in more details in the coming months.

GENERAL SUMMARY

1. ORGANIZATION OF THE SESSION

1.1 Opening of the session

1.1.1 The joint fourth session of the CIMO/OPAG-UPPER-AIR Expert Team on Upper-Air Systems Intercomparisons (ET) and the International Organizing Committee on Upper-Air Systems Intercomparisons (IOC) was held at the Yangjiang Meteorological Bureau, Yangjiang, China, 31 August – 4 September 2009.

1.1.2 Following one day of visit and evaluation of the proposed intercomparison site (Yangjiang Sounding Station), the meeting was officially opened on 1st September 2009 by Mr ZHOU Heng, Director General of the Department of International Cooperation of China Meteorological Administration (CMA), who welcomed the participants to the meeting in China. The list of participants is given in Annex I.

1.1.3 Dr John Nash, President of CIMO, welcomed the participants. He emphasized that the preparation of the intercomparison required a lot of work from the host country. He noted that the ET/IOC was looking forward to collaborate with the host in preparing and carrying out this intercomparison, so that it would yield mutual benefit to the host and WMO Members, leading to achievements that individual countries cannot do alone.

1.1.4 Mrs Isabelle Rüedi welcomed the participants in the name of WMO and expressed thanks to China for its offer to host the next WMO High-quality Radiosonde Intercomparison.

1.1.5 Mr Tim Oakley, Chairperson of the ET and IOC, opened the session.

1.2 Adoption of the agenda

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

1.3 Working arrangements for the session

The ET/IOC agreed on working hours and tentative timetable for the session.

2. REPORT OF THE CHAIRPERSON

2.1 The ET/IOC Chairperson summarized the status of preparation of the intercomparison. Seven manufacturers had just confirmed their willingness to participate in the intercomparison. Up to 10 different manufacturers might be interested in taking part, which would lead to a much larger intercomparison than the previous intercomparison that was held in Mauritus in 2005.

2.2 He welcomed the fact that the GCOS community had expressed a strong interest to participate in this intercomparison and was represented in this meeting. This would widen the scope of the intercomparison, focussing not only on operations, but addressing also research and would help improving the communication and collaboration between these two communities.

3. SITE INSPECTION AND LOGISTICAL ARRANGEMENTS FOR INSTRUMENTATION INSTALLATION AND OPERATIONS

3.1 Mr LI Wei, the CMA focal point for the organization of the intercomparison, made a presentation on the status of the local preparation for the 2010 Upper-Air System Intercomparison.

Site selection

3.2 Mr LI Wei presented the detailed evaluation of three possible sites (Yangjiang, Haikou and Beihai, all located in south-eastern China) for the intercomparison, including among others the main climatic conditions of each station, the intercomparison sites, airspace conditions, electromagnetic environment, hydrogen supply, living and transportation conditions and available

operational staff. Originally, the site of Guilin had been considered. However, it was not further envisaged in view of the extensive air traffic prevailing there that is related to its tourist attractions.

3.3 Mr LI Wei informed that any requirements raised by the meeting, beyond those that could be accommodated under the normal operation time of the station, needed to be approved by China air traffic control.

3.4 The meeting visited the proposed intercomparison site of the Yangjiang sounding station and agreed that the facilities were meeting the intercomparison needs. The ET/IOC appreciated the thorough investigation carried out by CMA in view of identifying the best site for the intercomparison and agreed with CMA's proposal that Yangjiang was the most appropriate site. The ET/IOC therefore decided that the intercomparison would be held in Yangjiang. The description of the site is available in Annex II.

3.5 Sufficient space is available for the installation of remote-sensing equipment on the test site.

3.6 Operational CMA L-band radiosondes are flown twice daily from the station at Yangjiang but are not available on the GTS. Monitoring results (ECMWF OB-FG Statistics) were presented to the meeting showing the performance of the Chinese network. While most sites provide acceptable quality data there were still a number of locations with lower performance. The ET/IOC was concerned that without access to the measurements from Yangjiang it would not be able to access the performance quality of its operational data prior to the experiment. CMA was asked to consider whether the TEMP data could be made available on the GTS for a temporary period of at least 6 months. If not, the ET/IOC requested that historical data, preferably 2 second ascii files covering the period from July to Sept. 2009 (but if not possible TEMP ABCD) should be made available to the project leader

Intercomparison dates

3.7 Two time windows were identified as meeting the requirements of the intercomparison. In view of the availability of CMA staff and of the tentative plan to hold the next session of CIMO in late September 2010, the meeting decided that the intercomparison would be held from 12 to 31 July 2010.

Site logistics

3.8 In view of the large number of manufacturers that were expected to take part in the intercomparison, the meeting agreed that both the facility of the original and current duty rooms would be needed to accommodate all ground receiving equipments. The meeting agreed that each of the rooms would be equipped with a desk, chairs, air-conditioning, power and internet access. If necessary, the storage room would also be transformed into an office. The Project Leader will inform the host of the exact needs following the final confirmation of the manufacturers' participation.

3.9 Given the large number of participants involved in night launches, the ET/IOC requested that the host install additional outside lights to sufficiently illuminate the outside working areas.

3.10 The local organizers informed that a fridge would be available to store some food and beverages that the participants would bring.

3.11 To avoid contamination of the computers by viruses, it was recommended that the host provides a computer that would be used solely for virus check prior to providing the flight data to the data manager.

3.12 In case participants have special requirements for fixing their antennas, they should provide this information to Mr LI Wei.

3.13 CMA agreed to cover the expenses related to the site logistics and adaptations recommended above as well as for the support staff in charge of the balloon flights (see Section 5 below).

3.14

4. LOCAL ARRANGEMENTS FOR PARTICIPANTS IN THE INTERCOMPARISON

4.1 The meeting reviewed the plans for the local arrangements for the participants in the intercomparison and agreed that arrangements similar to those made for its present meeting would be appropriate. It was expected that the price of the accommodation would be similar to that prevailing at the time of the meeting.

4.2 The town of Yangjiang offers suitable hotels. The participants should be given a choice of hotels, including hotels of different categories (3-5 stars) and different location (city centre and outskirts).

4.3 The meeting recommended to the participants to stay in the Yangjiang Country Garden Phoenix Hotel as it would simplify transportation to the intercomparison site and also as it appeared to be the most appropriate.

4.4 The ET/IOC recommended that a shuttle bus be organized between the Yangjiang Country Garden Phoenix Hotel and the intercomparison site a few times a day/night as well as a shuttle between Yangjiang and Guangzhou at the beginning and end of the intercomparison. The ET/IOC requested CMA to provide a costed proposal to the WMO Secretariat for these services.

4.5 The local organizers informed the meeting that it was not recommended to hire cars, but that taxis were also available at reasonable prices. Regular shuttle buses run from Yangjiang to Hong Kong airport and to Hong Kong city centre and need approximately 5-6 hours for the journey.

4.6 The ET/IOC recommended that CMA nominate a contact person for the local arrangements and welcomed the offer of Mr YU Jun to serve as this contact person.

5. ASSESSMENT OF NEED FOR SUPPORT TO LOCAL STAFF

5.1 The meeting visited the proposed test site and attended a radiosonde launch. The meeting agreed that the local staff was fully capable of carrying out the radiosonde launches and did not need additional training. The project team would provide dedicated support/training to the local staff during the first days of the intercomparison for the specificities of the test rig launches.

5.2 The meeting was informed about the arrangements that had been made in previous intercomparison for the flight preparation and evaluation. In the past, an average of 5 support staff from the host country had been needed to provide assistance to the balloon launch. The flight rigs had been made of bamboo, but could principally be made of any other appropriate light-weight slightly flexible material.

5.3 The ET/IOC proposed that CMA take the responsibility of the flight preparation and launching. It was agreed that Mr LI Wei would develop a proposal on how to hang the radiosondes according to the payload proposal and send it to the Project Leader for approval. Mr LI Wei would also develop a checklist for the flight preparation and launching procedure that he would send to the Project Leader for approval too. CMA will select 4 shift leaders from among its staff that will be in charge of the launches.

