

Questionnaire on Quality Management for Surface Meteorological Observations in Regional Association II (Asia)

RA II WIGOS Project to Enhance the Availability and Quality of Management Support for NMHSs in Surface, Climate and Upper-air Observations

March 2018

SUMMARY

This report presents the results of the Questionnaire on Quality Management for Surface Meteorological Observations in Regional Association II (Asia).

The survey was conducted under the RA II WIGOS Project to Enhance the Availability and Quality of Management Support for NMHSs in Surface, Climate and Upper-air Observations. A total of 20 RA II Member NMHSs responded.

Analysis of the results revealed that:

- automatic precipitation/hydrological stations were operated by only a third of responding NMHSs;
- two thirds of NMHSs had more manned precipitation/hydrological stations than automatic stations;
- precipitation/hydrological stations were generally manned, and observation data from them were not automatically reported to NMHS headquarters;
- precipitation/hydrological stations were characterized by difficulties with regard to checking of observation data quality and station environments;
- the percentage of NMHSs utilizing observation data from precipitation/hydrological stations for effective disaster risk reduction (such as issuance of advisories/warnings and nowcasting) was generally lower than the corresponding figure for data from weather stations;
- NMHSs recognized a lack of skilled staff rather than a lack of expertise; and
- NMHSs frequently implemented data correction as follow-up on erroneous

data, but user notification of such was rare.

Numerous observation stations were found to face difficulties in checking of observation data quality and station environments despite the key role of precipitation observation in DRR.

Due to the high priority of DRR, related challenges on various scales should be discussed by Member countries toward resolution of the above issues. Other aspects of the survey results highlighted the need for discussions regarding follow-up action on erroneous data and capacity building based on an optimal combination of telecommunications and face-to-face learning.

The content of this report leads to a proposal for Member countries to plan a workshop as a platform for learning about practical issues and discussion of related improvement.

1 INTRODUCTION

1.1 Background

At the 15th session of Regional Association (RA) II (Asia) under the World Meteorological Organization (WMO) held in December 2012 in Doha, Qatar, a decision was taken to launch the regional WMO Integrated Global Observing System (WIGOS) Project to Enhance the Availability and Quality of Management Support for National Meteorological and Hydrological Services (NMHSs) in Surface, Climate And Upper-air Observation. At the 16th session held in February 2017 in Abu Dhabi, the United Arab Emirates, RA II resolved to continue the project in order to facilitate further enhancement of capability and available services toward the improvement of observation data quality in RA II.

The project's specific aims are: (i) data quality improvement for Regional Basic Climatological Network (RBCN)/Regional Basic Synoptic Network (RBSN) stations; and (ii) capability enhancement for the Regional Instrument Centres in Tsukuba and Beijing. Improvement of surface meteorological observation quality is a major target among RA II Members. In this context, the RA II Survey on Surface, Climate and Upper-air Observations and Quality Management (2008) and the RA II Survey on Meteorological Instruments, Calibration and Training (2011) revealed major discrepancies among NMHS efforts and highlighted insufficient data quality due to a lack of capability and traceability to international standards. The survey results are presented in IOM Reports 111 and 122.

Following on from the above surveys, a questionnaire survey on quality management for surface meteorological observations in RA II was conducted in 2016 to evaluate a project intended to promote the sharing and exchange of information on the current status of quality assurance (QA) and quality control (QC) in surface meteorological observations in the region.

1.2 Organization

The questionnaire was distributed to all RA II WMO Members via the WMO Secretariat in April 2016 (copy provided in Appendix A). It was divided into *Current status of surface meteorological observations* (Section 1) and *Others* (Section 2).

Section 1 consisted of four parts and Section 2 consisted of two parts:

Section 1: Current status of surface meteorological observations

Part I: General

Part II: Observational data statistics

Part III: Management of surface stations

Part IV: Quality control for observational data

Section 2: Others

Part I: Use of surface observational data from external organizations

Part II: Progress of implementation work for siting classifications regarding surface observation

1.3 Responses

A total of 20 NMHSs among 35 RA II Members (Table 1) responded to the questionnaire.

Table 1 Responding NMHSs

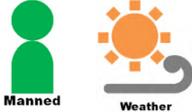
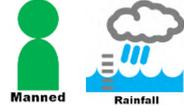
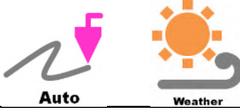
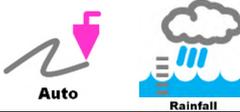
NMHSs	Reply to the questionnaire
Afghanistan	No
Bahrain	No
Bangladesh	Yes
Bhutan	Yes
Cambodia	Yes
China	Yes
Democratic People's Republic of Korea	No
Hong Kong, China	Yes
India	No
Iran, Islamic Republic of	Yes
Iraq	No
Japan	Yes
Kazakhstan	Yes
Kuwait	No
Kyrgyzstan	No
Lao People's Democratic Republic	Yes
Macao, China	Yes
Maldives	Yes
Mongolia	Yes
Myanmar	Yes
Nepal	No
Oman	No
Pakistan	Yes
Qatar	No
Republic of Korea	Yes
Russian Federation	Yes
Saudi Arabia	No
Sri Lanka	Yes
Tajikistan	No
Thailand	Yes
Turkmenistan	No
United Arab Emirates	Yes
Uzbekistan	No
Viet Nam	Yes
Yemen	No

2 SURVEY RESULTS

The questionnaire allowed NMHSs to define a group of observation stations in their responses. The column on the left of Table 2 shows these groups. For statistical validity, the groups were redefined in the report as shown in the column on the right with the minimum number of NMHSs as five. Four groups (**manned weather** stations, **manned precipitation/hydrological** stations, **automatic weather** stations and **automatic precipitation/hydrological** stations) are referred to in the report. The set of icons for each group is also shown in Table 2.

Table 2 Group definitions

Numbers of NMHSs reporting station configurations are shown in parentheses.

Station groups in questionnaire responses	Groups referred to in this report and icon combinations
Manned Synoptic (10)	Manned Weather (13) 
Manned Climatological (7)	
National Synoptic/Climatological (1)	
Climatological (1)	
Manned Agrometeorological (5)	
Manned Aeronautical Met (1)	
Manned Precipitation (5)	Manned Precipitation/Hydrological (9) 
Manned Rain Gauge (2)	
Manned Hydrological (4)	
Automatic Weather (13)	Automatic Weather (13) 
Automatic Rainfall (2)	
Automatic Rain Gauge (3)	Automatic Precipitation/Hydrological (6) 
Automatic Water Level (1)	

Responses to questions requiring the selection of a single option are represented as circle charts (Figure 1, left), and those requiring the selection of multiple options are shown as histogram charts.

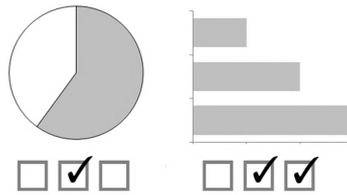


Figure 1 Graph styles for different question types

As shown in Table 2, the number of NMHSs in groups ranged from 6 to 13. Accordingly, ratios are indicated using the seven ranges.

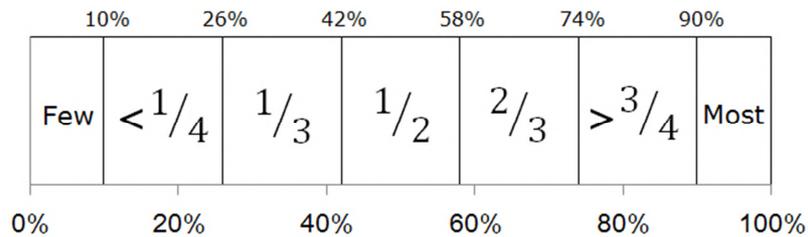


Figure 2 Range definitions

2.1 Section 1: Current status of surface meteorological observations

2.1.1 Section 1 summary

Section 1 questions related to NMHS surface observations, including general information, data statistics, station management and data quality management.

(a) Overview of RA II NMHS observing systems

More than three quarters ($> 3/4$) of responding NMHSs operated **weather** stations, two thirds ($2/3$) also operated **manned precipitation/hydrological** stations, and a third ($1/3$) operated **automatic precipitation/hydrological** stations (Figure 3, Q1-2).

Regarding the configuration of stations, at a third ($1/3$) of NMHSs the number of **manned** stations exceeded that of **automatic** stations, while two thirds ($2/3$) operated more **precipitation/hydrological** stations (Figure 4, Q1-2).

From a spatial viewpoint, less than a quarter ($< 1/4$) of NMHSs operated **manned weather** stations with a mean area per station (i.e., the country area divided by the number of stations) of 1,000 km² or less (Figure 5, Q1-2).

Two thirds ($2/3$) of NMHSs operated RBSN and/or RBCN **weather** stations (Figure 6, Q1-3).

(b) Reporting of observation results

More than three quarters ($>3/4$) of NMHSs reported automatic submission of observation results from **automatic** stations to NMHS headquarters. However, few NMHSs reported such submission from **manned precipitation/hydrological** stations (Figure 7, Q1-4).

(c) Utilization of observation results

Two thirds ($2/3$) of NMHSs made use of observation results for all specific applications. The percentage of NMHSs utilizing observation data from **precipitation/hydrological** stations in disaster risk reduction application (e.g., for advisories/warnings and nowcasting) was generally lower than that for observation data from **weather** stations (Figure 8, Q1-5).

(d) Observation elements

More than three quarters ($>3/4$) of NMHSs engaged in automatic observation of atmospheric elements ((a) atmospheric pressure, (b) air temperature, (c) humidity and (e) surface wind) at **automatic weather** stations, while only half ($1/2$) did so at **manned weather** stations (Figure 9 a, Q1-6).

The percentage of NMHSs observing radiative/weather elements at **automatic weather** stations was generally lower than that of NMHSs performing similar observation at **manned** stations (Figure 9 b, Q1-6).

Half ($1/2$) of NMHSs observed precipitation on a manual basis at **manned weather** stations, and the corresponding figure was more than three quarters ($>3/4$) for **manned precipitation/hydrological** stations (Figure 9 c, Q1-6).

(e) Observation data statistics

Most (all) NMHSs kept climatological observation statistics for **manned** stations, and more than three quarters ($>3/4$) kept them for **automatic** stations (Figure 10, Q1-7).

Most NMHSs stored both hard and soft copies of observation results and statistics for **manned** stations, while soft copies were favored for **automatic** stations (Figure 12, Q1-9).

(f) Station maintenance

Most NMHSs checked station conditions in all groups (Figure 13, Q1-10). Half (1/2) checked conditions on a daily or weekly basis for **manned weather** stations, while less than a quarter (<1/4) of **automatic weather** stations were checked on a daily or weekly basis (Figure 14, Q1-10-1).

At more than three quarters (>3/4) of NMHSs, station conditions were checked by NMHS staff or under their responsibility (Figure 15, Q1-10-2).

More than three quarters (>3/4) of NMHSs adopted all specific options (see 2.1.4.4) in checking station conditions. The adoption percentage for **manned precipitation/hydrological** stations was relatively low (Figure 16, Q1-10-3).

A third (1/3) of NMHSs recorded no problems with **weather** stations, and half (1/2) recorded no problems with **precipitation/hydrological** stations. More NMHSs cited problems with a lack of skilled staff than issues with a lack of expertise (Figure 17, Q1-10-4).

More than three quarters (>3/4) of NMHSs made use of guidance documents for site environment maintenance (Figure 18, Q1-11).

(g) Observation data quality management

Most NMHSs checked the quality of observation data from **manned** stations and **automatic weather** stations, and more than three quarters (>3/4) checked the quality of data from **automatic precipitation/hydrological** stations (Figure 20, Q1-12).

More than three quarters (>3/4) of NMHSs checked observation data automatically using all options (e.g., range checking, accordance testing for correspondence with other meteorological elements, comparison with results of neighboring stations and verification of report formats) for **weather** stations, and two thirds (2/3) checked observation data manually. For **precipitation/hydrological** stations, two thirds (2/3) checked observation data automatically using all options, and half (1/2) also performed manual checking (Figures 22 and 23, Q1-12-2, 3).

Based on the average of all groups, more than three quarters (>3/4) of NMHSs carried out data correction as follow-up for erroneous data. However, few adopted related user notification. The percentage of follow-up implementation for **automatic** stations was generally lower than that for **manned** stations (Figure 24, Q1-12-4).

2.1.2 Part I: General

2.1.2.1 Q1-2: How many observing stations does the group have?

More than three quarters ($>3/4$) of NMHSs operated **weather** stations, two thirds ($2/3$) operated **manned precipitation/hydrological** stations, and a third ($1/3$) operated **automatic precipitation/hydrological** stations (Figure 3).

At a third ($1/3$) of NMHSs, the number of **manned** weather stations exceeded that of **automatic** weather stations, while two thirds ($2/3$) had the same situation for **precipitation/hydrological** stations (Figure 4).

