2019 FENGYUN Satellite User Conference

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Authority / Openness / Win-Win

Introduction of Meteorological Data Service Platform Based on Public Cloud

ZHIQIANG ZHANG

2019-11

NATIONAL METEOROLOGICAL
INFORMATION CENTRE

目 录
CONTENTS

NMIC

INTRODUCTION 01

What is NMIC?

National Meteorological Information Centre

```
China Meteorological
Administration
(CMA)
```

Headquarter of CMA

- General Office
- 8 Departments
  Emergency Response, Public Services, Forecasting, Information, Observations

Operational Centers

- National Meteor. Centre (NMC)
  - Monitor and control of operation Division
- National Satellite Meteor. Centre (NSMC)
  - Data management And service Division
- National Climate Centre (NCC)
  - High-Performance Computing Division
- **National Met. Information Center (NMIC)**
  - Data and products research Division
- Meteorological Observation Centre (MOC)
  - Data Tel – communication Division
- Other 7 institutions
  - System design & development Division

Responsibilities

NMIC

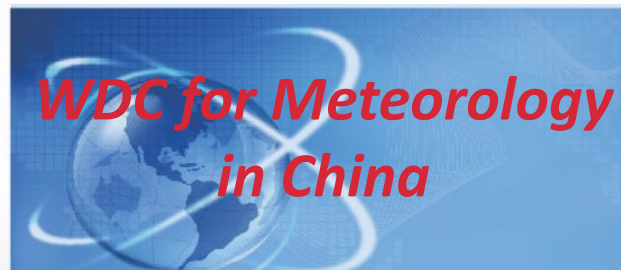| Telecommunication Center	Data Center	HPC Center
Globally data exchange, collection & distribution	Whole life cycle data management: data processing, storage, application services and archiving.	provide HPC resources and application support services for operations, research & development of numerical prediction models

RTH Beijing
WMO Regional Telecommunication Hub
GISC Beijing
Global Information System Centers

WDC for Meteorology in China

Application of wireless, satellite, network and other technologies

Big data, cloud computing and other new technologies

Parallel computing, resource monitoring and other application

Our Team

Service Team

Provide efficient meteorological data management and service support

R&D Team

Provide professional meteorological data processing and product production

Ops Team

Provide all-weather platform operation and monitoring operation and maintenance
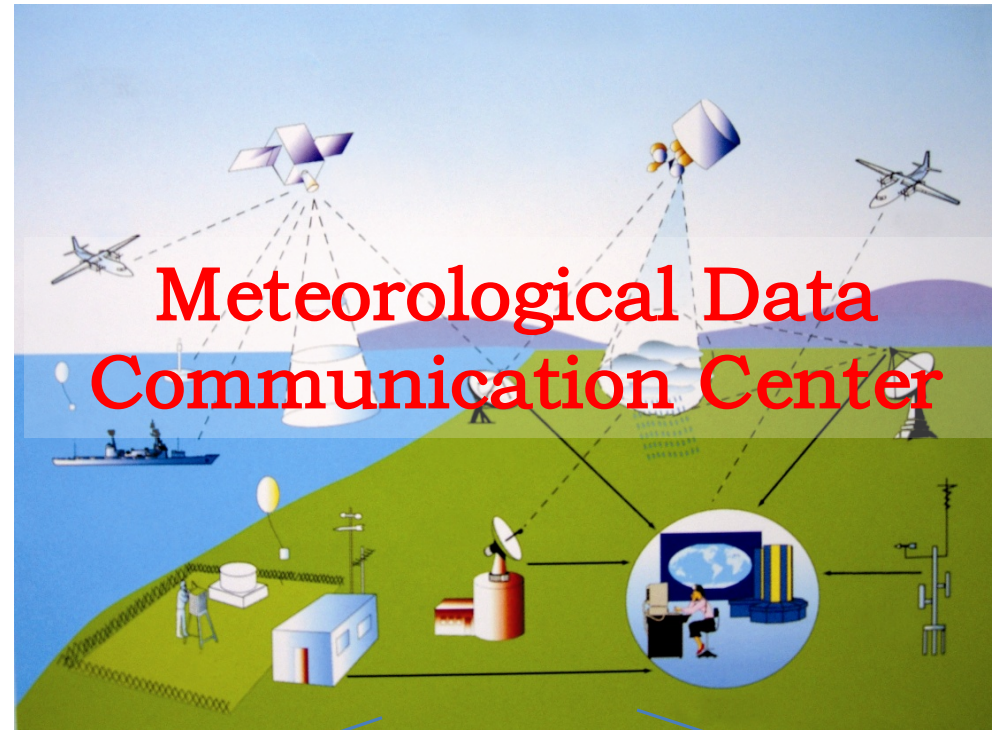
The 1st FYSUF 2019

NMIC
DATA COLLECTION 02

Data Collection

International Telecommunication

Domestic Telecommunication

The robust operational real-time data receiving process allows for nmic to collect various real-time and non-real-time meteorological observations

International Communication

- **RTH Beijing**

  - NMIC function as a WMO Regional Telecommunication Hub (RTH) in WMO Region-II (Asia)

- **GISC Beijing**

  - NMIC is also one of the WMO's newest Global Information System Centers (GISC Beijing)

  - exchanging meteorological, hydrological and ocean data with foreign centers

International Communication

RTH Beijing: GTS links to EUMETSAT, Offenbach, Tokyo, Moscow, New Delhi, Toulouse, Seoul, Bangkok, Hanoi, Pyongyang, Ulan Bator.
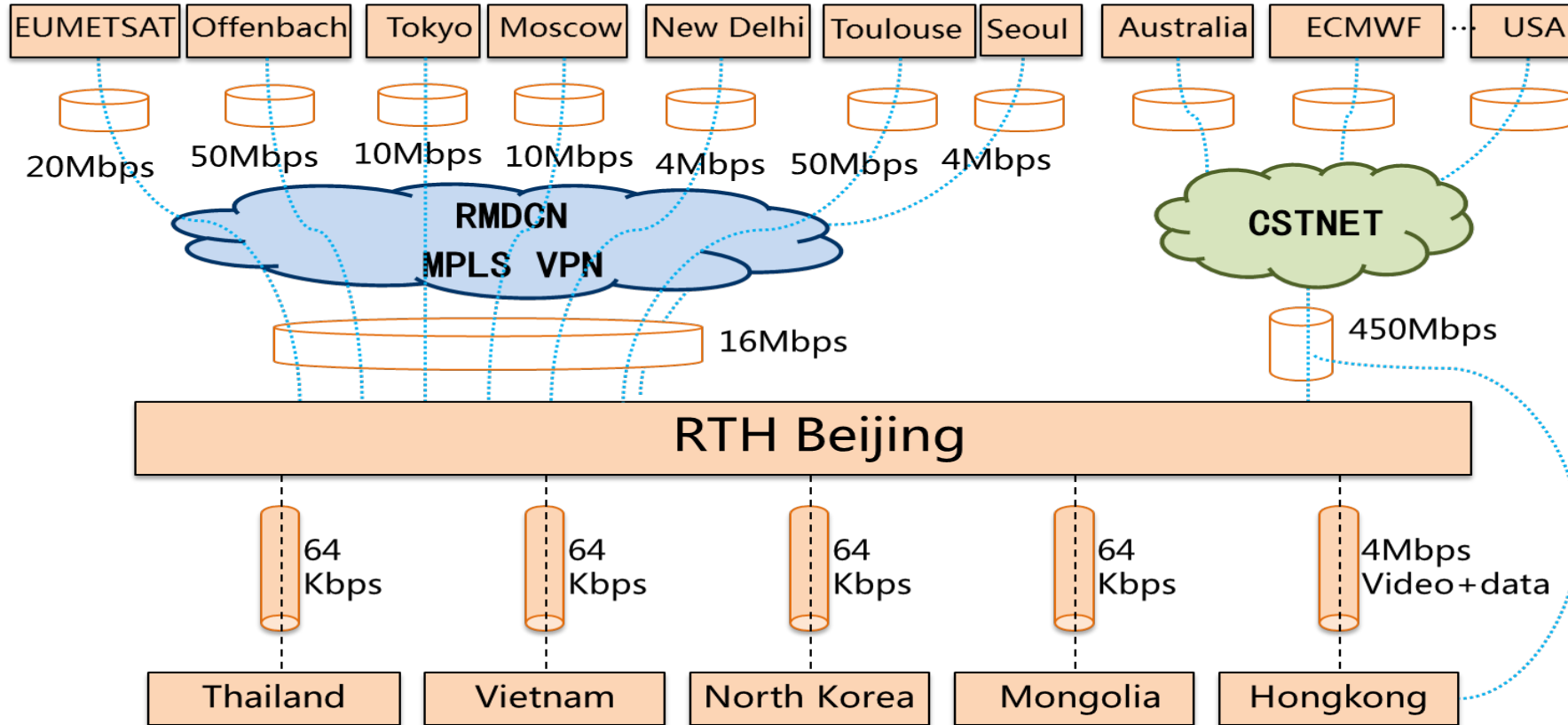
- **GTS(Global Telecommunication System):** surface, upper-air, radar, AMDAR, AWS, Ocean, satellite(METOP, METEOSAT, NOAA, GOES, AQUA, TERRA, ···), NWP Products(JMA, Germany, America, ECMWF, ···) ~28GB/day

- **CSTNET(Internet):** High Resolution NWP(ECMWF, JMA, NCEP), Ensemble prediction products(ECMWF, NCEP, CMC), ··· ~270GB/day

International Communication

GISC Beijing： Approved to provide routine services by WMO in 2011. It is one of 13 operational GISCs of WIS.

GISC (Global Information System Centre)

Data Services:

➢ **Data Access & Retrieval – from 24h Data Cache**

   - Provide real-time GTS data in 24 hours

➢ **Data Access & Retrieval – through Data Request**

   - Provide near real-time data in the past (GTS / TIGGE / DCPC)

➢ **Data Access & Retrieval – through Data Subscription**

   - Provide routine real-time data in future (GTS / TIGGE)

WMO Information System (WIS)

Programmes > WWW > WIS > GISCs

WMO Global Information System Centres

Here is a list of currently operational GISCs and links, including links to the interim metadata management services where available.

