The WMO Space Programme
Serving
WMO’s Global Observing System

Dr Donald E. Hinsman
Director
WMO Space Programme
World Meteorological Organization
Outline

• Status of the WWW’s space-based sub-system GOS
• Integrated Global Data Dissemination Service (IGDDS)
• Global Space-based Inter-calibration System (GSICS)
• Rolling Review of Requirements Process
  • Wind Profiling
Unparalleled international cooperation has been achieved in satellite activities.
Status of the WWW’s space-based component
GOS

Standing members
• operational satellite operators

Newest members
• NASA – Aqua, Terra, NPP, TRMM, QuickScat
• JAXA – GCOM series
• ESA – ERS 1 and 2, ENVISAT
• FSA – METEOR 3M N1 (R&D inst), OKEAN series
• CNES – Jason-1, SPOT-5
• IMD – INSAT series
• Republic of Korea – COMS-1
• CNSA – HY-1A, HY-1B

Possible future members
IGDDS
Integrated Global Data Dissemination Service

• A WMO-CGMS initiative to enhance satellite data access and use
• Thematic component of the WIS for space-based data & products
• IGDDS project addresses specific issues raised by satellite data:
  – Rapidly evolving requirements
  – Data concentration (incl. GEO, LEO, RARS, R&D, products)
  – Data distribution (ADM, Direct Broadcast, Internet push/pull, GTS)
  – Service management (interoperable catalogue, metadata, access control, quality of service monitoring) and interactive services, user support
• Expanding current assets:
  – Rolling Requirements Review for observation data
  – EUMETCast as a model of ADM dissemination
  – EARS as a model for RARS
  – Point-to-point GTS as backbone to send products to NWP centres
ADMs by satellite operators

- **Europe**: EUMETCast-Ku band *(EUMETSAT)*
- **Africa and Caribbean**: EUMETCast-C band *(EUMETSAT)*
- **Central & South-America**: 
  - pilot EUMETCast-C band *(EUMETSAT) for 3 years*
  - considerations for a transition to a NOAA ADM service by 2008 covering North-, Central, South-America and Pacific islands
- **Asia-Pacific regions**: 
  - current Shinetek ADM over China
  - trial planned in 2006 for wide Asia-Pacific ADM including DVB-S broadcast and terrestrial links
EUMETCast Overall Coverage
Ku Band to C band (AsiaSat-4 at 122E)
Global Space-based Inter-calibration System

• A WMO requirement responding to:
  – WMO Space Programme Implementation Plan
  – GCOS Climate Monitoring Principles
  – EUMETSAT SAF on Climate Monitoring
Global Space-based Inter-calibration System

- Relevant to many (most) societal benefit areas in the Global Earth Observing System of Systems (GEOSS)
- WWW/GOS will contribute to the space-based component of the GEOSS
- Imperative to have a space-based inter-calibration system as subsystem of the space component of the WWW/GOS and the GEOSS
- Achievable especially with new instruments and missions
Global Space-based Inter-Calibration System (GSICS)
The **RRR process**

1. **CREATE AND UPDATE**
   - User requirements database

2. **CRITICAL REVIEW**

3. **CREATE AND UPDATE**
   - Observing system capabilities database

4. **GENERATE STATEMENT OF GUIDANCE**
   - Statement of Guidance
Features of RRR

• Generate and maintain databases of user requirements (URs) and observing system capabilities (OSCs)

• URs should be:
  – “technology-free” - should not pre-judge the technology to meet them
  – specified separately for each “application area”, e.g. global NWP, regional NWP, nowcasting, seasonal/inter-annual forecasting, …

• Critical Review (CR) - objective comparison of URs and OSCs

• Statement of Guidance - interprets output of CR - highlights key points and priorities - requires judgement
How user requirements are specified

• for each application, in terms of geophysical variables (level 2 products)

• for each variable, in terms of the following parameters:
  – horiz. and vert. resolution, observing cycle, accuracy and timeliness

• for each parameter, in terms of the “max” and “min” requirements, recognising that observations increase in usefulness over a range from “min” to “max”
  – “min” = value beyond which observations have no significant value
  – “max” = value beyond which observations give no additional value
# Wind profile 500-100 hPa (HT)

## Analysis for GDRS IP Atm os

### 1. Requirement Summary and assessment key

**Note:**
This chart is a comparison between a requirement and expected observing system performances. It is a component of the Critical Review and Statement of Guidance used by the CBS OPAG IOS Expert Team on Data Requirements and Redesign of the GOS.