Less than a quarter ($<1/4$) of NMHSs operated **manned weather** stations with a mean area per station (i.e., country's area divided by the number of stations) of $1,000 \text{ km}^2$ or less, while a third ($1/3$) had the same situation for **automatic weather** stations. In terms of **weather** and **precipitation/hydrological** station combinations, a third ($1/3$) of NMHSs operated **manned** stations with a mean area per station of $1,000 \text{ km}^2$ or less, and half ($1/2$) had the same situation for **automatic** stations (Figure 5).

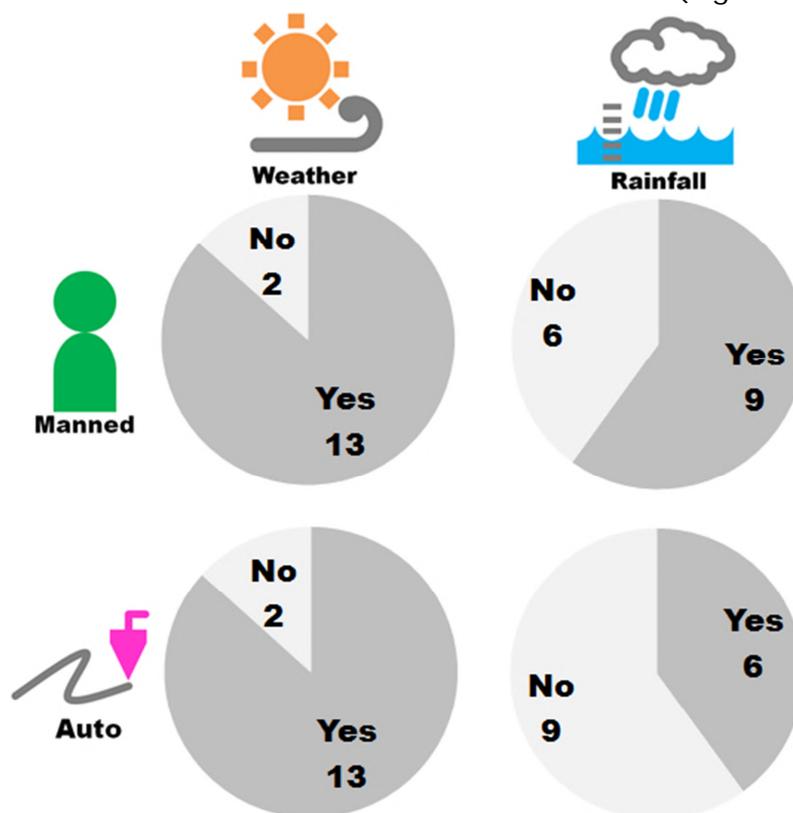


Figure 3 Operational observation stations

Ratio of manned to total

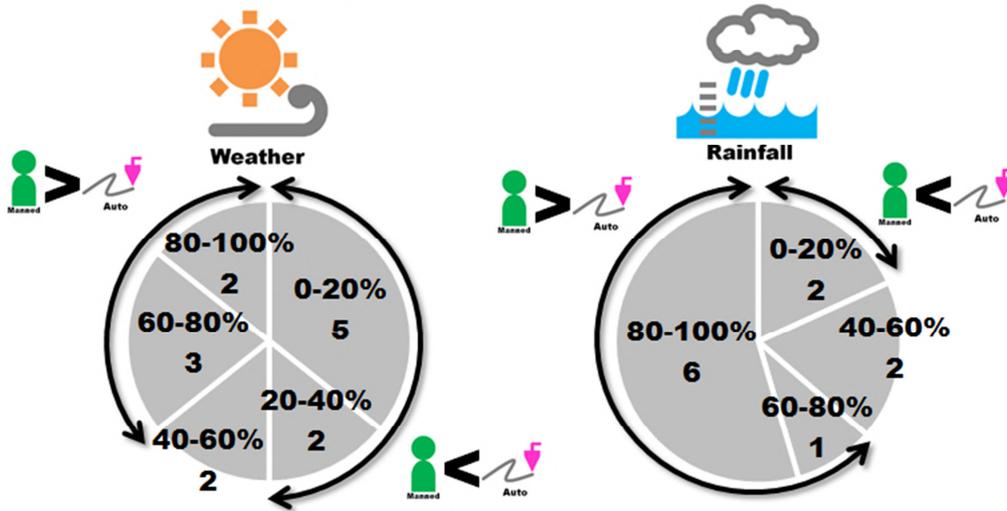


Figure 4 Ratio of the number of manned stations to the total

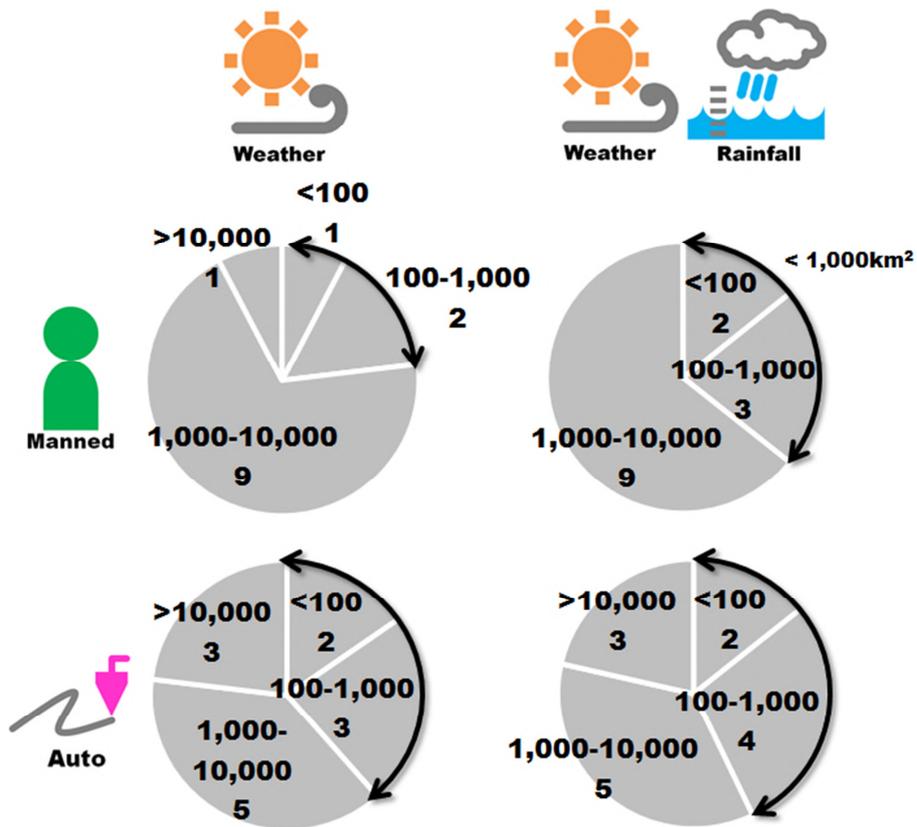


Figure 5 Area per station

2.1.2.2 Q1-3: Are there any RBSN/RBCN stations in the group?

More than three quarters ($>3/4$) of NMHSs operated **manned** RBSN and/or RBCN **weather** stations, and two thirds ($2/3$) operated **automatic** ones. Less than a quarter ($<1/4$) operated **manned** RBSN/**precipitation/hydrological** stations, and a third ($1/3$) operated **automatic** ones (Figure 6).

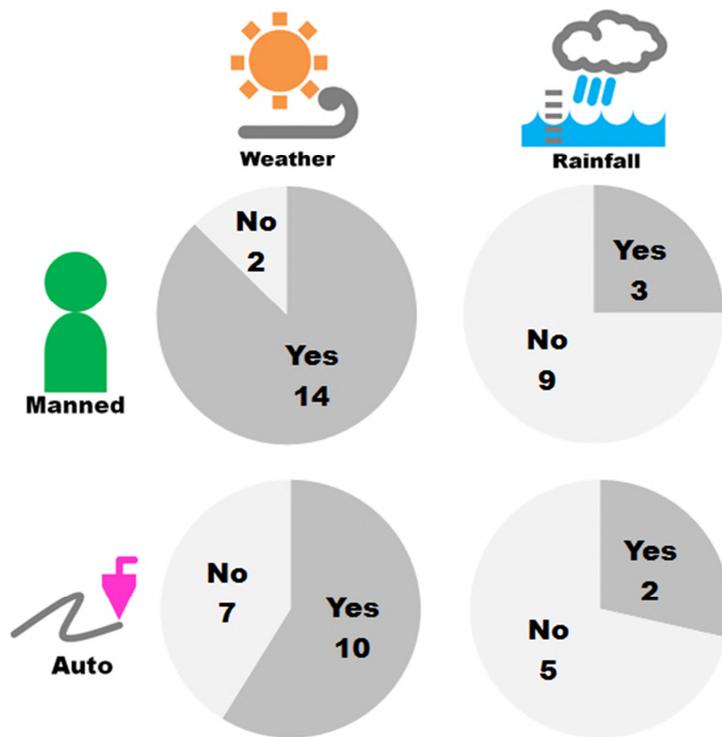


Figure 6 Availability of RBSN/RBCN

2.1.2.3 Q1-4: How are the results of observation from the stations reported to Headquarters?

While more than three quarters (> 3/4) of NMHSs reported observation results from **automatic precipitation/hydrological** stations automatically to headquarters, few observation data from **manned precipitation/hydrological** stations were reported automatically to headquarters. Two thirds (2/3) of NMHSs reported observation results from **automatic weather** stations automatically to headquarters, and a third (1/3) reported them automatically from **manned weather** stations (Figure 7).

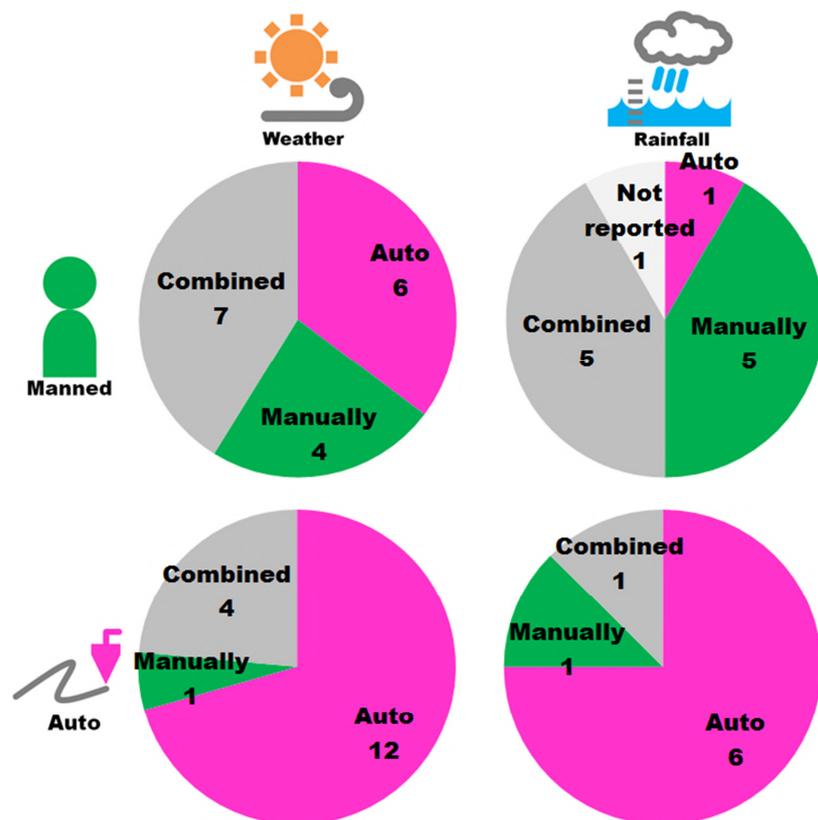


Figure 7 Reporting of observation data from stations to headquarters

2.1.2.4 Q1-5: What are the results of observation used for?

Two thirds (2/3) of NMHSs made use of observation results for all specific applications. The percentage for precipitation/hydrological stations was generally lower than that for weather stations, especially in application for disaster risk reduction efforts such as NWP, nowcasting and advisories/warnings (Figure 8).

