KMA's standard observatories; plan and role of CIMO Testbed and Lead Centre

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ABSTRACT

Korea Meteorological Adminstration(KMA) is operating 3 standard observatories, Chupungnyeong, Gochang and Boseong, which provide the environment for various field experiments regarding the meteorological observation technology. CIMO designated Chupungnyeong as a Lead Centre for the evaluation of precipitation measurement accuracy, and Boseong as a Testbed for the integration of 3D Weather Observation System in 2012. Gochang observatory is supporting Chupungnyeong by hosting intercomparison experiments, especially regarding solid precipitation observation.

This presentation includes a> the introduction for the facilities of KMA's standard observatories, b> the explanation of research activities, c> a few results of previous intercomparison experiments, and d> the research plan and promotion for many WMO member's participation.

1 Introduction

The standardization of meteorological observation is highly required in weather prediction, climate monitoring, and various environmental application areas. In order to standardize the observation processes performed by various domestic agencies and institutes, KMA launched “The national meteorological observation standardization project” in 2006, and also enforced the “Weather Observation Standardization Act” to encourage multiple domestic agencies to join this project. And this Act provides a legal basis for the KMA WIGOS Demonstration Project in RAII with the title of “Establishment of a Common Information Infrastructure for Meteorological Observation Data” during the test of concept phase 2008-2011. KMA’s roles within this project are to provide technological support for other observation agencies; to enforce standardization policies; to collect and manage observation metadata; to optimize meteorological observation network; and to implement common use of data via quality control and observation education.

KMA’s standard observatories, which are designated as the CIMO Lead Centre and Testbed, were originally established for supporting the project mentioned, especially to provide standard technical guidance for the domestic angencies. Chupungnyeong station was firstly modified and upgraded as the standard observatory in 2008, which is one of KMA's oldest (since 1935) synoptic observational stations located at the middle area of Korean Peninsula. Gochang is located at the west coast of Korea, which is newly constructed in 2009 for characterizing heavy snow events caused by the cold surge over the yellow sea, and it is to be considered as a part of Chupungnyeong as the WMO CIMO Lead Centre. And as part of its endeavor of the Republic of Korea to participate in WIGOS activities, the KMA has been creating an observing site at Boseong including 300m tall tower since 2009 in cooperation with the local government.

KMA officially applied Chupungnyeong observatory as the CIMO Lead Centre for the evaluation of precipitation measurement accuracy and Boseong observatory as the CIMO Testbed for the integration of 3D Weather Observation System at CIMO-XV in 2010, and CIMO approved their designation in January 2012.

2 Chupungyeong Observatory

This facility is located at 36.22 N, 127.99 E, 241 m above mean sea level with hilly surroundings in Chungcheongbuk-do, Republic of Korea. As it is one of the operational observation site of KMA, new field needed to be established for the various test and comparison experiments, and the necessary equipments are installed and operated independently.

The following is the list of equipments installed;

- Pits gauge: Weighing precipitation gauge and 10 precipitation gauges available for comparison.
- DFIR(Double Fence Intercomparison Reference).
- Parallel observing equipment for 12 anemometer intercomparison.
- Synoptic observing facility: Automatic Weather Systems (AWSs) [3 (10-m) observing towers, 2 (5-m) mobile towers]
- Radiation measuring equipment: 3 types of trackers and reference radiometer (PMO6).

Figure 1 presents major field instruments currently operating.

Figure 1. Rain gauge inter-comparison facility (upper left), AWS with USN system under testing (upper right), Comparison between conventional 3-cup anemometer vs sonic anemometer (lower left), Pedestals for solar radiance measurement and comparison (lower right)

Chupungnyeong observatory has a laboratory, which included the reference equipments for temperature, humidity, precipitation, radiation and rain gauge calibration system (weighing and burette type). Figure 2 presents the equipments in the laboratory..