6. ANY OTHER BUSINESS

Import-Export Procedure

6.1 Mr ZHANG Wei presented CMA's proposal for the import-export procedure of equipment as depicted in Annex III. It should be noted that all equipment needed to be dispatched to China 40 days before the intercomparison start to allow for the custom clearance time. As all radio-transmitting equipment required a pre-approval from the authority before they can be shipped into China, a notification on the equipment that will be imported is needed 4 months in advance in order to verify the need for and apply for radiofrequency certificates. Mr ZHANG Wei will provide a template for this notification that will be posted on the WMO website. Furthermore, the shipping/insurance costs provided in Annex III are estimates and the exact costs would be calculated upon precise description of the shipment.

6.2 The ET/IOC requested the Secretariat and Mr ZHANG Wei to investigate the possibility of declaring consumable equipment as being a donation from WMO, which would be exempted from import tax.

6.3 The ET/IOC strongly recommended that the participants used the proposed agent to ensure that all equipment be delivered on time at the site and advised them to contact Mr ZHANG Wei as soon as possible to discuss the procedure to be followed. However, manufacturers are free to choose other shipping agencies at their own risk.

GRUAN

6.4 Mr Holger Vömel made a presentation on GRUAN and stressed that GRUAN measurements needed to have an estimate of the measurement uncertainty associated to each observation point. His role in the intercomparison is to investigate the characteristics of sounding instrumentation that could be used as reference for GRUAN. He would therefore carry out a more detailed data analysis than that needed for operational soundings in view of proposing possible improvements for reference sounding instruments. It was recognized that the analysis of such data sets would need more time than the analysis of the operational soundings. It is therefore expected that the statistics and basic results of the GRUAN measurements will be published in the final report of the intercomparison. However, it is expected that the final results of the research sounding equipment will need more time to be completed and published in scientific journals.

Project Team

6.5 The ET/IOC welcomed the interest of China to participate in the work of the data evaluation team and noted that Mr LI Wei was the CMA representative in the IOC that was in charge of agreeing on the results of the intercomparison. The ET/IOC agreed to involve Mr LI Wei in the analysis of the data and nominated him as a member of the Project Team. CMA was requested to inform the ET/IOC on any restriction that may come from the Government of China on the use of the data sampled during the intercomparison.

6.6 As Mr Engelbart that had been foreseen to act as data-processing expert for the remote-sensing instruments will not be available for the intercomparison, the ET/IOC requested the Secretariat to help in identifying a replacement for him.

Participation and Radio-Frequency Interferences

6.7 The ET/IOC was informed that three manufacturers from China planned to participate in the intercomparions. These were two China-made GPS radiosonde manufacturers and the manufacturer of a new type L-band radiosonde. CMA also informed the meeting that it had been performing intercomparisons of its L-Band and GPS radiosondes for a year and had not observed any interferences produced by the L-Band system.

6.8 CMA requested to continue doing its twice-daily operational flights, independently of the intercomparison flights. It was noted that the China L-Band radiosonde was different from the radiosonde used operationally until now in Yangjiang. Also, the meeting agreed that it was not essential that all the Chinese radiosondes be flown on the same balloons.

6.9 Besides the seven manufacturers that had expressed interest to participate in the intercomparison at the time of the previous ET/IOC meeting (Payerne, Switzerland, 2-6 June 2008), Mr Kats (Russian Federation) expressed recently interest to participate with the Russian L-Band radar. The ET/IOC recognized the need to test the Russian system. However, the ET/IOC noted that it would not be possible to test two L-Band systems simultaneously (namely the Russian and Chinese L-Band systems). As China would need to continue doing its operational flights independently of the intercomparison flights, the ET/IOC recognized that it would unfortunately not be possible to accommodate the Russian L-Band system in this intercomparison and requested the Project Leader to inform him accordingly.

Flight schedule

6.10 Mr Tim Oakley presented the potential instruments' participation in the intercomparison as shown in Annex IV. It included on one hand the operational quality radiosondes (QRS) that will

be the main focus of the intercomparison and on the other hand the scientific sounding instruments (SSI).

6.11 In view of the large number of instruments participating, the ET/IOC decided to divide the systems into three groups as follows and proposed provisional frequency assignment for each system:

Group A [01.15,13.00] 2000 gr balloon	China L-Band Intermet Modem Graw Meteolabor (+ Snow White)	1675 404 402 401 403
Group B [08.00, 20.00] 2000 gr balloon	China GPS1 China GPS2 LMSippican Vaisala Meisei	401 402 403 404 405
SSI Group [08.45,20.45] 1200 gr balloon	CFH on Intermet Vaisala reference Other references?	404.5 403.5 402.5, 401.5

6.12 The launch times for the different group must ensure that all radiosondes are flown during day and night conditions. Therefore, the ET/IOC agreed on a provisional launch schedule as follows:

Local time (UTC+8)	Group
01.15	Group A
07.15	China operational radiosonde
08.00	Group B
08.45	SSI Group
13.00	Group A
19.15	Operational Radiosonde
20.00	Group B
20.45	SSI Group

It was noted that the time between the three morning and evening launches could be reduced for the purpose of the intercomparison, provided the organization does not get too complicated for the local staff.

6.13 The meeting agreed that CMA would request the needed authorization for these flights by the air traffic authority and provide its reply to the Project Leader as soon as possible to ensure that other arrangements could be made in case of a negative response.

6.14 The manufacturers would be responsible for operating their systems. Should they require any support from the local staff they should contact Mr LI Wei to ensure that corresponding arrangements could be made.

6.15 The operational radiosondes will be flown 30 times (15 daytime, 15 night-time), while the SSI Group will be flown at least 10 times (5 daytime, 5 night-time). The SSI Group would not be flown during the first days of the intercomparison period to release the load on the local staff and acquire sufficient training in the launch of the big groups. The meeting agreed on the provisional launch schedule throughout the duration of the intercomparison:

Date	Flight times
12-13 July	Preparation
14	08, 13, 19
15	01, 08, 13, 19
16	01, 08, 13, 19 + SSI
17	01, 08, 13, 19
18	01, 08, 13, 19 + SSI
19	01
20	08, 13, 19
21	01, 08, 13, 19+ SSI
22	01, 08, 13, 19
23	01, 08, 13, 19+ SSI
24	01, 08, 13, 19
25	01, 08, 13, 19+ SSI
26	01
27	08, 13, 19
28	01, 08, 13, 19
29	01, 08, 13, 19
30	01, 08, 13, 19
31	01, Pack

However, it was noted that the SSI group would not be flown in case of rain. In such cases, the schedule would be modified accordingly. In view of ensuring sufficient day- and night-time flights, the ET/IOC recognized that a contingency of 4 days would be needed in case of very bad weather.

6.16 The ET/IOC decided that the Group A and B would consists only of operational QRS that have been pre-qualified in national tests and possibly also of Snow White. All instruments listed in the column QRS of the Table provided in Annex IV have been accepted by the ET/IOC as qualified. Manufacturers would be allowed to bring additional R&D reference radiosondes that could be flown on the SSI Group subject to availability of space. Mr Vömel will be in charge of coordinating the flights of such references and could organize some additional flights for these instruments at the times reserved for the SSI Group.

6.17 The ET/IOC considered how the link between Group A and B would be done, as they will not be flying simultaneously and there would be no instruments that would be flown in both groups. It is planned that the Chinese radiosondes would be linked through the results of the China intercomparison which is presently being run, while the other radiosondes would be linked using the results of the LUAMI campaign and the UK test that will be carried out next month.

6.18 The ET/IOC decided that no parachute would be used for Group A and B, while parachute that will be provided by Mr Vömel will be used for the SSI group.

6.19 Under normal conditions, it is expected that no unwinders would be used. However a contingency of unwinders would be needed for bad weather conditions. The Project Leader will coordinate their provision.

Funding

6.20 The meeting reviewed the funding proposals that had been made during the previous meeting of the ET/IOC and felt they were still appropriate unless specifically mentioned above.

