WMO OMM

World Meteorological Organization

Working together in weather, climate and water

International coordination of the Space-Based Global Observing System, Satellite Utilization and related Training

NOAA Satellite Science Week, Kansas City MO, USA
30 April 2012

Stephan Bojinski
WMO Space Programme

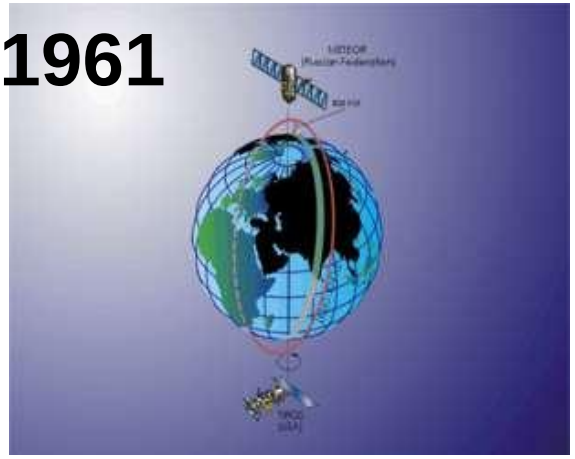
World Meteorological Organization (WMO)

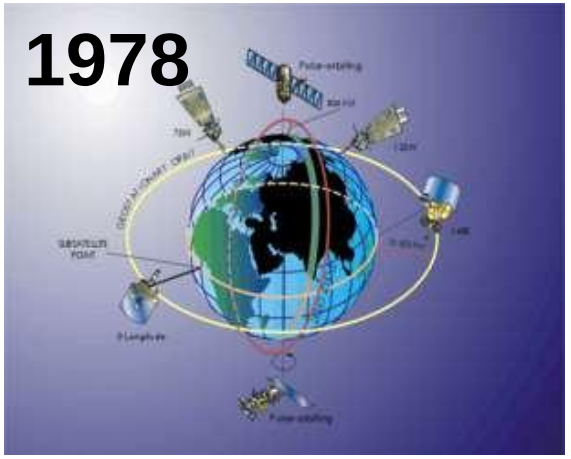
- Specialized agency of the United Nations for
  - meteorology (weather and climate),
  - hydrology and
  - related geophysical fields (e.g., atm chemistry; oceanography; space weather);
- International coordination and cooperation
- 189 Member states

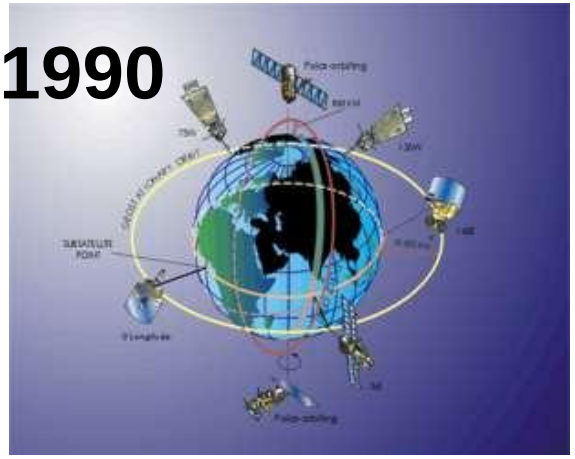
- Best practices, data exchange, standards, capacity development
- R&D and operational

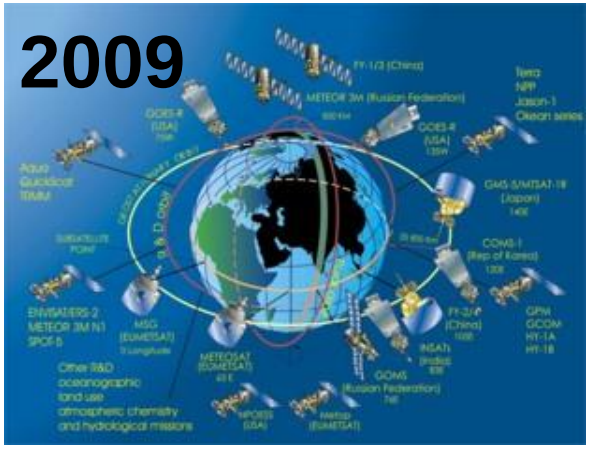
- Main stakeholders: National Meteorological and Hydrological Services
- Satellite operators, Research & Academia, Other gov't services