Figure 2. Temperature calibration equipments (upper left), Radiation calibration equipments (upper right), Rain gauge calibration equipments (lower left), RH calibration equipments (lower right)

Currently, a comparison between 3 cup and sonic anemometer is on-going as one of the R2O study. Though the sonic technology for wind observation was developed and tested by many agencies around the world, it is necessary to identify the real or potential differences of sonic instrument's characteristics and data comparing to the conventional sensor. Figure 3 shows the preliminary results, which present the relatively highly recorded gust by sonic anemometer. Those results are to be summarized and instructed to the operators of KMA after the experiment ends.

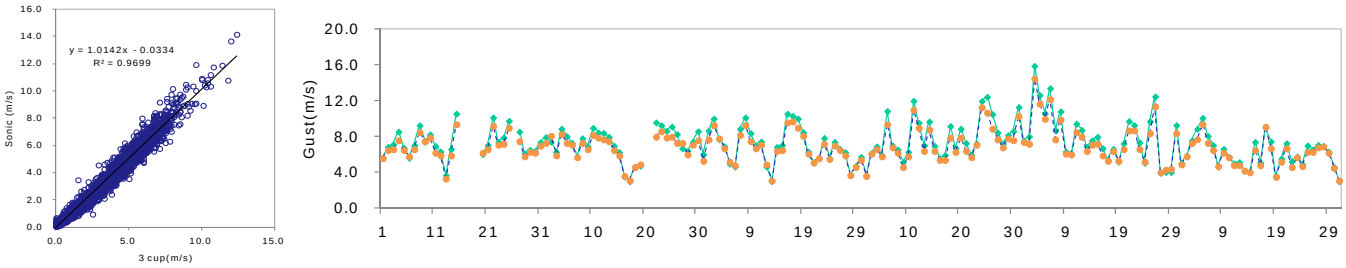

Figure 3. 1:1 comparison of 10 min wind speed between 3 cup and sonic anemometer, Dec. 2011~May 2012 (left), sample of gust data (right, sonic-cyan, 3 cup-orange)

3 Gochang Observatory

This facility is located at 35.34 N, 127.36 E, 52 m above mean sea level with agricultural surroundings in Jeollabuk-do, Republic of Korea. It is also one of the operational observation site of KMA, but has only 3 years of observation history. Gochang's climate is characterized by the heavy snow caused by the cold surge over the Yellow Sea during winter time. Therefore, several kinds of automatic snow depth and precipitation measuring instruments are installed at the experiment field of Gochang. Figure 4 shows the various equipments for snow measurement, which are the basis for KMA's participation in CIMO's SPICE(Solid Precipitation Intercomparison Experiment) programme.

Figure 4. Snow depth measuring equipments at Gochang; Ultra Sonic sensors (upper left), DFIR and instruments (upper right), several precipitation equipments including weighing type rain gauge (lower right)

One of field experiments being performed at Gochang is for testing the accuracy and robustness of mutisensors, which are expected to be widely utilized for the future weather observation in complicated urban areas. Several manufacturers are providing these kind of equipments to the market, and some field test are on-going in various regions. As Korea is one of the most urbanized country, the request for higher density of observation are increasing. The critical difference between conventional AWS and multisensory is the location of measurement. Multisensors measure T, RH, WD, WS, P at same point, while AWS provide T, RH, P at 1.5~2m above the ground, and WD and WS at 10m. And the degradation pattern should be investigated before these kinds of equipments are utilized for operation or any kinds of public services. As Gochang site was established recently, the field test results are not fully summarized yet.

Figure 5. New platform for the intercomparison of multiseonsors and conventional AWS' components. There are 9 masts with 2m high for installing sensors for T, RH, WD, WS and several kinds of multisensors.

4 Boseong Observatory

This facility is located at 34.76 N, 127.21 E, 3 m above mean sea level in landfill area in Jeollanam-do, Republic of Korea. It is a site dedicated for observation test experiment with some facility newly introduced in Korea, such as tall tower of 300m high.

