Space Weather Observing Infrastructure in China

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Chinese Academy of Sciences

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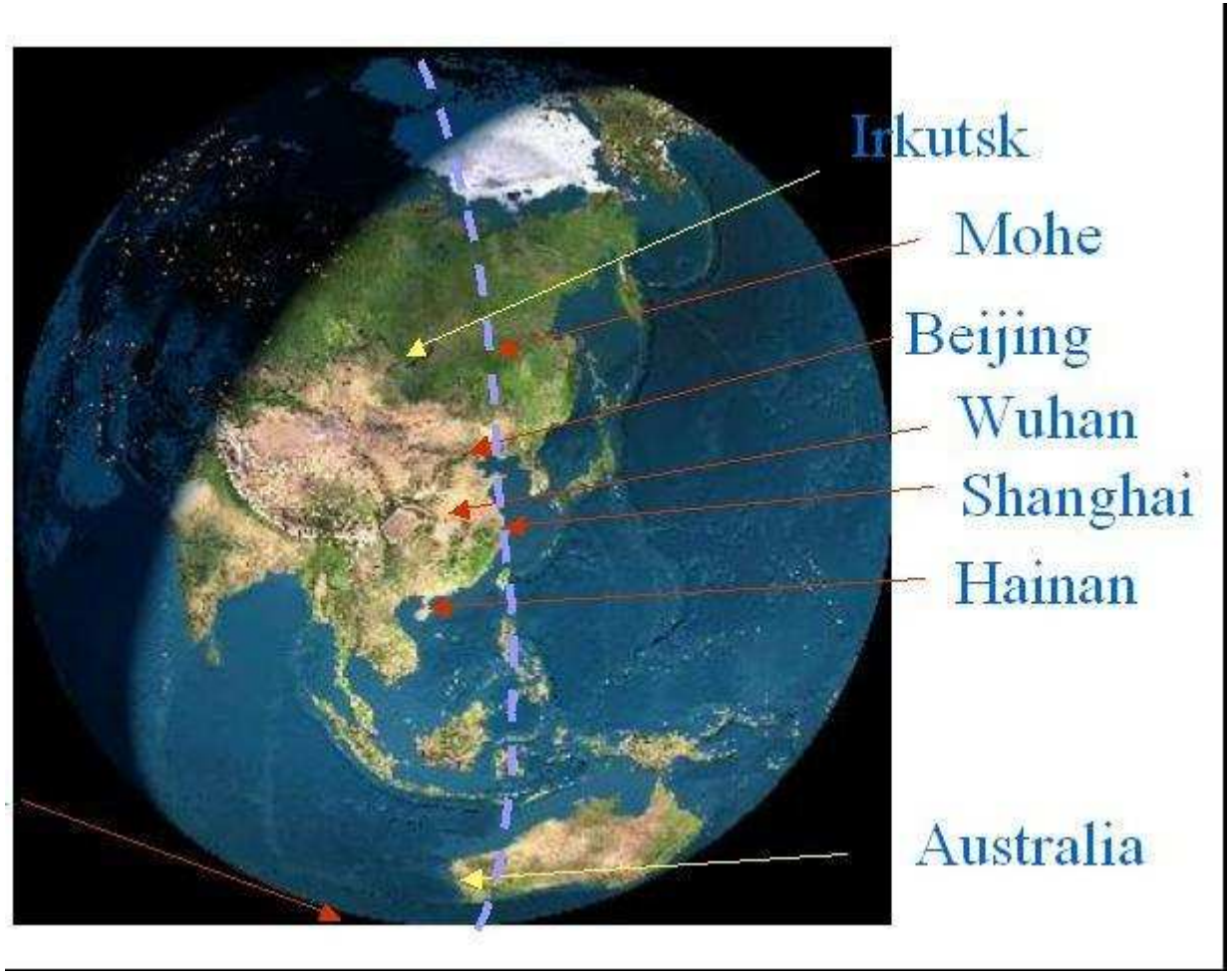
Meridian Project



It is a Chinese multi-station chain along 120ºE to monitor space environment, starting from Mohe, the most northern station in China, through Beijing、 Wuhan、Guangzhou and extended to Chinese Zhongshan station in the Antarctic.

Scientific Principles

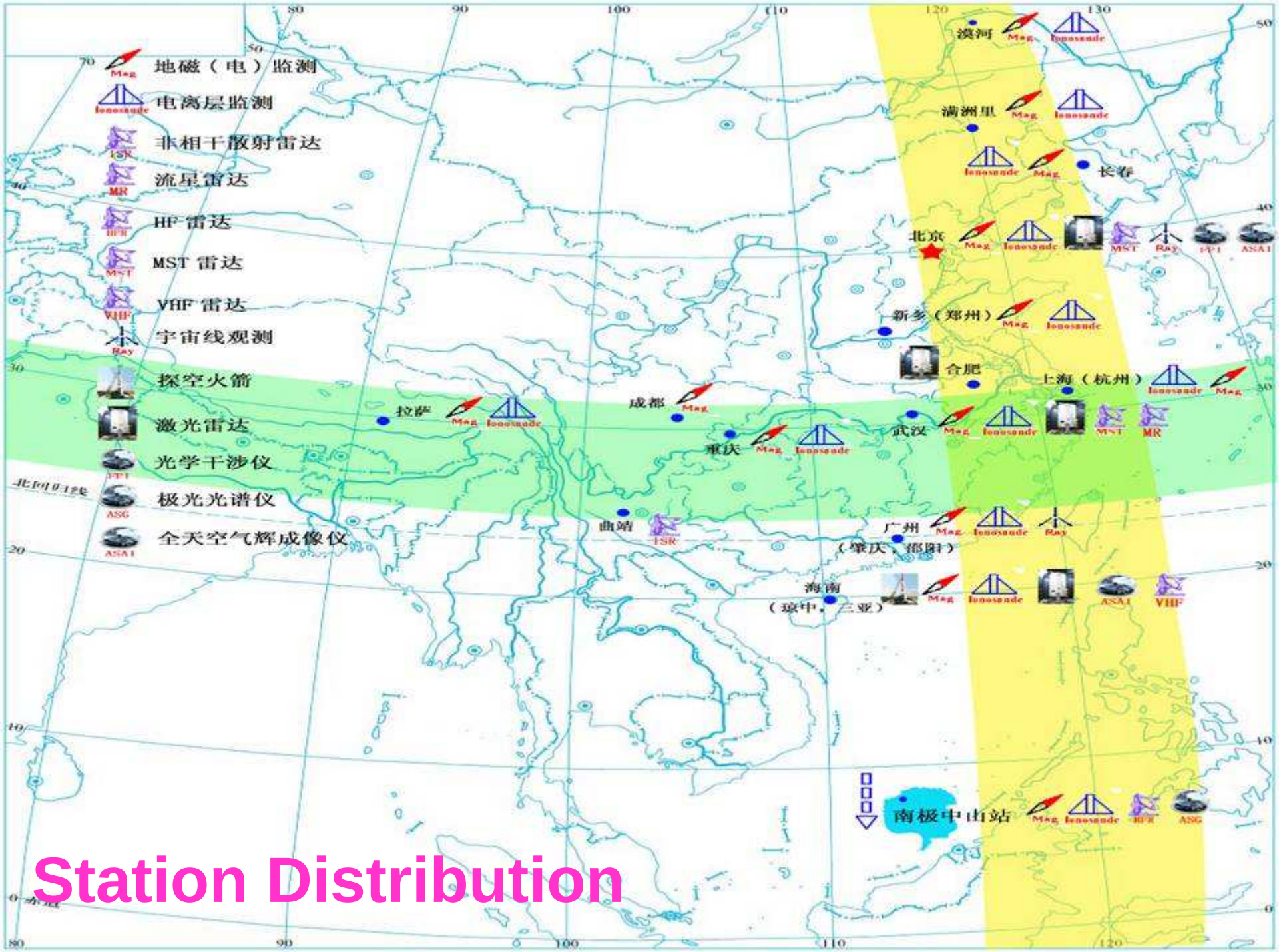
☑ **Many basic physical processes occur along the meridian circle.**

