



国家气象信息中心
National Meteorological Information Centre

QUALITY MANAGEMENT IN SURFACE, CLIMATE AND UPPER-AIR OBSERVATIONS IN CHINA

Zhang Hongzheng, Meng Zhaolin

National Meteorological Information Centre(NMIC)

Meteorological Observation Centre(MOC)

CMA

July, 2010

China Meteorological Administration (CMA)

Headquarter of CMA

General Office

8 Departments
Emergency Response, Public Services, Forecasting, Information, Observations

Institutions under CMA

National Meteor. Centre (NMC)

National Satellite Meteor. Centre (NSMC)

National Climate Centre (NCC)

National Meteor. Information Centre (NMIC)

Meteorological Observation Centre (MOC)

Other 7 institutions

Telecommunication Division

High-Performance Computer Division

Climate Data Center (CDC)

Network Division

Application Service Division

.....

2010-8-3



National Meteorological Information Centre

OUTLINE

- **Observation Networks**
- **Instruments and sensors' upgrade and maintenance**
- **Quality Control**
- **Training Activities**
- **Data Statistics and Application**
- **Current issues and future plan**



OUTLINE

- **Observation Networks**
 - **Surface observation network**
 - **Upper-air observation network**
- Instruments and sensors' upgrade and maintenance
- Quality Control
- Training Activities
- Data Statistics and Application
- Current issues and future plan

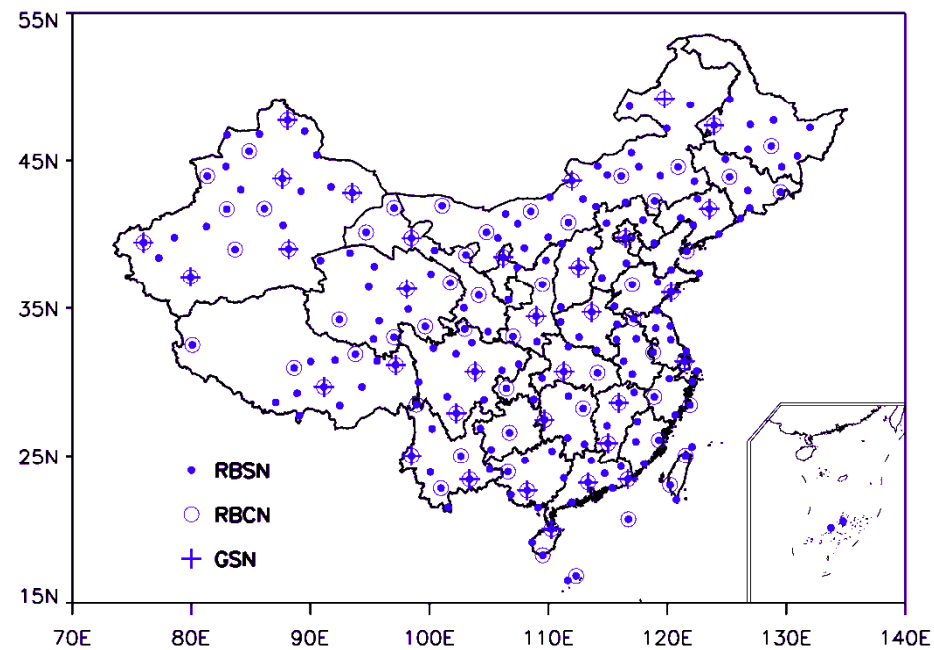


Surface observation network

Number of China's surface stations

| | RBSN | RBCN | GSN | Manned stations | AWS |
|--------|------|------|-----|-----------------|-----|
| Number | 219 | 82 | 33 | / | 220 |

Station map



Distribution of China's surface stations

2010-8-3



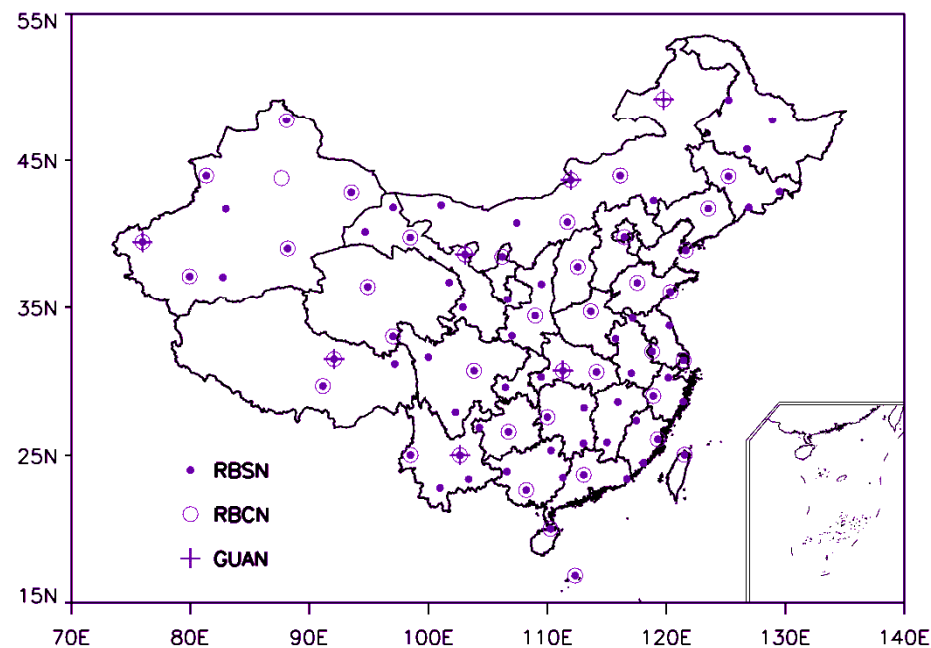
国家气象信息中心
National Meteorological Information Centre