However some part of whole facility, which is under construction in 2012 Autumn, have rather significant history of severe weather observation. National Institute of Meteorological Research (NIMR) of KMA has established the National Center for Intensive Observation of Severe Weathers at Haenam site about 40 km west of Boseong since 2000. This facility was the base of KEOP (Korea Enhanced Observing Program) during 2001~2008 with such instruments as Austosonde, Wind profiler, Micro Wave Radiometer(MWR), Micro Rain Radar, Optical Rain Gauge and several sets of AWS sensors. And NIMR/KMA has participated in T-PARC (THORPEX-Pacific Asia Regional Campaign, 2003) and International Field Campaign for Typoon Observation (2008). Facilities and instruments have moved from Haenam to Boseong (April, 2010). Additionally GNSS receiver was installed, and a Cloud radar system will be tested here in 2013. (the autosonde system was moved to other location to avoid potential accidents with the tall tower during the radiosonde launch)

With these remote sensing instruments, the intercomparison and cross cutting experiment of 3D observation techniques shall be performed. Some of instruments are operationally utilized by KMA such as wind profiler and MWR, however there are still some limitation of operating these systems concerning the maintenance, quality control, and their data utilization by NWP models. This situation is mainly due to the lack of field test before operation, and affecting the integration of observation negatively. KMA is establishing or upgrading Boseong observatory aiming at resolving the limitation and stepping forward to the true integration of observation recommended by WIGOS.

The main facility to be added at Boseong observatory is the tall tower, and its construction is scheduled to be finished in Spring 2013. It is designed with 300m height secured by cables in three directions. The tower has 11 levels of observation platform of 10, 20, 40, 60, 80, 100, 140, 180, 220, 260, 300 m. It will provide high quality of platform for the micro- or agro-meteorology and environmental observation with various profile and flux data to be installed. Figure 6. shows the imaginary picture of Boseong tall tower, and the plan of instrumentation.

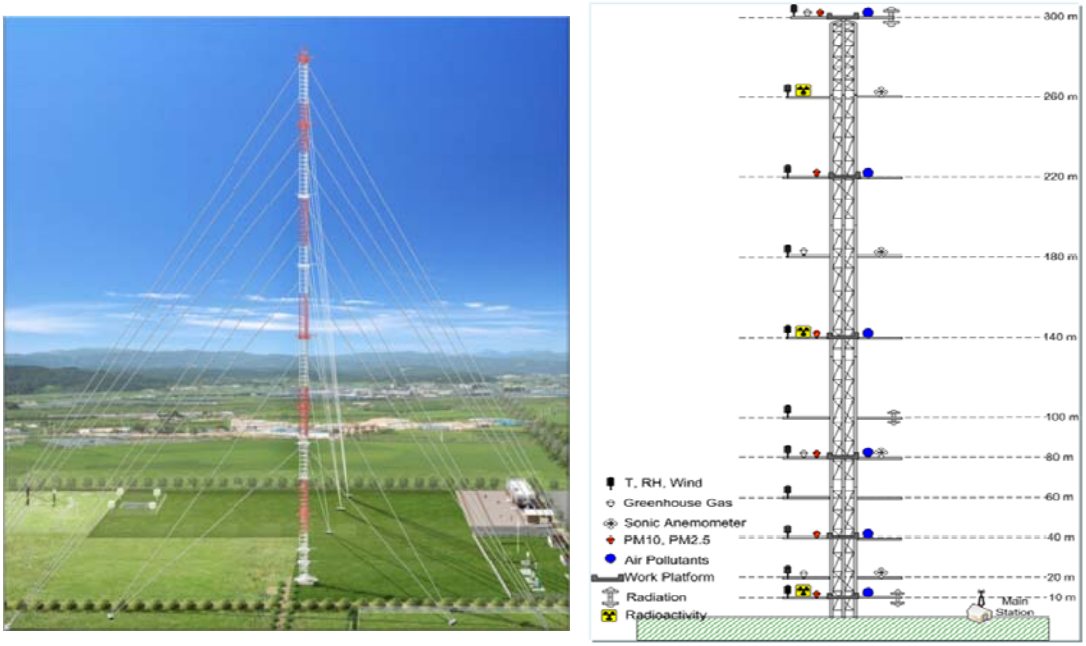

Figure 6. Tall Tower of Boseong with 300m height. Construction to be completed in Spring 2013