☑ **With the rotation of the Earth, we can make global measurements of the space environment.**

Observatories

15 Stations ：

- 120° E Meridian Chain (10 stations)： Mohe、Manzhouli、Changchun、Beijing、Xinxiang、Hefei、Wuhan、Guanzhou、Hainan、Zhongshan；
- 30° N Chain (5 stations)： Shanghai（Hangzhou）、Chongqing、Chengdu、Qujing、Laasa。
- Among them, Beijing、Wuhan、Hainan、Zhongsan are multi-tasking stations.


地磁（电）监测
电离层监测
非相干散射雷达
流星雷达
HF 雷达
MST 雷达
VHF 雷达
宇宙线观测
探空火箭
激光雷达
光学干涉仪
极光光谱仪
全天空气辉成像仪
漠河
满洲里
长春
北京
新乡（郑州）
合肥
上海（杭州）
拉萨
成都
武汉
重庆
曲靖
广州
（肇庆，邵阳）
海南
（琼中，三亚）
南极中山站
Station Distribution

Chinese Meridian Project

- Geomagnetic
- Optical-atoms.
- Radio
- Rocket


DIM


OFM


FGM

SCM

SED

DEM


ASAI


FPI


LIDA


AURO


CRM


TEL IPS


DPS IONO


DOPP TEC

METR


HFR


MST


VHF


ISR

SROC MROC

Spatial Coverage

By

The Meridian Project

中国科学院国家空间科学中心
National Space Science Center, CAS

Parameters Observed

- **Earth Surface：** **Geomagnetic field、Geoelectronic field 、Cosmic Rays；**
- **Middle-Upper Atmosphere：** **density、temperature、composition、electric current；**
- **Ionosphere：** **density of electron and proton, temperature, irregular structures, electric current**

