Some Issues of Surface-Based Observations for Climate Monitoring and Services

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Outline

1、 For Long-Term Climate Change Monitoring

2、For Climate Services

3、Conclusion and Suggestions

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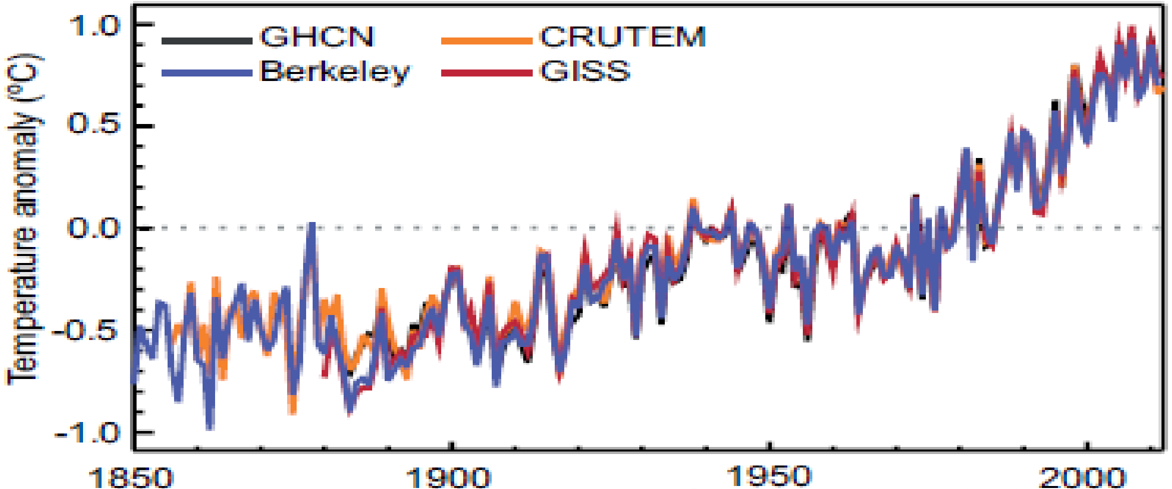
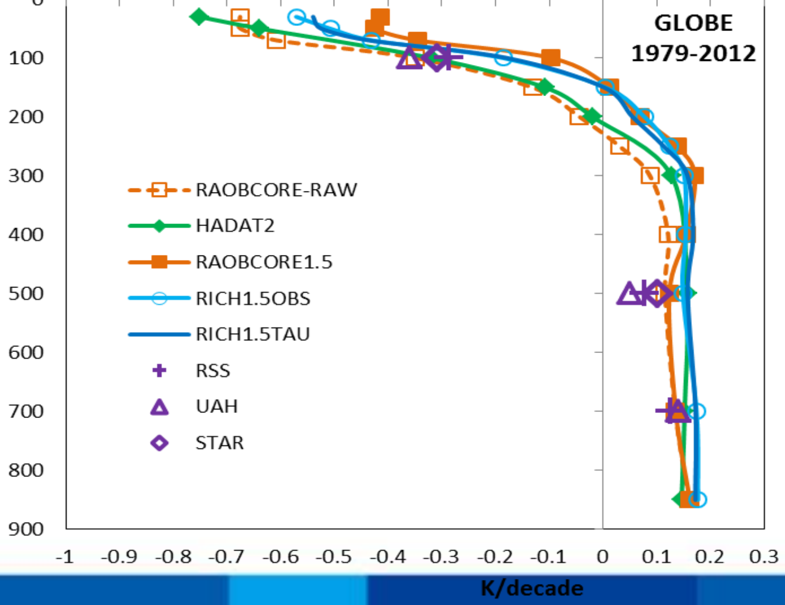
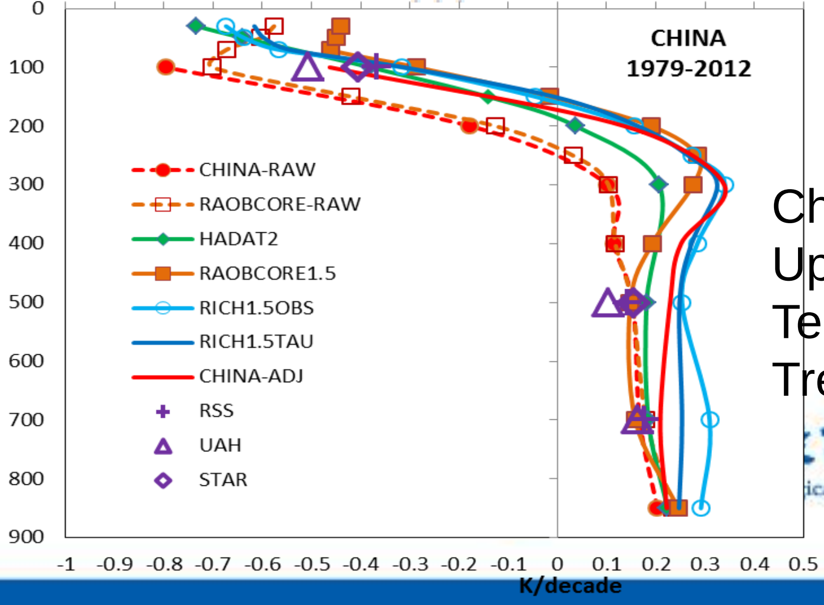
1. For Long-Term Climate Change Monitoring



Global
Surface
Temperature

--IPCC AR5,2013





China
Upper air
Temperature
Trends

Sources of the Uncertainty of Climate Change

1. **The uncertainty in observational records**
   - instrumental errors
   - effects of representation (e.g., exposure, observing frequency or timing)
   - physical changes in the instrumentation (such as station relocation, new sensor, new calibration,…).

