Space Based Global Observing System Requirements for Satellite Sounders

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Outline

1. satellite sounders’ capabilities
2. “User” requirements
3. Global access to training
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1. satellite sounders’ capabilities

2. “User” requirements

3. Global access to training
Satellite Sounders’ Capabilities

WMO space-based sub-system of the WWW’s Global Observing System (2006)

Unparalleled international cooperation has been achieved in satellite activities
Space-based sub-system of GOS (2005)

Operational meteorological geostationary satellite system
- EUMETSAT _ Meteosat
- United States of America _ GOES
- Japan _ GMS-5/MTSAT
- People's Republic of China _ FY-2/ FY-4
- Russian Federation _ GOMS-N1
- Indian _ INSAT and Kalpana (formerly MetSat)
- Korean _ COMS (being developed)

Operational meteorological sun synchronous satellite system
- People's Republic of China _ FY-1 and FY-3
- United States of America _ NOAA series, NPOESS, DMSP
- European _ Metop
- Russian Federation _ METEOR series

Research &Development satellite system
- CNES
- ESA
- JAXA
- NASA
- ROSKOSMOS
-…
# Sounds on operational satellites

(September, 2005)

<table>
<thead>
<tr>
<th>GEOSTATIONARY</th>
<th>Meteosat</th>
<th>GOES</th>
<th>MTSAT</th>
<th>Elektro-L</th>
<th>FY-2</th>
<th>INSAT-3D</th>
<th>Kalpana</th>
<th>COMS</th>
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<tr>
<td>Sounder</td>
<td>GOES</td>
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<td>MTSAT</td>
<td>Elektro-L</td>
<td>FY-2</td>
<td>INSAT-3D</td>
<td>Kalpana</td>
<td>COMS</td>
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<td>Advanced sounder</td>
<td>MTG Sounder</td>
<td>SOUNDER</td>
<td>HES</td>
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<th>SUNSYNCHRONOUS</th>
<th>NOAA</th>
<th>DMSP</th>
<th>NPOESS</th>
<th>Metop</th>
<th>Meteor-3M / Meteor-M</th>
<th>FY-3</th>
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<tr>
<td>IR sounder</td>
<td>HIRS 3/4</td>
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<td>IR advanced sounder</td>
<td>CrIS</td>
<td>CMIS</td>
<td>IASI</td>
<td>IRFS-2</td>
<td>MTVZA</td>
<td>IRAS</td>
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<td>MW imager/sounder</td>
<td>SSMIS</td>
<td>CMIS</td>
<td>AMSU-A</td>
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<tr>
<td>MW sounder</td>
<td>AMSU-A</td>
<td>SSM/T</td>
<td>AMSU-A</td>
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<td></td>
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<tr>
<td>(temperature)</td>
<td>AMSU-B, MHS</td>
<td>SSM/T2</td>
<td>MHS</td>
<td></td>
<td></td>
<td>MWTS</td>
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<tr>
<td>MW sounder (humidity)</td>
<td>AMSU-B, MHS</td>
<td>SSM/T2</td>
<td>MHS</td>
<td></td>
<td></td>
<td>MWHS</td>
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<tr>
<td>MW advanced sounder</td>
<td>ATMS</td>
<td>~ATMS</td>
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<tr>
<td>Radio-occultation sounder</td>
<td>GPSOS</td>
<td>GRAS</td>
<td>GRAS</td>
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<td></td>
<td>Radiomet</td>
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Coverage of current Geostationary satellite with Sounder (as of Oct 2006)
For the next two decades, between 4 and 5 IR and MW sounders, all grouped around 2 orbital planes (mid-morning and early afternoon) instead of 4 equally spaced in time.
The 15th international TOVS study Conference Maratea Italy, 4-10 October, 2006
The Implementation Plan (IP) for the Evolution of the GOS

• S3.GEO Sounders - All meteorological geostationary satellites should be equipped with hyper-spectral infrared sensors for frequent temperature/humidity sounding as well as tracer wind profiling with adequately high resolution (horizontal, vertical and time).

• S5.LEO data timeliness - More timely data are needed to improve utilization, especially in NWP. Improved communication and processing systems should be explored to meet the timeliness requirements in some applications areas (e.g. Regional and Global NWP).

• S12.RO-Sounders - The opportunities for a constellation of radio occultation sounders should be explored and operational implementation planned. International sharing of ground support network systems (necessary for accurate positioning in real time) should be achieved to minimize development and running costs.
Outline

1. satellite sounders’ capabilities
2. “User” requirements
3. Global access to training
“User” requirements

Commission for Basic Systems (CBS)
- ET-ODRRGOS & ET- EGOS
- Rolling Requirements Review (RRR)
- Critical Review

__ NWP & climate research
“User” requirements

- **3D wind field**
  - Advanced geostationary imager-sounders (e.g. GIFTS)
  - Cloud-free areas
  - Horizontal resolution 40km
  - Vertical resolution 2km.