Geomagnetic Instrument

Geo-electric

Overhauser

Fluxgate

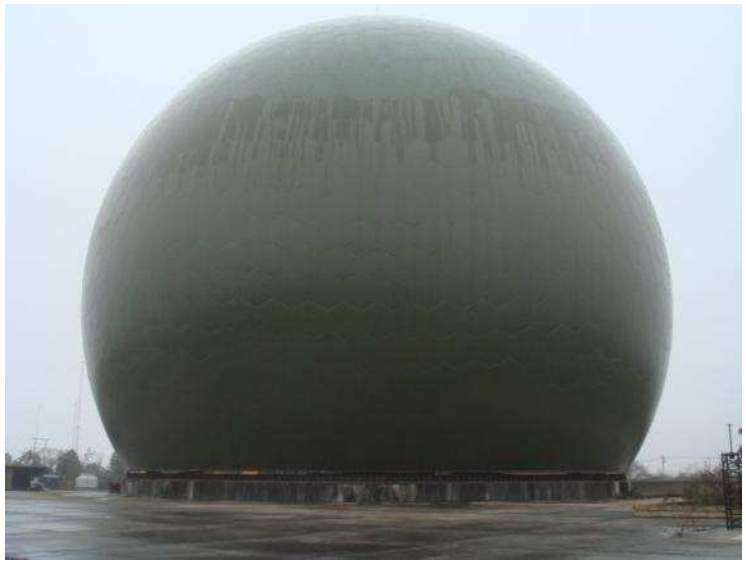
Atmospheric electric

Induction

DI-fluxgate

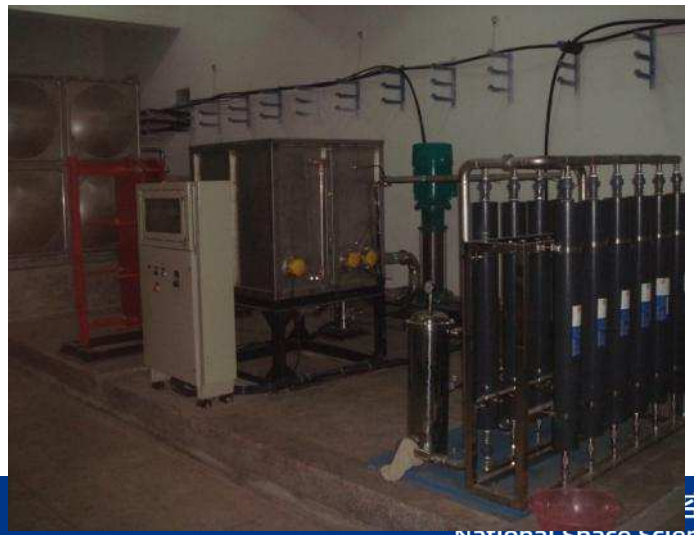
ISR Radar

Aetna doom



Control room

transmitter



Cooling system

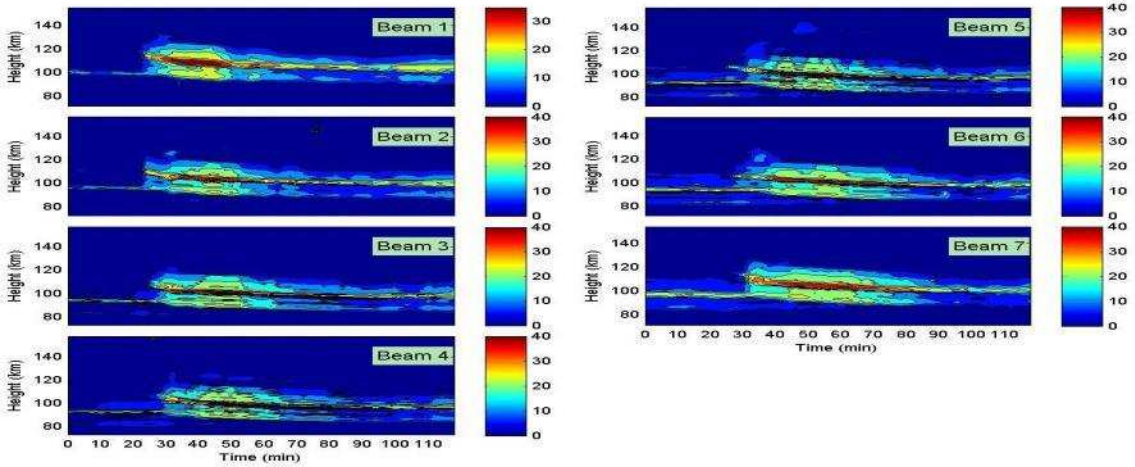
MST Radar

Beijing

Wuhan

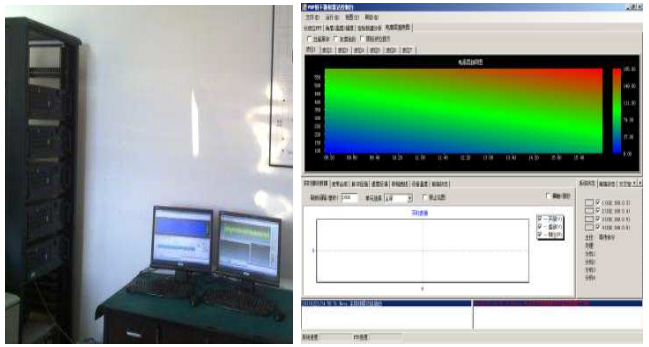