According to WIGOS Implementation Plan, the integration of observation must be pursued to ensure interoperability and facilitate optimization across observing instruments and equipments. From 2013 Boseong observatory will be one of the bases of observation researches in Korea. The researcher's network or working group shall be organized for maximizing the facility's capacity. Boseong testbed is bound to be connected with other observatories, Chupungnyeong and Gochang. Furthermore, KMA operating GAW sites and other climate monitoring facilities shall be networked in order to ensure the integration and interoperability. Figure 7. shows the potential network of Korea's observation research facilities in nationwide. Surely, the international network or cooperation opportunity for various intercomparison shall be prepared.

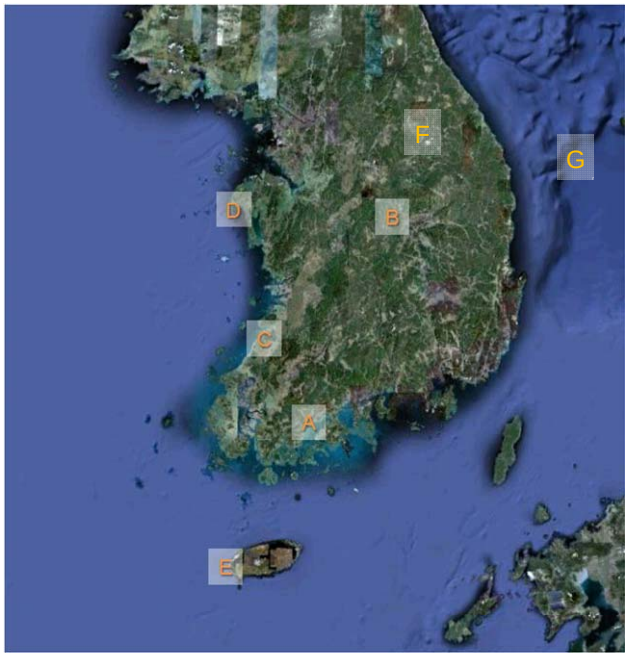

Figure 7. KMA's observatories to be networked for the integration of observation research; A) Boseong, B) Chupungnyeong, C) Gochang, D) Anmyeon (WMO GAW site), E) Gosan (GAW supporting), F) Daegwanryeong (NIMR Cloud Physics Research Center), G) Ulreung (GAW supporting)

4 Conclusion

This article presents current status and future plan of KMA's 3 standard observatories, which include Chupungnyeong Lead Centre and Boseong Testbed of WMO CIMO. Chupungnyeong and Gochang are utilized for several field experiments, such as investigation of sonic anemometer performance, intercomparison of rain gauges and snow depth equipments, performance validation of multisensors. Boseong is being upgraded with several facilities, especially a 300m tall tower is going to begin operation in Spring 2013. KMA's standard observatories will be networked with other special observation sites domestically and internationally for enhancing the integration of observation, hence contribute the WIGOS implementation.

5 Reference

- Terms of Reference CIMO Testbed and Lead Centre, WMO, 2010
- Proposal for CIMO Lead Centre for the evaluation of precipitation measurement accuracy (Chupungnyeong), and CIMO Testbed for the integration of 3D Weather Observation System (Boseong), CIMO TECO 2010, KMA, 2010
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- WIGOS framework Implementation Plan, WMO, 2012