- **3D temperature and humidity field**
  - Polar satellites ⇒ global coverage
  - New microwave measurements (AMSU) ⇒ substantial improvements
  - Geostationary infrared soundings (GOES) ⇒ expand coverage
  - Vertical resolution substantially improved in cloud-free areas ← EOS-Aqua, METOP and NPOESS.
“User” requirements

- **Clouds**
  - Infrared imagers and sounders ⇒ cloud cover, cloud-top height, good horizontal and temporal resolution and good/acceptable accuracy.
  - Microwave imagers and sounders ⇒ cloud liquid water of good horizontal resolution and acceptable temporal resolution, with an accuracy that is probably acceptable (though validation is difficult).

- **Additional observations for model validation**
  - Advanced infrared sounders (e.g. AIRS, IASI, CrIS)
    ⇒ complete or near-complete spectral coverage & high spectral resolution (infrared)
    ⇒ surface emissivity with good horizontal resolution and accuracy.
“User” requirements

WMO/ CEOS Database

http://www.wmo.int/web/sat/satsun.html

- Goals, objectives and publications
- Satellite operator status reports
- Global Observing System (GOS) status reports
- Other satellite related organizations
- Online database information
- APT/WEFAX to LRPT/LRIT transition
- Online satellite imagery sites
- Working documents for Upcoming Meetings
- Education and Training Materials
- CGMS Virtual Laboratory for Education and Training in Satellite Matters
Outline

1. satellite sounders’ capabilities
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Virtual Laboratory for Education and Training in Satellite Meteorology

• **Collaboration between satellite operators & training centres**
  – along WMO strategy for Education & Training in Satellite Meteorology
  – adopted by CGMS (2001)

• **Coordinated by VL Management Group**
  – reporting to WMO and CGMS

• **Three-year VL goal of staging a Global VL High-Profile Training Event (HPTE).**

• **Maintains a Virtual Resources Library**
  – accessible on line via Home Page of each VL partner
  – Includes training materials, lectures, S/W tools

• **Runs training events (on-line or face-to-face)**
  – Distribution of E-Notebooks had strong positive impact
# Centres of Excellence

<table>
<thead>
<tr>
<th>Satellite operator</th>
<th>Centre of Excellence</th>
<th>Primary language</th>
<th>WMO Region</th>
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<tbody>
<tr>
<td>EUMETSAT</td>
<td>Niamey (Niger)</td>
<td>French</td>
<td>RA I</td>
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<td>Nairobi (Kenya)</td>
<td>English</td>
<td>RA I</td>
</tr>
<tr>
<td>EUMETSAT and IMD</td>
<td>Oman</td>
<td>Arabic</td>
<td>RA II</td>
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<tr>
<td>NOAA/NESDIS</td>
<td>CIMH (Barbados)</td>
<td>English</td>
<td>RA IV</td>
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<td>RA III &amp; IV</td>
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<tr>
<td>CMA</td>
<td>Nanjing (China)</td>
<td>Chinese &amp; English</td>
<td>RA II &amp; V</td>
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<tr>
<td>JMA</td>
<td>BMTC (Australia)</td>
<td>English</td>
<td>RA V</td>
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<tr>
<td>CONAE and NOAA/NESDIS</td>
<td>Buenos Aires (Argentina)</td>
<td>Spanish</td>
<td>RA III</td>
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<td>CPTEC and NOAA/NESDIS</td>
<td>Brazil</td>
<td>Portuguese</td>
<td>RA I &amp; RA III</td>
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<tr>
<td>+ ESA &amp; NASA</td>
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Anticipated Outcomes For The HPTE

• VL capacity building
• Improvements in Education and Training options
• Provide practical experience in planning, implementing and delivering online training events for WMO Members as well as other groups such as GEOSS, JCOMM and CEOS.
• Improved utilisation of satellite data and products
High Profile Training Event (HPTE)

• 16-27 October 2006: simultaneous training period involving all WMO Regions
• All CoE involved in classroom training and/or interactive on-line lectures
• 4 key on-line lectures provided globally (scheduled twice to account for time differences, and translated)
• Inter-regional on-line discussion on a “live” situation with image/product interpretation
• A project Plan endorsed at ET-SUP and CGMS

➢ Demonstration of VL efficiency and relevance at global scale
➢ Fostering cooperation at global and regional level (focus groups)
➢ Training opportunity for all WMO Regions
Thanks for your attention