Upper-air observation network

Number of China's upper-air sounding stations

| | RBSN | RBCN | GUAN | Manned stations | Automated system stations |
|--------|------|------|------|-----------------|---------------------------|
| Number | 82 | 43 | 7 | / | 83 |

Station map

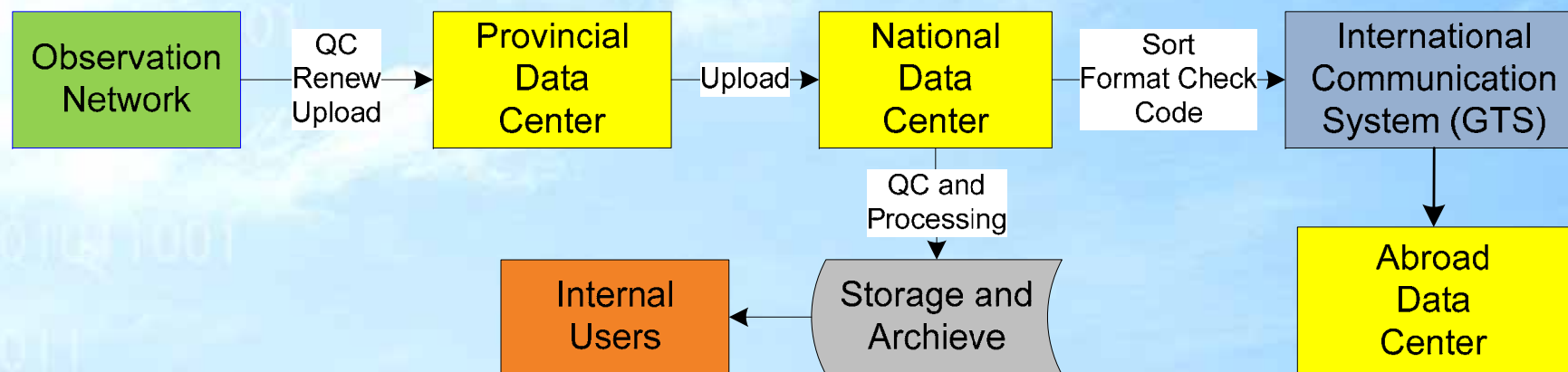


Distribution of China's upper-air sounding stations

Transmission

- **Surface**
 - 4 times per day, at 00, 06, 12, 18 UTC
- **Climate**
 - once a month, at 06 UTC on the 4th day of each month
- **Up-air**
 - twice per day, at 00 and 12 UTC
- Each transmission will be completed **30 minutes** after each observation hour





Flow diagram for data transmission

OUTLINE

- Observation Networks
- Instruments and sensors' upgrade and maintenance
 - Upgrade
 - Maintenance
- Quality Control
- Training Activities
- Data Statistics and Application
- Current issues and future plan