2. **The uncertainty in dataset or product**
   - parametric uncertainty
   - structural uncertainty (analytical framework)

---IPCC AR5，2013

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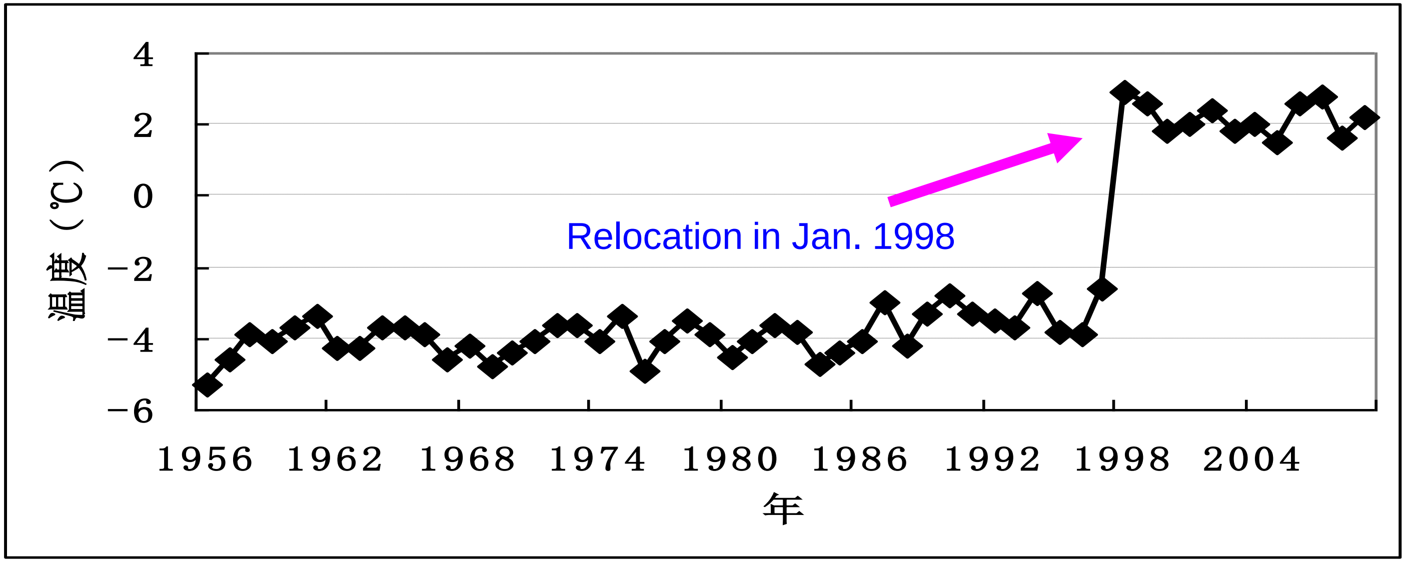
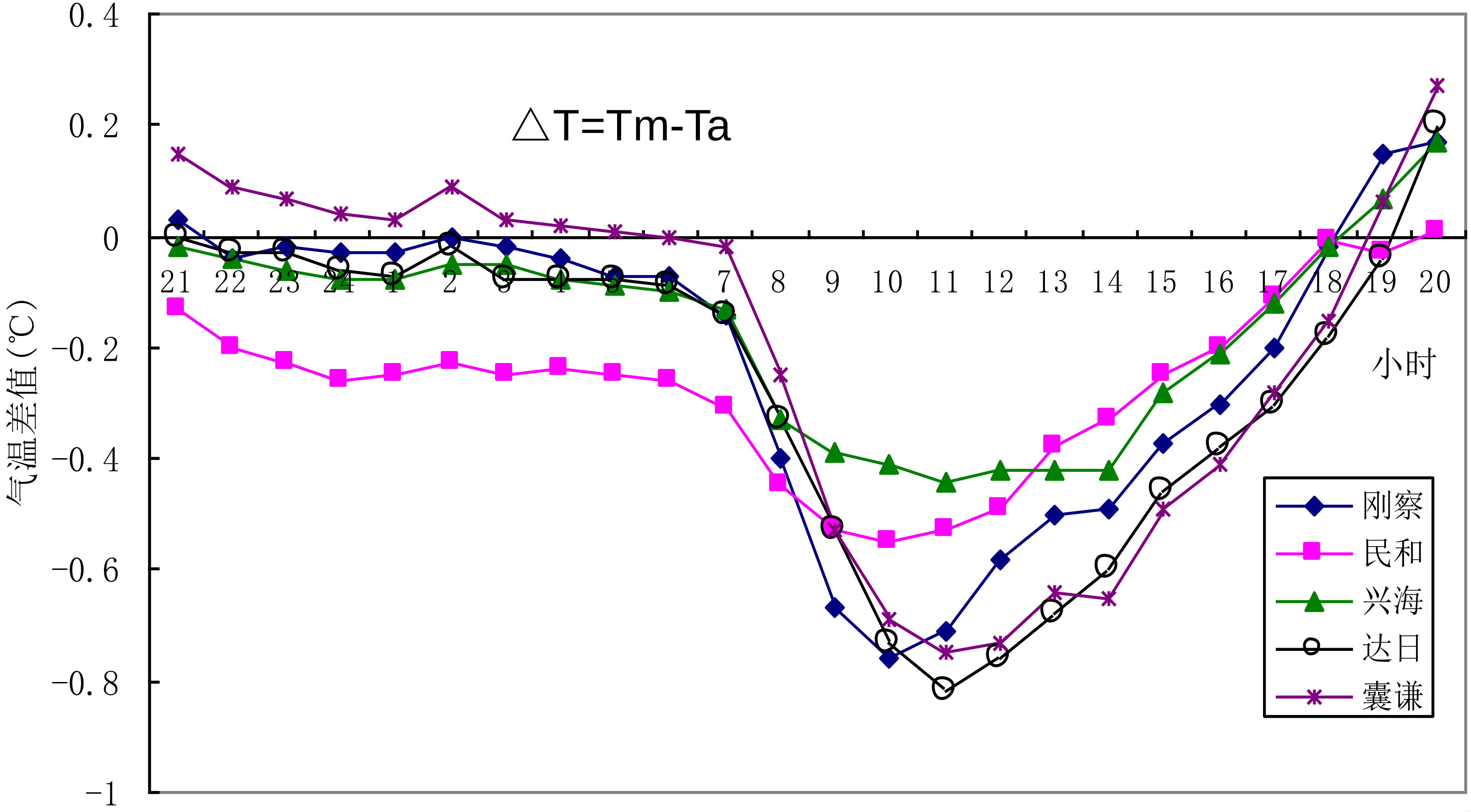
Major Factors Causing inhomogeneity of climate series