HF Radar

VHF Radar



前端数字单元实物

时钟同步设备



后端处理系统

Meteor Radar

Digisonde

Beijing

Hainan

Wuhan

Zhongshan

Mohe

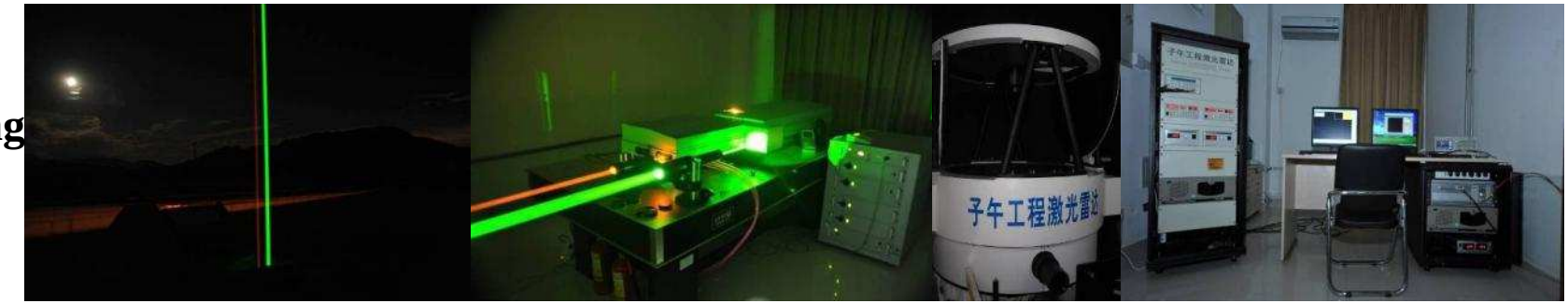
Neutron Monitor

Beijing

Guangzhou

Lidar

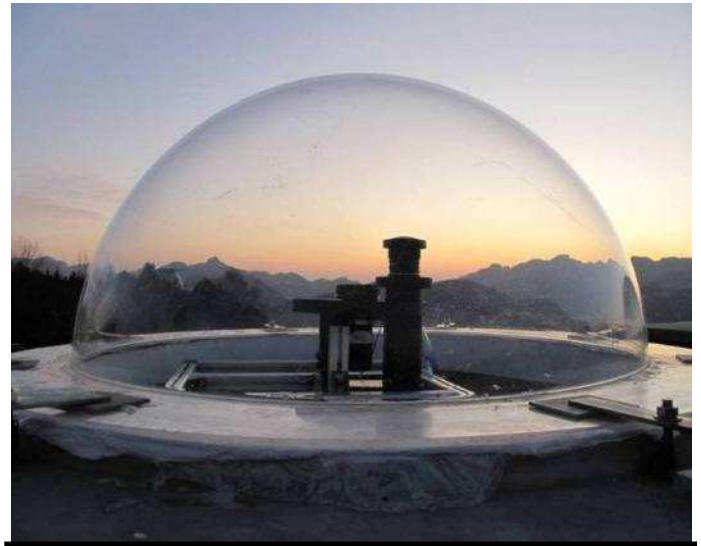
Beijing

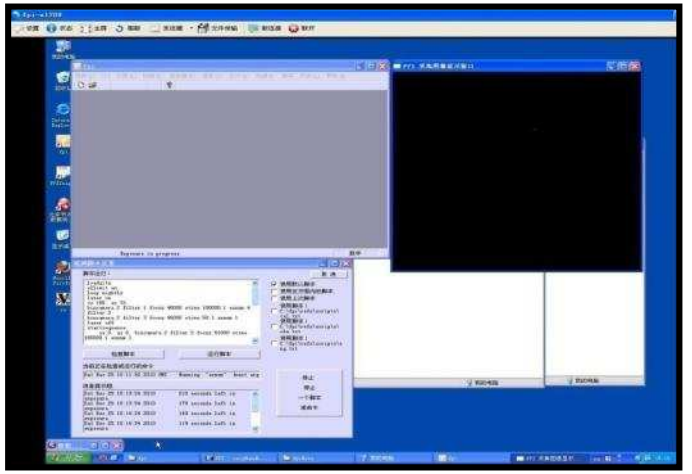


Hainan

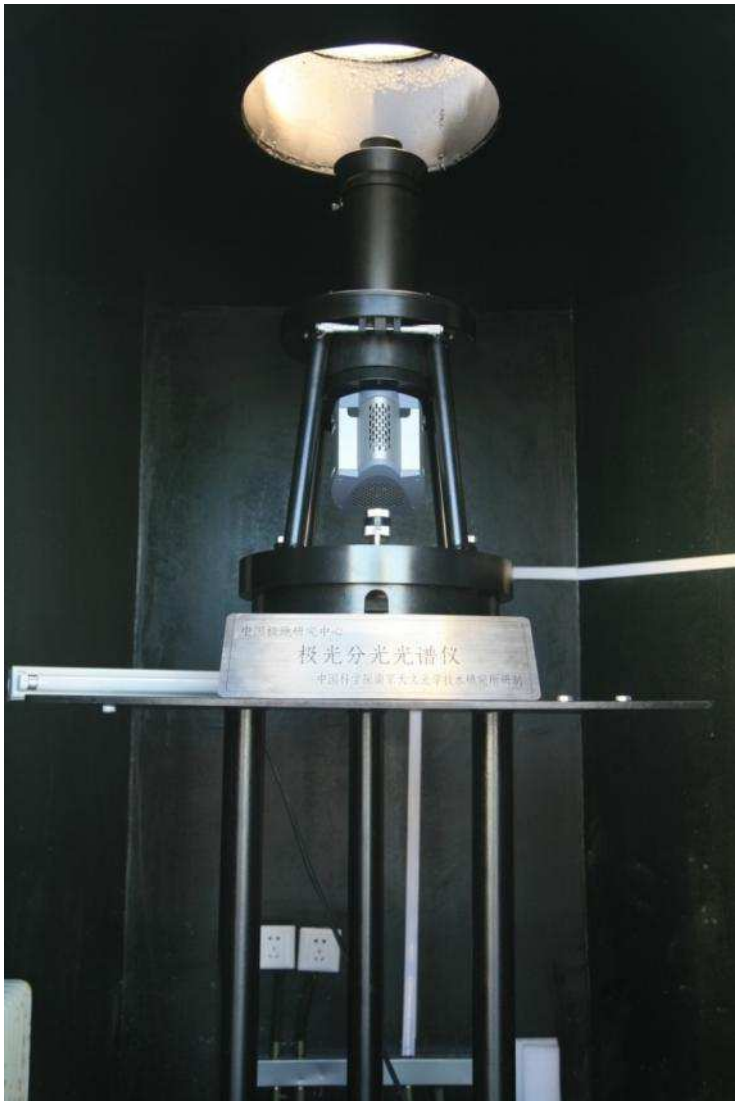
Hefei

All-Sky Imager