- GISC Beijing (offering Interim Metadata Management Service)
- GISC Exeter
- GISC Jeddah
- GISC Melbourne
- GISC Moscow
- GISC Offenbach
- GISC Seoul (offering Interim Meta...
- GISC Tokyo (offering Interim Meta...
- GISC Toulouse
- GISC Tehran
- GISC Washington

Domestic Communication

In China, whole meteorological observation data's communication is done by CMA's domestic communication system, which includes three routines:

- **CMALan:** Data sharing between Operational Centres of CMA

- **CMANet:** Observations collecting, disseminating across China

- **CMACast:** Data disseminating for CMA domestic users and the Asia and Oceania users under GEO framework

GEO-Group on Earth Observations

Data Resources

NMIC has the longest history, the largest stock, the most complete type, the highest timeliness and the best quality meteorological scientific data in China. The total amount of data is 24Pb, more than 2Pb online.

Global:
>100，000 Ground observation station
>1000   Upper-air stations
>6000   Aircraft detection
>20   Polar orbit / geostationary satellite
>2000   Ship
>3500   Oceanographic buoy
....   Other sensors

The earliest data sources date back to 1841

Data Resources

Deep-processing products
CRA-40(1979~2018) is coming!

Meteorological department
49 kinds of observation data in 7 categories within domestic departments' exchange

Ministries and committees
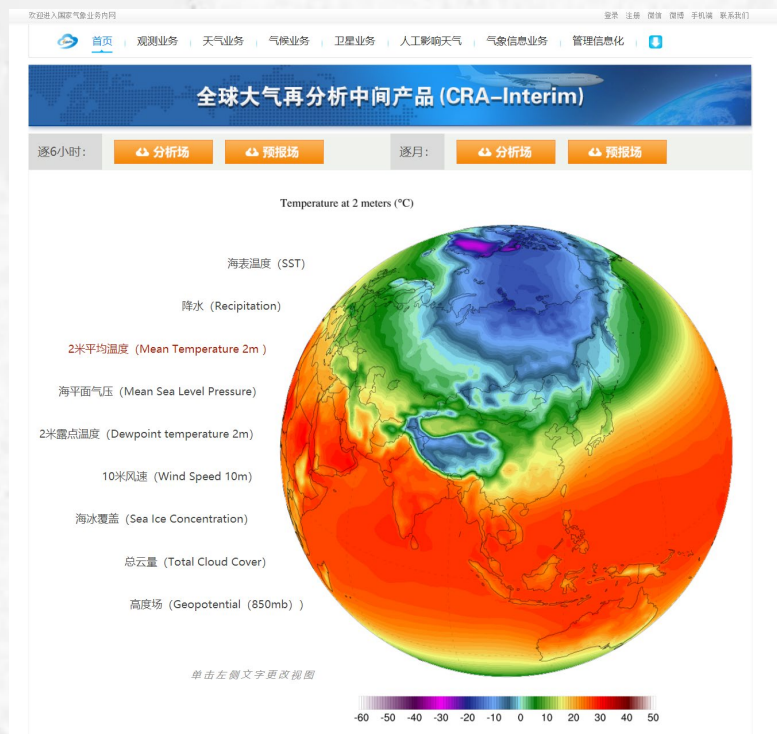15 kinds of data in 10 categories through relevant ministries and committees' data exchange

Foreign countries
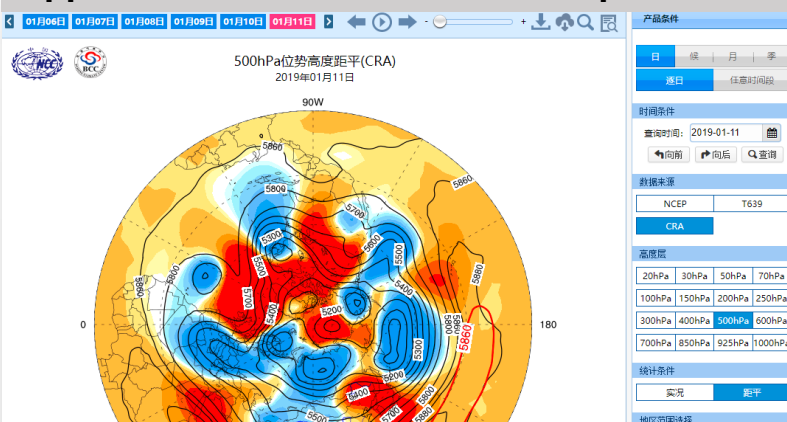21 kinds of foreign data in 5 categories from 230 coutries.

Deep-processing products
41 kinds of Deep-processing Meteorological products in 4 categories

Applied to national climate center operations

Applied to typhoon process simulation

The overall objective of CRA-40 program (CMA's Global Atmospheric ReAnalysis，1979~2018) is producing four 40-year datasets: Original observation data set, reanalysis data set, assimilation feedback data set, and reanalysis uncertainty data set.
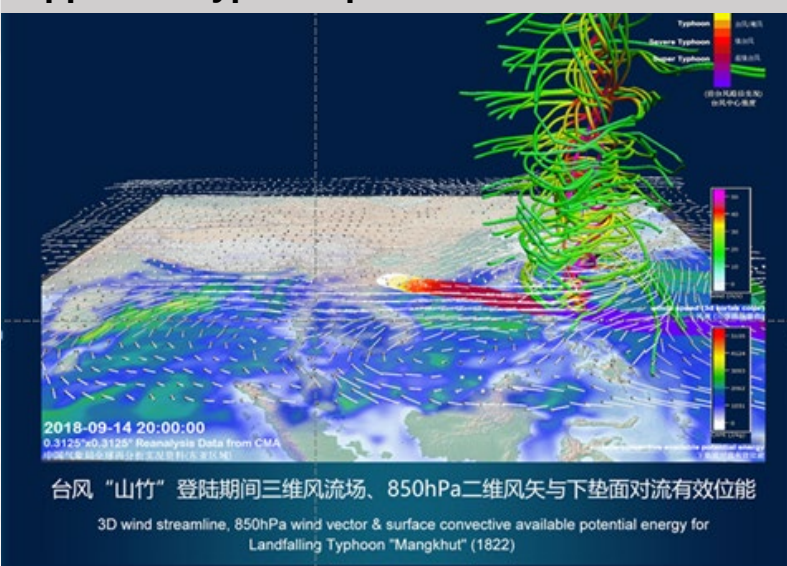
The 1st FYSUF 2019
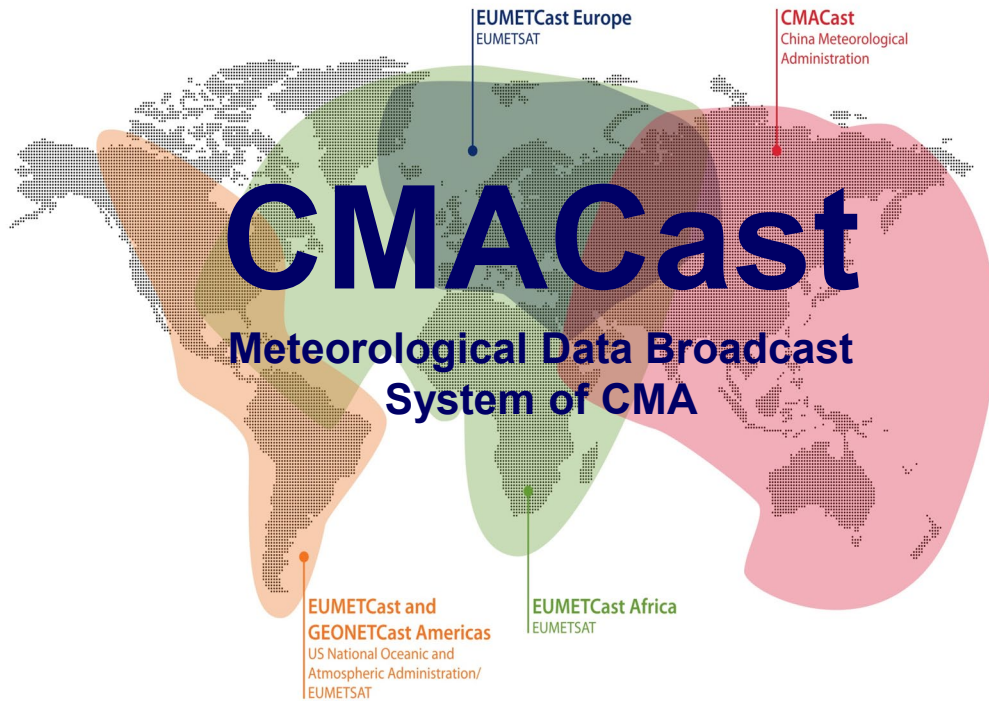
NMIC