Site shift from hill top to bottom, station of Wutaishan, China

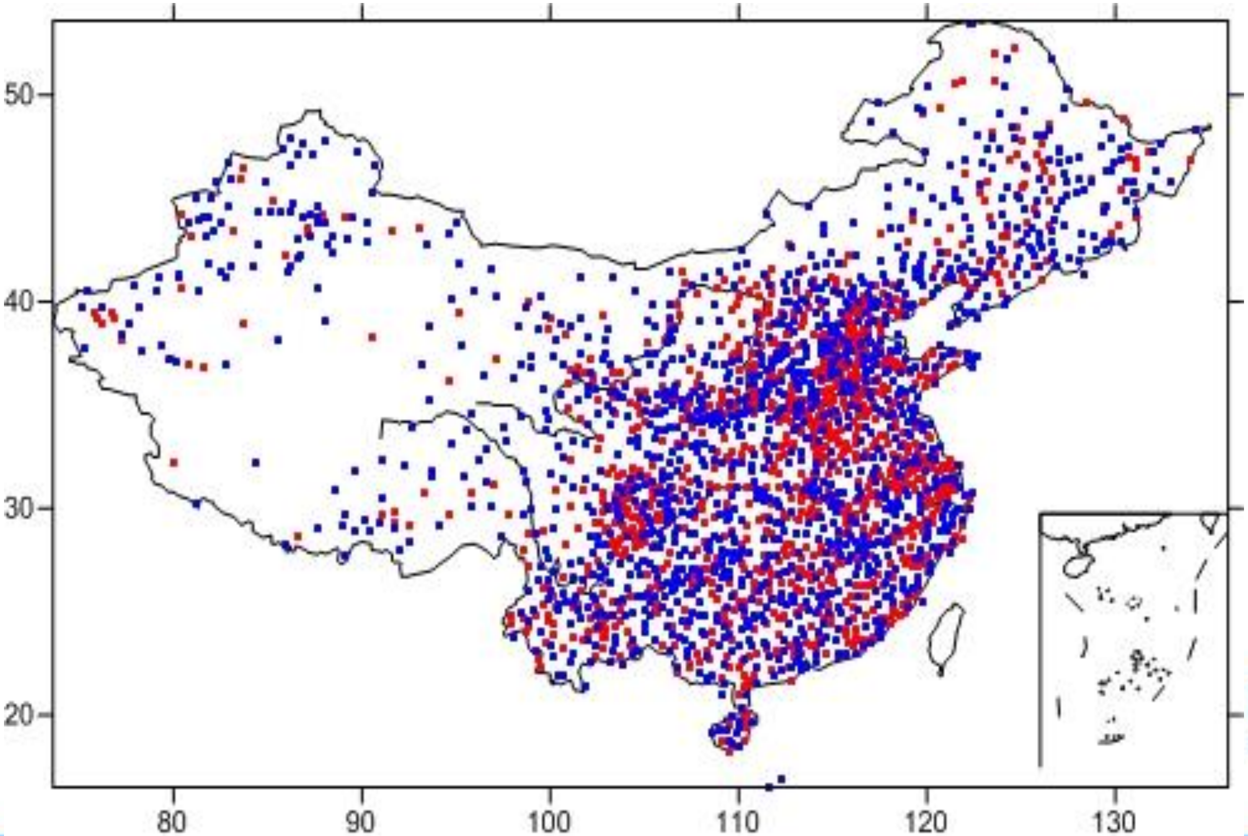
Major Factors Causing inhomogeneity of climate series