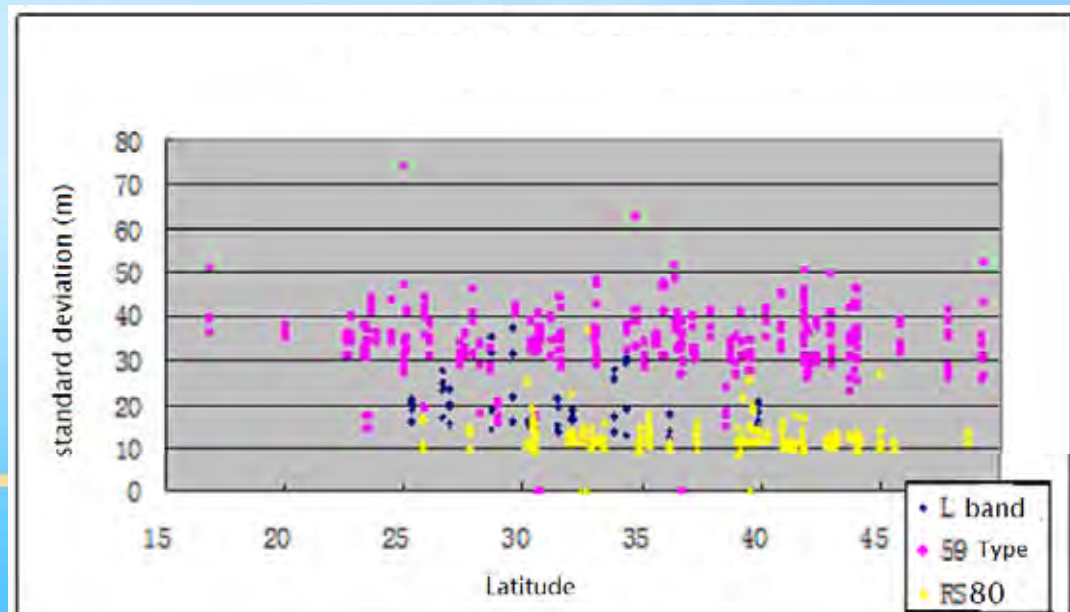
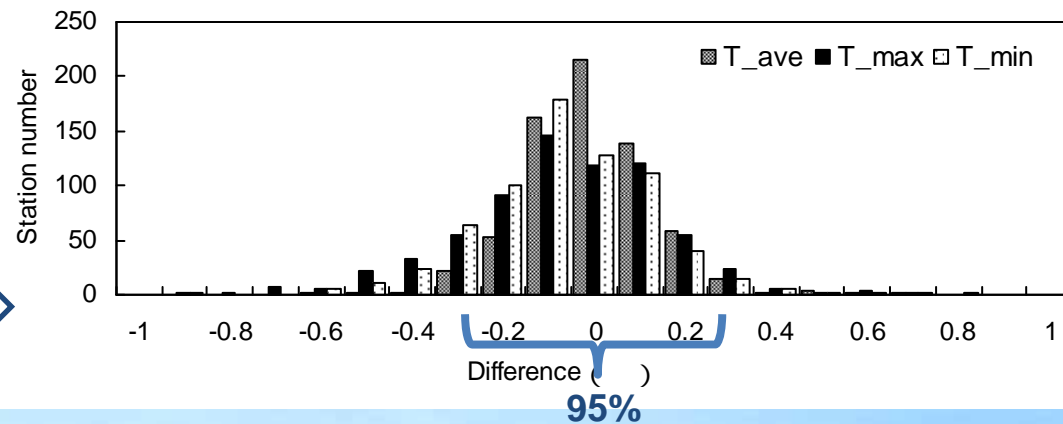
Instruments and sensors' upgrade

- **all national surface station**
 - Manual to AWS
 - the weather phenomena, clouds amounts/types/height, visibility
- **up-air station**
 - Type 49 to type 59-701
 - Type 59-701 to L band electronic radiosonde and windfinding radar
 - By April 2010, almost all up-air stations have been replaced by L band sounding system



Instruments and sensors' upgrade

Difference between
manual and AWS
(annual mean/max/min
temperature)