DATA SERVICE 03

Data Service

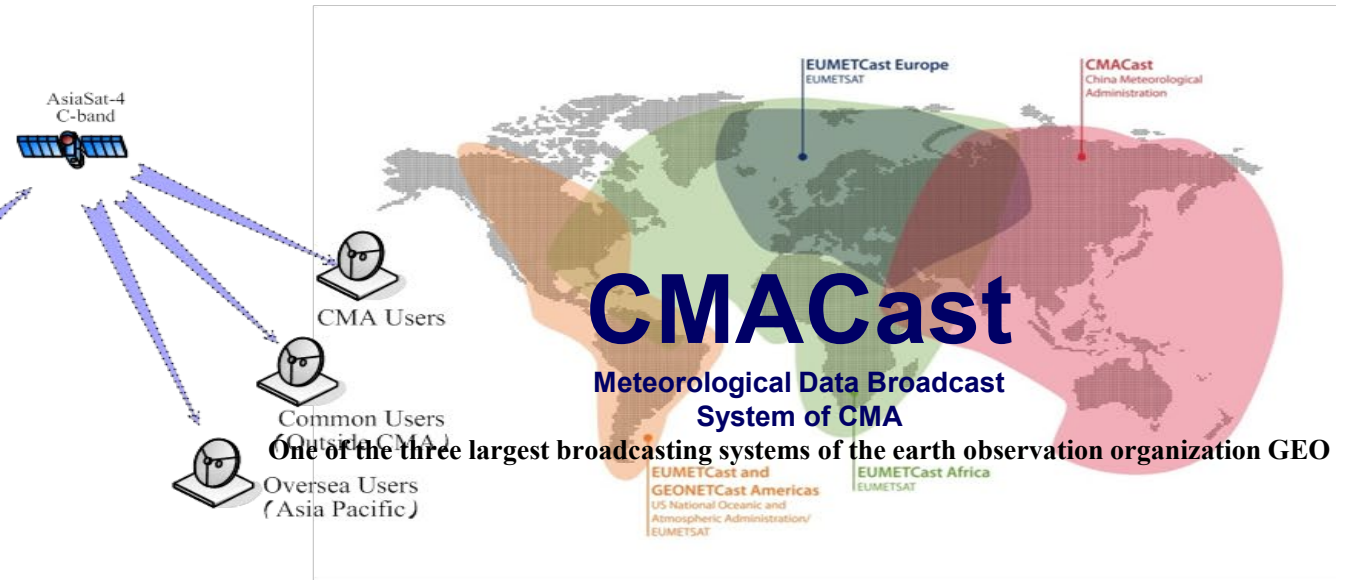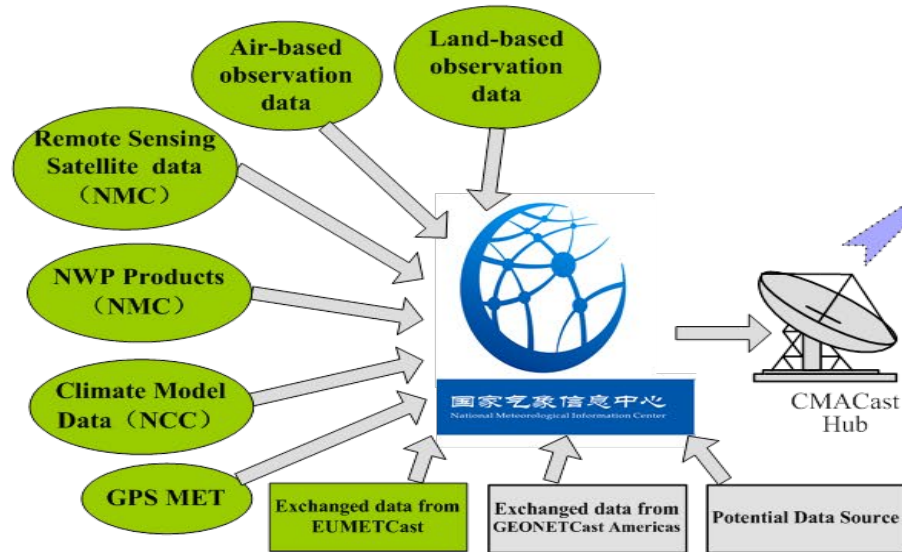## Satellite Broadcast

Web Services

CMACast System Service

CMACast: **Data dissemination system for Asia and Oceania under GEO framework**

One of the three largest broadcasting systems of the earth observation organization GEO

- **DVB-S2** standard
- **36MHz** C-band transponder Up to **70Mbps** rate
- More than **2600** domestic users
- **24** international users

CMACast Users
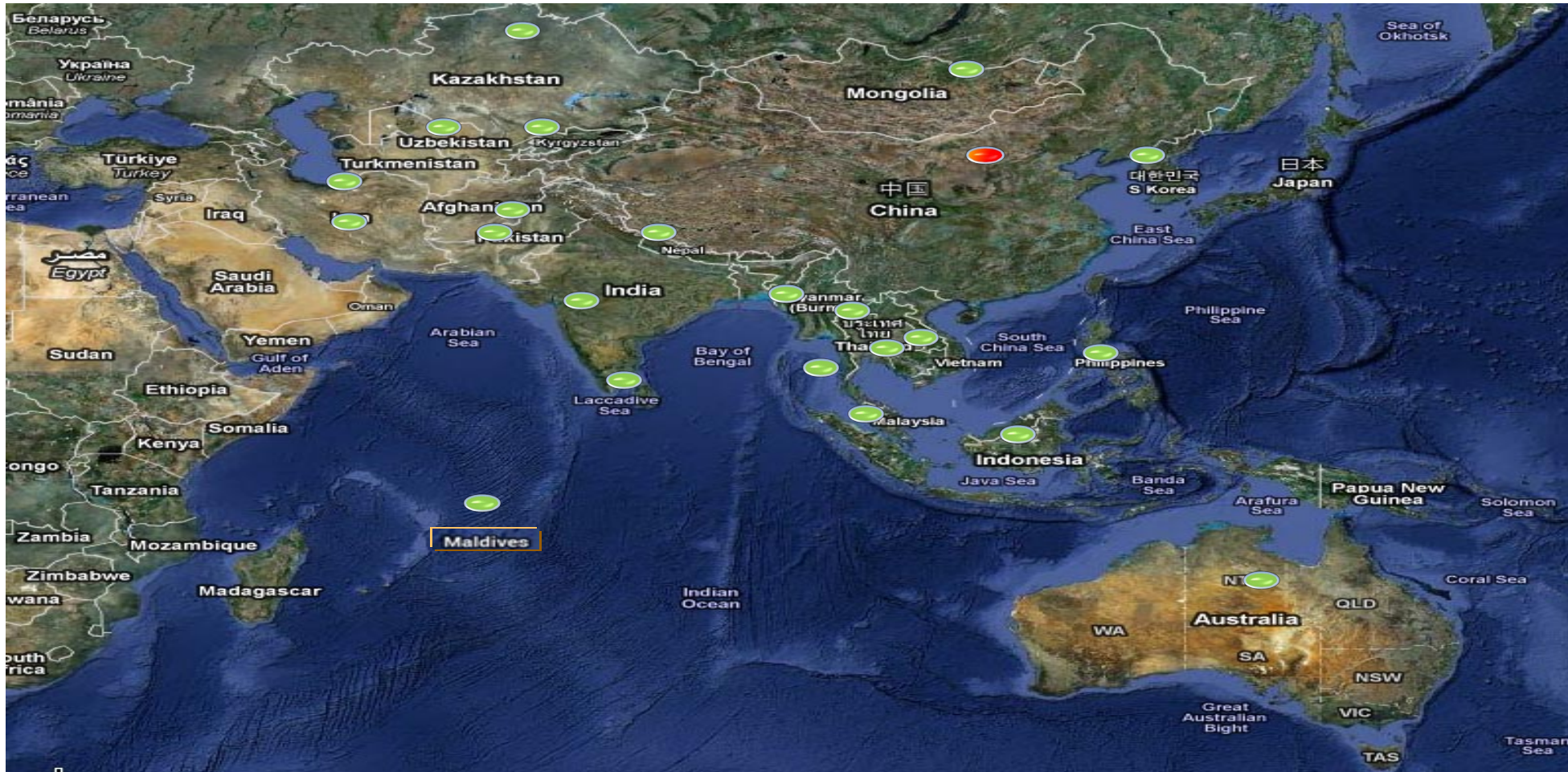
CMACast system oversea user:
1. Australia
2. Bangladesh
3. DPR Korea
4. Indonesia
5. Iran(2)
6. Kyrgyzstan
7. Laos
8. Malaysia
9. Mongolia
10. Myanmar
11. Nepal
12. Pakistan(2)
13. Philippines
14. Sri Lanka
15. Tajikistan
16. Thailand(2)
17. Uzbekistan
18. Kazakhstan
19. Vietnam(2)
20. Maldives

Covers 17 countries along the "One Belt One Road"

Integrated CMACast System for International Users

Satellite Receiver

Receiver (computer No.1)

Process System

computer No.2

computer No.3
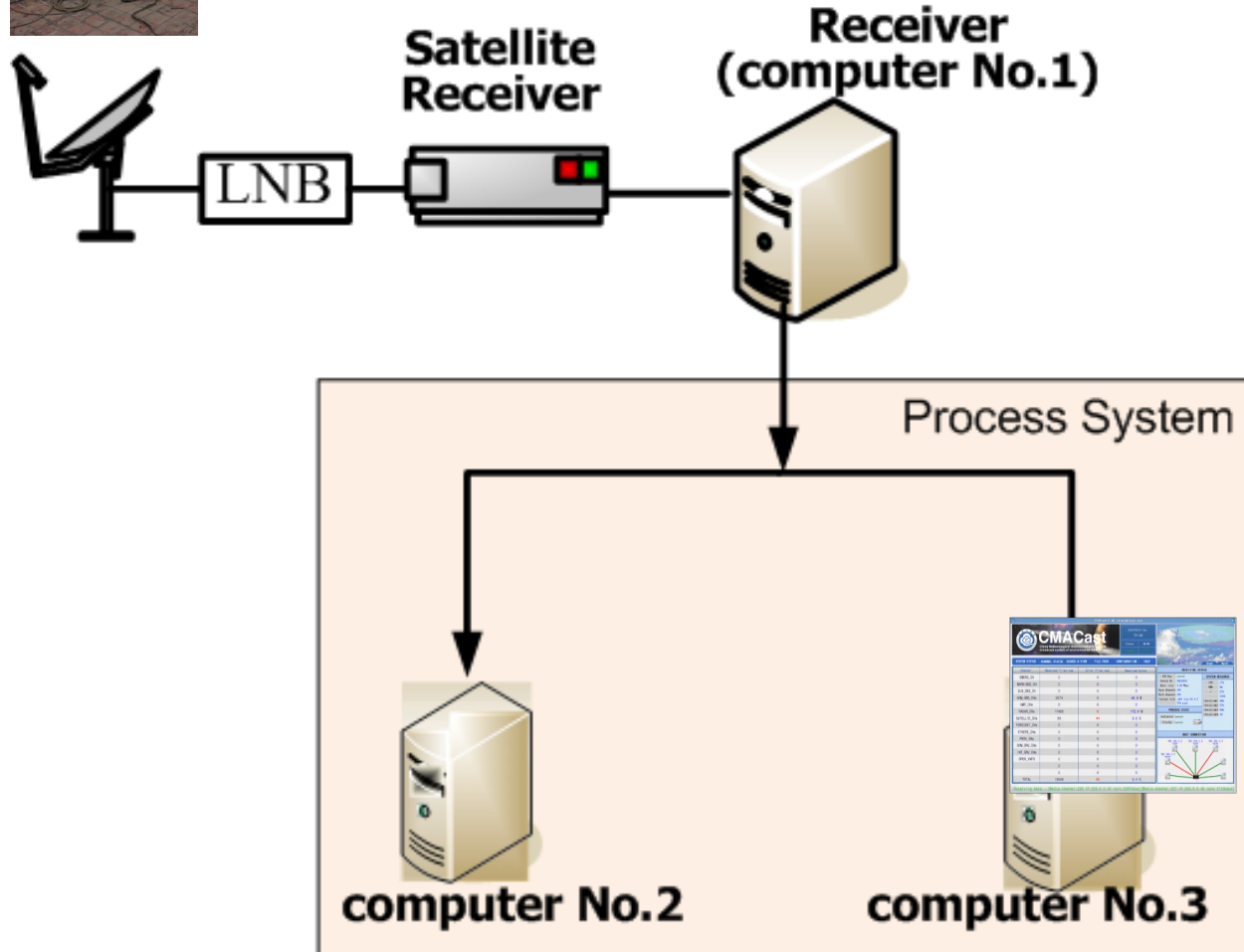
Application Software:

➢ **CMACast Reception Software(PC1)**
  - ingest and decrypt digital stream
  - regenerate data and products
  - push data to destination in real time
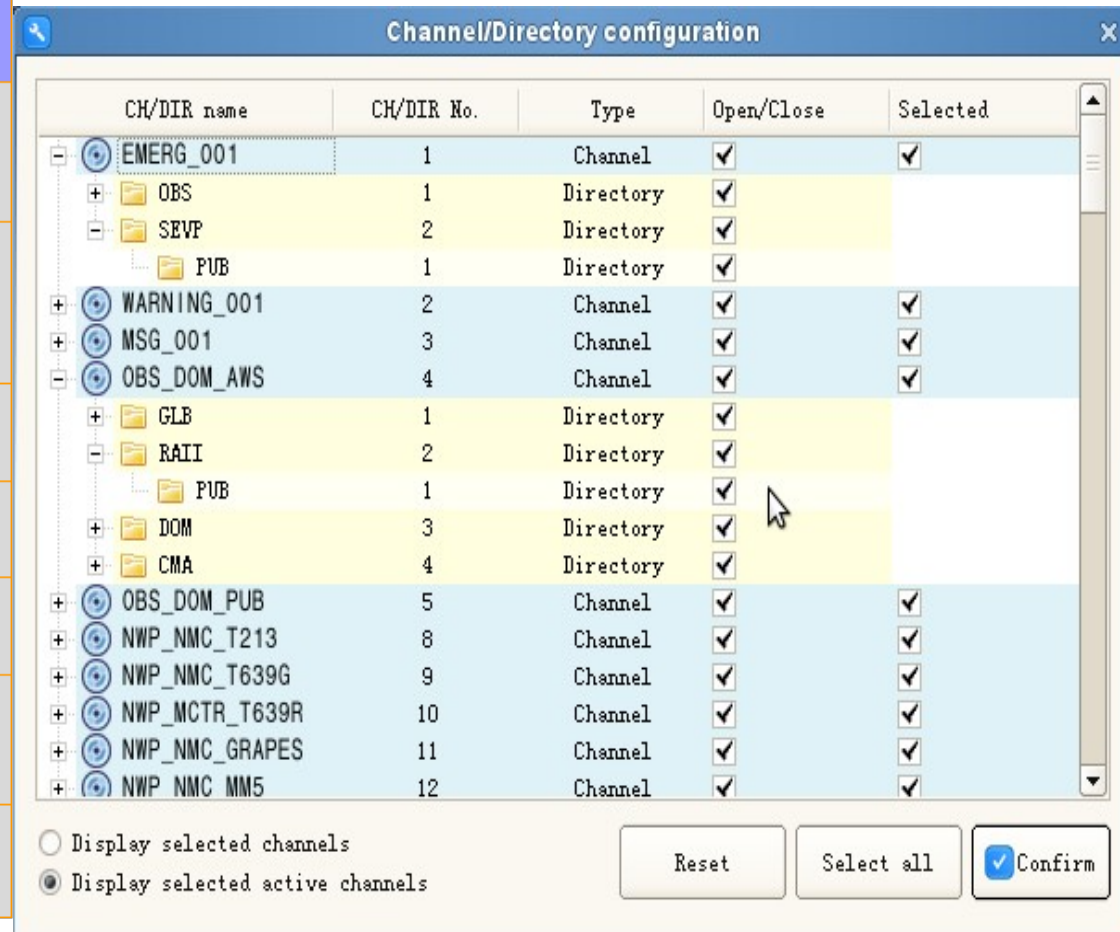 - monitor operation status

➢ **MICAPS(PC2)---->upgrade to Micaps4**
  - graphics workbench for forecaster
  - Micaps Data Server Software

➢ **SWAP(PC3)---->upgrade to SWAP2.0**
  - Image processing tools
  - overlay GIS information
  - generate products by interactive processing

  - After the upgrade, users will be able to fully use the data and products of FY2F/2G/2H/4A.

CMACast Data for International Users

Category	Data and products	Timeliness
GTS data	**Warnings** Warning for tropical cyclone, tsunami, tornado, severe thunderstorm, volcanic ash clouds ...	10 seconds
	Observations SYNOP; TEMP; PILOT; SHIP; BATHY; BUOY; CLIMAT; AIREP; AMDAR; TRACKOB; TESAC; WAVEOB; SATEM; SARAD; and SATOB.	1 minute
	Model Products ECMWF, EDZW, RJTD, KWBC	20 minutes
	Fax charts BABJ, EDZW, RJTD	5 minutes
CMA Products	**Model products** T639 GRAPES products	20 minutes
	Satellite data **FY-2F/2G/2H/4A images and products**	10 minutes
Others	Satellite data from EUMETSAT METOP-B, NOAA19, JASON2,MET8	10 minutes

Channel/Directory configuration

CH/DIR name	CH/DIR No.	Type	Open/Close	Selected
EMERG_001	1	Channel	✓	✓
OBS	1	Directory	✓	
SEVP	2	Directory	✓	
PUB	1	Directory	✓	
WARNING_001	2	Channel	✓	✓
MSG_001	3	Channel	✓	✓
OBS_DOM_AWS	4	Channel	✓	✓
GLB	1	Directory	✓	
RAII	2	Directory	✓	
PUB	1	Directory	✓	
DOM	3	Directory	✓	
CMA	4	Directory	✓	
OBS_DOM_PUB	5	Channel	✓	✓
NWP_NMC_T213	8	Channel	✓	✓
NWP_NMC_T639G	9	Channel	✓	✓
NWP_MCTR_T639R	10	Channel	✓	✓
NWP_NMC_GRAPES	11	Channel	✓	✓
NWP_NMC_MM5	12	Channel	✓	✓

○ Display selected channels
◉ Display selected active channels

[Reset] [Select all] [✓ Confirm]

- **Up to 200 logical channels for file broadcast**
- **Min, Max bandwidth and priority definition for each channel**
- **First layer, second layer for data selection**

Getting Data from Beijing WIS Portal

Online register

Register

online	Offline

Registration form

BeijingWIS email	CMACast email

Find data

BeijingWIS

Subscribe data

Automatically served

Via GTS, Internet and CMACast

CMACast

The annual service volume is over 1400 TB
and the daily service volume is over 400 GB
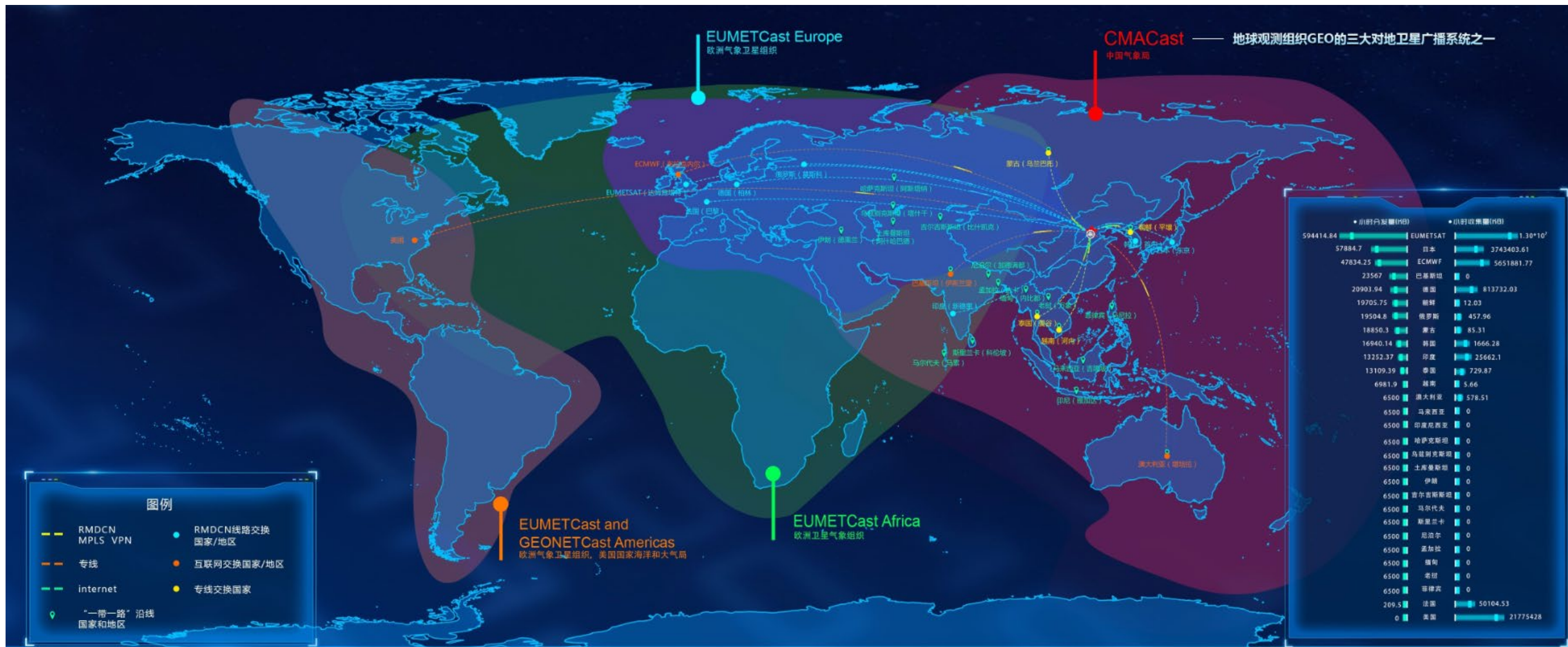
CMACast Helpdesk Service