Hourly temperature differences between manual and automatic observation in 5 stations of China in which the sensor changes from mercury thermometer to thermistor.

Major Factors Causing inhomogeneity of climate series in China

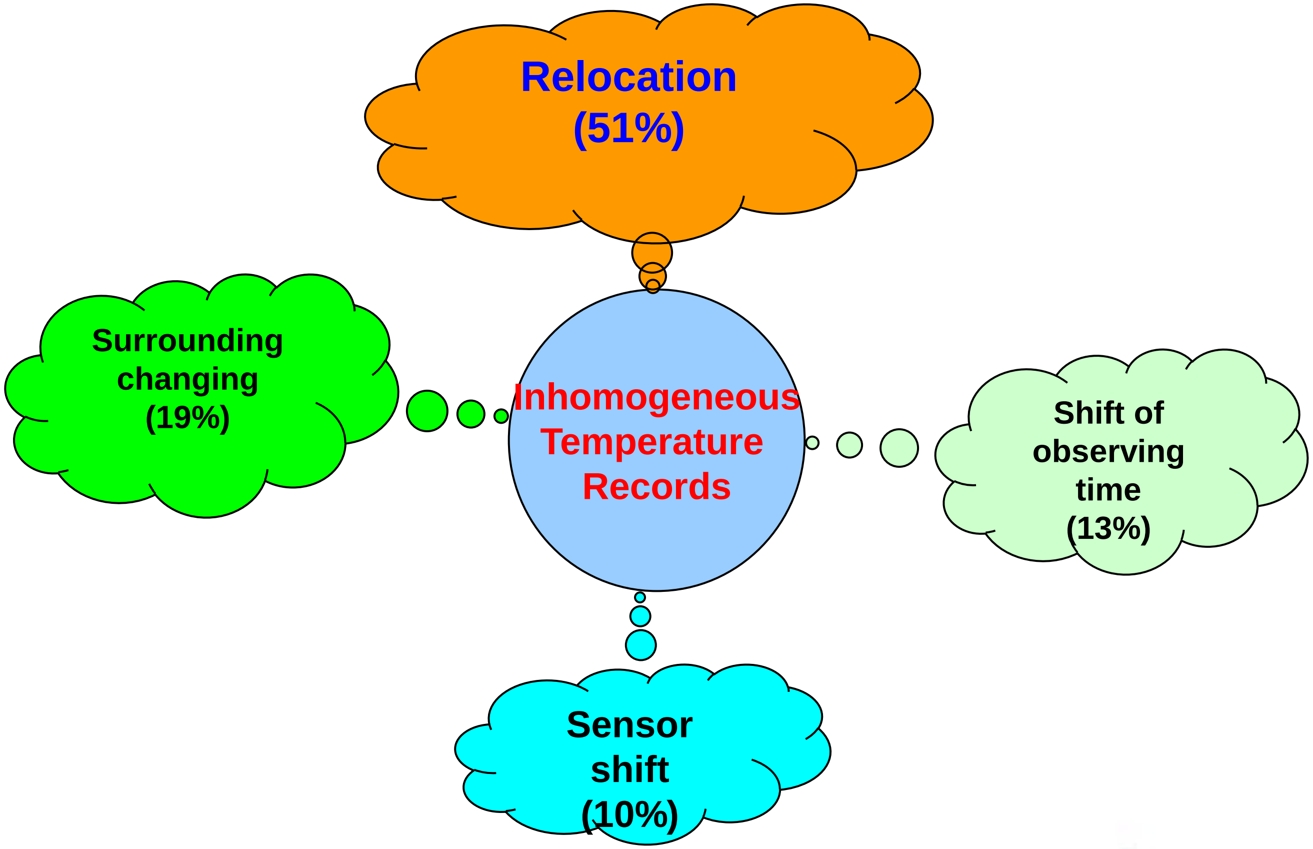
The daily mean, max and min temperature series of 2419 surface stations in China were checked for homogeneity. 34%~56% among the stations have significant discontinuities.