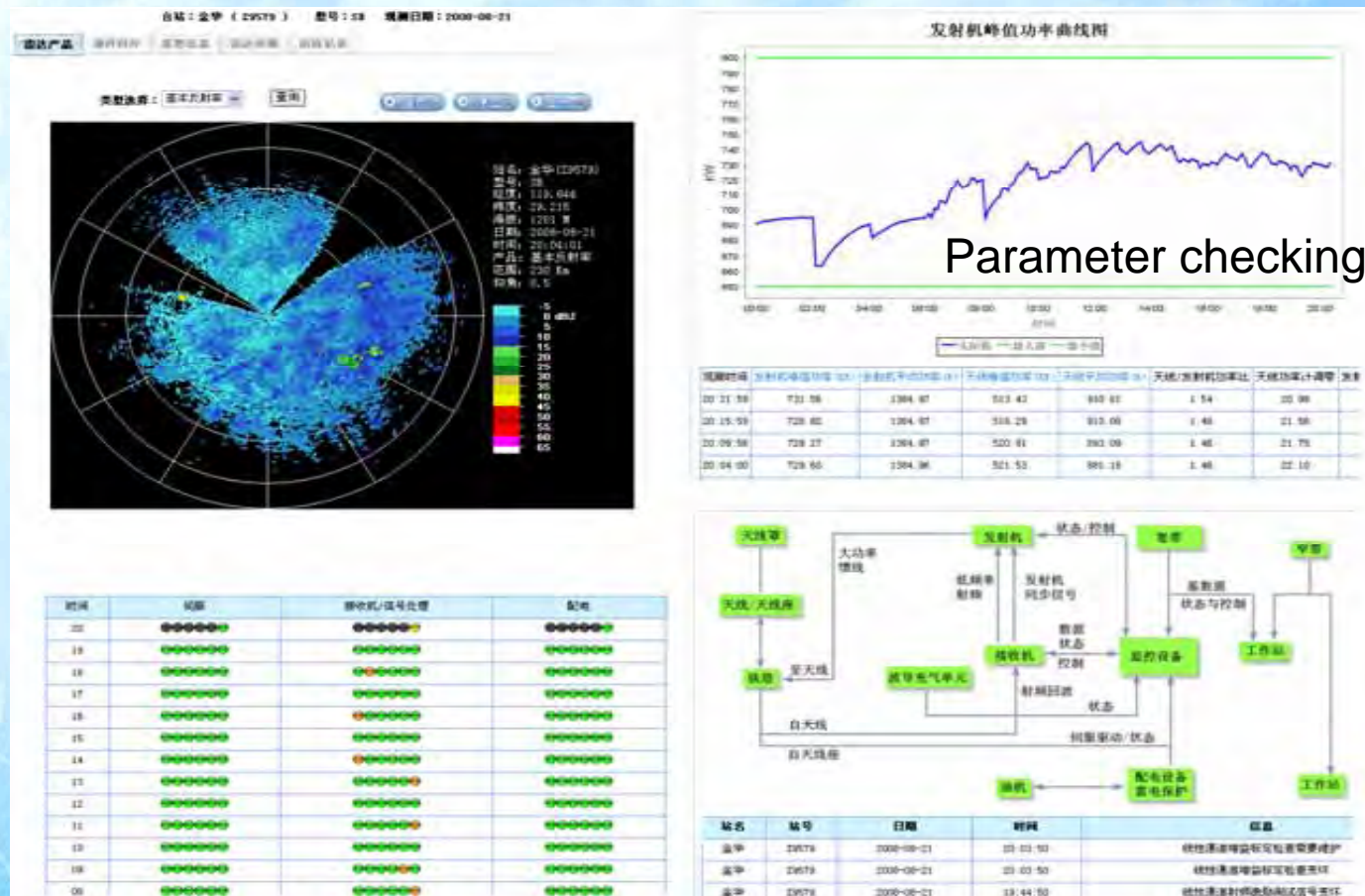
Instruments and sensors' maintenance

- **A**tmospheric observing **S**ystem **O**perations and **M**onitoring (**ASOM**)
 - Equipments operation monitoring
 - Equipment maintenance management
 - Logistic management
 - Observation site management