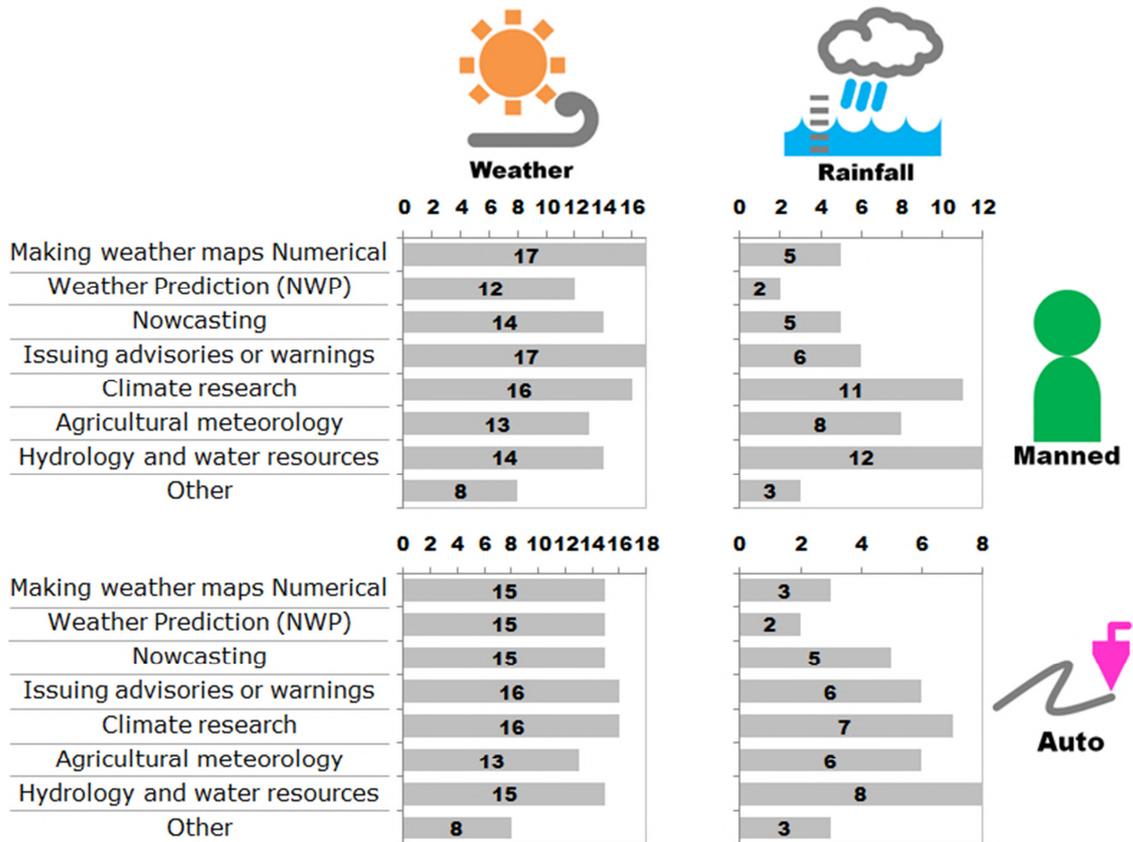


Figure 8 Application of observation data

2.1.2.5 Q1-6: What is the primary observation method for each meteorological element?

A third (1/3) of NMHSs observed atmospheric elements (i.e., (a) atmospheric pressure, (b) air temperature, (c) humidity and (e) surface wind) on an automatic basis for **manned weather** stations, and the corresponding figure was more than three quarters (>3/4) for **automatic weather** stations (Figure 9 a).

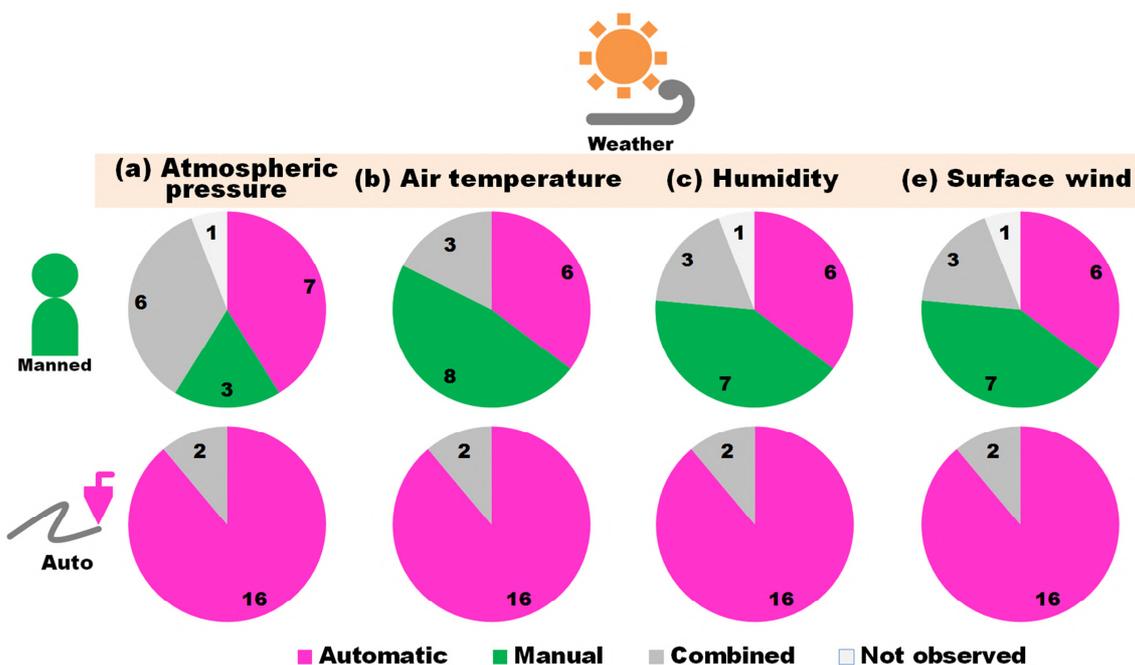


Figure 9 a Methods for atmospheric elements
 "Combined" includes combination with "Not observed."

Regarding radiative/weather elements (i.e., (f) sunshine duration, (g) solar radiation, (h) visibility and (i) weather), the percentage of NMHSs observing elements for **automatic weather** stations was generally lower than that for **manned weather** stations. Half (1/2) observed (f) sunshine duration and (g) solar radiation on an automatic basis for **automatic weather** stations, while less than a quarter (<1/4) observed (h) visibility and (i) weather. Two thirds (2/3) observed (f) sunshine duration on a manual basis for **manned weather** stations, half (1/2) (i) weather, a third (1/3) (h) visibility, and less than a quarter (<1/4) (g) solar radiation (Figure 9 b).

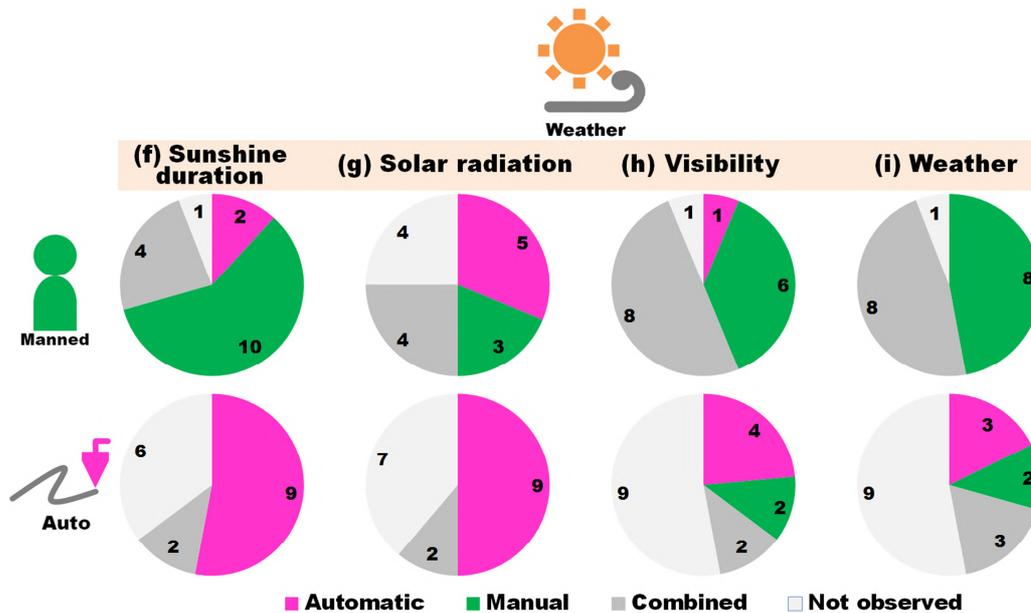


Figure 9 b Methods for radiative elements

Half (1/2) of NMHSs observed precipitation on a manual basis for **manned weather** stations and more than three quarters (>3/4) on an automatic basis for **automatic weather** stations. More than three quarters (>3/4) observed precipitation on a manual basis for **manned precipitation/hydrological** stations, and most performed observation on an automatic basis for **automatic precipitation/hydrological** stations (Figure 9 c).

For snow depth, manual observation was the primary method for **manned** stations and automatic observation was the primary method for **automatic** stations. Such operation was performed by only a few NMHSs (Figure 9 c).

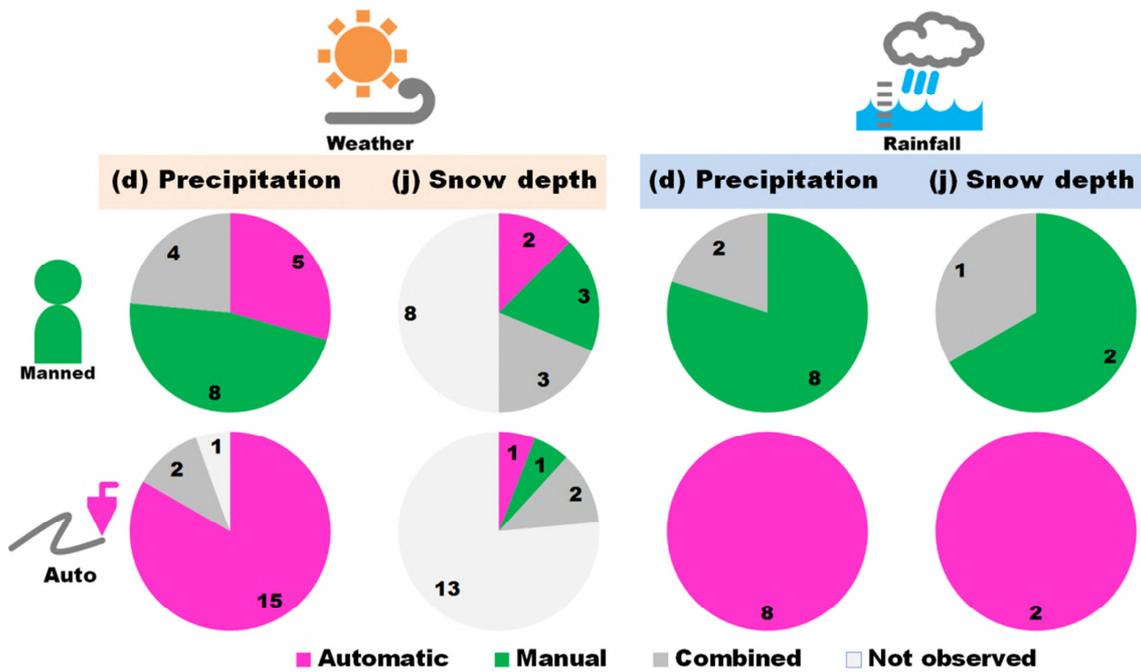


Figure 9 c Methods for precipitation and snow elements

2.1.3 Part II: Observational data statistics

2.1.3.1 Q1-7: Are climatological observation statistics kept?

Most (all) NMHSs kept climatological observation statistics for **manned** stations, and more than three quarters (>3/4) kept them for **automatic** stations (Figure 10).

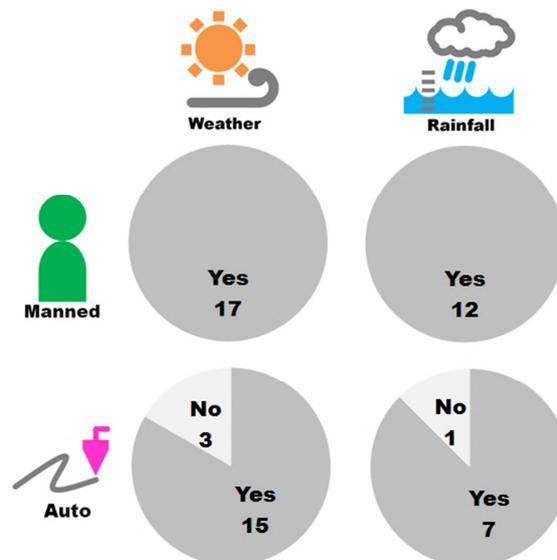


Figure 10 Availability of climatological observation statistics

2.1.3.2 Q1-8: Are climate standard normals (averages of climatological data over consecutive periods of 30 years) kept?

Most (all) NMHSs kept climate standard normals for **manned weather** stations, more than three quarters (>3/4) kept them for **manned precipitation/hydrological** stations, and two thirds (2/3) kept them for **automatic** stations (Figure 11).