Aurora Spectrometer



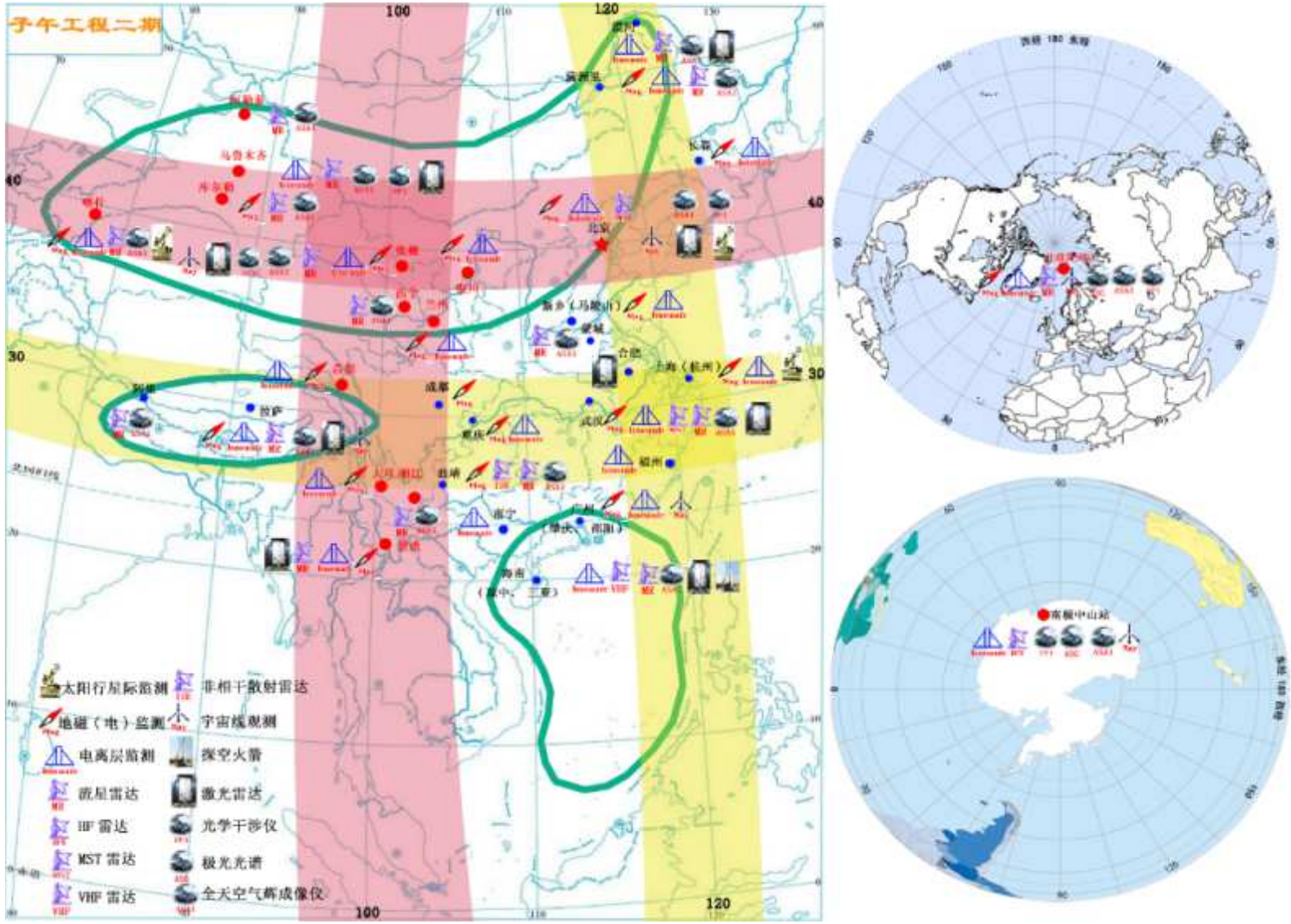
Zhongshan

Sounding rocket

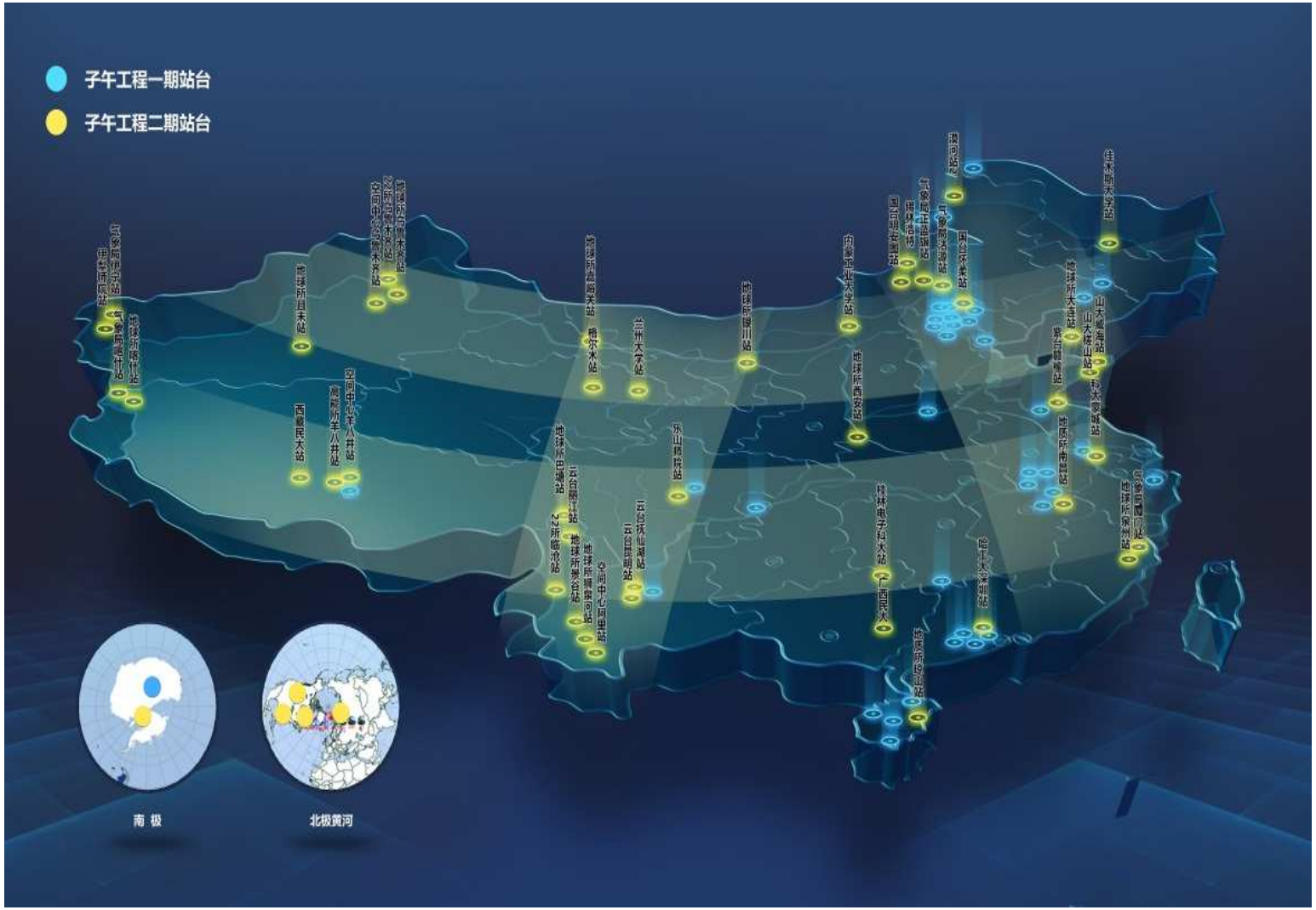
Status

- Chinese Meridian Project started data collection in Oct., 2012
- Up to Jan., 2017, it has collected 4.8 TB of scientific data for 23 space environment key parameters.
- More than 200 peer – reviewed paper have been published.

