XilinHot GRUAN Site Work Progress

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Content

1. XilinHot GRUAN site development Plan (2018-2022)
2. Progress of XilinHot site work in 2018
3. National Radiosonde Test Lab
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1. Layout

**GRUAN SITE**
ground and Upper air observation, production, data center and laboratory.

**Groud-based observation instrument TESTBED**
Construct MWR, MR, Lidar and etc. Ground-based remote sensing instrument testbed.

**Weather and Environmental Protection Services for Autonomous Region**
Analysis and assessment for Climate Change, Interaction between observation and prediction, Grassland Quality monitor.

**National Upper-air observation research centre**
Process/analyze/publish data, product and report by MOC of CMA
2. Investment plan (before 2022)

Total: 325.715 million CNY (about 50 million US dollars), and a total 4.5 million US dollars have been invested in 2018.

Priority
A. Construct radiosonde for GRUAN;
B. Construct ground-based vertical observation;
C. Network of observation for Underlying surface of grassland.
D. Construct ability of ground-based remote sensing testing;
E. Construct ability of Aerostat-based observed technology;
F. Authenticity verification of satellite;
G. New technology of radiosonde;
H. Observed-data center;
I. Grassland observation;
J. Application of observation instrument;
K. Basic ability;
Progress of XilinHot site work in 2018

Task

1. RS41 Observation (we have 50 radiosonde funds this year, once a week this year, should be start before Sep.)

2. Chinese GNSS radiosonde observation (not sure, once a week at least)

3. MWR/wind profile lidar/ Ka band Radar/validation observation and etc. purchasing and installation (1.5 million US dollar)

4. Xilinhot basic ability upgraded (electric power, instrument maintenance, communication, local data process and etc.)
1. RS41 Observation

There are 1 MW31 (be modified for RS41) and 3 SHC have been building in Xilinhot, and about 50 RS41 (and balloon) will be purchased by the end of June.

Xilinhot would using RS41 follow the routine base requirement of GRUAN site radiosonde observation work (once a week this year) by the end of September.
2. High accuracy radiosonde selecting

There are 4 type GNSS (GPS+Beidou) radiosonde may be selected for Xilinhot. And There will be a comparison experiment for CMA to make the decision of choosing the best one, and will apply to GRUAN site.
3. WMR observation experiment

- Joint calibration test
- WMR-RS92 20 flight

<table>
<thead>
<tr>
<th>Site</th>
<th>owner</th>
<th>type</th>
<th>Entry time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meteorological Observation Test</td>
<td>Airda, Beijing</td>
<td>RPG*2</td>
<td>Nov 2016</td>
</tr>
<tr>
<td>Bed of CMA</td>
<td>206 Research Institute, Xi’an</td>
<td>MWP967KV</td>
<td>Nov 2016</td>
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<tr>
<td>Shallow-Sea, Beijing</td>
<td>MP-3000A</td>
<td>Nov 2016</td>
<td></td>
</tr>
<tr>
<td>22 Research Institute, Qingdao</td>
<td>QFW-6000</td>
<td>Feb 2017</td>
<td></td>
</tr>
<tr>
<td>Beijing Normal University</td>
<td>RPG</td>
<td>Feb 2017</td>
<td></td>
</tr>
</tbody>
</table>

- Methods: LN2 and built-in blackbody were used as radiation standard source to calculate the brightness temperature error of each channel.
- Result: RPG and MP3000 Tb measurement error is ~0.5k.
- RPG T deference between RS92 1-2K <20%
- RPG H deference between RS92 <20%
4. Ka Band Scanning Millimeter Wave Cloud Radar

1. The radar adopts the all-solid state system.
2. The radar has a high detection sensitivity (-30dBz@5km), and is more capable of detecting weak targets such as weak clouds and fog.
3. Dual polarization system can be used to detect more polarization information such as ZDR, KDP, ROHV and so on.
4. The radar has a high range resolution (30 meters) and a great speed detection range (25m/s).