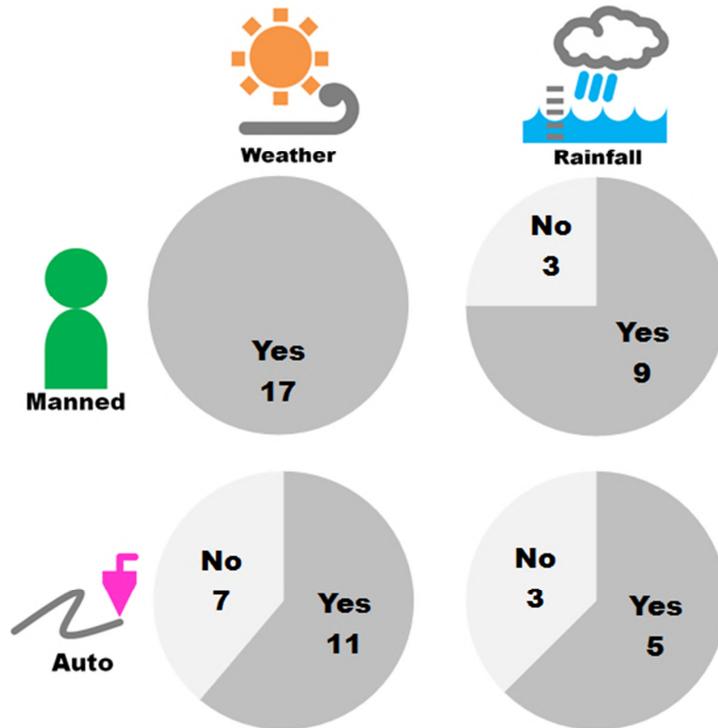


Figure 11 Availability of climate standard normals

2.1.3.3 Q1-9: How are observation results and statistics stored?

More than three quarters (>3/4) of NMHSs stored both hard and soft copies of observation results and related statistics for **manned** stations and soft copies for **automatic** stations. A third (1/3) of NMHSs stored hard copies for **automatic** stations (Figure 12).

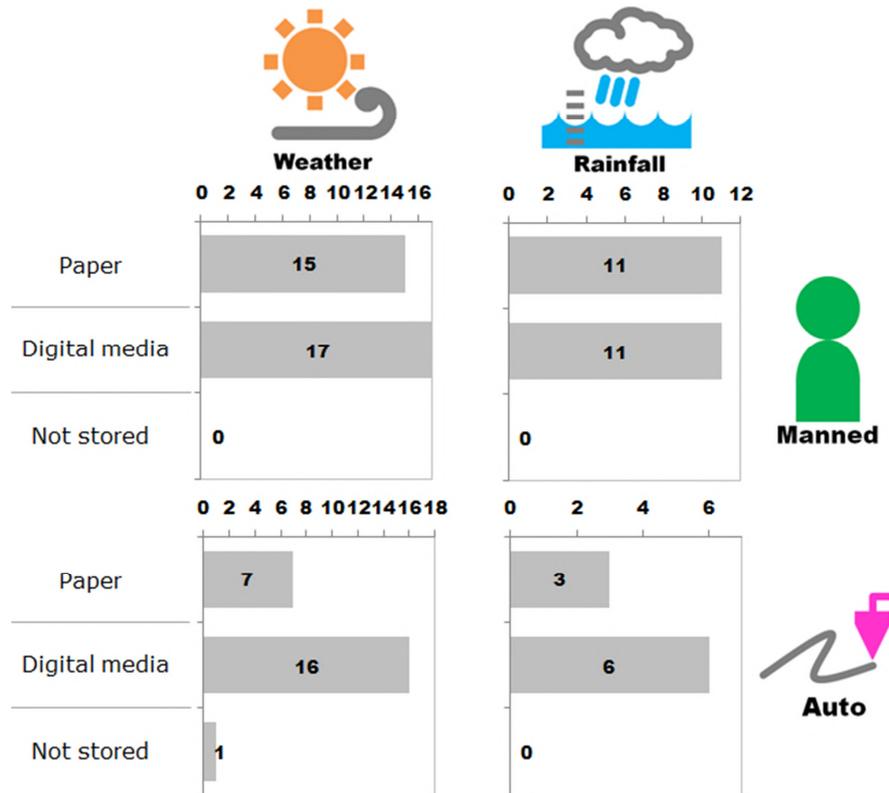


Figure 12 Observation results and statistic storage

2.1.4 Part III: Surface station management

2.1.4.1 Q1-10: Are the conditions or situations of stations ever checked?

Most NMHSs checked station conditions in all groups (Figure 13).

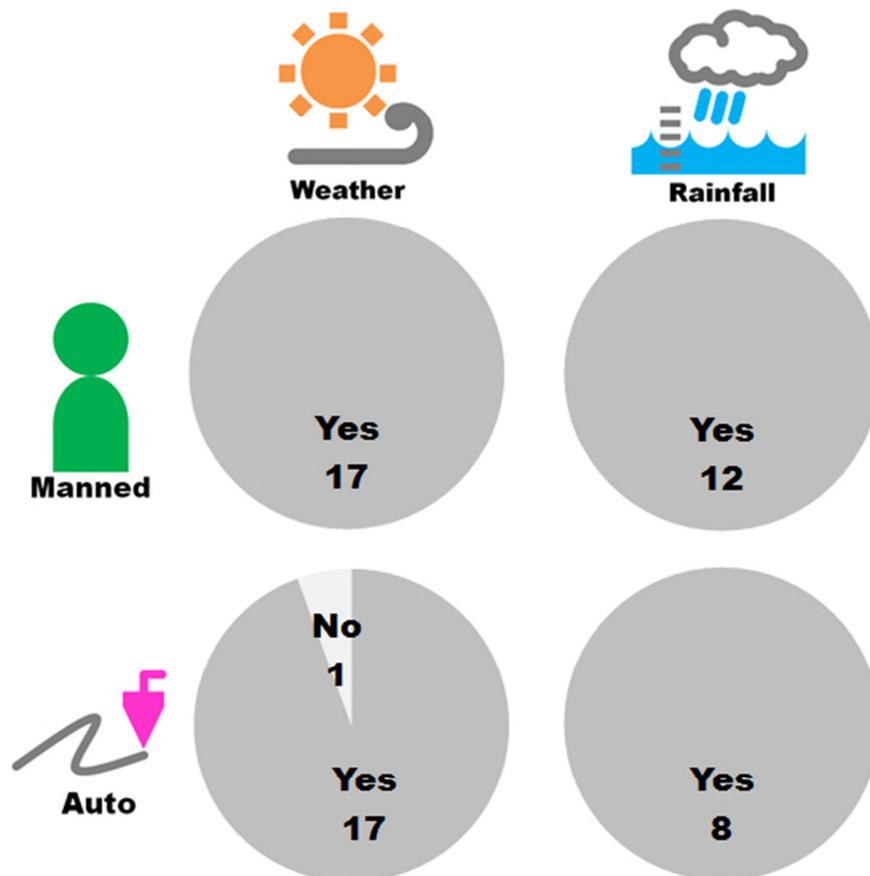


Figure 13 Practice of checking station conditions

2.1.4.2 Q1-10-1: How often are the conditions or situations of stations checked?

Half (1/2) of NMHSs checked the conditions of **manned weather** stations on a daily or weekly basis. Those of **automatic weather** stations were checked by less than a quarter (<1/4) of NMHSs, while those of **manned precipitation/hydrological** stations were checked by a third (1/3) (Figure 14).

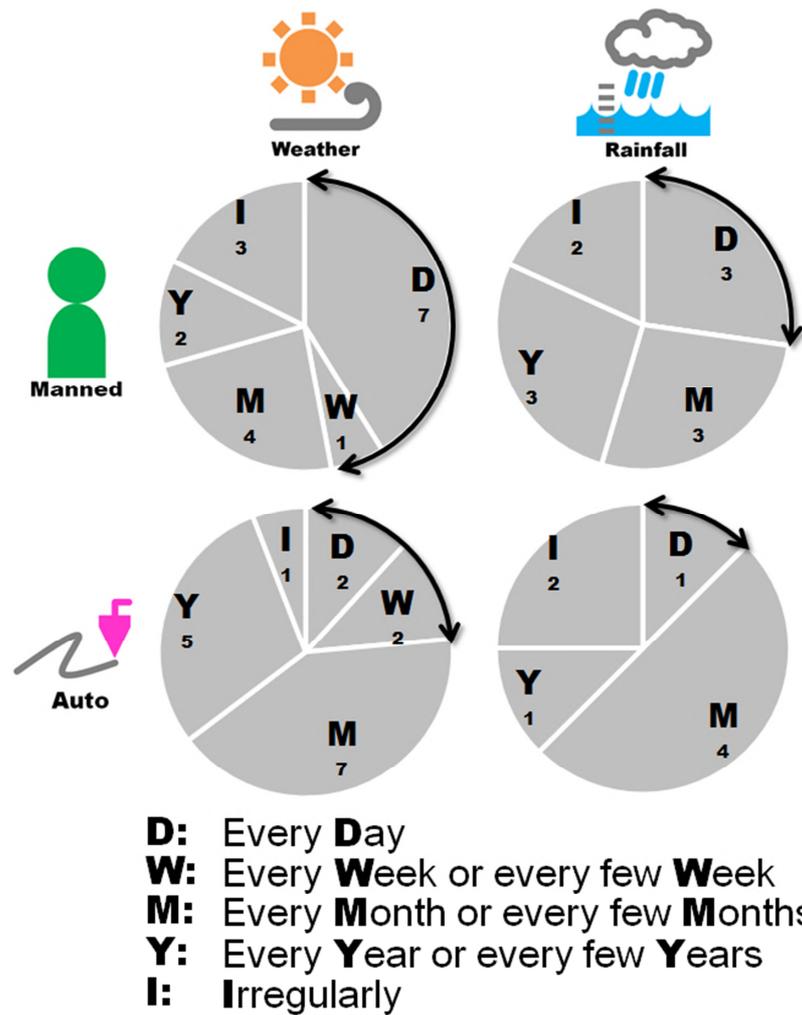


Figure 14 Frequency of station condition checking

2.1.4.3 Q1-10-2: Who is responsible for checking the conditions or situations of stations?

At more than three quarters (>3/4) of NMHSs, station conditions were checked by, or under the responsibility of, NMHS staff. At a quarter or less (<1/4) of NMHSs, conditions were checked by non-NMHS staff only (Figure 15).

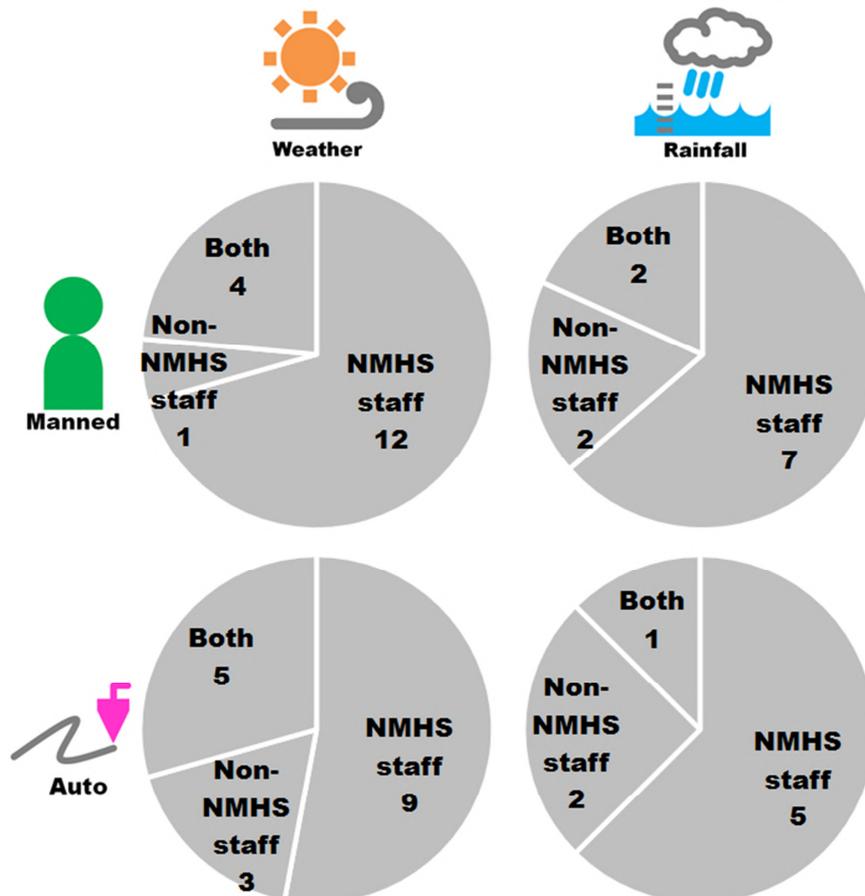


Figure 15 Staff responsible for checking station conditions

2.1.4.4 Q1-10-3: What items does such checking include?

At more than three quarters (>3/4) of NMHSs, station conditions were checked using all options for relevant methods. The percentage of selected options for **manned precipitation/hydrological** stations was relatively low (Figure 16).