Red: inhomogeneious

Blue: homogeneious

Major Factors Causing inhomogeneity of climate data records in China



Relocation
(51%)

Surrounding
changing
(19%)

Inhomogeneous
Temperature
Records

Shift of
observing
time
(13%)

Sensor
shift
(10%)

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10 principles for Climate Observation

① **The impact of new systems or changes to existing systems should be assessed prior to implementation**

② **A suitable period of overlap for new and old observing systems is required**

③ **Metadata should be documented and treated with the same care as the data themselves**

④ The quality and homogeneity of data should be regularly assessed as a part of routine operations

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(Source: WMO/TD No. 1185 & Karl T., 1995)

10 principles for Climate Observation

⑤ Consideration of the needs for environmental and climate-monitoring products and assessments, such as IPCC, should be integrated into national, regional and global observing priorities

⑥ **Operation of historically-uninterrupted stations and observing systems should be maintained**

⑦ **High priority for additional observations should be focused on data-poor regions, poorly-observed parameters, regions sensitive to change, and key measurements with inadequate temporal resolution**

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10 principles for Climate Observation

⑧ **Long-term requirements, including appropriate sampling frequencies, should be specified to network designers, operators and instrument engineers at the outset of system design and implementation**

⑨ **The conversion of research observing systems to long-term operations in a carefully-planned manner should be promoted**

⑩ Data management systems that facilitate access, use and interpretation of data and products should be included as essential elements of climate monitoring systems

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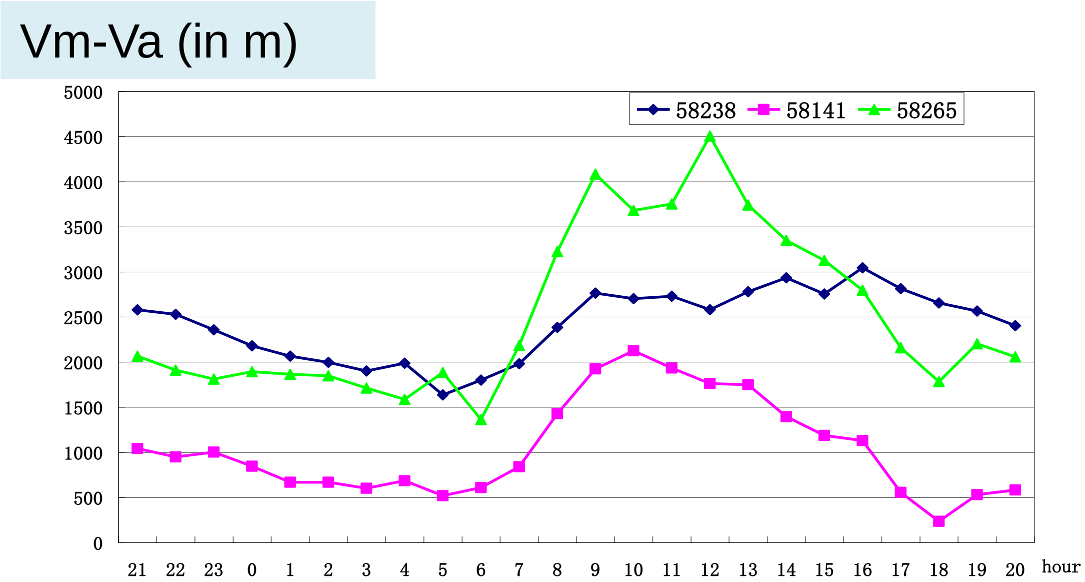
2. For Climate Services