Instruments and sensors' maintenance

Equipments operation monitoring



Status in time series

Failure parts analyzing

Status and parameter display

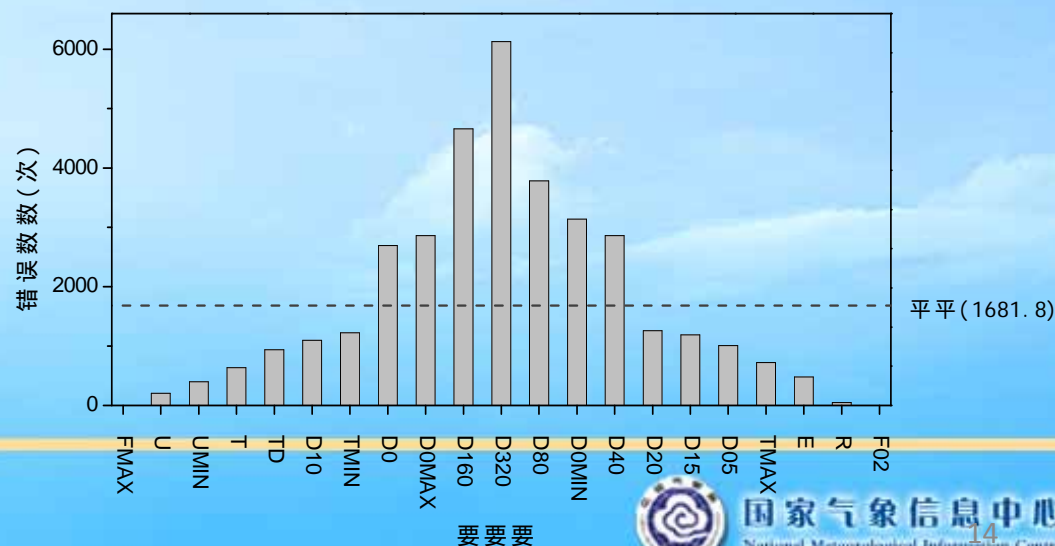
Instruments and sensors' maintenance

Equipment maintenance management

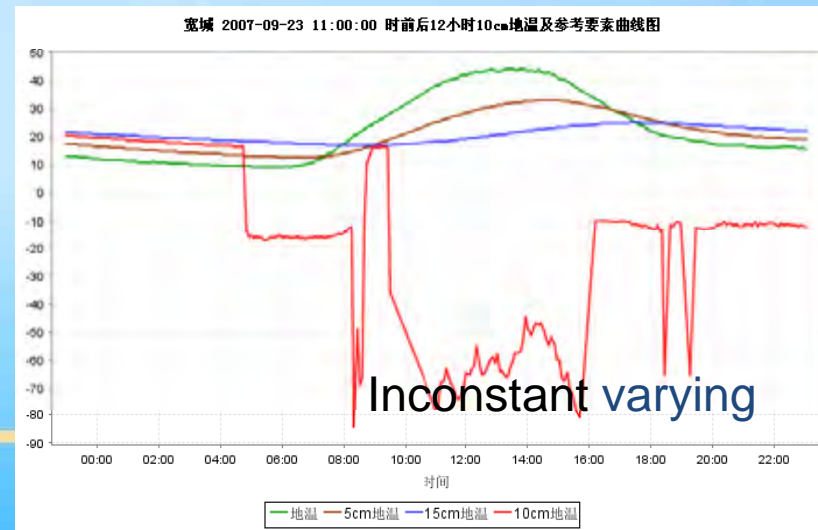
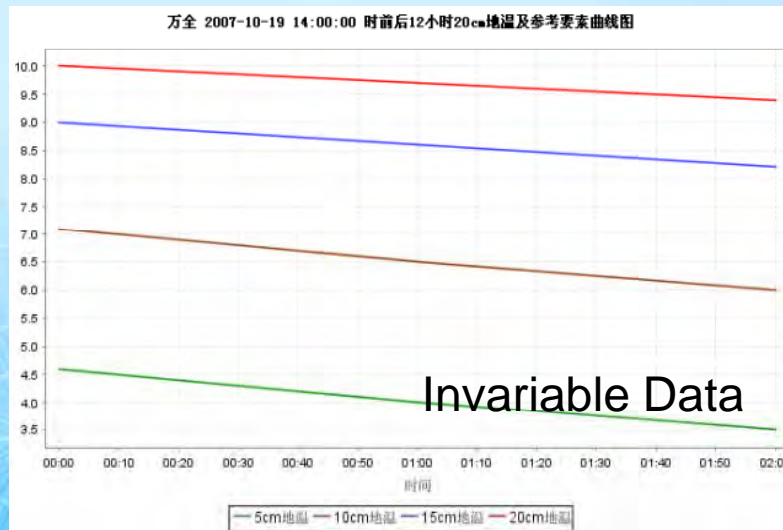
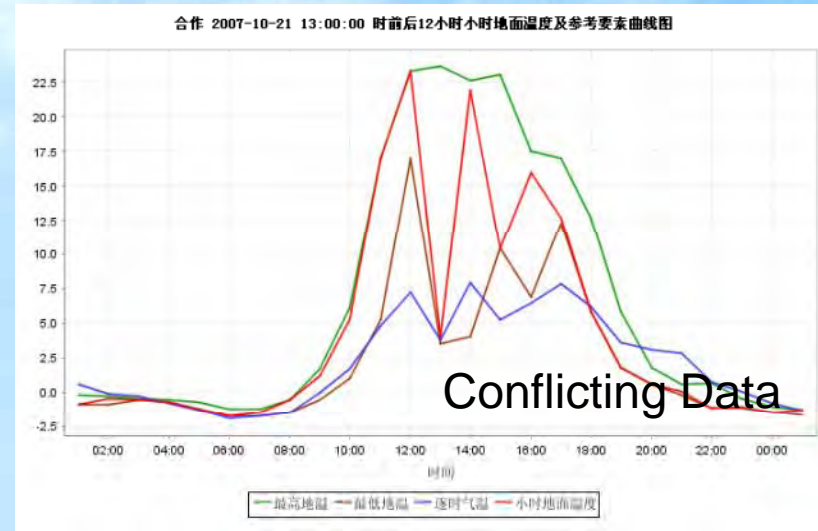
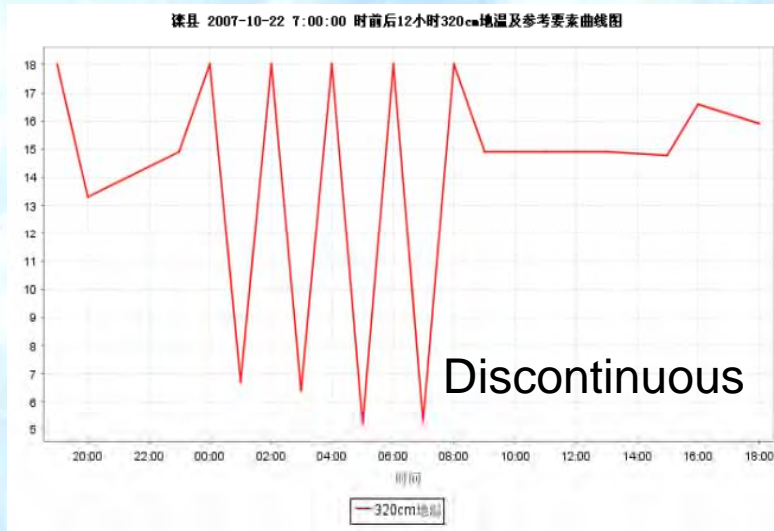
- **Data quality monitoring**
 - Guide the maintenance technicians to find failure in time
 - Offer evidences to hardware and software updating for decision-makers.
 - Evaluate data quality.

全国自动站数据质量检查 起始时间: 2007-10-12 00:00:00 结束时间: 2007-10-12 14:54:17 查询

| 站号 | 站名 | 省份 | 要素 | 要素中文名 | 质量控件等级 | 出现次数 |
|-------|-----|----|-------|----------|--------|------|
| 54587 | 霞云岭 | 北京 | DOMIN | 小时最低地面温度 | 3 | 1 |
| 54597 | 霞云岭 | 北京 | DOMIN | 小时最低地面温度 | 2 | 2 |
| 54499 | 昌平 | 北京 | TD | 逐时露点 | 2 | 1 |
| 54513 | 石炭山 | 北京 | UMIN | 逐时最小相对湿度 | 2 | 1 |
| 54511 | 北京 | 北京 | TD | 逐时露点 | 1 | 2 |
| 54511 | 北京 | 北京 | U | 逐时相对湿度 | 1 | 2 |
| 54511 | 北京 | 北京 | UMIN | 逐时最小相对湿度 | 1 | 2 |
| 54410 | 佛爷顶 | 北京 | D0 | 小时地面温度 | 1 | 1 |
| 54410 | 佛爷顶 | 北京 | DOMAX | 小时最高地面温度 | 1 | 1 |
| 54421 | 上甸子 | 北京 | TMIN | 逐时最低气温 | 1 | 1 |