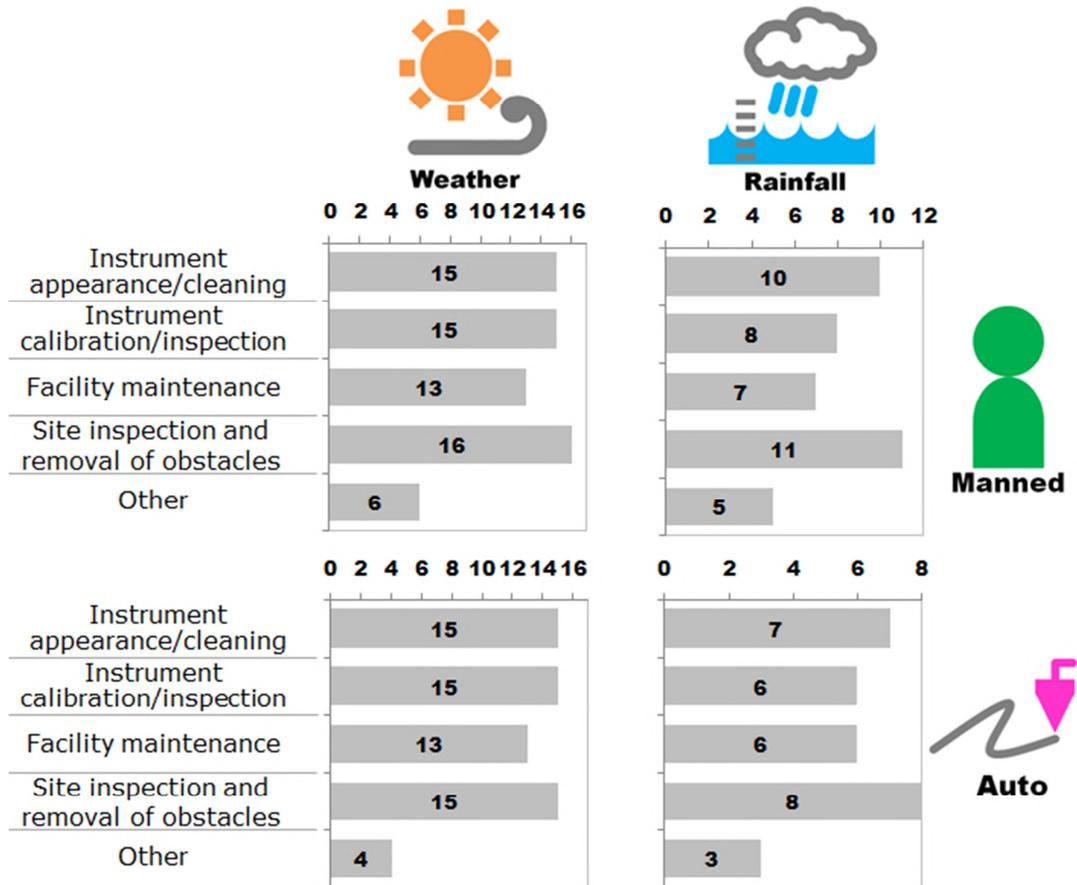


Figure 16 Station condition checking activities

2.1.4.5 Q1-10-4: What problems are experienced in checking?

Between a third (1/3) and a half (1/2) of NMHSs had experienced specific problems with data checking. More NMHSs indicated a lack of skilled staff than a lack of expertise (Figure 17).

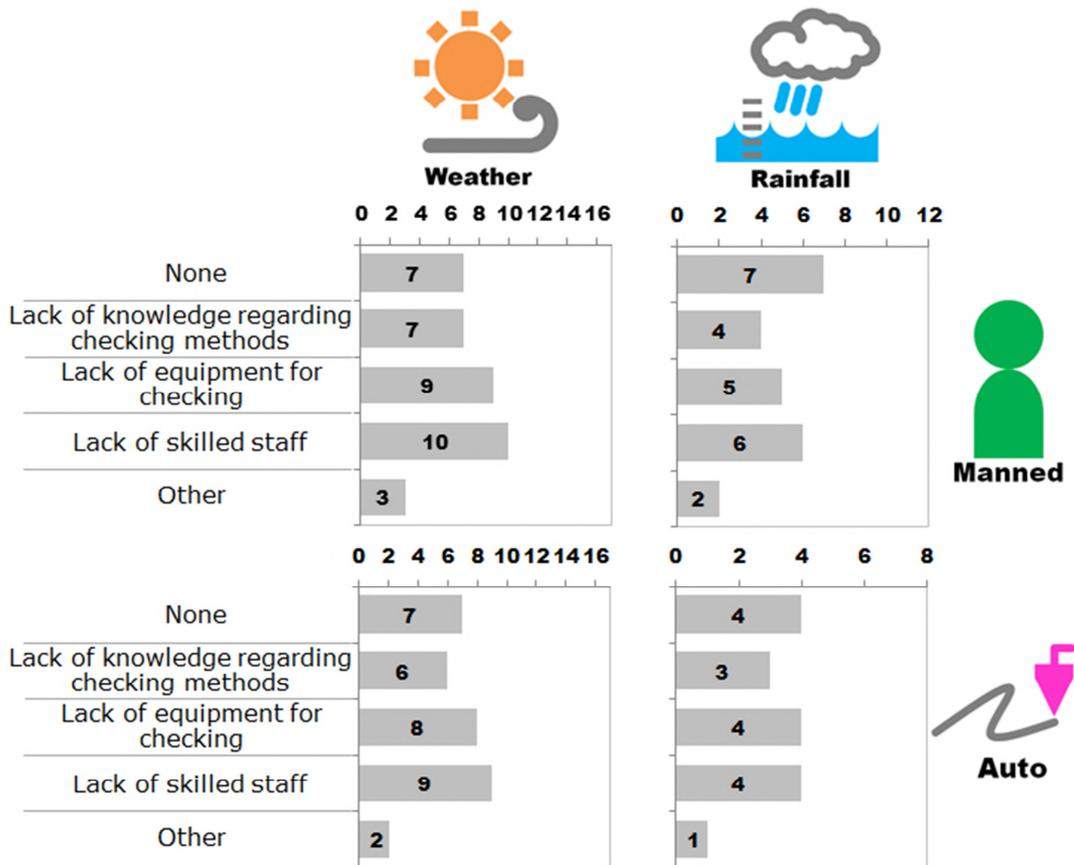


Figure 17 Problems experienced in checking

2.1.4.6 Q1-11: Are in-house guides or manuals used to maintain site environmental conditions?

More than three quarters (>3/4) of NMHSs made use of guidance documents on site environment maintenance for **manned** stations and **automatic precipitation/hydrological** stations, while two thirds (2/3) used such documents for **automatic weather** stations (Figure 18).

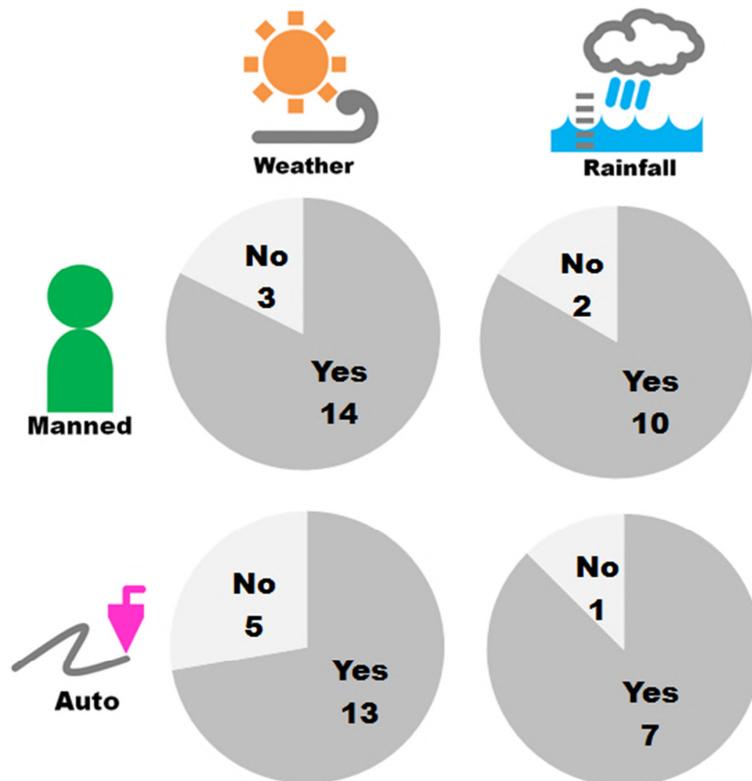


Figure 18 Guidance for site environment maintenance

2.1.4.7 Q1-11-1: What literature is referenced for the maintenance of site environmental conditions?

Most NMHSs referred to the Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8) for observation at **manned weather** stations, while more than three quarters (>3/4) referred to it for other groups. More than three quarters (>3/4) referred to manuals or support documents provided by manufacturers for **automatic** stations and for **manned weather** stations, while half (1/2) referred to the same for **manned precipitation/hydrological** stations (Figure 19).

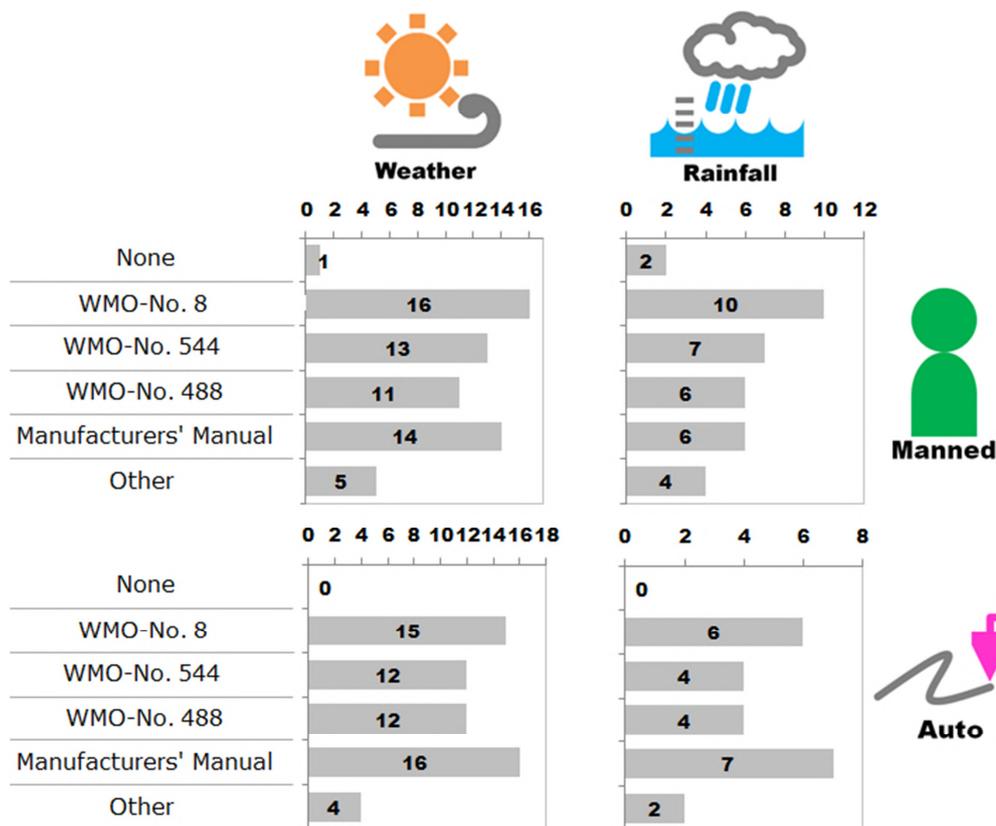


Figure 19 Literature for site environment maintenance

2.1.5 Part IV: Quality control for observational data

2.1.5.1 Q1-12: Are observational data quality-checked?

Most NMHSs checked the quality of observation data both from **manned** stations and **automatic weather** stations, while more than three quarters (>3/4) checked the quality of such data from **automatic precipitation/hydrological** stations (Figure 20).

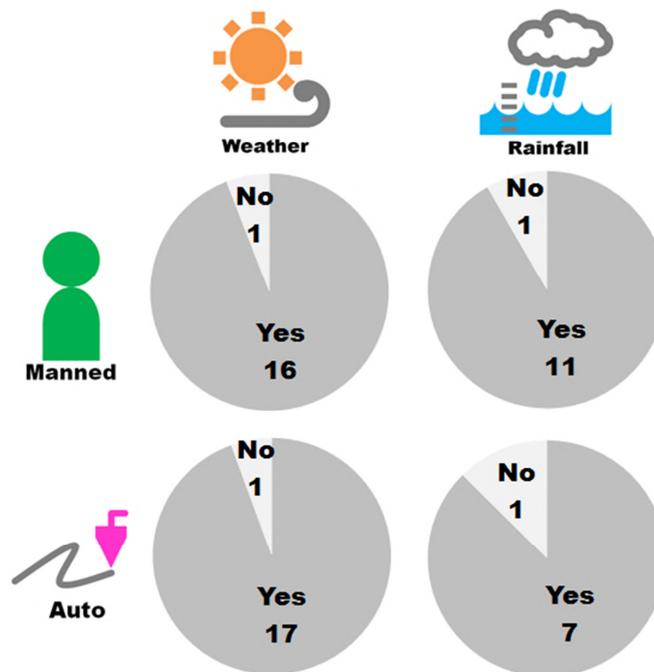


Figure 20 Implementation of quality checking

2.1.5.2 Q1-12-1: In quality checking for observational data, are Reports on the Quality of Land Surface Observations in Region II referenced?