* ☀ Provide remote assistant by email/TeamViewer/Vedio Conference.
* ☀ Provide on-site maintenance and training for the system.
* ☀ Provide upgrating of System.
* ☀ Provide training.
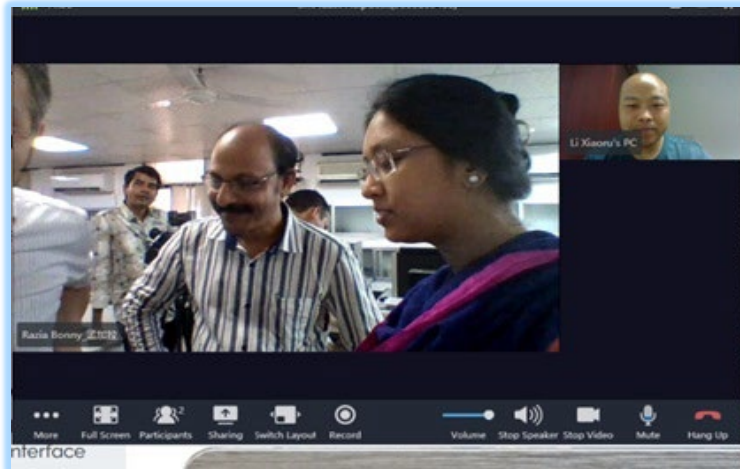
Data Opening Process

In 2001, China Meteorological Administration as China 's one of pilot units of SDSP（Scientific Data Sharing Project）, first issued a "meteorological information sharing management measures" and started for **the public welfare departments** and **research institutions** to provide the meteorological data sharing service。

In 2004, National Meteorological Information Center had completed "China Meteorological Data Sharing Service System", to implement the meteorological data **on-line** sharing service.

It is an authoritative and unified shared service platform for China Meteorological Administration to open its meteorological data resources to domestic and global users.

Web Service

What is CMDC? China Meteorological Data Service Centre

the Big Data Action Plan
(the Chinese State Council, on August 31,2015)

On Sept.29,2015, the China Meteorological Administration (CMA) officially announced the Directory on Shared Essential Meteorological Data and Products and kept its data open to the whole society for free.

- It is an **alternative and upgraded system** of China Meteorological Data Sharing Service System (CMDSS)

- It is **authoritative data service platform** to for CMA to open its data resources to domestic and global users.

Technical Platform—CMDC

To meet the needs of users as the first priority, establish a comprehensive data service portal in Chinese and English with the integration of website, mobile app, wechat, microblog and API interfaces.

中国气象数据网
http://data.cma.cn
权 威 / 开 放 / 共 赢

- Annual visits：**120 million+**
- User number：**280 thousand+**
- Concurrent access：**million level**
- Annual data order quantity: **nearly one million**
- New media visits：**3 million +**

Data discovery services

Data visualization service

App Service

Thematic services

API Service

Our data are widely applied in 43 industries including education, medicine, finance, agriculture, and environmental protection.
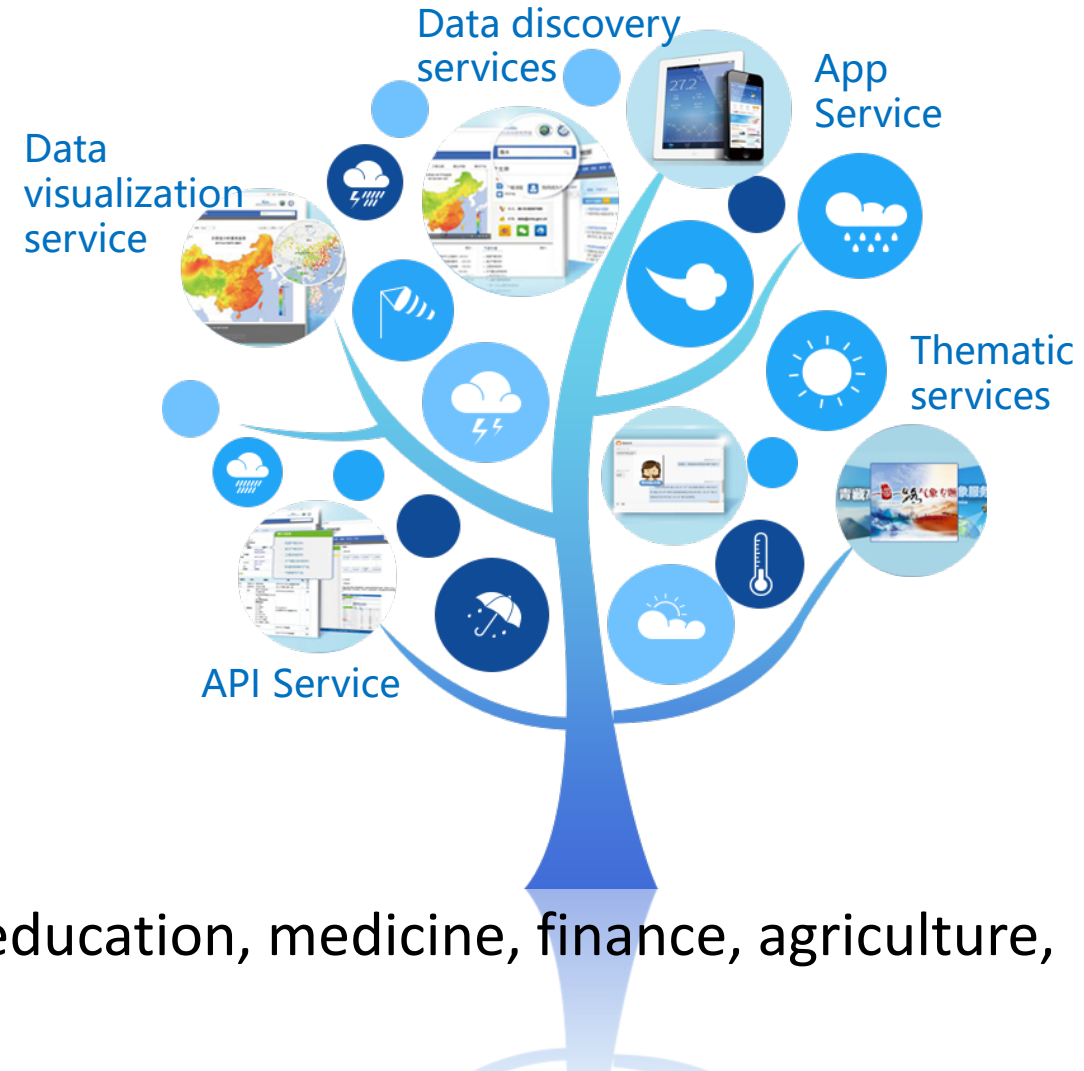
Data Service

☀ More Varieties

Fully share the basic meteorological data and products, 5 categories, 17 varieties, including surface, upper air, meteorological satellite, radar observations and numerical model weather forecasts

☀ Broader spatial coverage

Fully cover the observations from the surface weather stations and the real-time images from weather radar sites

☀ More frequent update

Surface station observations	⟶	hourly
Radar image products	⟶	6 minutes
Model data	⟶	2 or 4 times a day

☀ Longer time series

30 year ground and upper-air climate normal
Historical data from geostationary and polar-orbiting satellites from CMA and abroad

国家气象信息中心
National Meteorological Information Center

Data Service
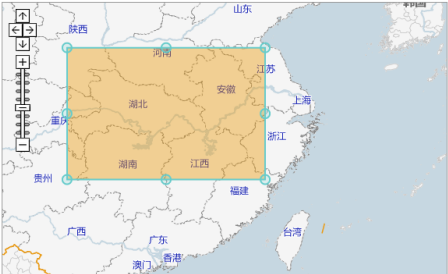
■ WEBGIS retrieval
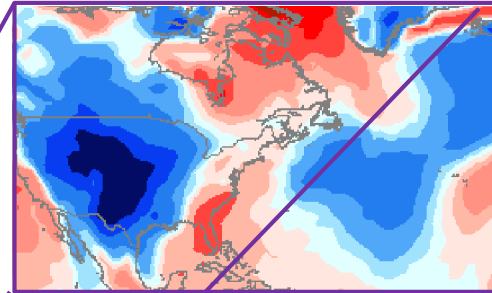
■ Data clipping

■ Data preview

Knowledge Service

Professional knowledge service system: for the meteorological industry, it is the first time to develop professional knowledge relationship map of meteorological science by using knowledge map, relationship mining and other technologies, so as to realize the extension from data service to knowledge service.

Meteorological data resources

- Meteorological products
- Numerical model
- Observed data
- News
- Literature
- …

Heterogeneous resource integration

Knowledge base processing

Link to retrieve

Data gene

Trend analysis

Visual illustration
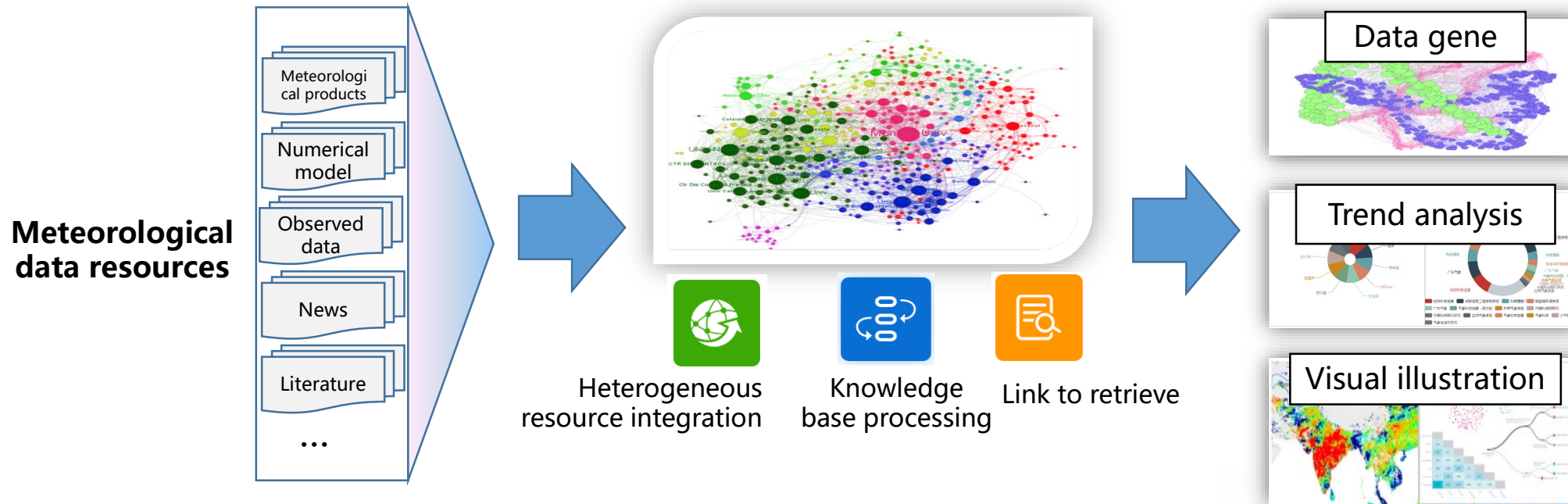
Data Visualization Service

Based on the integrated meteorological data visualization product processing platform, it realizes the full coverage of meteorological visualization products, intelligent and automatic processing, and effectively improves the generation efficiency of visual products.