Guiding to maintenance



Instruments and sensors' maintenance

Observation information management

- Every Instruments have IDs number.
- Observation information management includes
 - Log on duty
 - Repair record
 - Validity of calibration
 - Logistics
 - Station environment pictures and cameras



OUTLINE

- Observation Networks
- Instruments and sensors' upgrade and maintenance
- **Quality Control**
 - Real-time quality control
 - Message format check
 - Non-real-time quality control
- Training Activities
- Data Statistics and Application
- Current issues and future plan



Real-time quality control

- Real-time quality control at the station level
 - climatic extreme
 - element allowance range (B-QC),
 - check element continuity (E-QC)
 - element consistency

| ID code | Description |
|----------|---|
| 0 | “Right” : the data does not exceed a given limit. |
| 1 | “Doubtful” : not credible. |
| 2 | “Wrong” : erroneous data that exceeds a given limit. |
| 3 | “Inconsistent” : one or more parameters are inconsistent; the relationship between different elements does not meet the required standards. |
| 4 | “Checked” : Raw data that are identified as doubtful, wrong or inconsistent and that are reconfirmed as right using other verification procedures. |
| 8 | “Missing” : Data are missing. |
| 9 | “Not checked” : the variable has not been checked for quality control purpose. |
| N | No sensors. No data. |

Real-time quality control

- **National real-time quality control**

- **Surface**

- Limiting value or allowable values of climate
 - Extreme value check at station
 - Internal consistency check

- **Upper air**

- The allowable value check
 - The climatological threshold value check
 - Internal consistency check



Real-time quality control

Through the aforementioned real-time quality control, statistics is taken for quality check results of international exchange stations **from Jan. to Jun. 2010**, with **erroneous** data accounting for **0.01%** of the total data. The percentage of various types of errors is shown in the table.

| Error type | Percentage |
|-------------------|------------|
| Equipment failure | 44.44% |
| Operation failure | 37.04% |
| Unexplained | 18.52% |

Error type and percentage of quality control of real-time data

Message format check

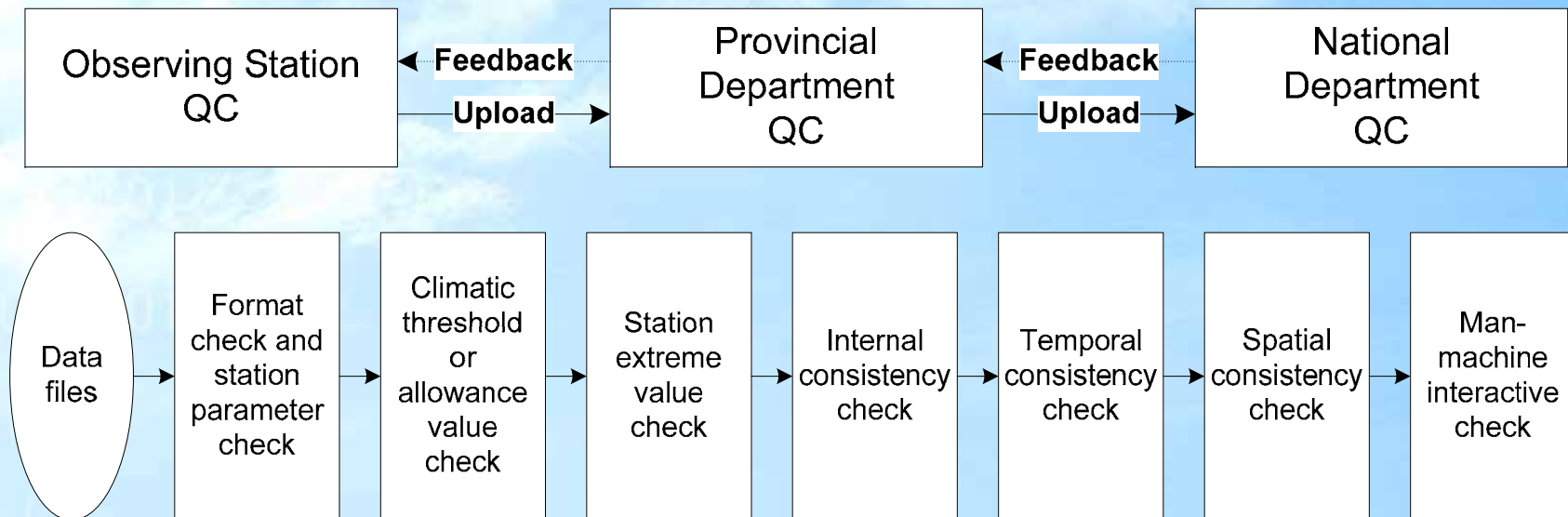
- **Integrity of the bulletin**
 - mainly checking the starting line, end line, correctness of the bulletin length
- **Header**
 - checking the bulletin header format, the correctness of time group
- **Bulletin content**
 - checking the bulletin formats of various kinds of data according to the WMO *Manual on Codes* (WMO-No.306).
 - ground report FM12, upper-air report FM35, ground monthly report FM71, upper-air monthly report FM75

After format checking, the correct data will be sorted and coded, and sent to overseas data centre by GTS.