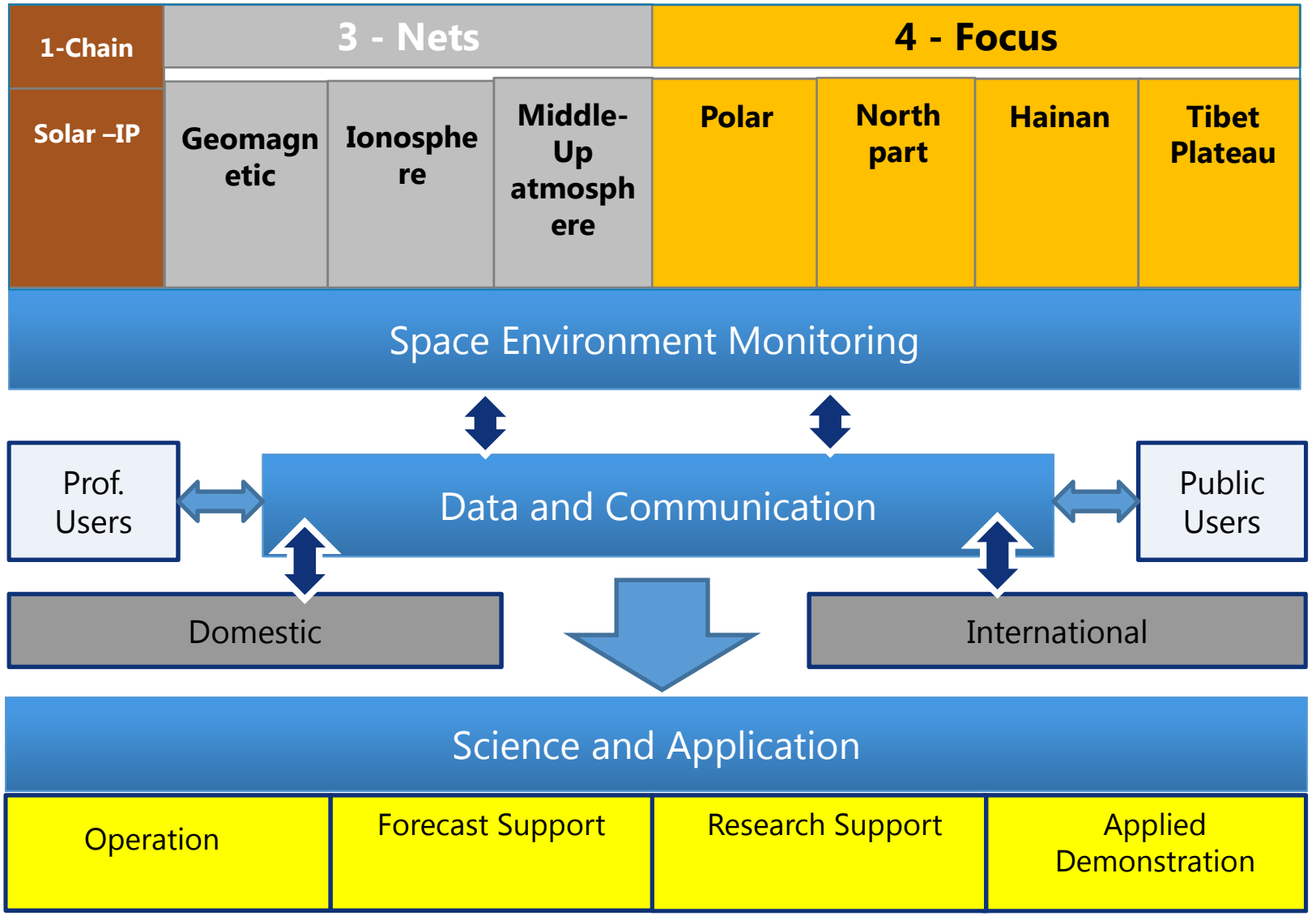
Meridian Project II



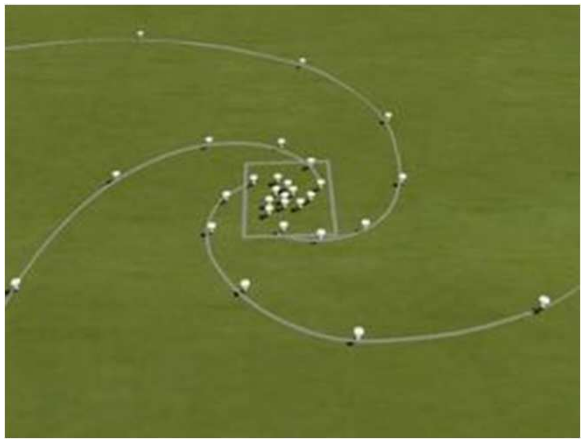
Meridian Project II



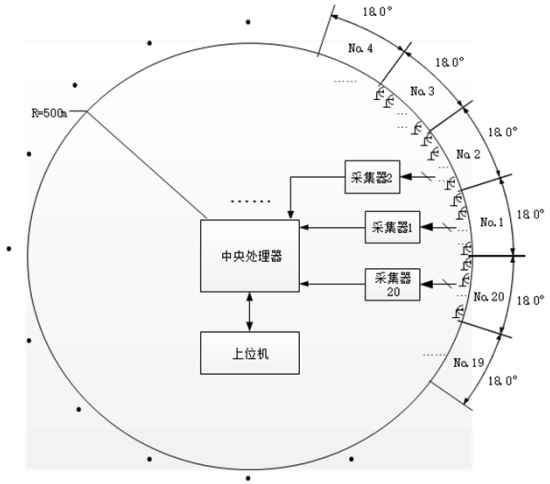
Framework


1-Chain
Solar –IP
3 - Nets
Geomagnetic
Ionosphere
Middle-Up atmosphere
4 - Focus
Polar
North part
Hainan
Tibet Plateau
Space Environment Monitoring
Prof. Users
Data and Communication
Public Users
Domestic
International
Science and Application
Operation
Forecast Support
Research Support
Applied Demonstration

Solar Radio Heliograph



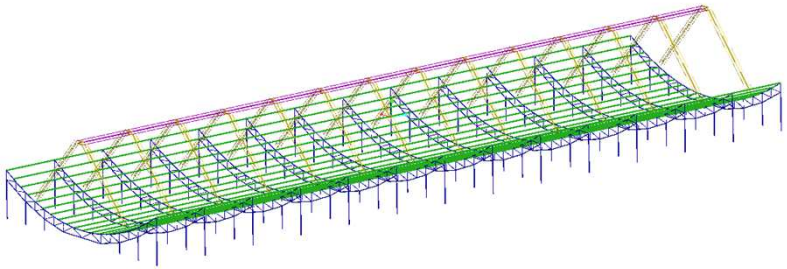
- Frequency： 30MHz－240MHz
- Freq. Resolution: 1 MHz
- No. of antenna： ～100
- Time Resolution: ~100ms
- Polarization： I、Q、U、V



- Frequency： 150MHz－450MHz
- Freq. Resolution: 2 MHz
- No. of antenna： 401
- Time Resolution: 0.1s
- Array Diameter: 1000m