Half (1/2) of NMHSs referred to "Reports on the Quality of Land Surface Observations in Region II" for **manned weather** stations. A third (1/3) referred to the same for **automatic weather** stations, while less than a quarter (<1/4) referred to it for **precipitation/hydrological** stations (Figure 21).

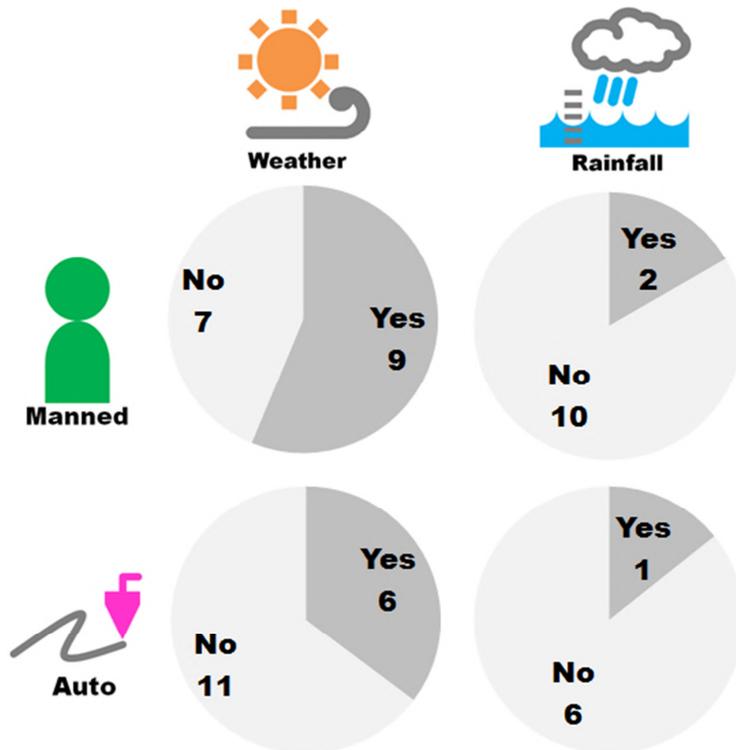


Figure 21 Reports on the quality of land surface observations in Region II as practical reference

2.1.5.3 Q1-12-2: What kind of checking is automated using computers and the like?

More than three quarters (>3/4) of NMHSs automatically checked observation data using all options for **weather** stations and **automatic precipitation/hydrological** stations, while two thirds (2/3) performed checking using all options for **manned precipitation/hydrological** stations (Figure 22).

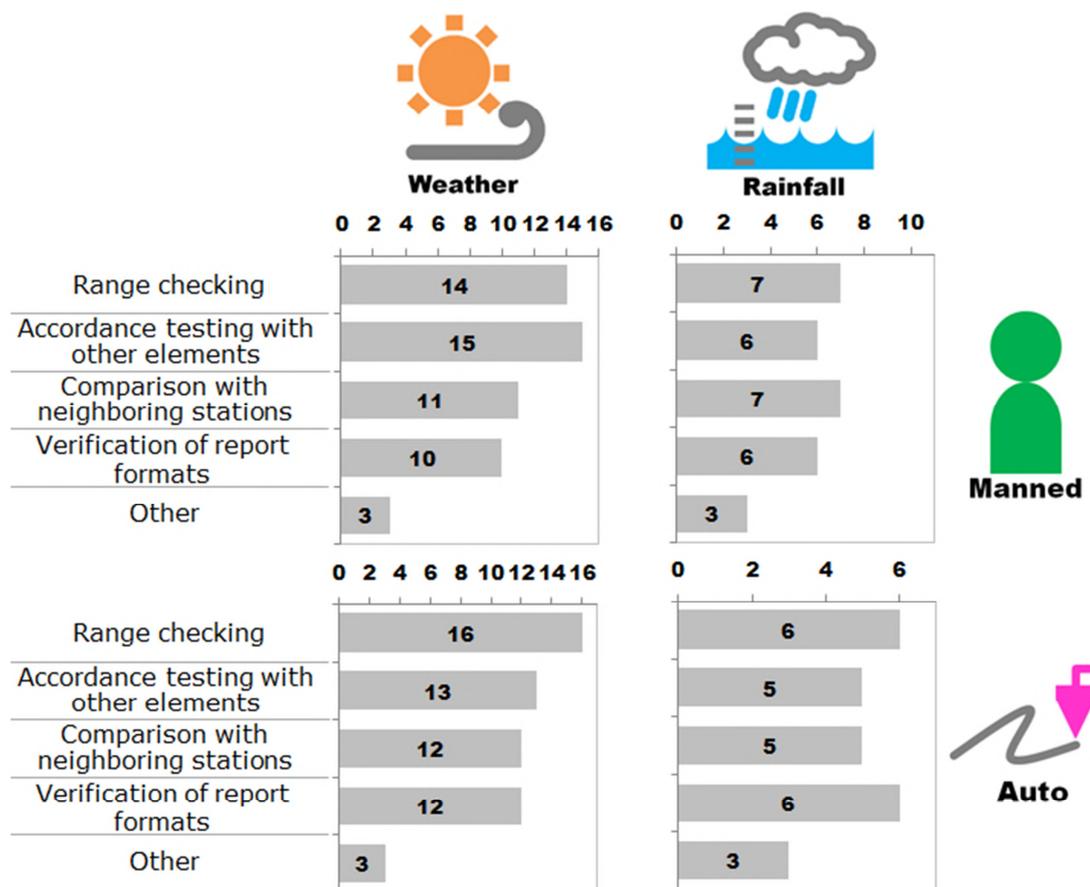


Figure 22 Methods of automatic checking

2.1.5.4 Q1-12-3: What kind of checking is performed manually?

Two thirds (2/3) of NMHSs manually checked observation data using all options for **weather** stations, and half (1/2) checked manually using all options for **precipitation/hydrological** stations. The percentage of implementation for manual checking methods was slightly lower than that for automatic methods as described in Q1-12-2 (Figure 23).

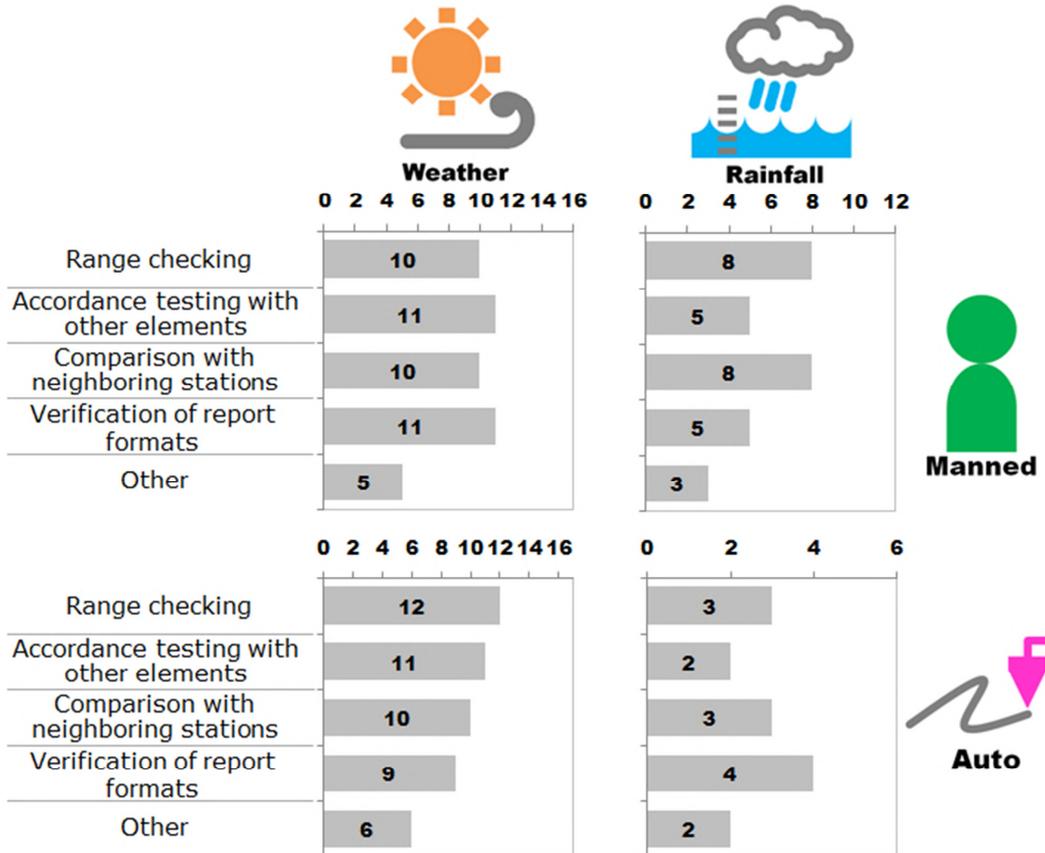


Figure 23 Methods of manual checking

2.1.5.5 Q1-12-4: What kind of follow-up action is taken if problems with observational data are found?

Based on the average of all groups, more than three quarters (>3/4) of NMHSs carried out data correction as follow-up, two thirds (2/3) carried out remark addition, half (1/2) carried out observer notification, and less than a quarter (<1/4) carried out user notification. The percentage of implementation for follow-up action with **automatic** stations was generally lower than that for **manned** stations (Figure 24).

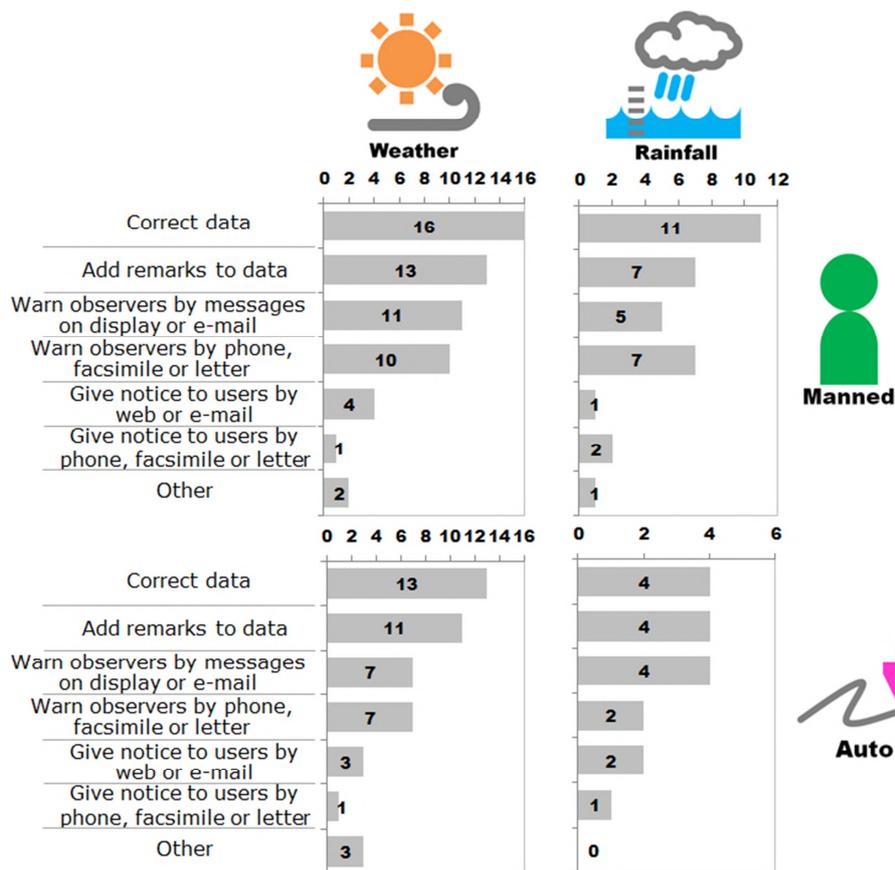


Figure 24 Follow-up action for problematic data

2.2 Section 2: Others

2.2.1 Summary of Section 2

Questions in Section 2 referred to observation data from organizations other than NMHSs.

(a) NMHS utilization of observation data from external organizations

Two-thirds (2/3) of NMHSs responding to the questionnaire utilized surface observation data from operators other than NMHSs in the relevant country in their operations (Figure 25, Q2-1). National and local governments were most often (more than three quarters) seen as providers of observation data, and two thirds (2/3) of NMHSs input observation data via a combination of online and offline methods (Figures 26 and 28, Q1-1-1, 3). Air temperature, humidity, precipitation, surface wind and atmospheric pressure data from non-NMHS organizations were most often used by NMHSs (Figure 27, Q2-1-2). These data were mostly used in issuing warnings and less in numerical weather prediction (Figure 29, Q2-1-4).

The quality of observation data from non-NMHS operators was checked by more than three quarters of NMHSs responding to the questionnaire, while the environmental conditions of stations operated by external organizations were checked by half (1/2) (Figures 30 and 31, Q2-1-5, 6).