6.21 The local host will need advance payment for the purchase of the balloons, hydrogen, etc. The meeting therefore recommended that the WMO establish a Trust Fund for the purpose of this intercomparison in which donors and manufacturers could pay their participation to the purchase of the required services.

Remote-sensing instruments

6.22 The meeting noted that little progress has yet been made in the provision of remote sensing instrumentation as part of the radiosonde comparison. Remote sensing observations of water vapour are essential to reference between the daytime and nighttime performance of the relative humidity sensors and also to identify the cloud conditions experienced during the comparison flights.

6.23 In the case of GPS water vapour observations, there is a GPS sensor in Yangjiang town, a short distance from the proposed test site. The GPS integrated water vapour observations from this sensor will be suitable to provide a reference between the different radiosonde observation times. In addition, during the comparison, CMA was requested to provide observations from another 5 GPS water vapour sites surrounding Yangjiang, so that variations in the horizontal of the water vapour field could be identified from day to day.

6.24 A microwave radiometer suitable for water vapour observations would further strengthen the referencing between water vapour observations at different times of day.

6.25 A Doppler weather radar is available on the comparison site.

6.26 CMA agreed to investigate what other remote sensing instrumentation, as listed in the ET/IOC-3 meeting (Payerne) and reproduced in Annex V, might be provided from within China (e.g. aeorosol lidar or wind profiler). Institutions willing to support the deployment of remote sensing systems at the site, would have access to all the radiosonde data, thus providing a unique opportunity to develop knowledge of the error characteristics of instruments such as wind profilers and cloud measuring systems. CMA would request the Intercomparison Project Team to clarify specifications for remote sensing systems, if this is necessary.

6.27 The expert nominated at the meeting in Payerne to manage the remote sensing during the Radiosonde Comparison has resigned. Thus, the relevant CIMO and CBS Surface-based remote sensing teams, meeting in November 2009, are requested to develop a small task team to take on this responsibility and to work with experts from China. They are also requested to see whether they can identify suitable systems which could be available and shipped to China for the test.

6.28 The COST- Action EG-CLIMET will also meet in November 2009 and Dr Nash is requested to find out whether this Action can support deployment of systems in China, as had happened previously in Mauritius in 2005.

6.29 Obtaining help from WMO and COST would be helped by China providing a preliminary report in early November 2009 of what remote sensing would be available for Yangjiang from within China.

6.30 The meeting agreed that any remote sensing instrument for the test needs to be deployed well in advance of the start of the Radiosonde Comparison, so that any errors from conditions found at Yangjiang can be found and eliminated before the Radiosonde Intercomparison starts. For instance a wind profiler at Yangjiang would have to be sited so that it was not in line of sight of the weather radar antenna, and so would not see anomalous signals (Doppler shifts) reflected from the weather radar antenna as it rotates.

6.31 China would need to organise further radiofrequency surveys of conditions at Yangjiang, depending on the frequencies used by any remote sensing system proposed for the Yangjiang test.

Rules and Procedures of the intercomparison

6.32 The meeting reviewed the rules and procedures of the intercomparison that had been agreed on during the ET/IOC-3 meeting and amended them as needed. The updated version of these rules is provided in Annex V.

6.33 The meeting recommended that a 2-day meeting be organized to finalize the planning including necessary funding as well as the details of the scientific planning, with all manufacturers and participants representatives, preferably during the last week of January to agree on the final intercomparison plans.

7. REVIEW OF THE REPORT

The meeting reviewed and approved the report of the session.

8. CLOSURE OF THE SESSION

The meeting was closed on 4 September 2009 at 12:15.

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Investigation Report on Yangjiang International Intercomparison Station Site

(I) The Station's Climatic Data

1. Basic climatic data of the station

Yangjiang station started its upper-air sounding in May 1966. Yangjiang station is situated in the south of the Tropic of Cancer, with an altitude of 88m. At 21°50′ north latitude and 111°58′ east longitude, it is of tropical climate with plentiful rainfall all the year around. Its humidity at 500-hPa is 33% in March and the amount of precipitation from May to Sept. is about 54%~67%. The annual mean ground temperature stands at about 22.6°C, while the annual mean surface humidity is around 81%. The troposphere height at Yangjiang station is about 16780m, while the height of zero-degree layer is about 4808m. The number of days with the sounding temperature below -80°C reaches more than 140 days all the year round, while the annual ground wind speed is about 3.9m/s on average, with the maximum ground wind speed reaching 7.6m/s (See Table 1.1 for details).

Table 1.1 Monthly Statistics of Climatic Data of Yangjiang Station in Recent 3 Years

Month	Mean temp.	Mean humidity	Mean precipitation	Mean surface wind speed	Mean maximum wind speed	500hPa monthly mean humidity	Upper-air sounding troposphere height	Upper-air sounding 0° layer height
1	14.9	71	33.1	4.4	7.8	15	16968	4448
2	16.1	81	36.3	3.8	7.1	18	16747	4027
3	19.0	85	70.7	3.9	7.1	33	16927	4361
4	22.3	88	101.5	3.9	7.6	41	16997	4715
5	25.3	86	489.5	3.8	7.4	58	17061	5021
6	27.2	90	501.9	3.7	7.9	67	16855	5215
7	28.2	85	191.4	3.8	7.5	59	16596	5271
8	27.4	87	375.8	3.7	7.8	58	16475	5270
9	26.8	80	189.8	3.9	7.7	54	16582	5183
10	25.2	77	52.3	3.8	7.3	38	16715	5096
11	20.8	65	44.5	4.5	8.2	30	16576	4711
12	17.5	66	12.2	4.4	8.0	13	16861	4375
Annual mean	22.6	81	209.0	3.9	7.6	40	16780	4808

2. Typhoon landing status

In 2006, Typhoon Prapiroon made landfall at the south China coastal area between Yangxi County and Dianbai County in western Guangdong at 7:20 p.m. on 3 Aug.. With a central pressure of 975 hPa and a speed of 33 meters per second, the maximum wind power reached 12 degrees at the Beaufort Scale near its eye.

Tropical Storm Kammuri formed in the northern part of the South China Sea on 5 August 2008 and intensified into strong tropical storm on the morning of 6 August. After an evening landfall from Xitou Town, Yangxi County in Guangdong province with the strength of severe tropical storm, the maximum wind power reached 10 degrees (25m/sec) on the Beaufort Scale near its eye.

In 2009, the tropical storm Soudelor made landfall on the morning of 12 July between Yangjiang and Xuwen in Guangdong.

(II) Clearance Conditions of the Station

1. Upper-air wind observation environment

Yangjiang station is built atop an independent mountain, free from occlusion from high mountains or other buildings. The antenna of its L-band radar sounding system for its operation is erected on the top of duty room (2-storey building). There is a new generation weather radar building 50m true east of the antenna with an occlusion elevation angle exceeding 5 degrees and an electric wire iron tower northwest of the antenna with an occlusion elevation angle also exceeding 5 degrees, while there is no occlusion in other directions (See Fig. 1.1 for Eight azimuth diagrams of the site for flying sounding balloon and Fig. 1.2 for Ground obstacles occlusion diagram). Yangjiang station's ground prevailing winds are northeaster and southeaster. The weather radar building is at the windward side of the site of flying sounding balloon for the international sonde intercomparison, therefore, generally there will be no influence on sounding balloon flying (See Fig. 1.3 for wind rose diagram).