<table>
<thead>
<tr>
<th>Radar Name</th>
<th>Ka-SACK</th>
<th>D3R(Ka band system)</th>
<th>HMB-KST</th>
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</thead>
<tbody>
<tr>
<td>Produced by</td>
<td>Department of Energy U.S.A</td>
<td>NASA U.S.A</td>
<td>BIRM China</td>
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<tr>
<td>Center Frequency</td>
<td>35.3GHz</td>
<td>35.56GHz</td>
<td>33.44GHz</td>
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<tr>
<td>Sensitivity</td>
<td>-27.8dBZ@5km</td>
<td>-19.5dBZ@5km</td>
<td>-30dBZ@5km</td>
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<tr>
<td>Operational range resolution</td>
<td>25m</td>
<td>150m</td>
<td>30m</td>
</tr>
<tr>
<td>Maximum range</td>
<td>20km</td>
<td>30km</td>
<td>30km</td>
</tr>
<tr>
<td>Angular coverage</td>
<td>0～360° Az -0.5～90° EL</td>
<td>0～360° Az -0.5～90° EL</td>
<td>0～360° Az -2～90° EL</td>
</tr>
<tr>
<td>Nyquist velocity</td>
<td>10.6m/s</td>
<td>25m/s</td>
<td>25m/s</td>
</tr>
<tr>
<td>Antenna size</td>
<td>1.82m</td>
<td>0.6m</td>
<td>1.8m</td>
</tr>
<tr>
<td>Transmitter type</td>
<td>Klystron amplifier</td>
<td>Solid-state</td>
<td>Solid-state</td>
</tr>
</tbody>
</table>

Data Display of PPI Scan Mode

Scanning Cloud Radar

Technical specifications of millimeter wave cloud radars
5. Coherent Doppler Wind Lidar

Experimental comparison: lidar vs radiosonde (GTS1, 6 times), lidar vs wind tower (below 100 meter, 3 days)

- Range resolution: 20m/30m/50m/75m/100m
- Temporal resolution: < 1 min
- Detection range: 0-75m/s
- Error: < 1m/s, < 0.6°

(1) The performance of local lidar meet the requirement of the task this year.
(2) Need for long term stable operation assessment.
5. micro unmanned rotorcraft meteorological observation - For validation

- Parameter of rotorcraft:
  - Ceiling: ≥1500m
  - Endurance: ≥30min
  - Payload: ≤5kg
  - Hovering accuracy:
    - Vertical: ±0.5m
    - Horizon: ±1.5m

- Parameter of observation instrument:
  - Temperature:
    - Measurement range: +40~−40°C
    - Resolution: ±0.1K
  - Humidity:
    - Measurement range: 100~20%RH
    - Resolution: ±2%
  - Pressure:
    - Measurement range: 1050~500hPa
    - Resolution: ±0.5hPa
  - Wind direction:
    - Measurement range: 0.5~60m/s
    - Accuracy: ±0.5m/s
  - Wind speed:
    - Measurement range: 0~360°
    - Accuracy: ±5°

Measuring the temperature, humidity, pressure, wind direction & speed of boundary layer (Also the Captive balloon)
Xilinhot Government have invested 3 million US dollars of DPC and the power supplement upgrade since last year.
As a unified platform for detection of sounding instruments, the NRTL covers the comprehensive testing items, such as sensor testing, electrical performance testing and environmental adaptability testing.

CMA have invested 300 thousand US dollars for high quality radiosonde uncertainty testing ability upgrade last year.
Lab Function

- **Sensor Testing**

**Temperature Testing**
(First Class Platinum Resistance)
- Sensitivity: 0.1Ω/℃
- Drift Rate: <0.001℃/100hrs

( Calibration Bath )
- Range: -95℃～+95℃
- Uniformity: ≤0.01℃

**Humidity Testing**
(First Class 373 Dew Point Mirror)
- Frost/dew point range: -95℃～+20℃
- Accuracy: ≤±0.1℃

(Frost/dew)

(First Class 473 Dew Point Mirror)
- Frost/dew point range: -20℃～+70℃
- Accuracy: ≤±0.1℃

(Frost/dew)

(The WLS-V type of two-pressure humidity generator)
- Range: 10%～95%RH
- Temperature uniformity in test room: ≤±0.1℃
- Accuracy:
  - -50℃～+50℃, ±1%RH
  - -60℃～-50℃, ±2%RH

**Pressure Testing**
(745-23A Pressure Standard)
- Ranges: 5hPa～1100hPa
- Accuracy: ±0.08hPa
Lab Function

- Electrical Performance Testing
- Environmental Adaptability Testing

- KEYSIGHT DSO9104A Oscilloscope:
  1 GHz, 4 Analog Channels

- SPIRENT GSS6300M
  Multi-channel GPS/BeiDou signals
Radiosonde Progress

- We now have 4 types of GNSS (GPS+BeiDou) radiosonde, which are better than ChangFeng in 2010 CIMO intercomparison.

- A comparison test should be taken for choosing one for GRUAN site.

- Would LC attend this comparison? (Plan and data process)
Question

Data sharing, Technical cooperation and Operating expenses is not clear yet for CMA.

XilinHot GRUAN site work process need more clear international frame for CMA.
Thanks for your attention!