Hong Kong, China

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Country Report of Hong Kong, China
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Summary and Purpose of Document

This country report describes the operation of the meteorological and climatological monitoring network of Hong Kong, China being operated by the Hong Kong Observatory.   Besides operational details, the quality assurance programme being used for data quality assurance is also described.

1. Observation networks

1.1 Surface observations

1.1.1 Number of stations: RBSN, RBCN, GSN, manned stations and AWS*
Table 1 summarizes the number of RBSN, RBCN and GSN stations as well as the number of manned stations and automatic weather stations (AWS) being operated in the territory of Hong Kong by the Hong Kong Observatory for surface observations.

Table 1   Number of stations for surface observations
(as at 31 December 2009)

	RBSN	RBCN	GSN	Manned stations	AWS *
number	1	1	0	19	73

* An automatic weather station (AWS) is defined as a "meteorological station at which observations are made and transmitted automatically".

1.1.2 Station map
Figure 1 shows the locations of the RBSN, RBCN and GSN stations as well as the manned stations and AWS being operated in the territory of Hong Kong by the Hong Kong Observatory.

1.1.3 Time and frequency of observations
At the synoptic land station in Hong Kong, surface synoptic observations are made and reported at hourly intervals.   At the manned rainfall stations, measurements are taken once a day.   AWS data are transmitted to the Hong Kong Observatory at one-minute intervals.

1.1.4 Data flow to users and archives
The surface observation data are transmitted in real time from the outstations to the Hong Kong Observatory Headquarters via leased line and/or radio link.   The data are then processed and quality checked (details in Section 4) automatically.   Both the data and the quality checked information are archived in a database system which serves different downstream users and applications.   Security measures such as user access privilege are implemented to safeguard the database.   Data are also archived on magnetic tapes for long term storage.

1.2 Upper-air observations

1.2.1 Number of stations: RBSN, RBCN, GUAN, manned stations and automated system stations
There is one upper-air station in Hong Kong.   It is automatic and its location is also shown in Figure 1.   The upper-air station is also one of the RBSN, RBCN and GUAN stations.

1.2.2 Time and frequency of observations
Regular upper-air soundings are made two times a day at 00 UTC and 12 UTC at the upper-air station.

1.2.3 Data flow to users and archives
The upper-air observation data are transmitted in real time from the upper-air station to the Hong Kong Observatory Headquarters via leased line.   The data are then processed and quality checked (details in Section 4) automatically.   Both the data and the quality checked information are archived in a database system which serves different downstream users and applications.   Security measures such as user access privilege are implemented to safeguard the database.   Data are also archived

on magnetic tapes for long term storage.

2. Siting and metadata
The siting of weather stations for surface observation generally follows the guidelines given in the WMO "Guide to Meteorological Instruments and Methods of Observation, WMO-No. 8 (CIMO Guide)". For metadata, the Hong Kong Observatory compiles annually a publication to provide users with comprehensive information of how, where, when and what surface observations are made at weather stations in Hong Kong. The metadata format and layout adopted in the publication generally follow the guidelines and recommendations suggested in the WMO "Guidelines on Climate Metadata and Homogenization, WMO-TD No. 1186". The historical records of measuring instruments at each station and the station location, including latitude, longitude and altitude, are given in the publication.

3. Instruments, sensors, upgrade, maintenance, instrument intercomparisons and traceability
In recent years, several Heat Stress Measurement Systems (system measuring the Wet Bulb Globe Temperature (WBGT)) have been installed at some automatic weather stations in the urban and rural areas. A network of weather camera has also been implemented to assist forecasters in the monitoring of weather conditions, visibility and sea conditions, and to provide the public and special users with real-time weather photos.

To maintain high data availability, backup instruments using independent data transmission paths are installed at strategic AWSs to provide data redundancy.

The Observatory implements calibration procedures for meteorological sensors to ensure that the measurement results are traceable to the System International (SI) standard. Solar radiation instruments are calibrated using a PMO-6 absolute radiometer, which itself is kept traceable to the WRR through intercomparisons with the regional standard kept by the Japan Meteorological Agency every 5 years. Sunshine duration and UV-Index radiometers are calibrated at factory every 2 years.

From December 2007 to January 2008, the Observatory carried out a comparison of the Hong Kong Standard Barometer with the Japan Meteorological Agency's Primary Standard Barometer through the use of travelling standards. In 2009, the Observatory upgraded its pressure standard from a Kew-pattern mercury barometer (WMO Class C barometer) to a high-accuracy digital barometer (WMO Class B barometer).

4. Quality assurance / quality control (real-time, non-real time)
The Hong Kong Observatory has implemented quality assurance procedures to carry out quality check and control of observational data both on a real-time and non-real-time basis.
The AWS data received by the central data acquisition system at the Hong Kong Observatory Headquarters are passed to an Integrated Meteorological Data Quality Assurance System (System) for real-time data quality check and control. The System is highly automatic. Through various real-time QC procedures including range test, trend (jump) test and consistency test, the System carries out quality assurance for each data received from the AWS by assigning a quality assurance flag to the data, filtering out erroneous data from the AWS, and alerting maintenance staff to action via automatic email. Operation of the AWSs can also be monitored via a webpage which displays the status of the AWS network in real-time. The automatic alerting feature enables early detection and diagnosis of faults as well as enhancing data availability. Apart from monitoring the operation of the AWS, the quality assurance flags also serve as an indication of quality, facilitating reference by users in future studies. The quality check and control procedures generally follow the "Guide on the Global

Data-Processing System WMO No.305."