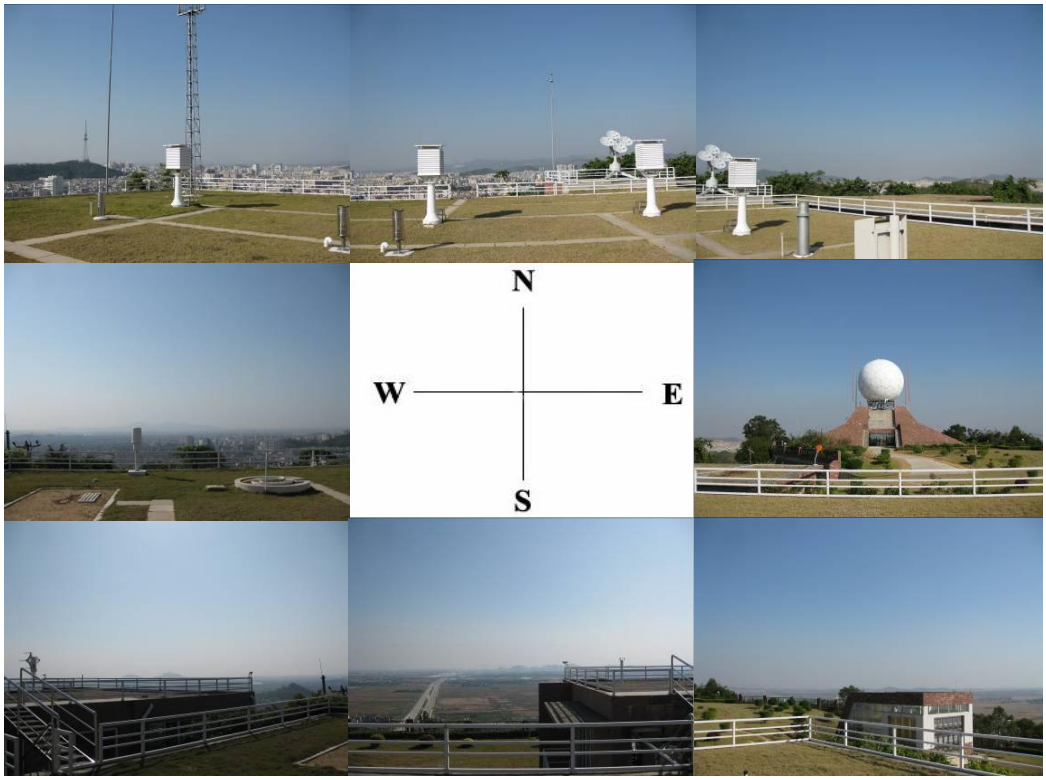

Fig. 1.1 Eight azimuth diagrams of the site for antenna erecting

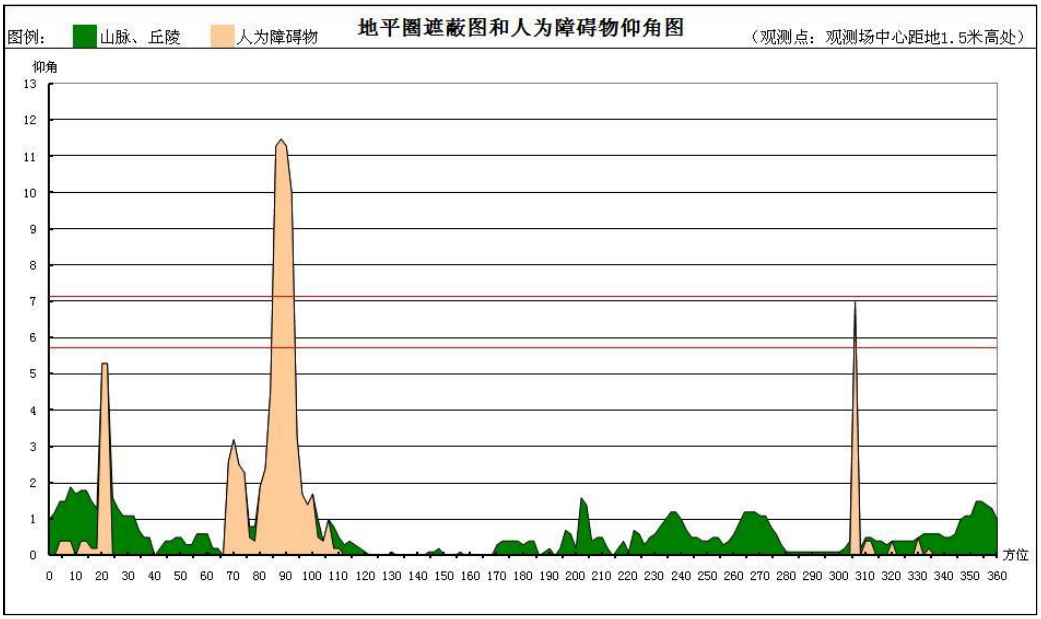

Fig. 1.2 Ground obstacles blocking angle diagram

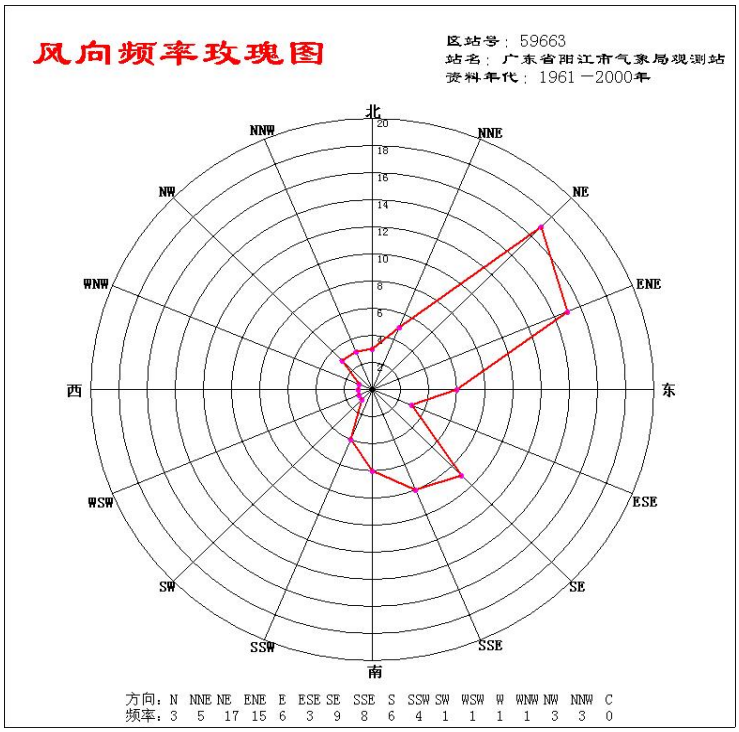

Fig. 1.3 Wind rose diagram

2. Airspace conditions

There is no airport at Yangjiang. There is no large airport within 100 km of the air sounding station but only a small civil airport within about 15 km-Heshan airport. Within 60km, 4 air routes will pass above the station, and the upper horizontal distance to Guangzhou air route is about 10km and that to Shenzhen air route is about 20km (See Fig. 1.4).

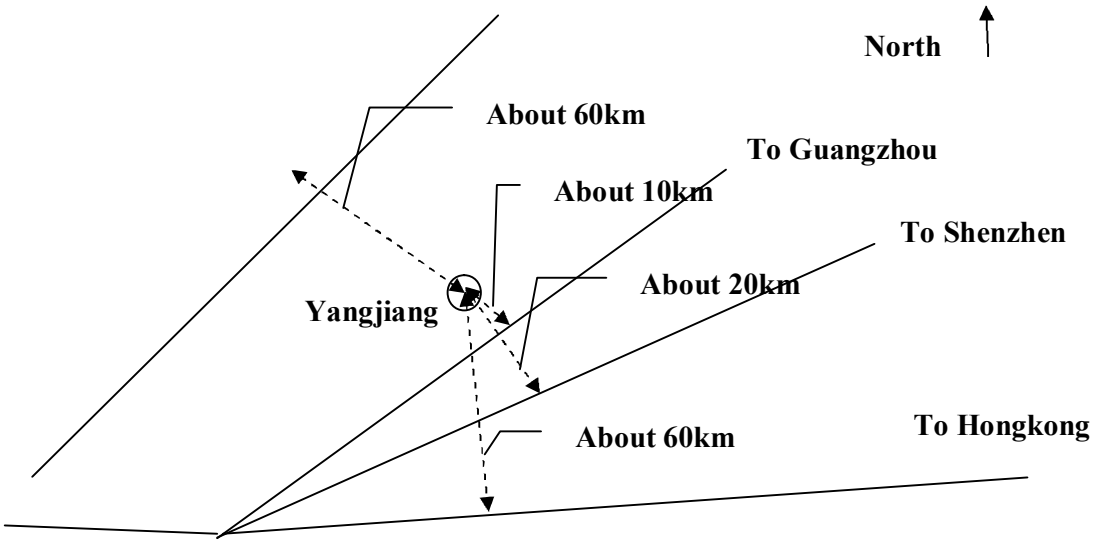

Fig. 1.4 Airspace diagram

3. Electromagnetic environment

The permissible electromagnetic frequency for China's GPS sounding is 400.3MHz ~406MHz, and the operating frequency of operatioanl L-band radar sounding systemis 1675±10MHz, while there is no electromagnetic interference within these 2 frequency ranges at Yangjiang station.