(b) Siting classifications

Siting classifications for surface observation stations on land, as adopted at WMO CIMO-15 (Helsinki, September 2010), were implemented by two thirds (2/3) of NMHSs responding to the questionnaire. Less than a quarter (<1/4) of NMHSs still had no specific plans for siting classifications (Figure 32, Q2-2).

2.2.2 Part I: Use of surface observational data from external organizations

2.2.2.1 Q2-1: Are surface observational data from other organizations used operationally in the relevant country?

Two thirds (2/3) of NMHSs made operational use of observation data provided by non-NMHS operators (Figure 25).

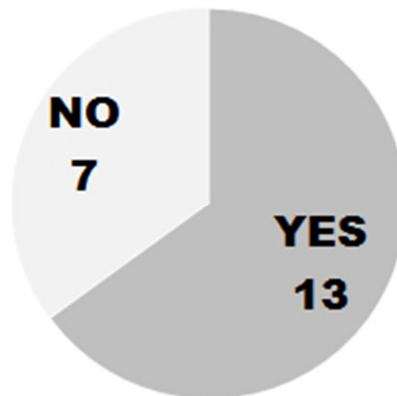


Figure 25 Operational use of non-NMHS observation data

2.2.2.2 Q2-1-1: Which external organizations provide observational data?

More than three quarters (>3/4) of NMHSs obtained observation data from national/local governments, while only a third (1/3) did so from private enterprises or research organizations (Figure 26).

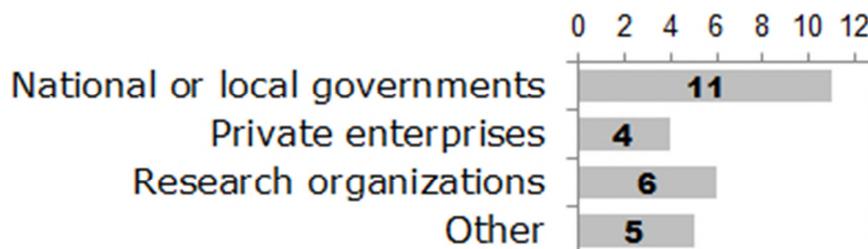


Figure 26 Non-NMHS data providers

2.2.2.3 Q2-1-2: Which meteorological elements are referenced?

Most NMHSs referenced data on atmospheric elements and precipitation observation, and half (1/2) referenced data on radiative/weather elements (Figure 27).

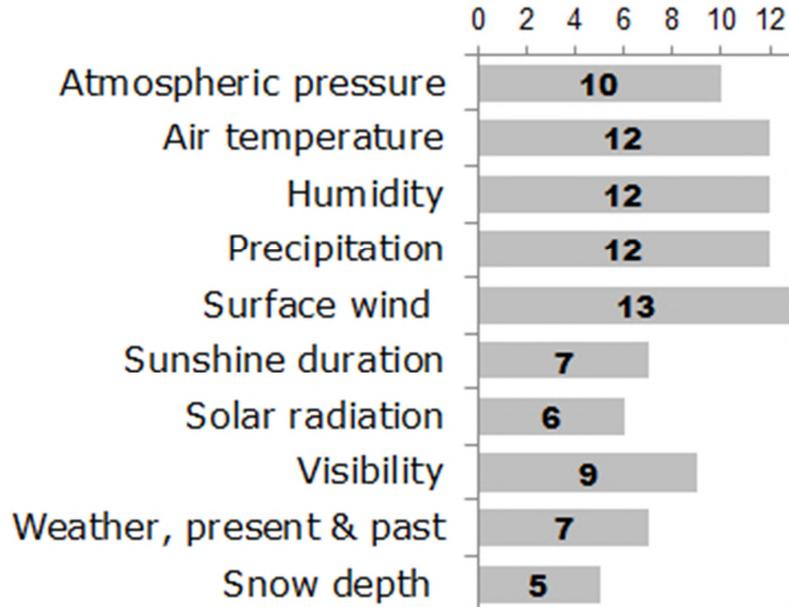


Figure 27 Operational elements provided by non-NMHS operators

2.2.2.4 Q2-1-3: How are observational data received from external organizations?

Two thirds (2/3) of NMHSs obtained observation data from non-NMHS operators both online and offline. A third (1/3) obtained such data online only (Figure 28).

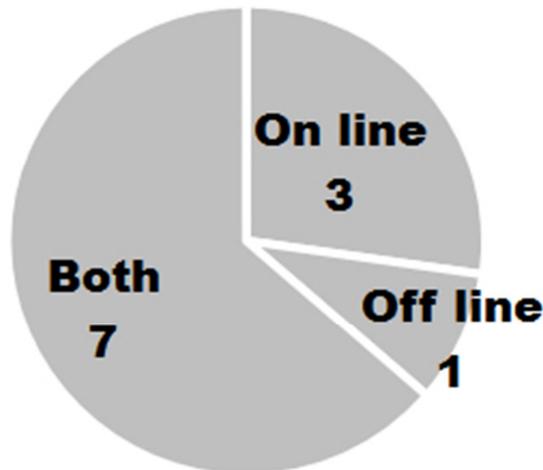


Figure 28 Data transfer from non-NMHS operators

2.2.2.5 Q2-1-4: What are observational data used for?

On average, two thirds (2/3) of NMHSs utilized observation data provided by non-NMHS operators for NMHS services. Most application was for issuance of advisories or warnings, and the lowest usage was for NWP (Figure 29).

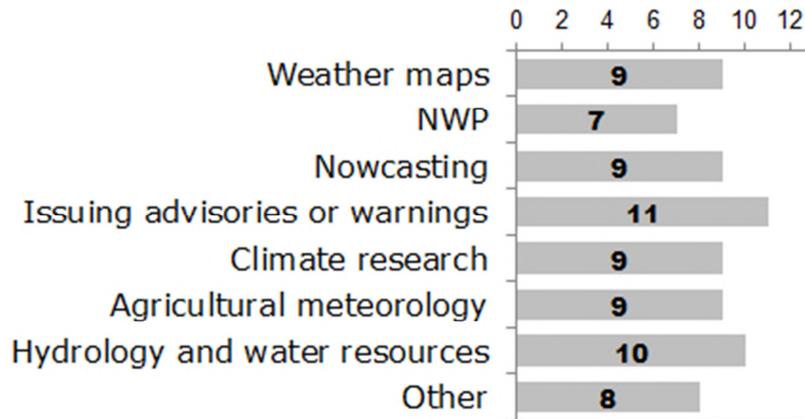


Figure 29 Application of non-NMHS observation data

2.2.2.6 Q2-1-5: Is the quality of observational data from external organizations checked?

More than three quarters (>3/4) of NMHSs checked the quality of observation data provided by non-NMHS operators (Figure 30).

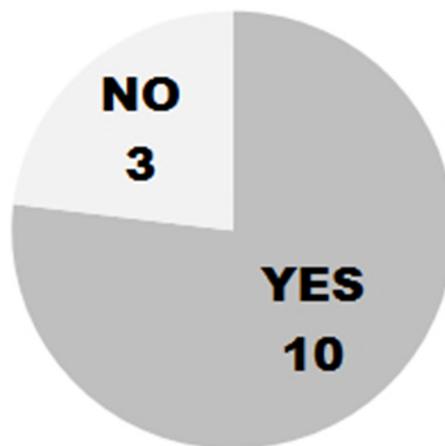


Figure 30 Practice of quality checking for non-NMHSs stations

2.2.2.7 Q2-1-6: Are the environmental conditions of stations operated by external organizations (e.g., distance from instruments to neighboring obstacles, size of meteorological observation fields) checked?

Half (1/2) of NMHSs checked the environmental conditions of stations operated by non-NMHS organizations (Figure 31).

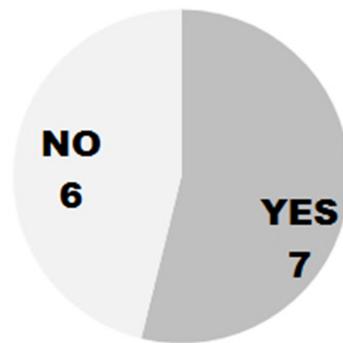


Figure 31 Practice of environmental checking for non-NMHSs stations

2.2.3 Part II: Progress of implementation work for siting classifications regarding surface observation

2.2.3.1 Q2-2: What stage is implementation work for siting classifications in?

A third (1/3) of NMHSs had already completed siting classifications, while two thirds (2/3) were in the process of implementation. Less than a quarter (<1/4) were still in the pre-planning phase (Figure 32).

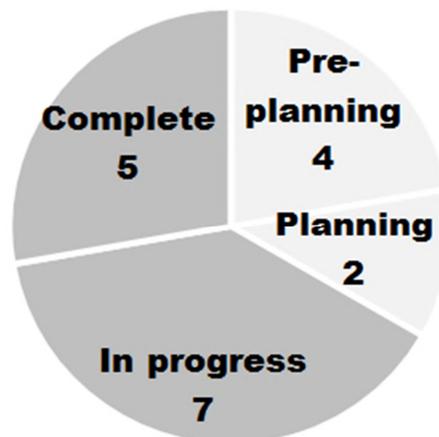


Figure 32 Stages of siting classification

3 DISCUSSION

Based on the analysis outlined in the previous section, the following issues were recognized:

- More than three quarters of NMHSs responding to the questionnaire operated weather stations, and two thirds operated manned precipitation/hydrological stations. Only a third operated automatic precipitation/hydrological stations.
- Two thirds of NMHSs operated more manned precipitation/hydrological stations than automatic ones.
- More than three quarters of NMHSs reported observation results from automatic stations automatically to NMHS headquarters, but few reported results automatically from manned precipitation/hydrological stations.
- Two thirds of NMHSs made use of observation results for all options in application. The percentage of NMHSs engaging in application, especially for disaster risk reduction (such as advisories/warnings and nowcasting), using observation data from precipitation/hydrological stations was generally lower than that for weather stations.
- The percentage of NMHSs operating specific methods to check manned precipitation/hydrological station conditions was relatively low.
- Two thirds of NMHSs automatically checked observation data using all specific methods for precipitation/hydrological stations. Half also reported manual checking.
- The number of NMHSs recognizing a lack of skilled staff exceeded those recognizing a lack of expertise.
- Based on the average of all groups, more than three quarters of NMHSs carried out data correction as follow-up on erroneous data, but user notification of such was rare.

Numerous responding NMHSs operated services in rainy regions. Although precipitation observation is a key component in DRR, observation stations often faced difficulties in the checking of observation data quality and station environments. Room for improvement was also observed in the application of observation data such as nowcasts and in the issuance of advisories/warnings.

Given the high priority of DRR, the various challenges involved should be

discussed by Member countries toward resolution of these issues.

The survey results also revealed that user notification was rarely adopted as follow-up to erroneous data. From a user viewpoint, improvement is required in this area. As a user-friendly approach is expected to produce positive results, discussions should focus both on improving observation data quality and on enhancing user-oriented services.

The results further indicated that NMHSs often recognized a lack of skilled staff rather than a lack of expertise. As technical innovation further facilitates the sharing of expertise and information, training methods must be developed to optimize the combination of telecommunications and face-to-face learning.

In conclusion, Member countries should plan a workshop to clarify actual conditions and discuss related improvement. This should incorporate conventional training and discussions on future activities to maximize benefits to all attendees. Discussions should include:

- (A) Ideas on future surface observation networks
- (B) Long- and short-term goals for observation data quality
- (C) Improvement of on-site quality management and control/checking of instrument calibration/maintenance and other activities
- (D) Approaches for training to improve staff skills

Trainees are expected to provide highly essential ideas for discussions on (D) approaches for training to improve staff skills, as only skilled staff can ultimately realize (A), (B) and (C). Accordingly, discussions on (A), (B) and (C) should be linked to (D).

4 CONCLUSIONS

The questionnaire survey was conducted as an activity of the RA II WIGOS Project to Enhance the Availability and Quality of Management Support for NMHSs in Surface, Climate and Upper-air Observations. This report summarizes the results from the 20 RA II NMHS respondents.

The outcomes highlighted the following major points:

- Automatic precipitation/hydrological stations were operated by only a third of responding NMHSs.
- Two thirds of NMHSs operated more manned precipitation/hydrological stations than automatic ones.
- Stations were mainly manned, with minimal reporting of observation data to NMHS headquarters.
- Difficulties with checking of observation data quality and station environments were reported.
- The percentage of NMHSs engaging in application using observation data from precipitation/hydrological stations was generally lower than that for weather stations, especially in disaster risk reduction applications such as NWP, nowcasting and advisories/warnings.
- NMHSs tended to recognize a lack of skilled staff rather than a lack of expertise.
- NMHSs frequently implemented data correction as follow-up on erroneous data, but user notification of such was rare.

Although precipitation observation is a key component in DRR, observation stations often faced difficulties in the checking of observation data quality and station environments. Given the high priority of DRR, the various challenges involved should be discussed by Member countries toward resolution of these issues. Other aspects of the survey highlighted a need for discussion on follow-up action regarding erroneous data and an optimal combination of telecommunications and face-to-face learning.