CODE FORM:

| | | | | | | |
|-----------|--|---|--------------------|--|--|---|
| SECTION 0 | MMM ₁ M ₂ M ₃ | $\left\{ \begin{array}{l} D \dots D^{****} \\ \text{or} \\ A_1 b_w n_b n_b n_b^{**} \end{array} \right\}$ | YYGGI _w | $\left\{ \begin{array}{l} I I I I^{**} \\ \text{or} \\ 99 L_a L_a L_a \quad Q_c L_o L_o L_o L_o^{****} \end{array} \right\}$ | MMM _U L _a U _{Lo} *** | h ₀ h ₀ h ₀ h ₀ m**** |
| SECTION 1 | i _R ⁱ _x hVV | Nddff | (00fff) | 1s _n TTT | $\left\{ \begin{array}{l} 2s_n T_d T_d T_d \\ \text{or} \\ 29UUU \end{array} \right\}$ | 3P ₀ P ₀ P ₀ P ₀ |
| | $\left\{ \begin{array}{l} 4PPPP \\ \text{or} \\ 4a_3 hhh \end{array} \right\}$ | 5appp | 6RRRt _R | $\left\{ \begin{array}{l} 7w w W_1 W_2 \\ \text{or} \\ 7w_a w_a W_{a1} W_{a2} \end{array} \right\}$ | 8N _h C _L C _M C _H | 9GGgg |

Non-real-time quality control



QC Flag

- 0 : Data correct
- 1 : Data suspicious
- 2 : Data error
- 3 : Data with corrected value
- 4 : Data has been corrected
- 8 : Lack Measured Data
- 9 : Data without quality control



OUTLINE

- Observation Networks
- Instruments and sensors' upgrade and maintenance
- Quality Control
- **Training Activities**
- Data Statistics and Application
- Current issues and future plan



Training Activities

- **Training centers** have been established in both **national** and **provincial** meteorological departments
 - basic meteorological knowledge
 - station network maintenance
 - observation and detection technology
 - quality control technology



2010-8-3



国家气象信息中心
National Meteorological Information Centre

OUTLINE

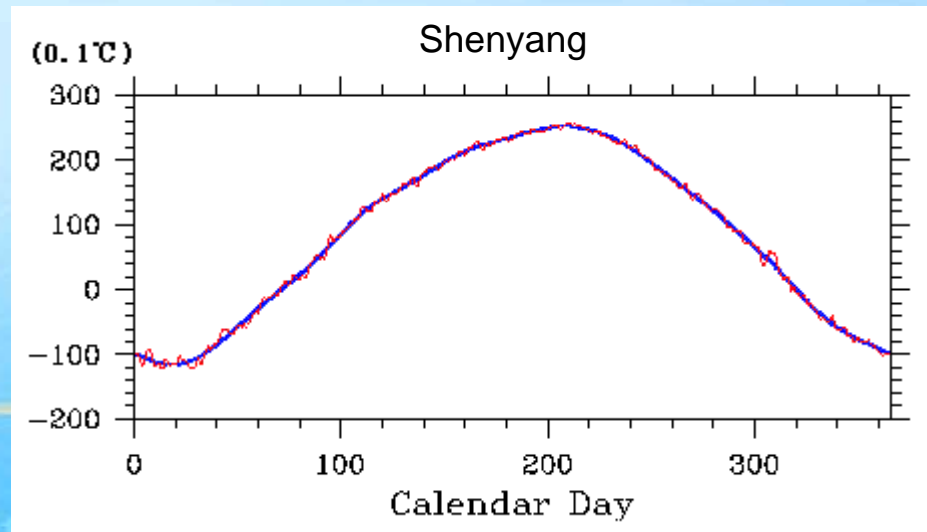
- Observation Networks
- Instruments and sensors' upgrade and maintenance
- Quality Control
- Training Activities
- **Data Statistics and Application**
- Current issues and future plan



Data Statistics and Application

- **The Climate standard value**

- WMO recommends : climate data taking **30 years** as the standard
- China's 30-year meteorological data have been collated and compiled for three times
 - 1951-1980, 1961-1990, and 1971-2000
- the fourth 30-year meteorological data are being prepared
 - 1981-2010