Super Typhoon Mangkhut
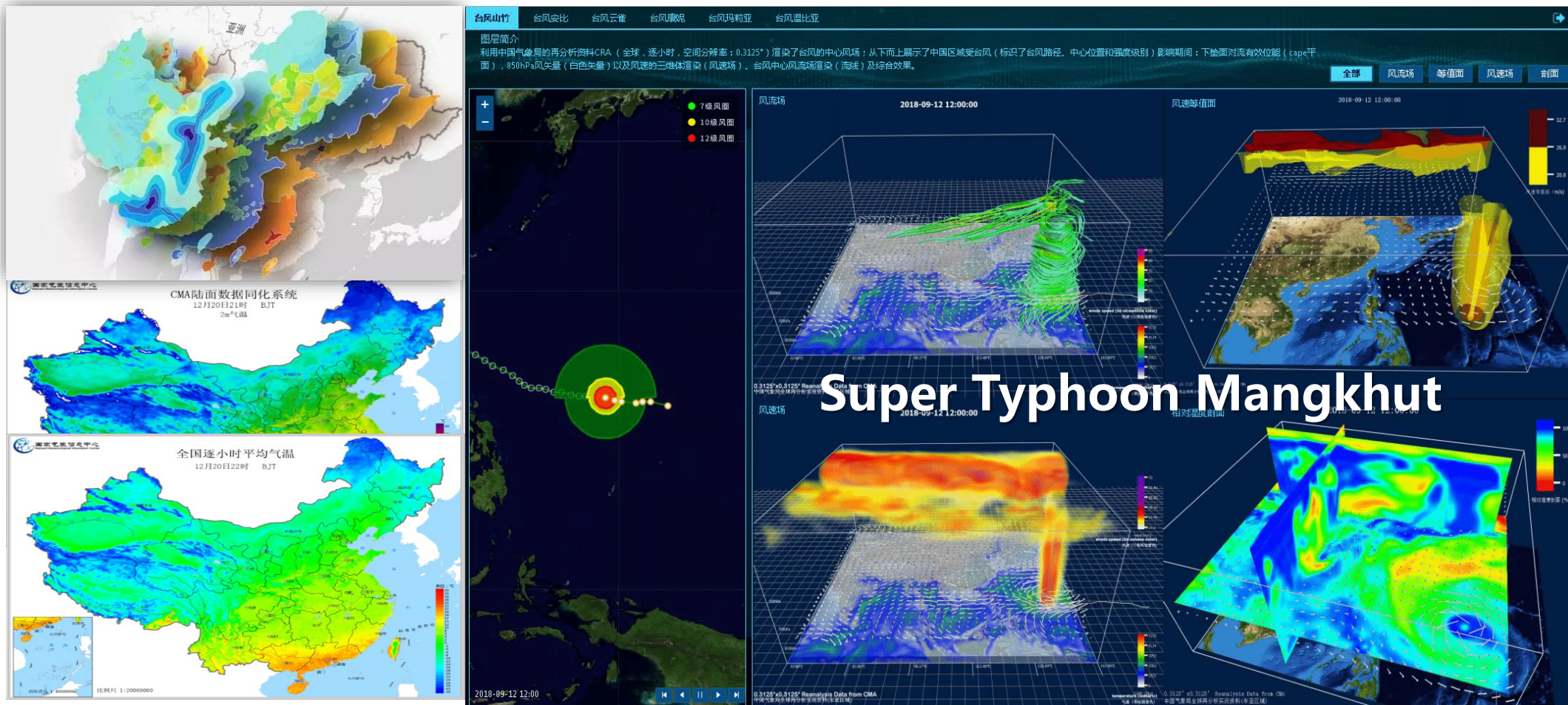
APP Service

◎Mobile APP Service

The function design for mobile application APP services of the China Meteorological Data Service Center is aligned with the Web application of the China Meteorological Data Service Center, which can mainly meet the needs of modern users in mobile office and life. Users can online download and install the APP through the User Support section on the home page of China Meteorological Data Service Center, and also install the APP directly through scanning two-dimensional code on the mobile terminal.
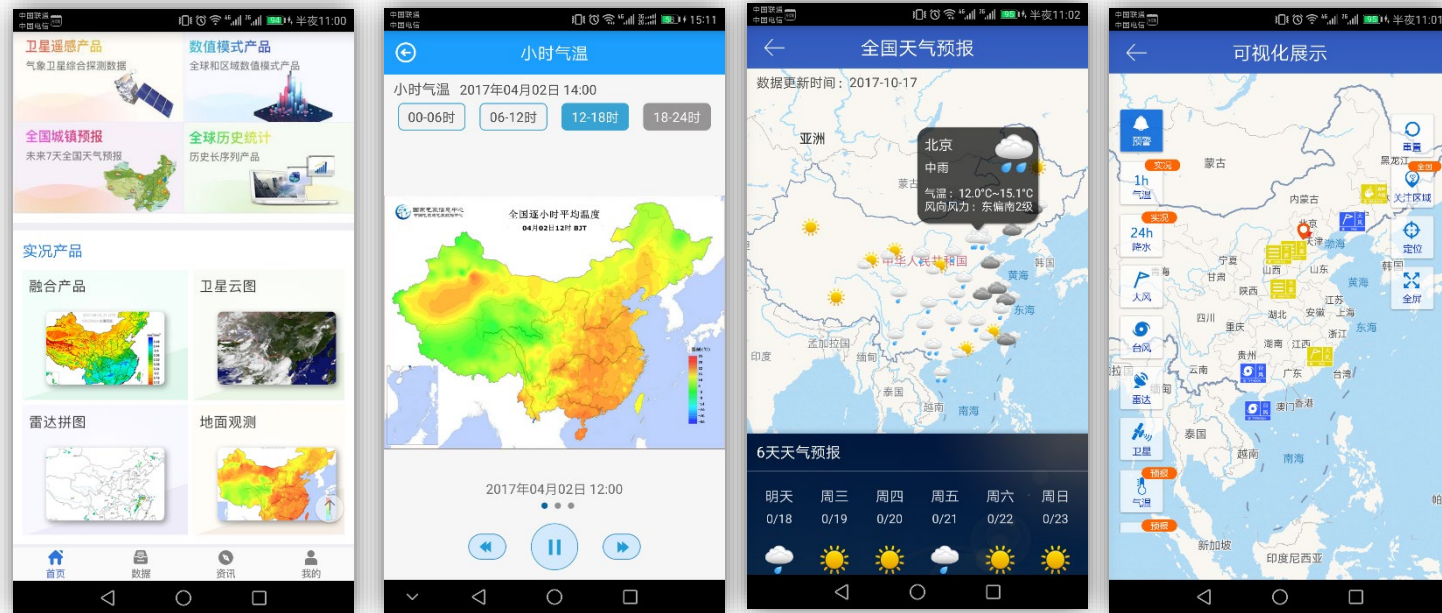
- Introduction of various data

- Exhibition of meteorological data and products

- Weather forecast

- Data analysis

- Service of orders

Thematic service

Providing professional service for disaster prevention, disaster reduction, transportation and tourism

" 一带一路 "城市天气

当前城市： 伊尔库茨克 [更换城市]

8℃

降水 : --
相对湿度 : 57%
风向风速 : 北偏东1级

climate background

今日白天

中雪
4℃ 北偏东1级

今日夜间

晴
-4℃ 北偏东1级

周六 11-2	周日 11-3	周一 11-4	周二 11-5
-4~4℃	-6~-1℃	0~9℃	2~12℃
中雪	多云	多云	多云
1级	1级	微风	1级
北偏东	北偏东	北偏东	北偏东

real-time weather conditions

丝绸之路
海
陆

disaster information services
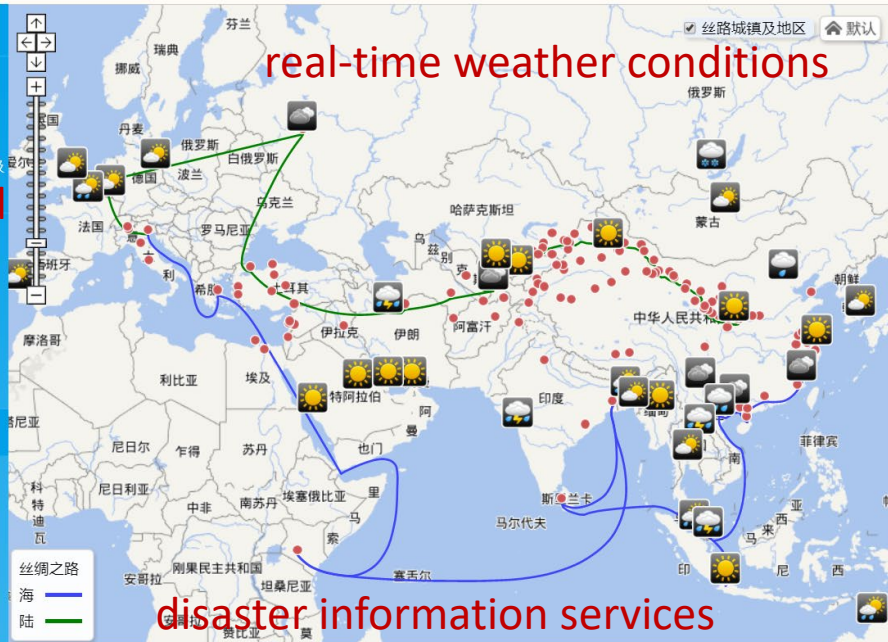
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NMIC