In conclusion, Member countries should plan a workshop to clarify actual conditions and discuss related improvement. This should incorporate conventional training and discussions on future activities.

5 ACKNOWLEDGEMENTS

The coordinator of the coordinating group for the RA II WIGOS Project to Enhance the Availability and Quality of Management Support for NMHSs in Surface, Climate and Upper-air Observations would like to thank all Members who responded and Ryuji Yamada (WMO) for his input in developing the questionnaire.

6 REFERENCES

- Survey on Meteorological Instruments, Calibration and Training - Regional Association II (Asia), 2015. Instrument and Observing Methods Report No. 122. World Meteorological Organization, Geneva.
- JMA/WMO Training Workshop on Calibration and Maintenance of Meteorological Instruments in RA II (Asia) (Tokyo and RIC Tsukuba, Japan, 19 – 22 February 2013)
<http://www.wmo.int/pages/prog/dra/rap/documents/Final-Report-JMA-WMO-Training-WS-Calibration-Maintenance.pdf>
- Commission for Instruments and Methods of Observation fifteenth session. Abridged final report with resolutions and recommendations. WMO-No. 1064. World Meteorological Organization. Helsinki 2 – 8 September 2010.
- JMA/WMO Workshop on Quality Management in surface, climate and upper-air observations in RA II (Asia) (Tokyo, Japan, 27 – 30 July 2010).
<http://www.wmo.int/pages/prog/dra/rap/documents/JMA-WMO-OBS-Workshop-Final-Report.pdf>.
- Survey on the Surface, Climate and Upper-air Observations and Quality Management in RA II (Asia) June 2011. Instrument and Observing Methods Report No. 111. World Meteorological Organization, Geneva.
- Regional Association II (Asia) fourteenth session. Abridged final report with resolutions. WMO-No. 1037. World Meteorological Organization, Tashkent, 5 – 11 December 2008.
- Guide to Meteorological Instruments and Methods of Observation. 2008 edition, WMO-No. 8. World Meteorological Organization, Geneva.

Questionnaire on Quality Management for Surface Meteorological Observations in RA II

RA II WIGOS Project to Enhance the Availability and Quality of Management Support for NMHSs in Surface, Climate and Upper-air Observations

At its 15th session held from 13 – 19 December 2012 in Doha, Qatar, the Regional Association II (Asia) of the World Meteorological Organization (WMO) decided to launch the regional WMO Integrated Global Observing System (WIGOS) project to enhance the availability and quality of management support for National Meteorological and Hydrological Services (NMHSs) in surface, climate and upper-air observations. The project has two aims in particular: (i) data quality improvement for Regional Basic Climatological Network (RBCN)/Regional Basic Synoptic Network (RBSN) stations; and (ii) capability enhancement for the Regional Instrument Centres in Tsukuba and Beijing. Improvement of surface meteorological observation quality is a major target among RA II Members, and this questionnaire survey (part of project activities) is intended to promote the sharing and exchange of information on the current status of quality assurance (QA) and quality control (QC) in surface meteorological observations conducted by these Members. The results will be analyzed and made public to help RA II Members consider possible further improvements to their services.

Please send the completed questionnaire to the Coordinator of the WIGOS project Coordination Group (contact details below; e-mail preferred) at your earliest convenience by 30 June 2016:

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Member name: _____

Questionnaire completed by:

Title: Mr [] Ms [] Dr [] Prof []

Name: _____

Organization: _____

Address: _____

Telephone: _____

Facsimile: _____

E-mail: _____

Date: _____

()

(Signature of Permanent
Representative)

Section 1: Current status of surface meteorological observations

This section relates to the current situation of surface meteorological observations from the viewpoint of site management and quality management for observational data. The surface stations of the relevant NMHS may be divided into several groups in line with methods of observation (manual/automatic) and the observation category (e.g., synoptic, climatological, agrometeorological, rainfall and hydrological types). Please answer the questions for each group.

The answer sheet for Section 1 should be used for this section, with answers given in rows for each group. If the number of groups in the NMHS exceeds four, please make an extra copy of the answer sheet.

Part I General

Q1-1 Indicate the groups of observing stations.

- Examples:
- Manned synoptic stations
 - Manned climatological stations
 - Manned agrometeorological stations
 - Manned precipitation stations
 - Manned hydrological stations
 - Automatic weather stations
 - Automatic rainfall stations

Q1-2 How many observing stations does the group have?

Q1-3 Are there any RBSN/RBCN stations in the group?

1. Yes
2. No

Q1-4 How are the results of observation from the stations reported to Headquarters?

1. Automatically
2. Manually
3. Not reported (off line)

Q1-5 What are the results of observation used for? (Multiple answers allowed.)

1. Making weather maps
2. Numerical Weather Prediction (NWP)

3. Nowcasting
4. Issuing advisories or warnings
5. Climate research
6. Agricultural meteorology
7. Hydrology and water resources
8. Other

Q1-6 What is the primary observation method for each meteorological element?

- | | | | |
|-----------------------------|--------------|-----------|-----------------|
| (a) Atmospheric pressure | 1. Automatic | 2. Manual | 3. Not observed |
| (b) Air temperature | 1. Automatic | 2. Manual | 3. Not observed |
| (c) Humidity | 1. Automatic | 2. Manual | 3. Not observed |
| (d) Precipitation | 1. Automatic | 2. Manual | 3. Not observed |
| (e) Surface wind | 1. Automatic | 2. Manual | 3. Not observed |
| (f) Sunshine duration | 1. Automatic | 2. Manual | 3. Not observed |
| (g) Solar radiation | 1. Automatic | 2. Manual | 3. Not observed |
| (h) Visibility | 1. Automatic | 2. Manual | 3. Not observed |
| (i) Weather, present & past | 1. Automatic | 2. Manual | 3. Not observed |
| (j) Snow depth | 1. Automatic | 2. Manual | 3. Not observed |

Part II Observational data statistics

Q1-7 Are climatological observation statistics kept?

1. Yes
2. No

Q1-8 Are climate standard normals (averages of climatological data over consecutive periods of 30 years) kept?

1. Yes
2. No

Q1-9 How are observation results and statistics stored? (Multiple answers allowed.)

1. Paper
2. Digital media
3. Not stored

Part III Management of surface stations

Q1-10 Are the conditions or situations of stations ever checked?

1. Yes
2. No

(If not, go to Q1-11.)

Q1-10-1 How often are the conditions or situations of stations checked? (Choose the closest one.)

1. Every day
2. Every week or every few weeks
3. Every month or every few months
4. Every year or every few years
5. Irregularly

Q1-10-2 Who is responsible for checking the conditions or situations of stations?

1. NMHS staff
2. Non-NMHS staff
3. Both

Q1-10-3 What items does such checking include? (Multiple answers allowed.)

1. Instrument appearance/cleaning
2. Instrument calibration/inspection
3. Facility maintenance (e.g., mowing of grass in meteorological observation areas)
4. Site inspection (including surroundings) and removal of obstacles
5. Other

Q1-10-4 What problems are experienced in checking?

1. None
2. Lack of knowledge regarding checking methods
3. Lack of equipment for checking
4. Lack of skilled staff
5. Other

Q1-11 Are in-house guides or manuals used to maintain site environmental conditions (e.g., distance from instruments to neighboring obstacles, size of meteorological observation fields)?

1. Yes

2. No

(If so, go to Q1-12.)

Q1-11-1 What literature is referenced for the maintenance of site environmental conditions?

(Multiple answers allowed.)

1. None
2. Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8)
3. Manual on the Global Observing System (WMO-No. 544)
4. Guide to the Global Observing System (WMO-No. 488)
5. Manuals or support documents provided by manufacturers
6. Other

Part IV Quality control for observational data

Q1-12 Is observational data quality checked?

1. Yes
2. No

(If not, go to Section 2.)

Q1-12-1 In quality checking for observational data, are Reports on the Quality of Land Surface Observations in Region II^{*} referenced?

1. Yes
2. No

^{*} These reports are issued twice a year and e-mailed to Permanent Representatives. They are also available on the Lead Centre for Monitoring Quality of Land Surface Observations in Region II web page (<http://qc.kishou.go.jp/clsf.html>).

Q1-12-2 What kind of checking is automated using computers and the like? (Multiple answers allowed.)

1. Range checking (testing for consistency with pre-determined thresholds)
2. Accordance testing for correspondence with other meteorological elements
3. Comparison with results of neighboring stations
4. Verification of report formats
5. Other

Q1-12-3 What kind of checking is performed manually? (Multiple answers allowed.)

1. Range checking
2. Accordance testing for correspondence with other meteorological elements
3. Comparison with results of neighboring stations
4. Verification of report formats
5. Other

Q1-12-4 What kind of follow-up action is taken if problems with observational data are found?

(Multiple answers allowed)

1. Data correction
2. Addition of remarks to data
3. Issuance of cautionary warnings to observers (message on display or e-mail)
4. Issuance of cautionary warnings to observers (telephone, facsimile or letter)
5. Issuance of public announcements to users (web or e-mail)
6. Issuance of public announcements to users (telephone, facsimile or letter)
7. Other

Answer Sheet for Section 1

Fill in the blanks with your answers or check the number corresponding to the answer for each question.

Answers should be provided in rows with respect to each group. If the number of groups in the NMHS exceeds three, please make an extra-copy of the answer sheet.

Q1-1	Example: Manned synoptic stations		
Q1-2	_____	_____	_____
Q1-3	1 2	1 2	1 2
Q1-4	1 2 3	1 2 3	1 2 3
Q1-5	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8
Q1-6 (a)	1 2 3	1 2 3	1 2 3
(b)	1 2 3	1 2 3	1 2 3
(c)	1 2 3	1 2 3	1 2 3
(d)	1 2 3	1 2 3	1 2 3
(e)	1 2 3	1 2 3	1 2 3
(f)	1 2 3	1 2 3	1 2 3
(g)	1 2 3	1 2 3	1 2 3
(h)	1 2 3	1 2 3	1 2 3
(i)	1 2 3	1 2 3	1 2 3
(j)	1 2 3	1 2 3	1 2 3
Q1-7	1 2	1 2	1 2
Q1-8	1 2	1 2	1 2
Q1-9	1 2 3	1 2 3	1 2 3
Q1-10	1 2	1 2	1 2
Q1-10-1	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Q1-10-2	1 2 3	1 2 3	1 2 3
Q1-10-3	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

	Q1-10-4	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	Q1-11	1 2	1 2	1 2
	Q1-11-1	1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
	Q1-12	1 2	1 2	1 2
	Q1-12-1	1 2	1 2	1 2
	Q1-12-2	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	Q1-12-3	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	Q1-12-4	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

Section 2: Others

This section relates to the progress of WIGOS implementation from the viewpoint of utilization of surface observational data from organizations outside NMHSs and the implementation of siting classifications for surface observation stations.

The answer sheet for Section 2 should be used for this section.

Part I Use of surface observational data from external organizations

This part relates to the utilization of surface observational data from organizations other than the NMHS in the relevant country.

Q2-1 Are surface observational data from other organizations used operationally in the relevant country?

1. Yes
2. No

(If not, go directly to Q2-2.)

Q2-1-1 What external organizations provide observational data ? (Multiple answers allowed.)

1. National or local governments
2. Private enterprises
3. Research organizations
4. Other

Q2-1-2 What meteorological elements are used? (Multiple answers allowed.)

1. Atmospheric pressure
2. Air temperature
3. Humidity
4. Precipitation
5. Surface wind
6. Sunshine duration
7. Solar radiation
8. Visibility
9. Weather, present & past
10. Snow depth

Q2-1-3 How are observational data received from external organizations?

1. On line
2. Off line (including data acquisition through website)
3. Both

Q2-1-4 What are the observational data used for? (Multiple answers allowed.)

1. Making weather maps
2. Numerical Weather Prediction (NWP)
3. Nowcasting
4. Issuing advisories or warnings
5. Climate research
6. Agricultural meteorology
7. Hydrology and water resources
8. Other

Q2-1-5 Is the quality of observational data from external organizations checked?

1. Yes
2. No

Q2-1-6 Are the environmental conditions of stations operated by external organizations (e.g., distance from instruments to neighboring obstacles, size of meteorological observation fields) checked?

1. Yes
2. No

Part II Progress of implementation work for siting classifications regarding surface observing stations

Siting classifications for surface observation stations on land were adopted at WMO CIMO-15 (Helsinki, September 2010), and were reflected in the Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8). This part relates to the status of implementation work for siting classifications regarding surface observation stations.

Q2-2 What stage is implementation work for siting classifications in?

1. Pre-planning

2. Planning
3. In progress
4. Complete

Answer Sheet for Section 2

Check the relevant number for each question.

Q2-1	1 2
Q2-1-1	1 2 3 4
Q2-1-2	1 2 3 4 5 6 7 8 9 10
Q2-1-3	1 2 3
Q2-1-4	1 2 3 4 5 6 7 8
Q2-1-5	1 2
Q2-1-6	1 2
Q2-2	1 2 3 4