(III) Hydrogen Production and Supply Conditions

At present, Yangjiang station has already ceased hydrogen production and started to buy hydrogen. There are many hydrogen providers at Yangjiang that can provide compressed hydrogen in tanks. According to the updating and upgrading arrangement for hydrogen production equipments from China Meteorological Administration, the hydrogen production equipments of the souding station in 2009 will all be replaced by Handan-made water-electrolytic hydrogen production equipments.

(IV) Living and Transportation Conditions

Situated within the urban district of Yangjiang, the traffic of Yangjiang air sounding station is really convenient. Several hotels above 3-star level within 2km can fully meet the accommodation, catering the needs of the international intercomparison participants. Yangjiang's main inter-provincial means of communication are train and long-distance bus. To pass the customs, the foreign personnel can enter Shenzhen customs via Hongkong, and then they can reach Yangjiang by inter-provincial means of communication or it is for Guangdong Provincial Meteorological Bureau to dispatch cars to pick them up at Shenzhen and send them to Yangjiang. Yangjiang station is equipped with vehicles for operation, and it can make corresponding arrangements to pick up and send off intercomparison personnel during the international intercomparison period.

(V) Professional Staff

There are 6 professional staff at Yangjiang station who can undertake such operations as flying sounding balloon, hydrogen production and sonde binding. In addition, professional staff with favorable technical skills can be transferred from Guangdong Provincial Meteorological Bureau and other stations throughout the country to undertake such operations as flying sounding balloon during this intercomparison.

(VI) Site Alteration

There is not much redundant area within the Yangjiang station. During the international intercomparison, operational sondes of 8 models as well as research-model sonde and other ground remote sensing sounding equipments will be involved in the intercomparison, therefore, the site layout shall be designed overall to make full use of the existing area. At present, Yangjiang station has carried out alteration planning over the existing site within the station and divided the site into the following functional areas (See Fig. 1.5):

1. Area for flying sounding balloon:

Intercomparison balloon-flying area takes advantage of the **original balloon flying area**[1]. The hydrogen production room situated to the south of the balloon flying area is moved southwards and new water-electrolytic hydrogen production equipments are installed.

2. Area for hydrogen production and storage:

The original hydrogen production room is still in operation, **the new hydrogen production room**[2] is now in the process of land-leveling operation. As the hydrogen consumption volume for sonde intercomparison increases, the real-time hydrogen yield of the water-electrolytic hydrogen equipments can not meet the demand of the intercomparison, thereupon, it is scheduled to buy hydrogen during the intercomparison period.

3. Area for sounding data summary:

According to the requirements of WMO sonde international intercomparison, the host country shall be responsible for the organization and summary of the intercomparison sounding data as well as the compilation of preliminary report of the intercomparison. This area is comparatively independent, and it is expected to be in the outer room of the station's **current duty room**[3] or within the **original duty room**[4].

4. Area for working group meeting:

During the intercomparison period, various problems encountered shall be negotiated and coordinated. The area for working group meeting is scheduled to be on the first floor of the **weather radar building**[5].

5. Area for ground receiving equipments:

This area is the working area of all producers participating in the intercomparison. Yangjiang station works out 2 solutions-open and close solutions. The open one lies in the outer room of the **current duty room**[3], and all the ground receiving equipments and personnel are within the same indoor space. It is convenient for management, but the current conditions make it too crowded; while the close one lies in **the original duty room**[4] which boasts 8 independent rooms of 10m^2, 7 of which are equipped with independent bathrooms.

6. Area for erecting receiving equipments' antennas:

It adopts open solution, with the area for erecting receiving equipments' antennas being on the top of the building of the **current duty room**[3]. It is comparatively crowded to erect over 8 antennas. If close solution is adopted, the area for erecting receiving equipments' antennas shall be atop of the building of the **original duty room**[4] (only 1 storey) where there is abundant area.

7. Area for ground remote sensing equipments:

Area to the north of the original duty room is **the area for erecting ground remote sensing equipment**[6]**.**

(VII) Investigation Conclusion

Situated at the top of the mountain, Yangjiang station has a favorable clearance condition. The station's climate environment accords with the high moisture conditions required by the international sonde intercomparison. The station possesses a strong technical capacity. There is not much redundant area within the Yangjiang station which is now carrying out alteration according to the international intercomparison site. Yangjiang station has accumulated relevant experience through evaluation and test of China's home-made GPS sonde and possesses obvious advantage. Besides Yangjiang station, China Meteorological Administration also considers Haikou meteorological air sounding station in Hainan as the alternative intercomparison site.