INNOVATION PRACTICE 04

China Meteorological Administration Data As A Service(CMADaaS)

CMADaas is a meteorological big data cloud platform

Integration
- Integrate superior data resources

Unified data source
Unified data caliber

Sharing
- Break down information barriers

Unified data access

Service
- High quality service

Professional analysis

We will promote the implementation of the national big data strategy, promote the integration and open sharing of data resources, ensure data security, accelerate the construction of a digital China, and better serve China's economic and social development and the improvement of people's lives

Data sharing service technology in hybrid cloud architecture

Management

Large-scale meteorological data classification management

Rapid synchronization of massive meteorological data

Rich meteorological data service interface

Cloud Center for Meteorological Data
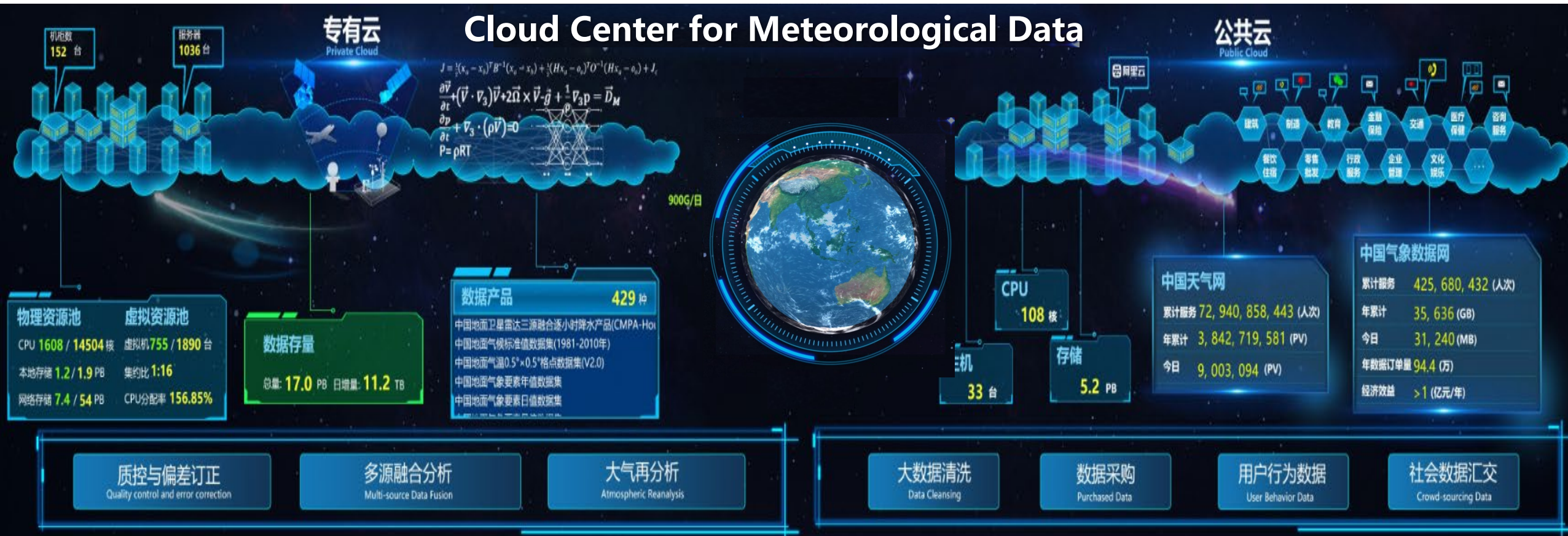
Data lifecycle management and core technology
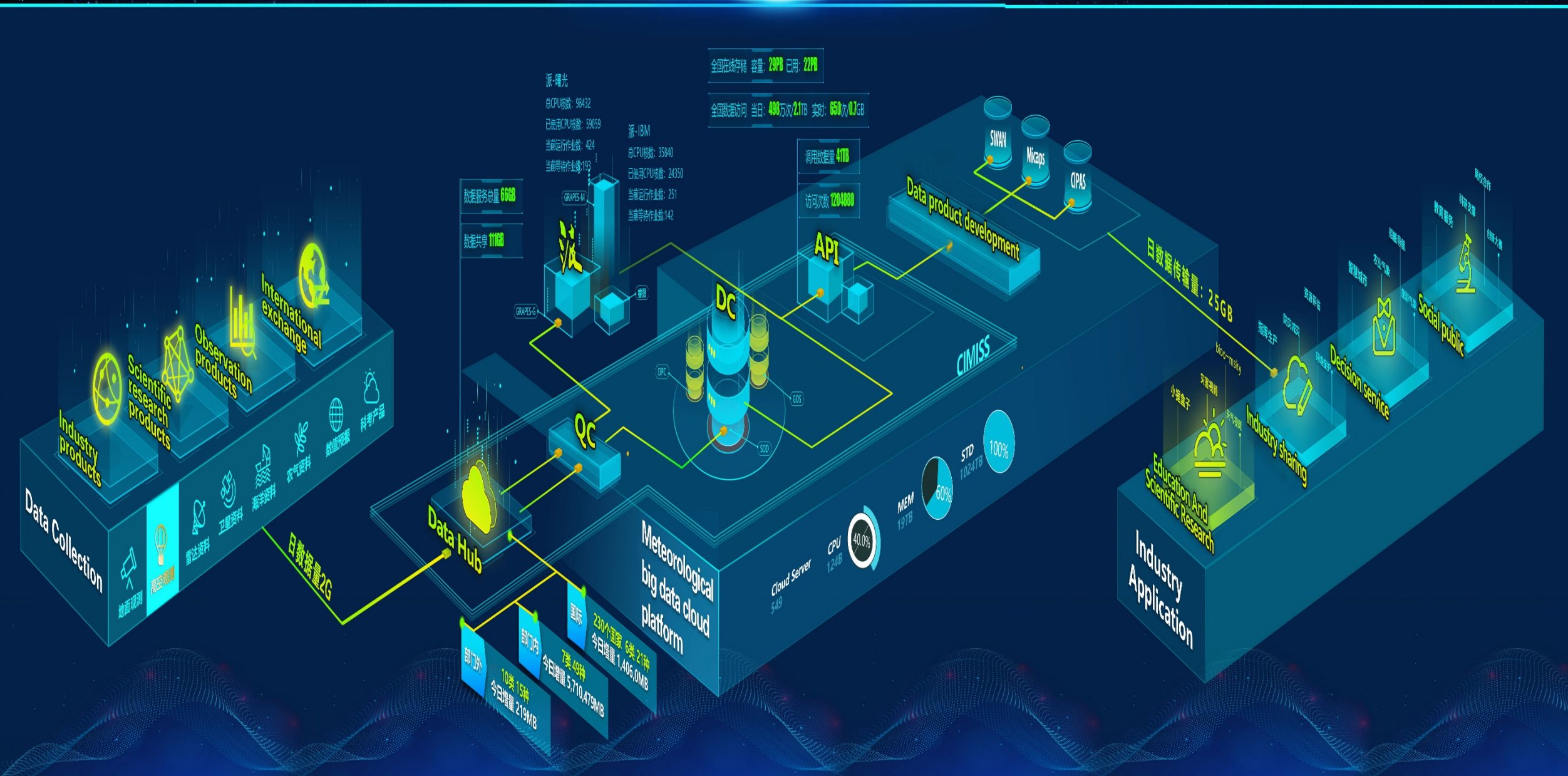
Covers the full life cycle of the data, from collection to processing and application.

Innovation Practice

Focus on four links of meteorological data collection, processing, management and Service to improve the platform capacity

Collection

Processing

Service

Management

Wide Coverage

Intellectual property protection

Intellectualization

The meteorological data service technology based on artificial intelligence

High-quality

Quality control and Evaluation and technology product development system

High Time Efficiency

Application of hybrid Cloud Architecture
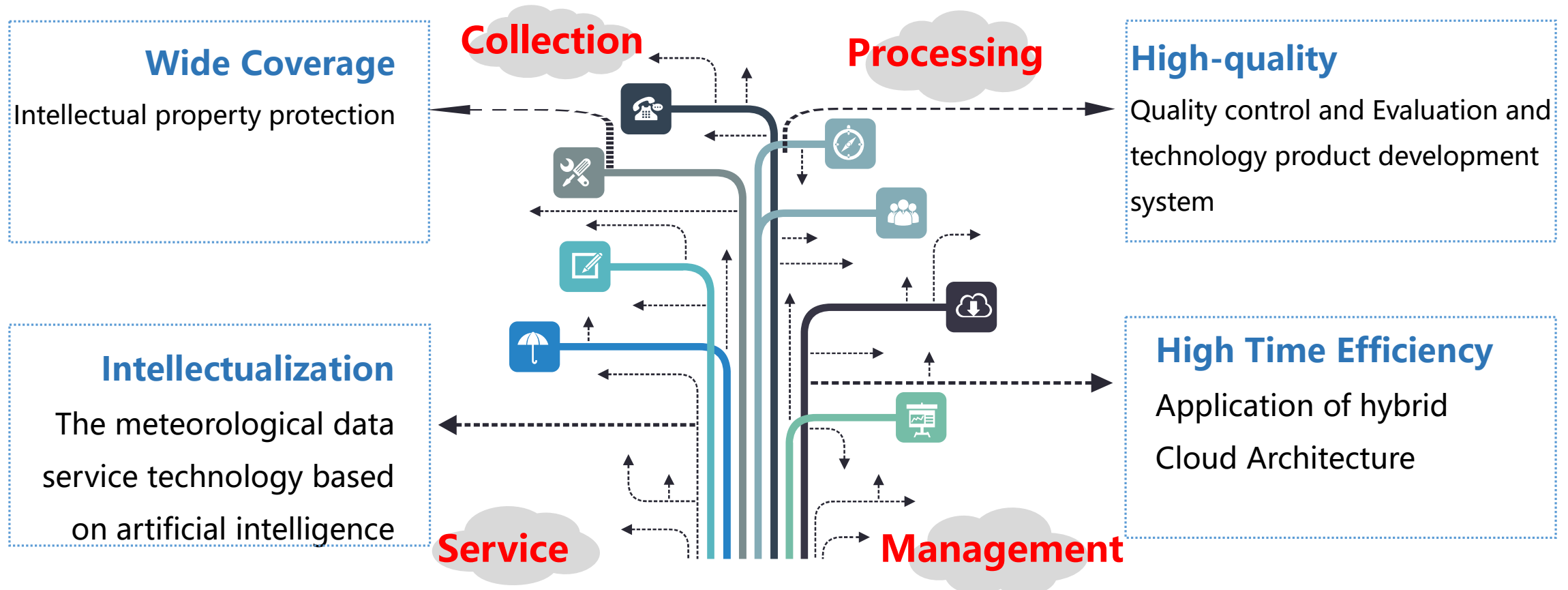
Data Collection Platform