Non-real-time checking of all observation data collected will also be conducted with the help of the quality check results of the System. Except spatial check of rainfall data and double-check of those erroneous data flagged by the System, non-real-time quality check, including range check and consistency check, are also conducted automatically using in-house developed computer programmes.

5. Training

A formal training course covering surface observations and related codes is conducted for relevant new recruits. The course lasts about 10 weeks.

6. Statistics and applications

Climatological statistics such as mean, total, mean maximum, mean minimum values of major weather elements are computed on monthly and annual basis for the publications of monthly and yearly weather summaries. The PDF versions of the summaries are also available on the Hong Kong Observatory's website. Climatological normals, extremes and ranking order information of some weather events are also compiled and available on the Hong Kong Observatory's website.

Apart from supporting the weather forecasting and warning operation of the Hong Kong Observatory, these observational data and statistical information are also provided to other government departments and private sectors such as shipping, aviation, engineering, industries, judicial proceeding, recreational activities and the public to meet their different needs. Based on these observational data and statistical information, a series of climatological studies including urban and regional climate, long term climate trends, frequency of occurrence of extreme weather events, and relationship between weather and health have been conducted.

7. Current issues and future plan

Meteorological observations at Hong Kong by the Hong Kong Observatory started in 1885. Part of the historical data, especially those collected before the 1950's, are still kept in paper format. Actions are being taken to digitize those historical data for permanent archive and facilitate climate analysis.

The increase in the number of meteorological observation stations in recent years has generated burden on the maintenance of high quality climatological data. Actions are being taken to develop a sophisticated climate data management system for better climate data management and more efficient climatological services.
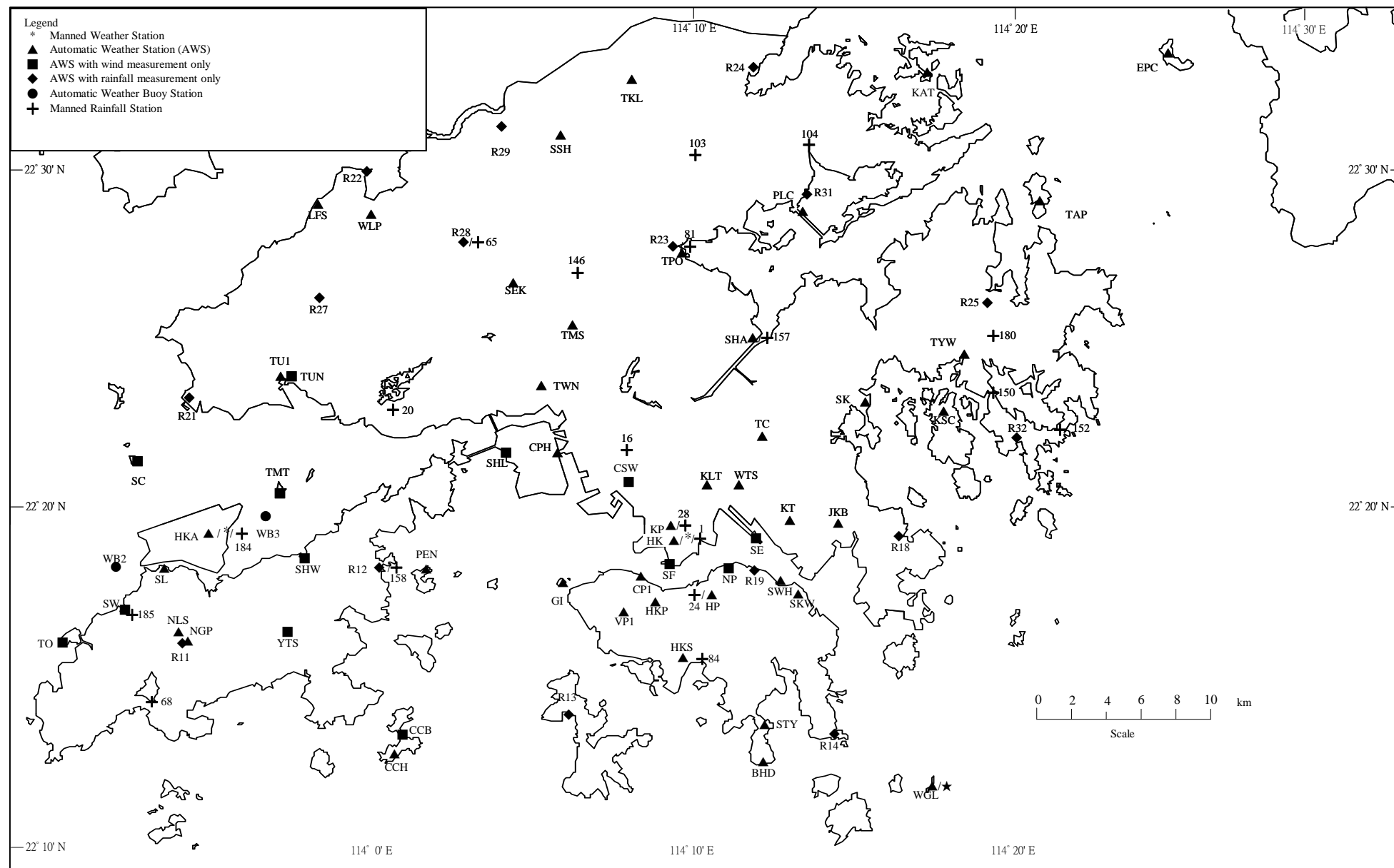
Note: A station code is assigned to each station.

For surface observations, HKA is RBSN station and KP is the RBCN station.

For upper-air obervations, KP is RBSN, RBCN and GUAN station.

Figure 1   Locations of surface and upper-air stations in Hong Kong as at 31 December 2009