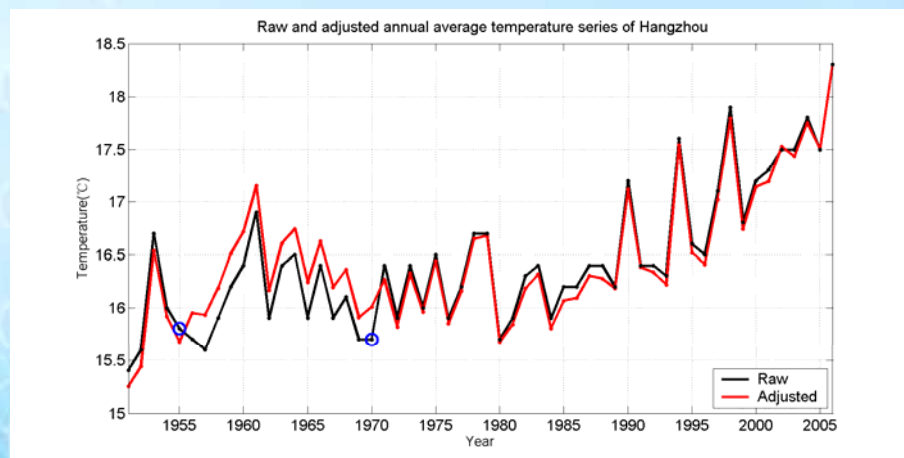
2010-8-3



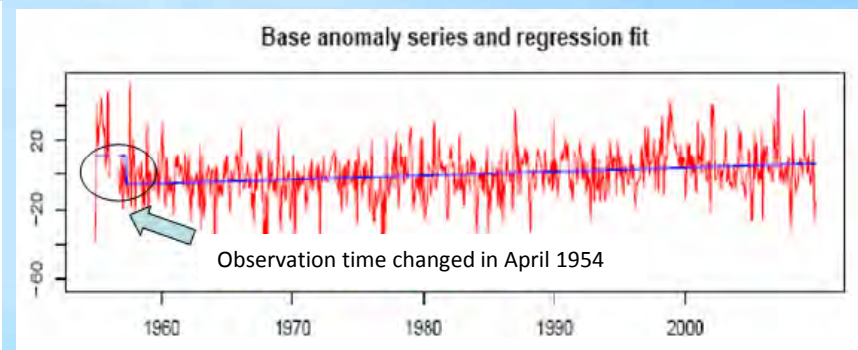
国家气象信息中心
National Meteorological Information Centre

Data Statistics and Application

- **Data homogenization**
 - surface and upper-air sounding observations
 - daily and monthly series of temperature, precipitation
 - upper-air temperature



surface temperature

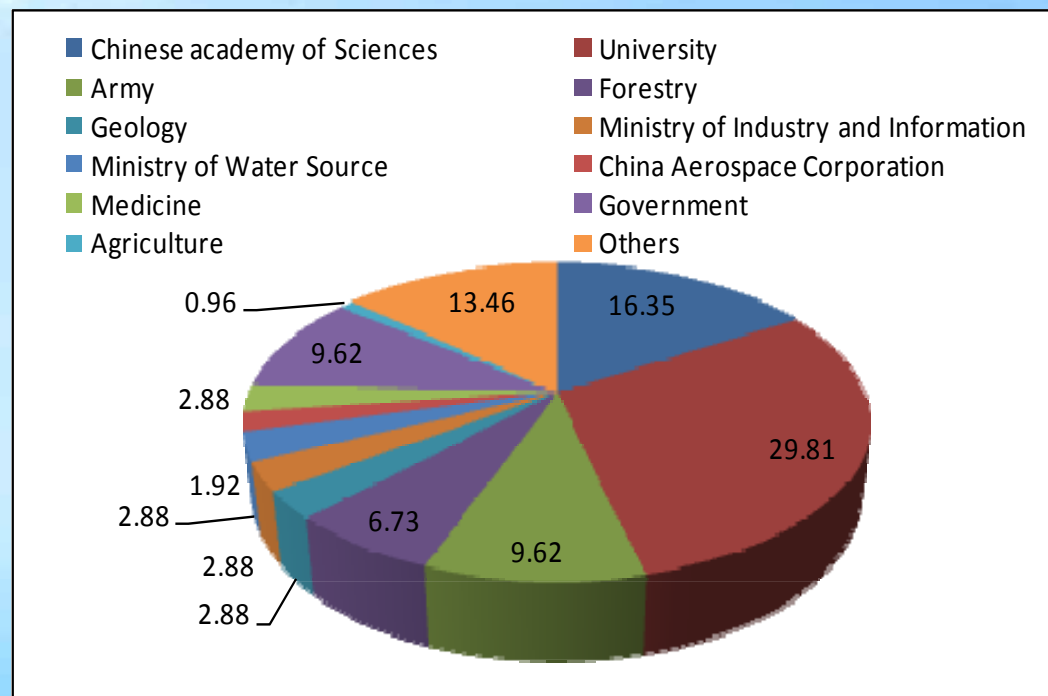


upper-air temperature

Data Statistics and Application

- **Application of meteorological data to various sectors**

- Education
- scientific research
- Government
- Agriculture
- Forestry
- water conservancy
- Military
- Pharmacy
- Ocean
- Railway
- public security
- Media
- environment protection



OUTLINE

- Observation Networks
- Instruments and sensors' upgrade and maintenance
- Quality Control
- Training Activities
- Data Statistics and Application
- **Current issues and future plan**



Current issues and future plan

- The improvement of **observation data quality** is needed
- **Quality control schemes** need to be improved
- **Metadata** are limited
- Improve **capabilities of data observers and recorders**





Thanks for your time

2010-8-3



国家气象信息中心
National Meteorological Information Centre