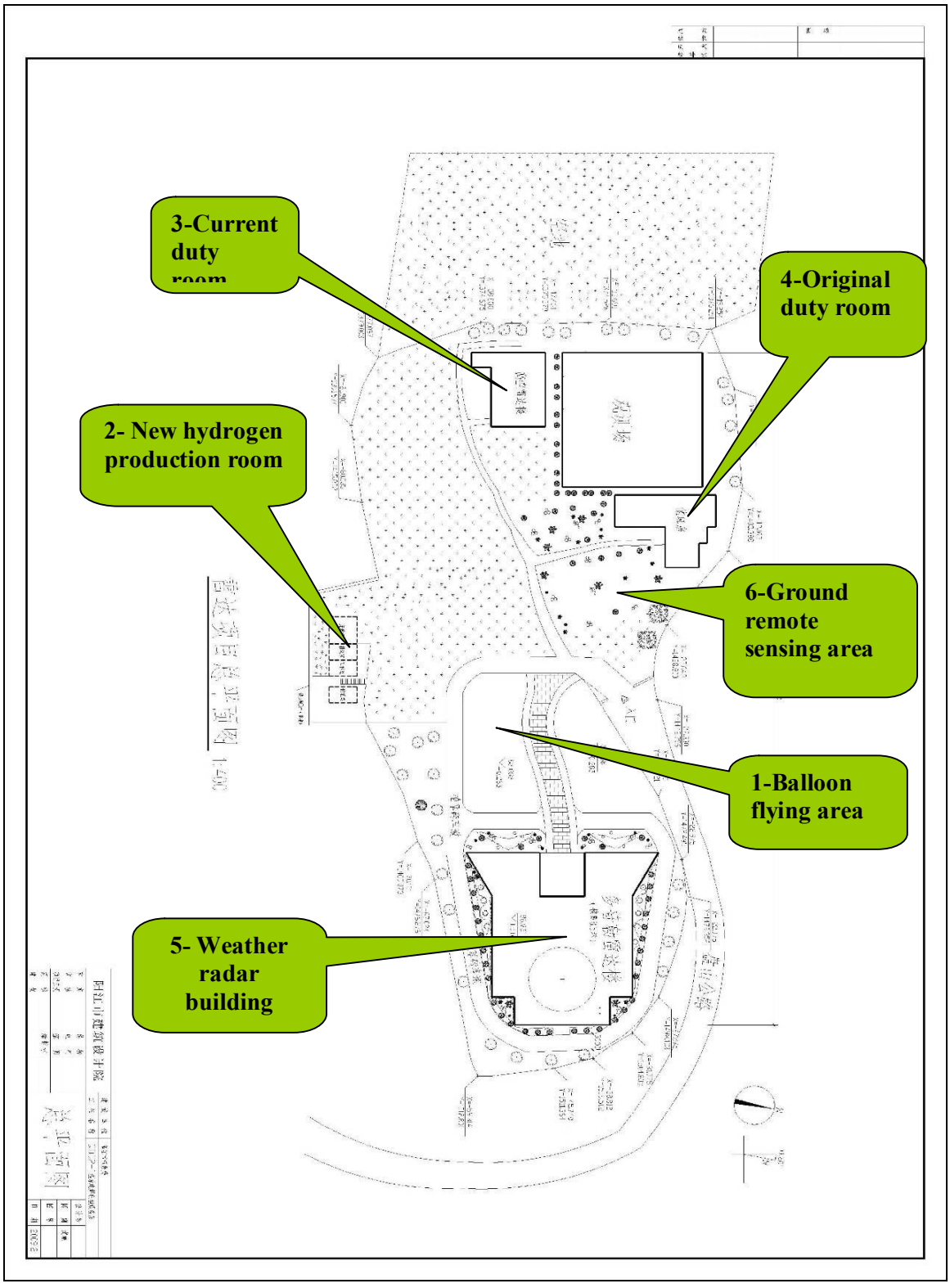

Fig. 1.5 Plane view of sounding station of Yangjiang Meteorological Bureau

IMPORT & EXPORT PROPOSAL OF THE 8th WMO RADIOSONDE INTERCOMPARISON EQUIPMENT

With regard to the import and export issue of abroad intercomparison equipment, a proposal is raised after meticulous investigation and analysis as the following:

1. Equipment Transport

1.1 Import

The China National HUAYUN Technology Development Corporation will be in charge of all equipments transport. For the purpose of duly grasping transport information and controlling custom clearance time, our shipping agency, which has cooperated with China National HUAYUN Technology Development Corporation for years, will pick up equipment at every manufacturer and directly store them into its warehouse. All equipments should be packed according to the airline requirements. Normally, it takes around 1 week on the airline from every manufacturer to the Beijing Custom, and 20 days for custom clearance and domestic transport. (The equipments should be dispatched before the end of May in 2010.) If equipment does not work caused by transport after arriving in intercomparison field, compensation will be claimed to insurance company; if it is not caused by transport, manufacturer will take the responsibility.

1.2 Export

Nonconsumable equipments will be returned abroad within 6 months, and should be packed in the same packing case as they are imported. The China National HUAYUN Technology Development Corporation will be responsible for delivering nonconsumable equipments from intercomparison field to Beijing Airport, and deal with custom clearance. One necessary condition for custom clearance is that all nonconsumable equipment's model, quantity, and weight should be accordant when they are imported.

2. Import & Export Customs Formalities

Since not all of the equipment will be returned to manufacturer, equipments are cleared through customs via two ways.

2.1 Consumable Equipment

The consumable equipment like Radiosonde will be declared to customs via the way of "donation" and tax would be paid based on the relevant China Custom rules.

2.2 Nonconsumable Equipments

The nonconsumable Equipments will be declared to customs as "Temporary Import & Export" when arriving in Beijing. They will also be returned to manufacturer through Beijing Custom after intercomparison. Certain deposit is required from the Beijing Custom and will be returned in 30 working days after ending the case of export custom clearance of nonconsumable equipments.

Additionally, concerning radio transmitting equipment such as radars, several documents are necessary for custom clearance like below:

2.2.1 “Temporary Frequency Usage Certificate”, will be applied in local provincial level Radio Regulating Committee.

2.2.2 “Ratification of Radio Equipment Import”, will be applied in the State Radio Regulatory Commission with documents of “Official Explanation Letter of Import Equipment Application”, “Temporary Frequency Usage Certificate”, and “Application Form of Radio Equipment Import”. That should be conducted with an official letter issued by China Meteorological Administration. The whole process will take 10 weeks.

3. Costs

Catalog	International Transport Cost & Insurance	Domestic Transport Cost & Insurance	Relevant Tax	Customs Deposit	Customs Clearance Cost, Storage Cost, Commodity Inspection Fee and Import & Export Certification Fee for Mechanical and Electrical Products	Products Specification	Packing Instructions	Import & Export Agency Service Fee to HUAYUN
Consumable Equipment	3%(Single)	1%(Single)	25%		2% (Import)	Product name, application, brand, principle, model, functions, technical specifications.	Avoid Solid wood	3%
Nonconsumable Equipment	6%(Return)	2%(Return)		25%	4% (Import & Export)			

4. Document, Payment and Deposit

4.1 Document Requirement

The documents are necessary to be provided to the International Affairs Department in China National HUAYUN Technology Development Corporation by participant manufacturers before the end of February in 2010, which describe departure port, contact person details, location to pick up equipment, equipment name, model, serial number, value (market price), quantity, weight and picture, etc. Our contact details are like below:

Consignee: China National HUAYUN Techonology Development Corporation
Contact person: Wei Zhang
Phone: +86 10 6840 7468
Fax: +86 10 6217 7789
Email address: zhangwei@cnhyc.com
Address: No. 46 Zhongguancun South Street, Beijing, 100086, China

4.2 Payment

Correlative charges will be figured out after manufacturers providing the product value and other product information to the China National HUAYUN Technology Development Corporation. The payment should be received 1 week before equipment transport. Our bank information is as the following:

Bank Name: HSBC
Branch Name: Ocean Centre Branch
Bank Address: Shop 355, 3/F, Ocean Centre, 5 Canton Road, Tsim Sha Tsui Kowloon
Bank Code: 004
Account No.: 491-886248-838
Company Name: China HUAYUN (Hong Kong) Company Limited
Swift Code: HSBCHKHHHKH
Telex Code: 73205 HSBC HX

4.3 Deposit

After nonconsumable equipments are delivered abroad and Beijing custom returns the deposit, the China National HUAYUN Technology Development Corporation will return the deposit to every manufacturer in time.

Notes: This proposal is designed and raised based on the current China policies. If there is any change on relevant policies, we will notice you and raise an alternative proposal in advance.

Required Information

Relevant Information	**Required time**
Departure port	Before the end of February, 2010
Contact person details	2 weeks before transport
Location to pick up equipment	Before the end of February, 2010
Packing Material	Before the end of February, 2010
Invoice	1 week before shipment
Packing List	1 week before shipment
Airway Bill	Within 1 day after shipment

Equipment Information:

Equipment name	Before the end of February, 2010
Brand	Before the end of February, 2010
Model	Before the end of February, 2010

Serial number	1 week before shipment
Application	Before the end of February, 2010
Functions	Before the end of February, 2010
Principle	Before the end of February, 2010
Value	Before the end of February, 2010
Quantity	Before the end of February, 2010
Weight	Before the end of February, 2010
Volume	Before the end of February, 2010
Picture	Before the end of February, 2010

Equipment Specification:

Frequency Range	Before the end of February, 2010
Bandwidth	Before the end of February, 2010
Transmitting Power	Before the end of February, 2010
Manufacturer	Before the end of February, 2010