(1) Big difference between manual and auto observation for visibility

The visiometer manufactured in China

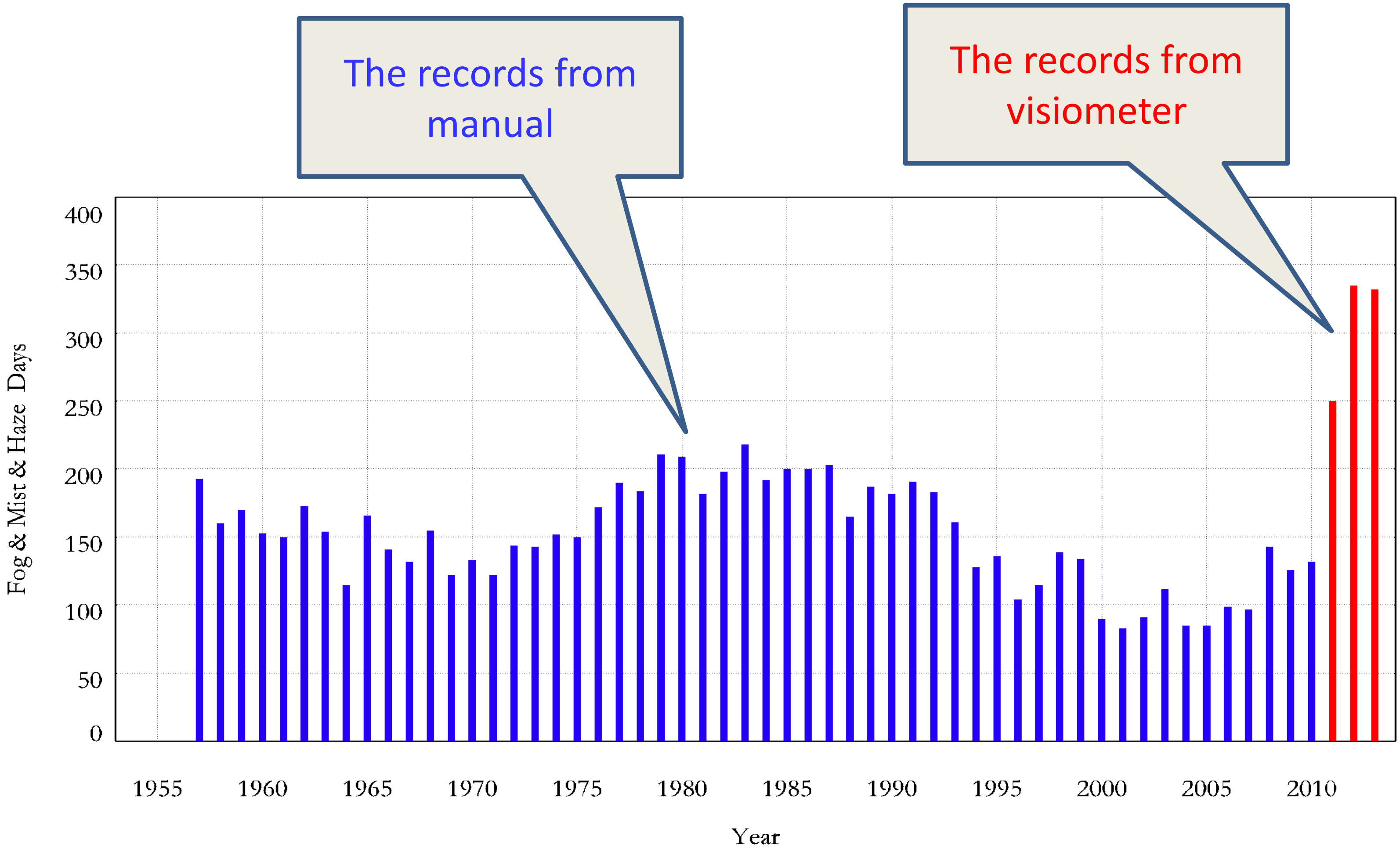


The hourly visibility difference between by manual and visiometer (Jun.-Dec., 2011)

The visibility difference for 70 stations at Jiangsu , China (Jun.-Dec., 2011)

Conditions	Num. Of Samples	Correlation coefficience	Bias(m)	RMSE(m)
All conditions	62439	0.79	3294.00	3860.87
daytime	34813	0.79	3769.69	4107.29
Night time	10211	0.82	2108.77	2754.96
rain	3635	0.65	2445.44	3661.44
fog	411	0.54	77.70	431.79
Visibility:[0-1)km	2257	0.35	1762.80	2269.67
Visibility:[[1-5)km	**27961**	**0.45**	**3455.83**	**3158.75**
Visibility:[[5-10)km	**19479**	**0.32**	**4028.28**	**3768.48**
Visibility:[[10-50]km	12742	0.63	2086.07	5076.84

The number of fog&mist&haze days at station of 58265(Lusi, Jiangsu province)



The records from manual

The records from visiometer

Which is accurate? How to form a long term homogeneous series?

2. For Climate Services

(2) Regulation for Haze

In China, with the increasing of atmospheric pollution, people pay more and more attentions to the haze weather.

© Getty Images

Is it fog or haze?

2. For Climate Services

(2) Regulation for Haze

- Operational definition for Haze in China:

  Vis<=10km & dry suspended particles (generally, RH <=65% ,depend on observer)

  From this regulation, the haze frequency is much less than that people perceive in recent years.

- CIMO has not specific definition for haze.