#### Exceeds

<table>
<thead>
<tr>
<th>Goal</th>
<th>Hor km</th>
<th>Vert km</th>
<th>Cycle d</th>
<th>Delay h</th>
<th>Acc m/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.0</td>
<td>1.0</td>
<td>6.0</td>
<td>12.0</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>

#### Critical Review Chart

**Wind Profile 500 - 100 hPa**

**Colour key**

- **Red:** Exceeds
- **Blue:** Goal
- **Green:** Breakthrough

**Cycle colour assessment based on a constellation of 2 polar-orbiting satellites (1 geostationary)**

#### 2. Instruments for:

**Showing relevant instruments for which details are available**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Hor km</th>
<th>Vert km</th>
<th>Cycle d</th>
<th>Delay h</th>
<th>Acc m/s</th>
<th>Mission</th>
</tr>
</thead>
<tbody>
<tr>
<td>RADAR RA-IV C</td>
<td>3.0</td>
<td>1.0</td>
<td>0.1</td>
<td>0.5</td>
<td>2.00 G W W in situ</td>
<td>G3</td>
</tr>
<tr>
<td>RADAR RA-VI WE</td>
<td>3.0</td>
<td>1.0</td>
<td>0.1</td>
<td>0.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Amdar FL RA-IV C</td>
<td>90.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>WND P 449 RA-IV C</td>
<td>700.0</td>
<td>0.3</td>
<td>1.0</td>
<td>0.5</td>
<td>1.50 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>WND P 915 RA-IV C</td>
<td>1000.0</td>
<td>0.1</td>
<td>1.0</td>
<td>0.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>GIFTS</td>
<td>40.0</td>
<td>2.0</td>
<td>1.0</td>
<td>1.0</td>
<td>3.00 G n m-3</td>
<td>G3</td>
</tr>
<tr>
<td>Raobs RA-VI WE</td>
<td>218.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G3</td>
</tr>
<tr>
<td>Raobs RA-IV E</td>
<td>294.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G3</td>
</tr>
<tr>
<td>Raobs RA-IV C</td>
<td>331.0</td>
<td>0.2</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G3</td>
</tr>
<tr>
<td>SEVIRI</td>
<td>100.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>4.00 M s g-1, 3</td>
<td>G3</td>
</tr>
<tr>
<td>Raobs RA-VI EE</td>
<td>369.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs RA-II S</td>
<td>442.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs RA-II N</td>
<td>444.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs RA-IV N</td>
<td>447.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>VISSR (FY-2)</td>
<td>50.0</td>
<td>5.0</td>
<td>1.0</td>
<td>2.0</td>
<td>5.00 G f y-2, a</td>
<td>G4</td>
</tr>
<tr>
<td>VISSR (FY-2)</td>
<td>50.0</td>
<td>5.0</td>
<td>1.0</td>
<td>2.0</td>
<td>5.00 G f y-2, b</td>
<td>G5</td>
</tr>
<tr>
<td>Imager</td>
<td>150.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.00 G e o e-s, 8, 9</td>
<td>G5</td>
</tr>
<tr>
<td>Imager</td>
<td>150.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.00 G e o e-K, P</td>
<td>G5</td>
</tr>
<tr>
<td>Imager</td>
<td>150.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.00 G e o e-M, O</td>
<td>G5</td>
</tr>
<tr>
<td>IMAGES/MTSAT-2</td>
<td>150.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.00 M t s a t-1, 2</td>
<td>G5</td>
</tr>
<tr>
<td>MIVIRI</td>
<td>150.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.00 M t e o s a t-3, 5</td>
<td>G4</td>
</tr>
<tr>
<td>MIVIRI</td>
<td>150.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.00 M t e o s a t-5</td>
<td>G4</td>
</tr>
<tr>
<td>Sounder</td>
<td>150.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.00 G e o e-8, 9</td>
<td>G5</td>
</tr>
<tr>
<td>Sounder</td>
<td>150.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.00 G e o e-K, P</td>
<td>G1</td>
</tr>
<tr>
<td>Sounder</td>
<td>150.0</td>
<td>5.0</td>
<td>1.0</td>
<td>1.0</td>
<td>5.00 G e o e-M, O</td>
<td>G2</td>
</tr>
<tr>
<td>VISSR (GMS-5)</td>
<td>150.0</td>
<td>5.0</td>
<td>1.0</td>
<td>2.0</td>
<td>5.00 G e o e-s, 8, 5</td>
<td>G5</td>
</tr>
<tr>
<td>Amdar FL NAO CST</td>
<td>50.0</td>
<td>5.0</td>
<td>24.0</td>
<td>1.0</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Amdar FL RA-VI WE</td>
<td>38.0</td>
<td>5.0</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs ARC</td>
<td>793.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs M ED</td>
<td>703.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs NAO CST</td>
<td>1455.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs NAO OPN</td>
<td>1839.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs NIO OPN</td>
<td>1633.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs NPO OPN</td>
<td>2008.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs RA-I N</td>
<td>1406.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
<tr>
<td>Raobs RA-II S</td>
<td>652.0</td>
<td>0.3</td>
<td>12.0</td>
<td>1.5</td>
<td>2.00 G W W in situ</td>
<td>G9</td>
</tr>
</tbody>
</table>
Implementation Plan for the space-based component of the GOS

• CBS Implementation Plan for the Evolution of the GOS
• Twenty items assigned to the WMO Space Programme
  – Wind profiling:

S10. LEO Doppler Winds - Wind profiles from Doppler lidar technology demonstration programme (such as Atmospheric Dynamics Mission - Aeolus) should be made available for initial operational testing; a follow-on long-standing technological programme is solicited to achieve improved coverage characteristics for operational implementation.