CHINA INTERCOMPARISON 2010 – Potential instrument participation

	Company	QRS System	Freq/Weight	RSI System	Other Details	2nd System / Comments
1	**China LBAND**	**GTS**	**1675±3MHZ (R/Sonde) 1680±10 MHZ (Radar) 370 grms**			
2	**China GPS-1**	**XGP-2**	**400.15-406 120 grms**		**Surface antenna:Omni Antenna**	
3	**China GPS-2**	**CF-06-A**	**400.15-406 300 grms**		**Surface antenna:Omni Antenna**	
4	**GRAW**	**DFM-06**	**400-406**	**DFM-xx**	**Receiver, PC +3 antenna. 40m cable**	**Redesigned DFM-06, new name, new housing, longer sensor boom. Frequency interface to external adapter electronics for interfacing with external sensors**
5	**INTERMET**	**iMet-2**	**400-406 225 grms**	**??**	**iMet – 3200 PC+ Antenna**	**iMet-2-AA (no pressure sensor) ready for intercomparison**
6	**MODEM**	**M2K2-DC**	**400-406 210 grms**	**??**	**Receiver, PC +antenna. 30m cable**	**New Radiosonde design ready for testing (150 grms) Working on a reference system**
7	**MEISEI**	**RS-06G**	**400-406 150 grms**	**??**	**Receiver, PC +antenna. 30m cable**	**New design with improved temperature sensor (200 grms)**
8	**METEOLABOR**	**SRS-C34 +Snow White**	**400-406**	**+ Snow White**		
9	**SIPPICAN**	**LMS6**	**400-406 230 grms**	+ ATM ?		**Can be configured to work with SnowWhite Can be configured to work with Multi-Thermistors**
10	**VAISALA**	**RS92-SGPD**	**400-406 290 grms**	**APS**	**MW31 30m cable**	**Propose to bring reference system with polymer sensor Weight – 550grms (max)**
11	Russia	MARL/Vektor	1680			Not able to operate at same time as China L-Band. Thus owing to operational priorities and timing of 'test' flights it is not feasible to operate the Russian system in this intercomparison.
12	**Reference 1**			**CFH**		**Working with INTERMET iMet-1-RB (245 grms)**
13	Reference 2			SnowWhite		Meteolabor or Sippican
14	Reference 3			ATM		

RULES AND PROCEDURES OF THE 8TH WMO INTERCOMPARISON OF RADIOSONDE SYSTEMS – UPDATED VERSION AS OF 4 SEPTEMBER 2009

7. 8th WMO INTERCOMPARISON OF RADIOSONDE SYSTEMS

In the preparation of planning for a future WMO global and regional radiosonde intercomparison, the ET/IOC took into account the need for global intercomparison driven by the changes made in the designs of the operation high Quality Radiosondes (QRS). There is a need to advise GCOS on the suitable radiosondes for use in the GRUAN network and to develop the use of best quality Scientific Sounding Instruments (SSI) to supplement the operational radiosondes in the GRUAN network.

In addition to the general rules and procedures for WMO Intercomparisons as defined in the Guide to Instruments and Methods of Observation (WMO-No. 8), Part III, Chapter 5, Annex 5.A and 5.B, and Part I, Chapter 12, Annex 12.C, the ET/IOC agreed on the following rules and procedures for the 8th WMO Intercomparison of Radiosonde Systems:

7.1 Objectives

7.1.1 The main objective of this intercomparison is to test in the tropical / subtropical moist conditions the relative performances of operational QRS in conjunction with the SSI. The results will be used to advise Members on a selection of QRS suitable for RBSN/RBCN and its GUAN sub-network as well as advise GCOS on a selection of systems suitable for GCOS Reference Upper-Air Network (GRUAN).

7.1.2 The ET/IOC agreed on further objectives as follows:

a) To improve the accuracy of daytime operational QRS measurements and the associated correction procedures to provide temperature and relative humidity accuracies currently possible with night time measurements.

b) To assess the accuracy and availability of the GPS wind measuring systems.

c) To evaluate the performance of geometric and geopotential height values obtained from GPS radiosondes (with a possibility to check the associated algorithms).

d) To evaluate the quality and reliability of SSI, and to use this information to evaluate the quality of the working references for the radiosonde test.

e) To evaluate the day-night differences of temperature, relative humidity of operational QRS and SSI against available remote sensing observations; and to identify, as far as possible, the origins of differences.

f) To recommend suitable QRS systems to be used in the RBSN/RBCN and GUAN.

g) To assess the magnitude of changes introduced by new radiosonde designs.

h) To identify the best practices used in the preparation of operational QRS radiosondes for launch.

i) To evaluate the added value of using remote sensing equipment in radiosonde systems intercomparisons as recommended by ET-RSUT&T experts (following testbed evaluations).

j) To publish the Executive Summary within three months, the draft Final Report within six months and the approved Final Report within nine months after the Intercomparison in the *WMO Instruments and Observing Methods Report* (IOM) series.

7.2 Qualification

The ET/IOC agreed on the tentative qualification procedure for participation in the 8th WMO Intercomparison of Radiosonde Systems, which prompt the respective manufacturers to take part in national test prior to the WMO-RSO-8, namely:

a) The candidate operational QRS should preferably pass through the national intercomparisons organized in the CIMO recognized intercomparison sites/testbeds, list of which is in the Annex VI, or

b) The candidate operational QRS should pass through the Regional WMO Radiosonde Intercomparison.

7.3 Project Team

7.3.1 The ET/IOC agreed on the composition and duties of the Project Team (PT). The PT will be responsible for preparing the intercomparison in liaison with the WMO Secretariat. The PT will organise the conduct of the intercomparison, the quality control and analysis of the results, and preparation of Executive Summary, draft Final and Final Reports. It will take part in the whole period of the intercomparison and the financial support for their participation should be equally shared among the WMO, GCOS and relevant COST Actions.

7.3.2 The WMO-RSO-8 Project Team will consists of:

- Project Leader (PL), Tim Oakley from the UK Met Office(IOC Chair);
- The Radiosonde Test Expert, John Nash from the UK Met Office;
- The Data Manager; proposed Sergey Kurnosenko, as he is the owner of the reference data processing software for WMO intercomparisons (RSKOMP); 2nd option is an expert nominated by the UK Met Office;
- The data-processing expert for operational QRS, Gonzague Romanens from MeteoSwiss;
- Holger Vömel as the data-processing expert for SSI;
- Data-processing expert for the remote sensing instruments, TBD;
- LI Wei, China Focal Point for the intercomparison.

7.4 Place, date and duration

Place

7.4.1 The ET/IOC agreed on the site of Yangjiang (China) for holding the WMO-RSO-8.

Date and Duration

7.4.2 The WMO-RSO-8 will last for 3 weeks, from 12 to 31 of July. An extension might be subject to weather conditions.

7.5 Participation

7.5.1 The following manufacturers have been accepted as participants in the WMO-RSO-8 with their operation quality radiosonde systems:

a) GRAW with DFM-06 GPS radiosonde, (400-406 MHz);

b) INTERMET with the iMet-1GPS radiosonde, (400-406 MHz);

c) LOCKHEED MARTIN SIPPICAN INC with LMS6 GPS radiosonde, (400-406 MHz);

d) MODEM with M2K2-DC GPS radiosonde, (400-406 MHz);

e) MEISEI ELECTRONIC CO., LTD with RS-06G GPS Radiosonde, (400-406 MHz);

f) METEOLABOR AG with SRS-C34, (400-406 MHz);

g) VAISALA OYJ with RS92 SGP GPS radiosonde, (400-406 MHz);

h) China, Operational GTS Radiosonde with Secondary WindFinding Radar 1680 MHz;

i) 1st GTS radiosonde to be nominated after completion of preliminary testing in China;

j) 2nd GTS radiosonde to be nominated after completion of preliminary testing in China.

7.5.2 China will decide on the participation with the operational GTS Radiosonde with Secondary WindFinding Radar 1680 MHz and GPS radiosondes (400-406 MHz).

7.5.3 The manufacturers of operational QRS will provide their radiosonde systems with 40 pieces of radiosondes for the intercomparison on their own account.

7.5.4 The following SSI should be accepted to participate in the WMO-RSO-8:

a) METEOLABOR SnowWhite, (400-406);

b) Cryogenic Frost-point Hygrometer (CFH), (works with one of the Radiosondes above);

c) A multi-thermistor radiosonde (ATM), (400-406 MHz).

7.5.5 Funding for the participation of the SSI will be shared between providers and GCOS. There is a need for 60 pieces of SSI measurement of temperature and 60 pieces for water-vapour measurement. As there is more than one potential SSI system for a water-vapour measurement, the Project Leader and data processing expert for SSI will need to agree on the numbers to be used.