----WMO, No. 8, Guide to Meteorological Instruments and Methods of Observation

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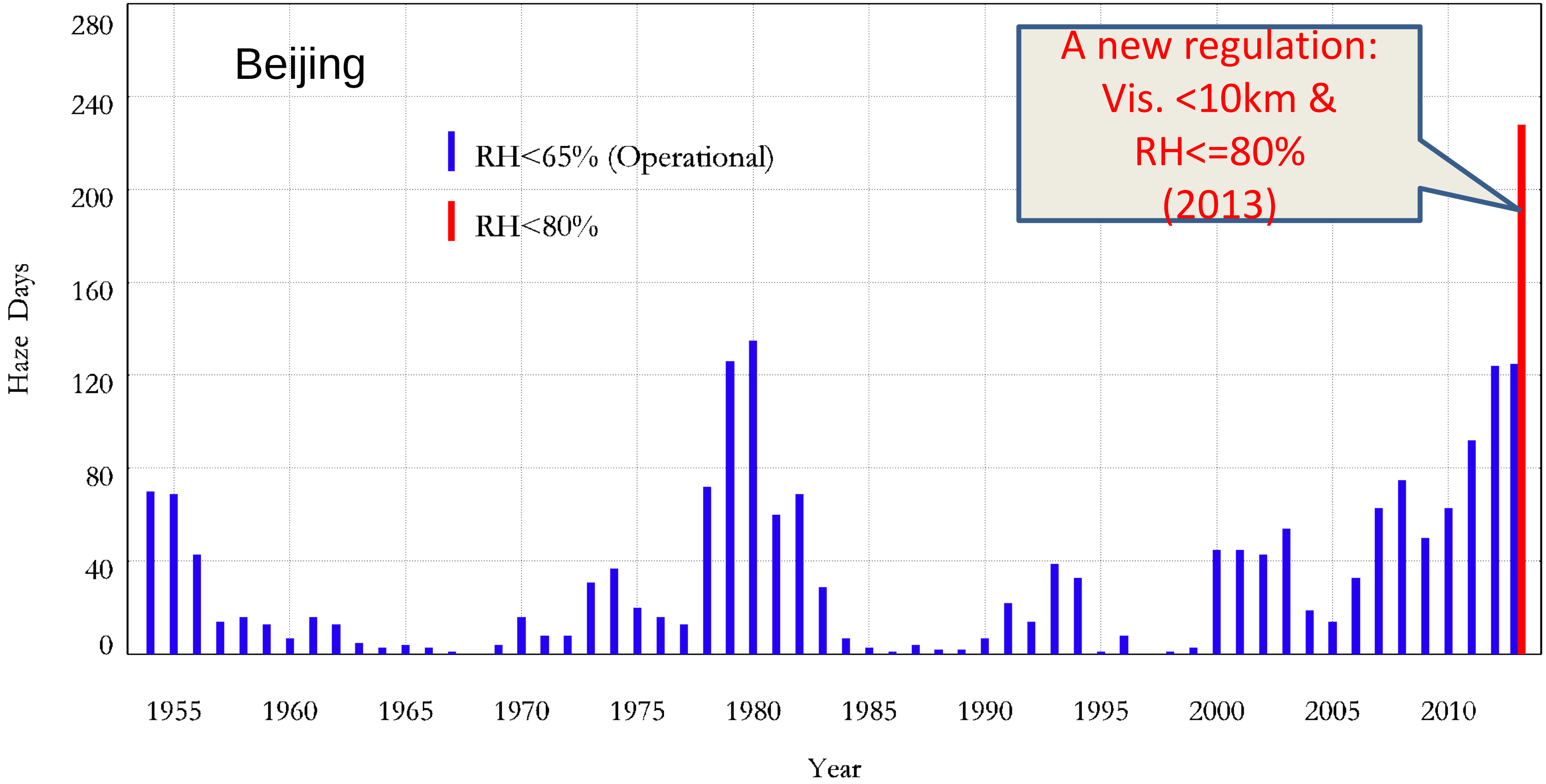

A new regulation:
Vis. <10km &
RH<=80%
(2013)

Annual total days of haze weather from 1954 to 2013

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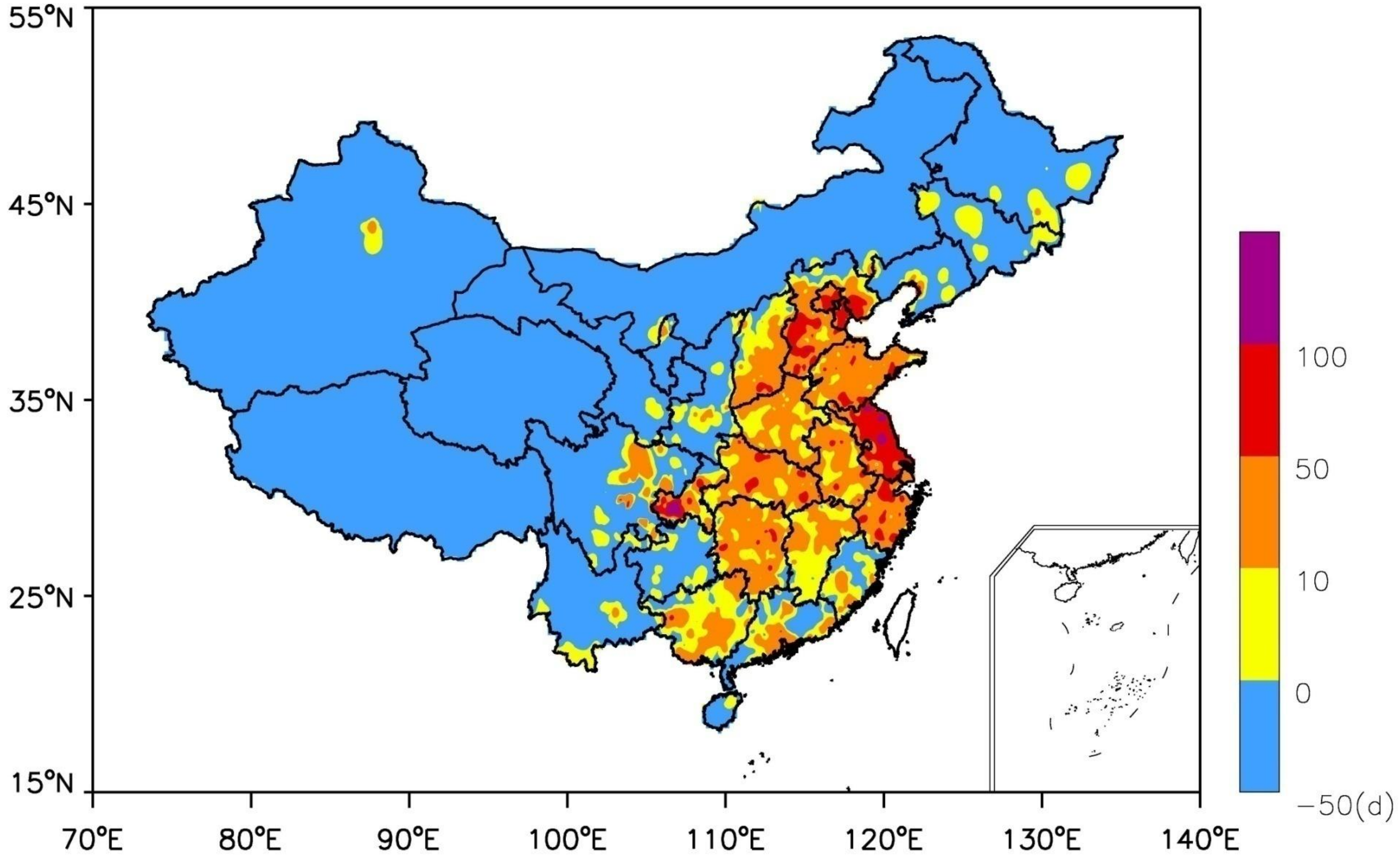
55°N
45°N
35°N
25°N
15°N
70°E
80°E
90°E
100°E
110°E
120°E
130°E
140°E
100
50
10
0
−50(d)