The technology of social meteorological data collection and exchange is developed to effectively improve resource coverage. From the three levels of management, law and technology, to achieve a virtuous circle of meteorological data aggregation, application and value-added.

| Data capture | Data cleaning | Association analysis | User portrait | | Data security | Application security | System security | Physical security |

- ✓ **The meteorological data collection platform based on Cloud collection technology is constructed, with 20 kinds of nearly 40G data collected daily**
- ✓ **Automatic observation equipment and cloud collection process of social meteorological data is developed in 2019 Beijing International Horticultural Exhibition**

Quality Evaluation and product development system

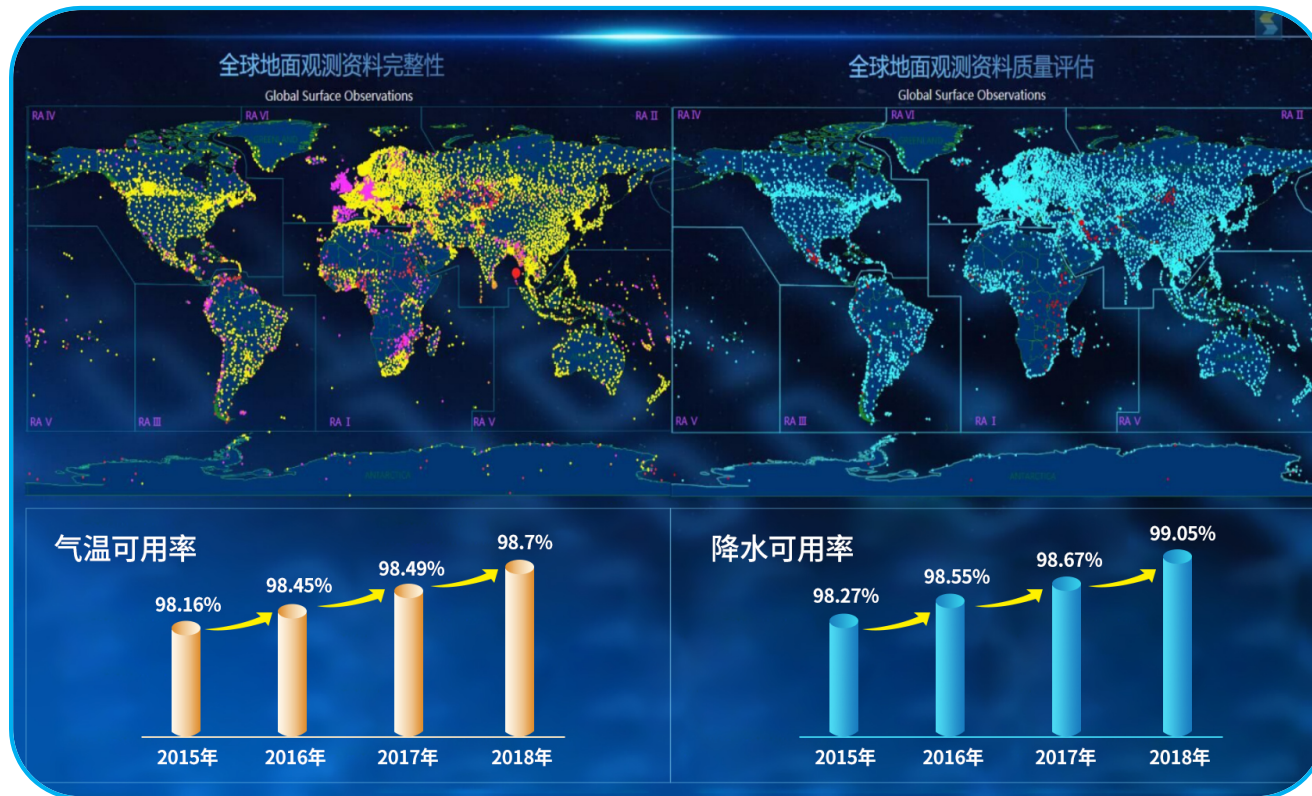- ❑ The data standards and specifications system has been established throughout the life cycle of data collection, processing, service and application, providing a scale for data management and application
- ❑ The quality control and quality evaluation system based on multi-source data was established to detect abnormal data in time, ensure data quality and improve data availability.

Technical Standard
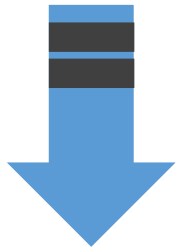
Normalization

Quality Control

Hi-Q

全球地面观测资料完整性
Global Surface Observations

全球地面观测资料质量评估
Global Surface Observations

气温可用率
98.16% → 98.45% → 98.49% → 98.7%
2015年　2016年　2017年　2018年

降水可用率
98.27% → 98.55% → 98.67% → 99.05%
2015年　2016年　2017年　2018年

Quality Evaluation and product development system

Focusing on new energy, aviation, insurance, ecology and other key areas, we have developed rich application service products, and created unprecedented value through the deep integration of Meteorology and industry.
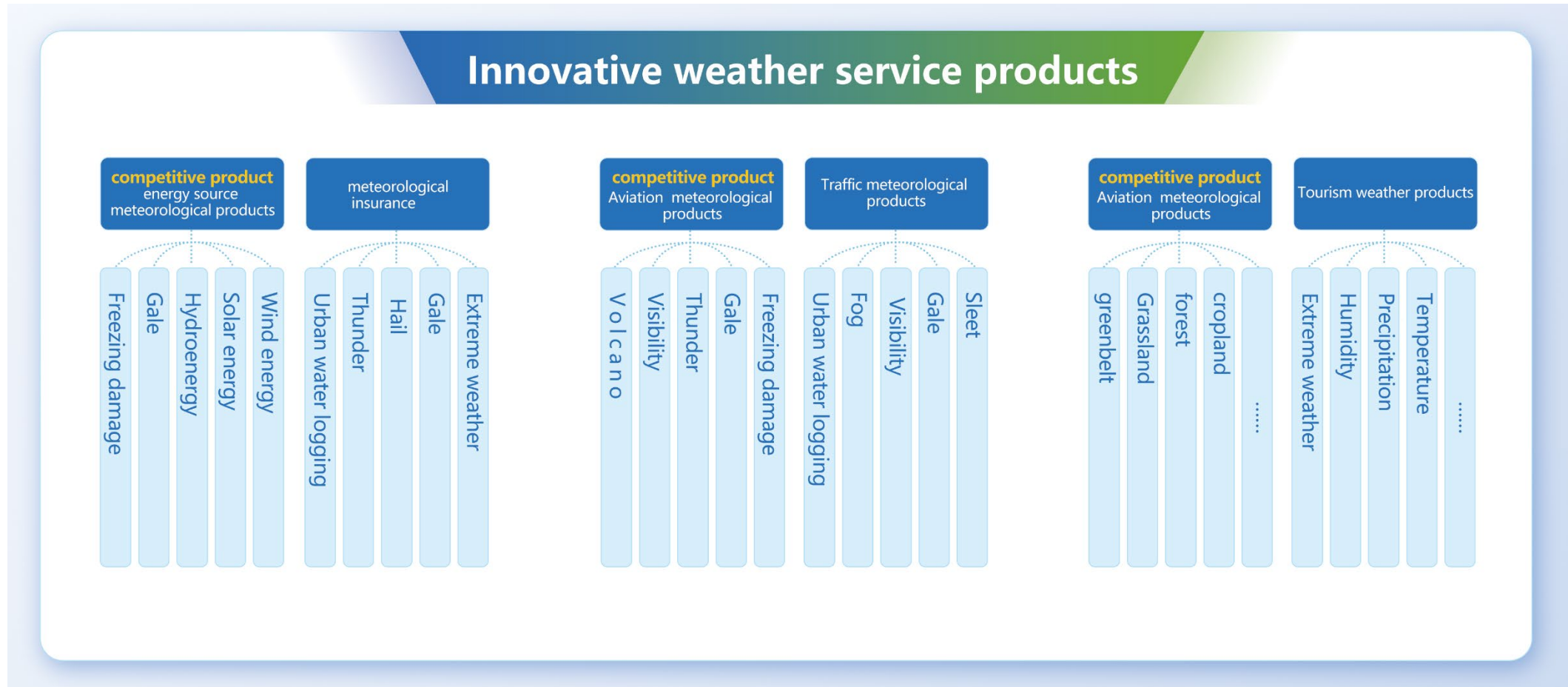

Innovative weather service products

competitive product energy source meteorological products
- Freezing damage
- Gale
- Hydroenergy
- Solar energy
- Wind energy

meteorological insurance
- Urban water logging
- Thunder
- Hail
- Gale
- Extreme weather

competitive product Aviation meteorological products
- Volcano
- Visibility
- Thunder
- Gale
- Freezing damage

Traffic meteorological products
- Urban water logging
- Fog
- Visibility
- Gale
- Sleet

competitive product Aviation meteorological products
- greenbelt
- Grassland
- forest
- cropland
- ……

Tourism weather products
- Extreme weather
- Humidity
- Precipitation
- Temperature
- ……

Integrated CMACast System Development Plan

1. Upgrade the software the system to meet the real-time demand of users for FY satellite products.(2019-2020)

2. Increase the coverage of satellite broadcasting and provide services for all users of 'One Belt One Road'.(2020-2021)

3. Integrate satellite and Internet data distribution services, provide users with a one-stop integrated application platform for data collection, exchange,procession and management(2020-2021).

Email: cmacast@cma.gov.cn
Tel: +86 10 68406543

Thanks for your attention !

We start with services, there's no end to satisfaction.