The Status of current and future CNSA Earth Observing System

Presented to CGMS-40 plenary session, agenda item [III.2]
Lugano Switzerland
Outline

- Introduction
- Status of Current CNSA EOS
- Status of Future CNSA EOS
- HJ-1
- HY-2
- Conclusion
Introduction

- Technology and application of satellite remote sensing has been extended rapidly in China.

- CNSA’S EOS will be built up, including FY series satellites, ZY series satellites, HY series satellites, and environment and disaster small satellite constellation (HJ).

- Meanwhile, China is also developing the ground receiving and processing system of EOS.
# Current Earth Observing System

Seven satellites are operating in orbit, including FY-3A, FY-3B, HY-1B, HY-2, HJ-1A/B, and ZY-3.

<table>
<thead>
<tr>
<th>Satellites</th>
<th>Space Agency</th>
<th>Equator Crossing Time + Altitude</th>
<th>Launch Date</th>
<th>Instrument</th>
<th>Status, applications and other information</th>
</tr>
</thead>
<tbody>
<tr>
<td>HY-1B</td>
<td>CNSA</td>
<td>10:30 (D) 798 km</td>
<td>04/07</td>
<td>4-band CCD Camera Ocean Colour and Temperature Scanner</td>
<td>Ocean colour and temperature monitoring</td>
</tr>
<tr>
<td>HJ-1A</td>
<td>CNSA</td>
<td>10:30 (D) 650 km</td>
<td>06/09/2008</td>
<td>Two 4-band CCD camera, Hyperspectral camera</td>
<td>Land, resource and environment monitoring</td>
</tr>
<tr>
<td>HJ-1B</td>
<td>CNSA</td>
<td>10:30 (D) 650 km</td>
<td>06/09/2008</td>
<td>Two 4-band CCD camera, IR camera</td>
<td>Land, resource and environment monitoring</td>
</tr>
<tr>
<td>HY-2</td>
<td>CNSA,</td>
<td>06:00 (D) 964 km</td>
<td>16/08/2011</td>
<td>Altimeter, MW radiometer, Scatterometer</td>
<td>Ocean dynamics environment monitoring</td>
</tr>
<tr>
<td>ZY-3</td>
<td>CNSA</td>
<td>10:30(D)</td>
<td>09/01/2012</td>
<td>3-D mapping camera, multi-spectral imager</td>
<td>mapping. Land resource monitoring</td>
</tr>
</tbody>
</table>
Future Earth Observing System

Five satellite will be launched in recent three years, including FY-4, HJ-1C, CBERS-03/04, and CFOSAT.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>HJ-1C</td>
<td>CNSA</td>
<td>06:00 (D) 500 km</td>
<td>2012.11</td>
<td>S band SAR</td>
<td>Phase D Land monitoring</td>
</tr>
<tr>
<td>CBERS-3</td>
<td>CNSA + AEB</td>
<td>10:30 (A) 778 km</td>
<td>end 2012</td>
<td>PAN CCD camera, MUX CCD camera IRMSS, WFI</td>
<td>Phase D Land, resource and environment monitoring</td>
</tr>
<tr>
<td>CBERS-4</td>
<td>CNSA + AEB</td>
<td>10:30 (A) 778 km</td>
<td>2014</td>
<td>PAN CCD camera, MUX CCD camera IRMSS, WFI</td>
<td>Phase D Land, resource and environment monitoring</td>
</tr>
<tr>
<td>CFOSAT</td>
<td>CNSA + CNES</td>
<td>07:00(D) ~600Km</td>
<td>2014</td>
<td>SCAT (Scatterometer) SWIM (Directional Wave spectrum form)</td>
<td>Phase C Ocean dynamics environment monitoring</td>
</tr>
</tbody>
</table>
HJ-1 small satellite constellation

- Environment and disaster small satellite constellation (HJ) consists of four optical satellites and four SAR satellites for monitoring land environment and disaster.
- The first stage of HJ, including 2 optical satellites (HJ-1 A/B) and one SAR satellite (HJ-1C), will be formed at the end of this month.
- HJ-1 is aiming to provide high temporal resolution data products in every two days with 30m spatial resolution.
- HJ-1A/B have been used for not only lands, but also regional atmosphere, water bodies.
- CNSA will evaluate the results of HJ-1 constellation in 2013, and then arrange the demonstration for the second stage of HJ constellation.
- CNSA will share our demonstration progress of the second stage on the CGMS platform.
HY-2 satellite characteristics

- HY-2 Satellite was launched in August 2011
- HY-2 payloads:
  - Radar altimeter (Ku & C bands)
  - Microwave scatterometer (Ku band)
  - Microwave radiometer (6.6, 10.7, 18.7, 23.8 & 37.0GHz)
- Orbit altitude: ~965 km, sun-synchronous, with 99° inclination
- Repeat cycle: 14 days (for three years) & 168 days
- Its data has been used in many application fields
Accuracy of HY-2 data products

In current stage, we assessed accuracy of each payload by many cases.

➢ For radar altimeter

-- Accuracy
the standard deviation of SSH at crossovers for Cycle22 is about 8.6 cm
Accuracy of HY-2 data products

- For microwave scatterometer
  - Accuracy
    - Wind speed: < 2 m/s or < 10%
    - Wind direction: < 20° rms
Accuracy of HY-2 data products

- For microwave radiometer
  - Accuracy
    - SST: 1.29K
    - Wind speed: 1.46 m/s
    - Water vapor content: 1.18 mm
    - Liquid water content: 0.033 mm

Water vapor content
RMS=1.18 mm

Cloud liquid water content
RMS=0.033 mm

Wind speed
RMS=1.29K

Wind speed
RMS=1.46 m/s
Typical Applications of HY-2’s products

- Radar altimeter

HY-2 altimeter data and the Jason-2 data are used to research the mesoscale eddies in the Agulhas retroflexion current area.
Applications of HY-2’s products

- Microwave scatterometer
  - Detection Typhoon Bolaven using the HY-2 scatterometer at 2012-08-26 21:42:52(UTC)
  - Detection of atmosphere front using HY-2 scatterometer
Current and future of HY-2

- Data discovery, ordering, distribution channels, and channels specific to instruments and additional information can be found online through the National Satellite Oceanic Application Service (http://www.nsoas.gov.cn).
- HY-2 designed lifetime is 3 years. It will be benefit to remove the gap of sea surface dynamic environment monitoring.
- CFOSAT is under developing with CNES, which is equipped with a directional wave spectrum form SWIM and a wind scatterometer SCAT. It will continue partly function of HY-2.
- Meantime, HY-2 operational satellites are demonstrated by state oceanic administration (SOA).
---Recently, many R&D satellites, such as HY-2, will be launched and tested in-orbit, and become gradually into the operation mode.
---CNSA is devoted into the transformation from R&D satellite to operating satellite. And is jointly organizing some discussion about operational satellite system with other administrations
---CNSA will continue to share experience with CGMS members, and make more contribution for the optimization of Globe Earth Observing System.
Thanks for your attentions !