IPS

- 3-station, 2-frequency
- Frequency： 327 and 654 MHz
- System Temperature: 120 K
- Sensitivity：0.3 Jy
- Sample Rate: 10 ms



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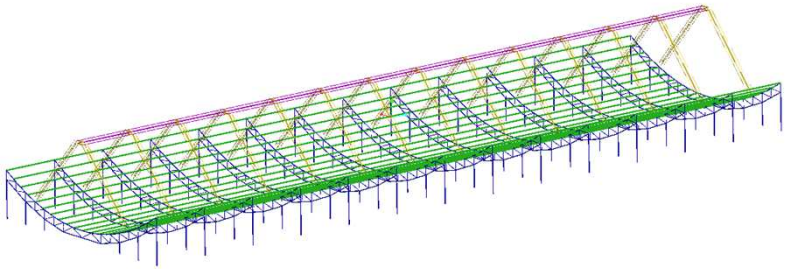


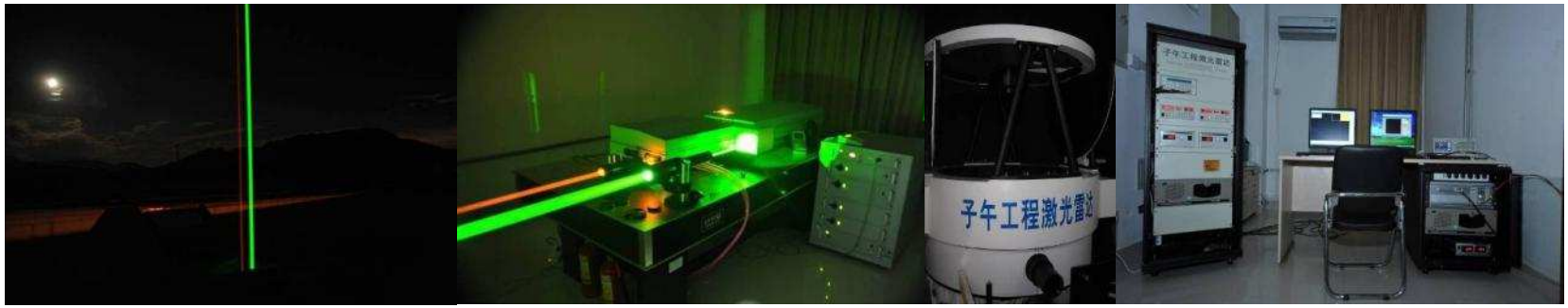
Digisonde

- Frequency： 1 - 30 MHz
- Power: 300W (peak)
- Height resolution: 2.5, 5, 10 Km
- Sensitivity：130 dBm

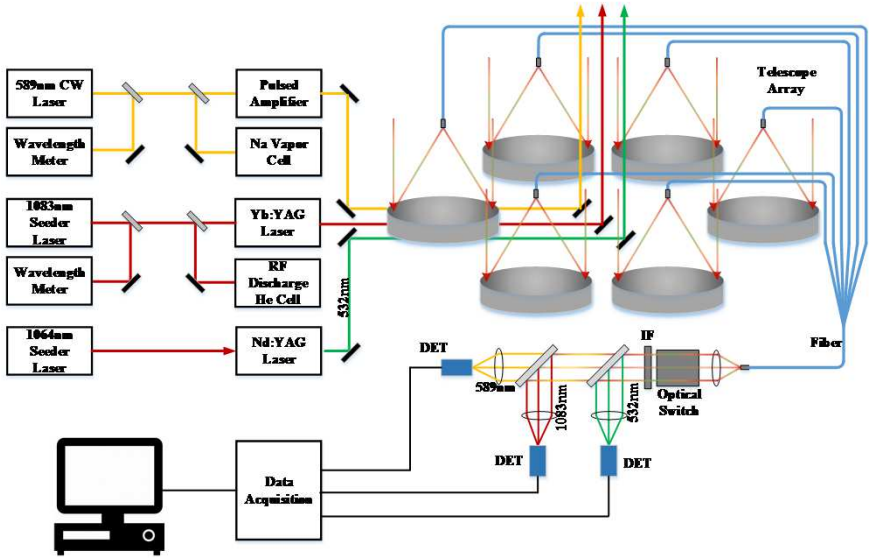
No. of Digisonde to be employed: 19

LIDAR

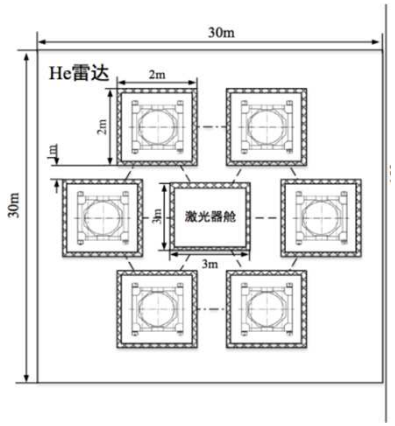
- Na- Lidar： 80-110 km, Temperature, Wind, and Density of Na-laye
  589.1 nm
- Enhanced –Lidar: 80-110km, Na, Fe, Ca, Ka, Diameter: 2m



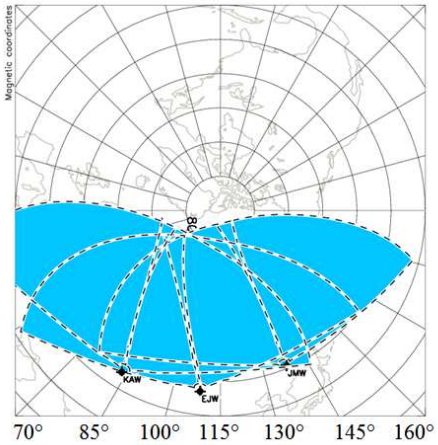
He- LIDAR



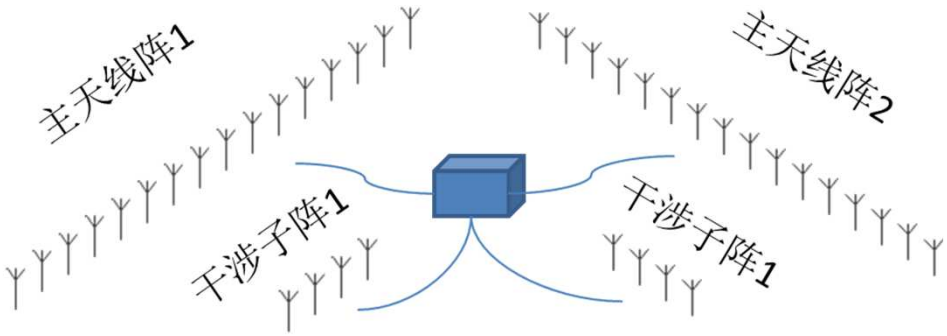
- Rayleigh: 30-90 km, T, N
- Na: 80-110km, wind, T, Na-density
- He: 200 -1000km, He-density
- Diameter: 6 m