7.5.6 The following remote sensing instruments may participate in the WMO-RSO-8:

a) GPS-MET,

b) Cloud Radar,

c) Ceilometer,

d) Microwave Profiler,

e) LIDAR,

f) Doppler weather radar,

g) Wind profiler.

7.5.7 Remote sensing instruments will be provided by volunteered NMHSs or manufacturers who will also arrange for the transport to the host country and for the installation. Funding for the participation of the remote sensing instruments will also be requested from relevant COST Actions. Systems need to be established at the test site well in advance of the test. CMA will consider whether it would be able to provide some of these instruments.

7.6 Responsibilities

Participants

7.6.1 Participants (manufacturers of operational QRS and providers of SSI) will be responsible for timely delivery of instruments to the intercomparison site according to the provided custom procedures.

7.6.2 Participants will run their systems in a near continuous mode (day and night) and will provide data according to a format to be agreed by the Data Manager.

7.6.3 Participants will share the cost of supplies of consumables, such as: balloons, gas, parachutes, un-winders, etc. They will also provide funding for the participation of Data Manager (one month of salary and travel expenses).

Host country

7.6.4 The host country will be responsible for all preparations relevant to the infrastructure needed for the intercomparison, offices for the international participants and WMO PT and for the logistic support during the intercomparison (installation of instruments, internet connection, production of gas and filling of balloons, production of bamboo rigs, etc).

7.7 Rules during the intercomparison

7.7.1 It was agreed that participants in the test would provide both fully processed and raw data from each radiosonde test flight.

7.7.2 Data formats would be similar to those used during the 7th WMO Radiosonde Intercomparison and would be finalised well in advance of the test with the agreement of the Data Manager. Care should be taken to avoid mistakes made during the 7th WMO Radiosonde Intercomparison (see Annex VII).

7.7.3 A uniform method of time stamping the data samples would be agreed to by the participants, utilising an agreed method of exploiting GPS timing.

7.7.4 Data samples need to be submitted to the Data Manager within 1-hour after the completion of the test flight.

7.7.5 The Project Team will take responsibility for resolving disputes between participants (e.g. potential radio frequency interference between some radiosonde types).

7.7.6 The Project Team will attempt to identify systematic problems in measurements with a given radiosonde type early in the test, and then will judge whether it is appropriate to rectify this problem.

7.7.7 Regular data meetings will be held with relevant participants to quantify progress in building up the comparison data bases.

7.7.8 The Data Manager or remote sensing data-processing expert will also have to arrange for archiving of relevant remote sensing observations, in a database that can be accessed by the other participants as appropriate.

7.8 Data Policy

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

- The complete intercomparison database is kept by the WMO Secretariat, the ET/IOC Chair, the Project Leader and Site Manager. WMO may, if requested by the ET/IOC, export whole or part of the comparison database on the CIMO/IMOP website, or other website controlled by the ET/IOC members, as soon as the Final Report is published.
- After the Intercomparison, every participant could get a copy of the comparison database. 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 database 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.

7.9 Radiofrequency issues

7.9.1 The radiofrequency environment at the intercomparison site was checked for potential interference well in advance of the intercomparison by the host.

7.9.2 If radiosondes are flown which use L-Band secondary radars, then other participants will have to be checked for radiofrequency compatibility with this system in advance of the test.

7.9.3 Transmissions from 403 MHz radiosonde systems need to be tuneable to designated frequency, of narrow bandwidth (100 kHz) and stable frequency (less than 10 kHz drift in flight).

7.10 Potential sampling problem

7.10.1 The method of suspending the radiosondes from the support rig must allow for the motion of the radiosondes during the ascent to be similar to that experienced in an individual radiosonde flight.

7.10.2 Operational radiosondes are not designed to measure accurately during descent, so either the SSI chosen must function reliably during ascent, or a method be agreed to for comparing between QRS ascent data and SSI descent data.

7.10.3 It should be considered whether GPS signals should be used to track the motion of the test rig and radiosondes during each comparison flight.

7.11 Data-processing and analysis

7.11.1 The three data processing experts in the Project Team will be responsible for organizing the data analysis in consultation with the Project Leader.

7.11.2 In particular, comparisons between the different types of data will require that the individual databases need to be compatible with the RSKOMP database.

7.12 Data processing and database availability

7.12.1 Each operational QRS participant will only be able to access their own measurements until the data analysis is completed.

7.12.2 When the final report is published the full data sets (both raw and processed high resolution data) should be made available to the general scientific community.

7.13 Schedule of the intercomparison

7.13.1 Before the intercomparison schedule is finalized, tests will have to be performed to identify the safe radiofrequency separation between individual radiosonde types that is practical. For instance if 500 KHz Separation were possible, then it might be possible to fly nine radiosondes at 401.5, 402, 402.5, 403, 403.5, 404, 404.5, 405 and 405.5, and it would also be necessary to establish the physical separation necessary between the radiosondes to avoid spurious interaction between the systems. However, this does not seem to be very practical when relatively long radiosonde suspensions from the support rig are required to ensure that the ventilation of the radiosondes in the test is similar to that of an individual radiosonde.

7.13.2 Thus, a practical schedule for test could be obtained by splitting the nine radiosondes into two groups so that at most 6 radiosonde types were flown together. The link between the two groups would have to be agreed by the Project Leader/IOC but would sensibly be based on a multi-thermistor radiosonde for temperature and suitable SSI for relative humidity/water vapour. Time separation between test flights needs to be about 4-hours.

7.13.3 The schedule needs to be prepared well in advance of the test in coordination between the Project Leader and the experts responsible for operational QRS and SSI.

7.13.4 Approximately equal numbers of day and night comparison flights need to be completed.

7.13.5 The number of flights that can be attempted will depend on the availability of lifting gas, with an individual test flight taking at least 3-hours to complete, start to finish. With possibly another hour for the data-processing staff to complete their activities, so that more than four test flights in 24 hours is difficult to sustain over any lengthy period.

CIMO RECOGNIZED INTERCOMPARISON SITES / TEST BEDS

a) Lindenberg, Germany

b) Camborne, UK

c) Payerne, Switzerland

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DATA FORMAT RECOMMENDATIONS

One of the problems the Expert Team has faced during the 7th WMO Radiosonde Intercomparison was the substantial difference in the entry data standards. This problem was anticipated and solved; however, it created extra significant workload and clearly increased the time needed to complete the post-flight analysis.

There were several sources of inconsistencies:

- Different units of measure and data reporting standards adopted by different manufacturers. For example:
  - (i) Wind speed in knots and m/s.
  - (ii) Standard and opposite wind direction conventions.
  - (iii) Height above sea-level and above surface.
  - (iv) Geopotential and geometric height.
  - (v) Time since start, time of day (in the both forms HH:MM:SS.hh and "seconds since midnight").
- Numerous data separators, such as space, tab, comma, <, >, +;
- Including pre-flight data;
- Too many data columns (up to 80) most of which did not contain any information.

All of the above inconsistencies increase the risk of misinterpretation of the data and must be removed by the participants before the data are submitted to the common database.

It is understood that modern radiosondes have multiple channels with the specific housekeeping parameters, so we do not suggest that all data sources follow the same strictly defined data format. Nevertheless, based on the Expert Team experience, the following general requirements were strongly recommended:

1. Participants should negotiate use of the same units of measure and interpretation of variables.
2. All data files from the same data source should have same number of header lines (which may be different for different data sources, of course).
3. Same variable is always reported in the same column (which may be different for different data sources, of course).
4. Clearly defined convention for the representation of the missed data. It is recommended that all data sources follow the same method.
5. There is no limitation imposed on the data precision but it is recommended to keep it reasonable (we sometimes observe precision of 0.001 in reporting, for example, relative humidity).
6. Pre-flight data should be removed; otherwise it creates additional synchronization problems.
7. Use the most common data separators such as Space and Tab characters to ensure readability by any software package.

These requirements will be helpful no matter what software is used to evaluate the combined dataset. If participants will choose to use RSKOMP software, they can further benefit by following rather flexible RSKOMP data formatting rules and using some optional possibilities (such as metadata), implemented in this package.

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