Space-based Global Observing System



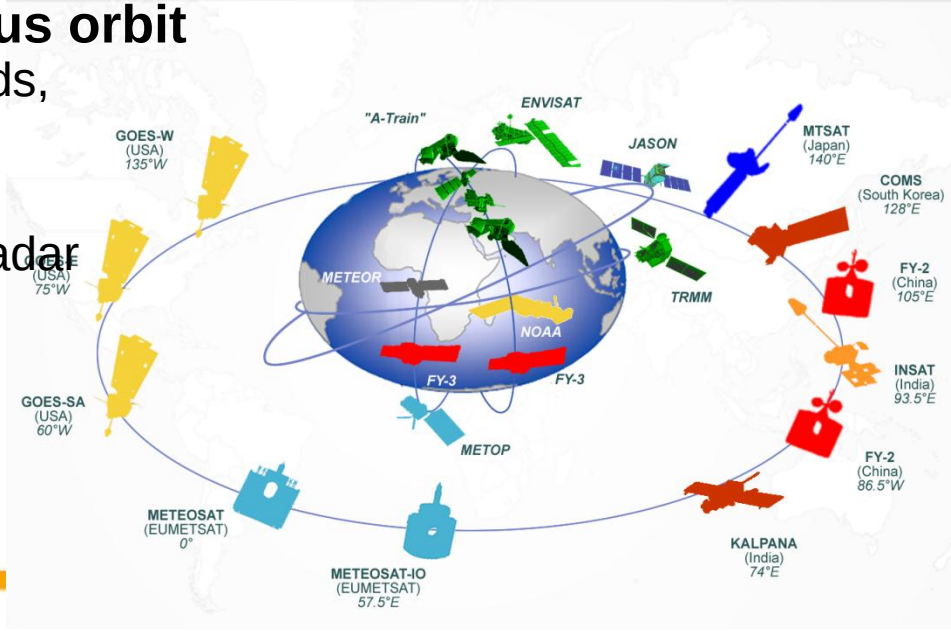




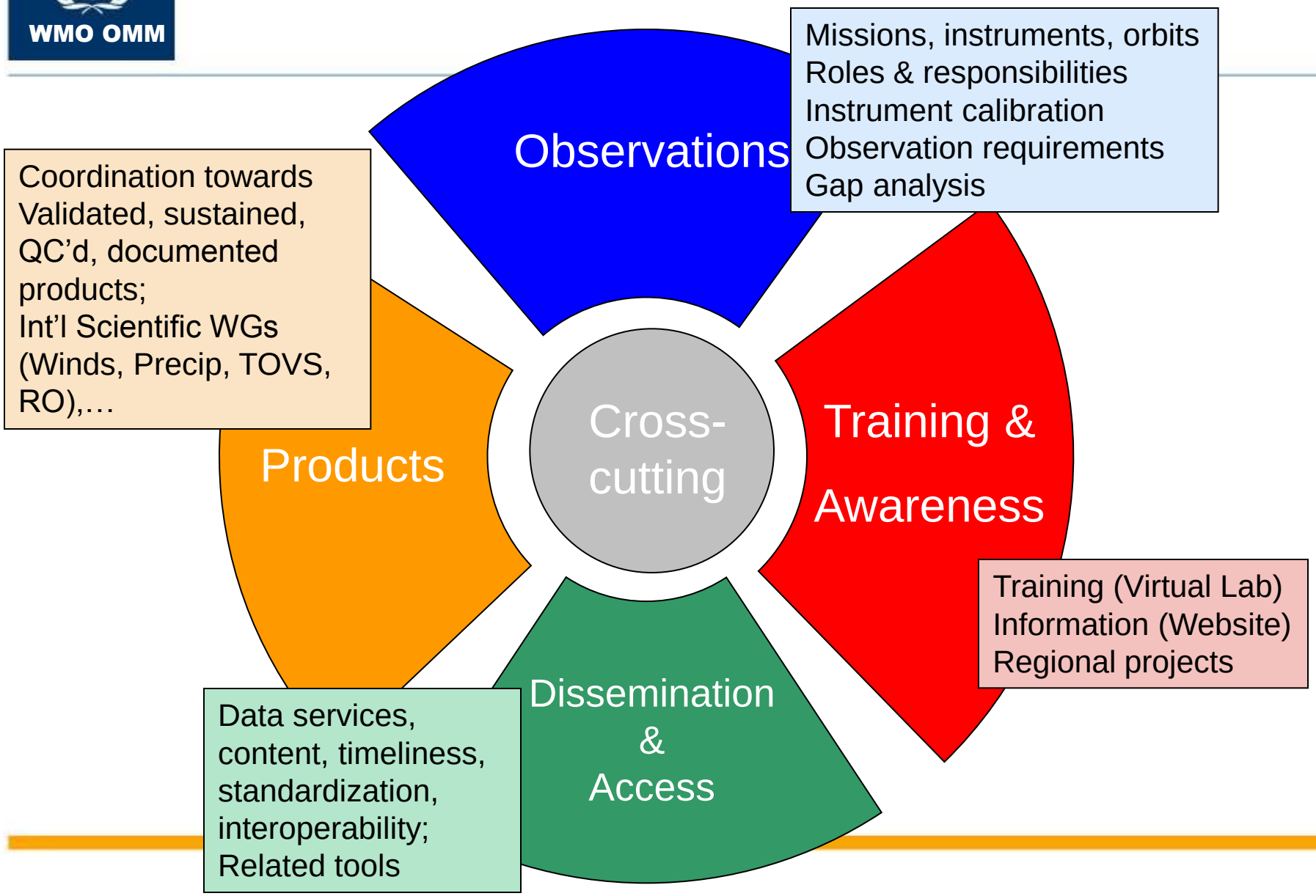


Status of the space-based GOS (Feb 2012)