The difference of number of haze days between after and before switch of new regulation, China, 2013

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2. For Climate Services

(3) Calibration of Weather Radar

- Weather radar calibration is essential and critical to high quality data and products.

- The most important problem of radar data availability is quality of radar base data.

- In China, the critical one is that there is different system bias of base reflectivity at different radar.

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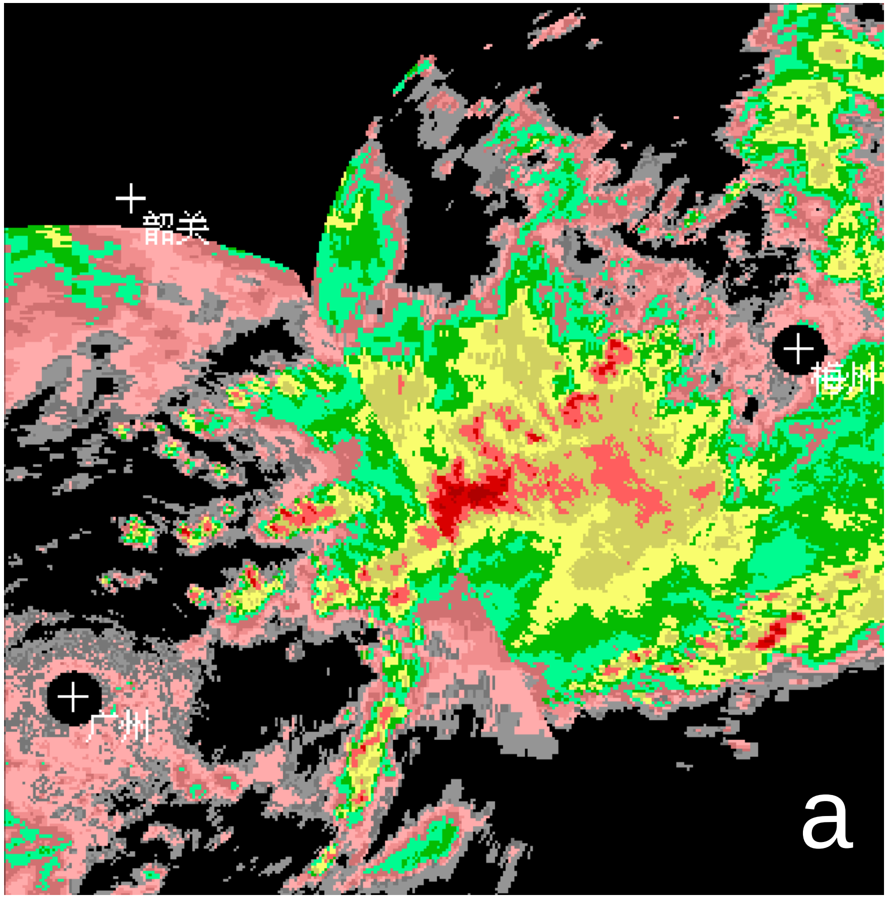

The mosaic of
two radars'
base reflectivity

We hope that there is a framework for regular calibration of operational weather radar as the same one of regular measurement sensors.

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3. Conclusions and Suggestions

(1) It is very important to re-state the 10 principles of climate observation for long term climate monitoring.

(2) The most important issues for climate observations are data/products accuracy(quality) and consistency(continuity), WIGOS should set up regulations to meet climate requirements.

(3) CIMO should be the leader to establish a global/regional/national framework for monitoring and controlling of all observations, esp. the remote sensing measurements to help Member for better data and products supporting services.

Thanks!

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