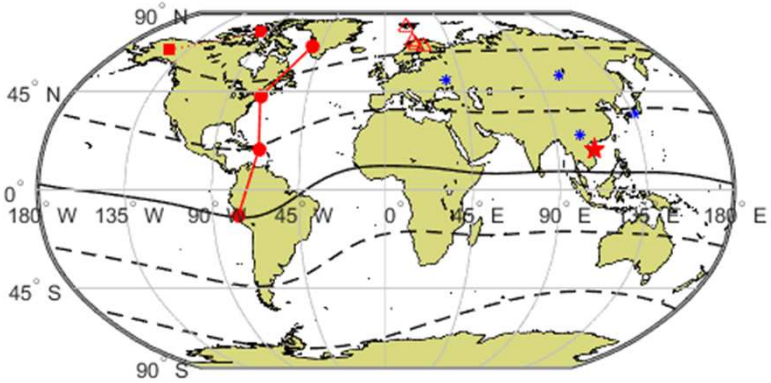
SuperDARN Radar



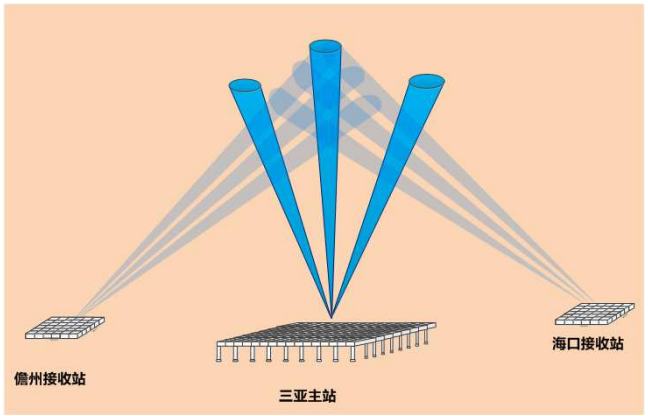
- Phased-array Radar
- Frequency： between 8 and 20 MHz
- Power: 9.6 kW
- Height resolution: 15 – 45 km

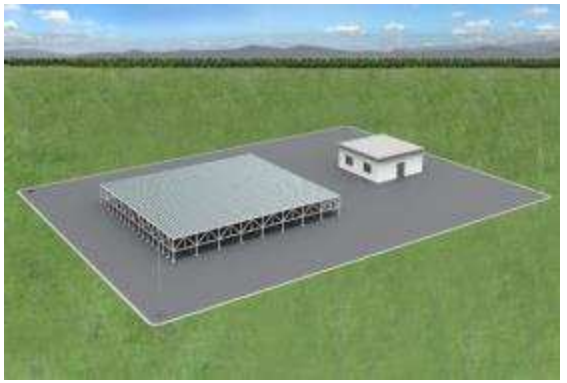


Sanya ISR



- 3-Station ISR
- Frequency：440 Mhz
- Power: 4 MW (peak)
- Detection Range: 190 – 4000 km





Status

- **Chinese Meridian Project II has been listed as one of the national key mega scientific infrastructure in 2016-2020 in China (Ranked #1 from 10).**
- **The construction phase is expected to start in 2018.**

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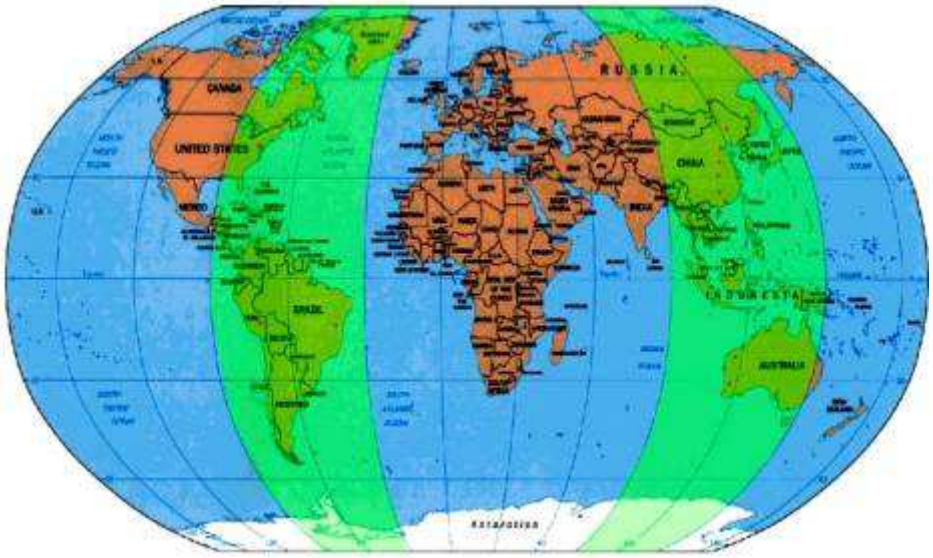
- Space Weather Missions
- Ground-based Projects
- International Meridian Circle Plan (IMCP)

International Meridian Circle Plan (IMCP)



To connect 120ºE and 60ºW meridian chains of ground based monitors worldwide, in order to provide a global picture of unfolding space weather events.

What will IMCP do?

- **Data sharing and Exchange**
- **Coordinating observational campaigns;**
- **Encouraging collaboration on scientific research and observations;**
- **Promoting education and public outreach**

Status

- The Ministry of Science and Technology (MOST) of China is going to set up a few mega international science plans within coming two years.
- MOST has hosted a discussion meeting with us, and encouraged us to submit a proposal. A NOI (Notice of Intention) to submit a proposal was submitted to MOST on April 23, 2017.

Thank You!