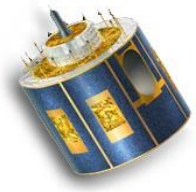
- **12 operational geostationary satellites** (plus back-up)
  for permanent weather watch with quasi-global coverage
  USA (3), EUMETSAT (3), China (2), India (2), Japan, Rep. Korea
- **6 operational sun-synchronous** (plus back-up)
  global VIS/IR/MW imagery, IR/MW sounding, scatterometry, GNSS radio-occultation
  USA (3), China (2), EUMETSAT
- **R&D satellites in sun-synchronous orbit**
  for land/ocean surface, O3, GHG, clouds, aerosols, radiative balance…
- **Missions in inclined orbits**
  for altimetry, GNSS RO, precipitation radar
- **Global inter-calibration system**

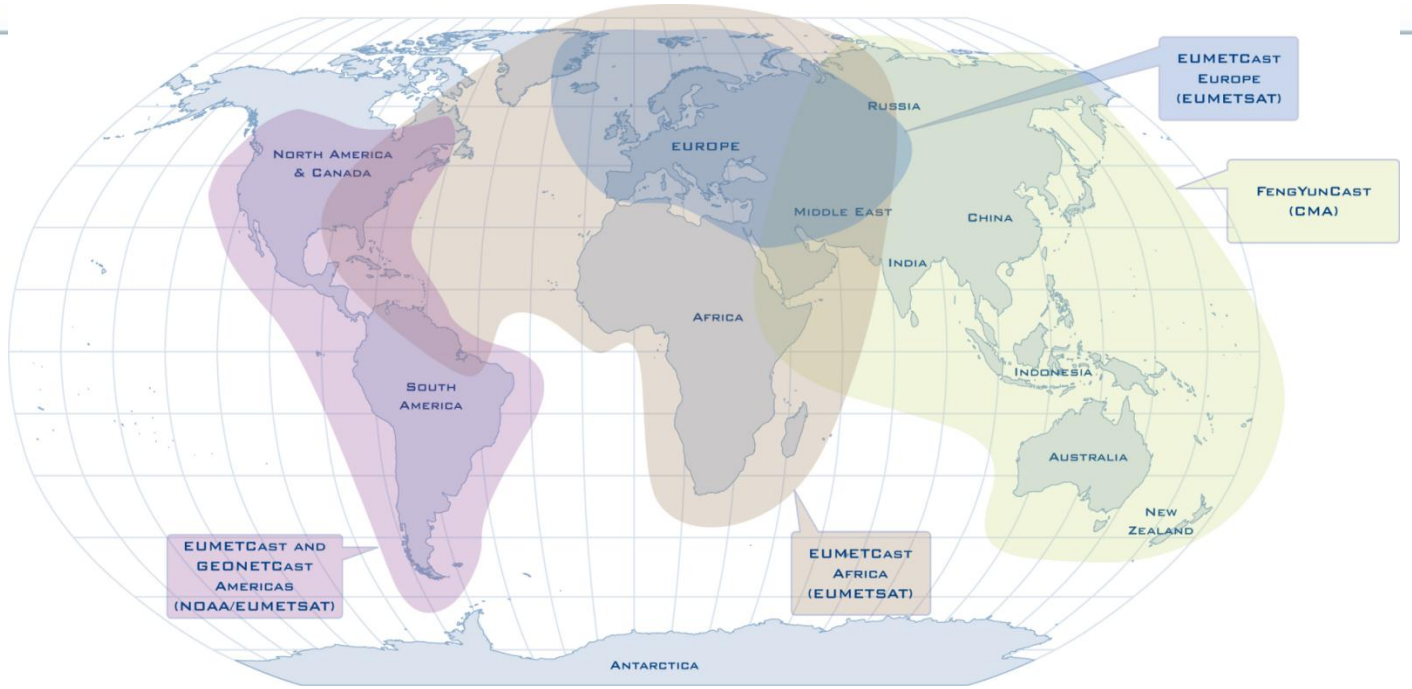


WMO Space Programme Activities



Data Accessibility



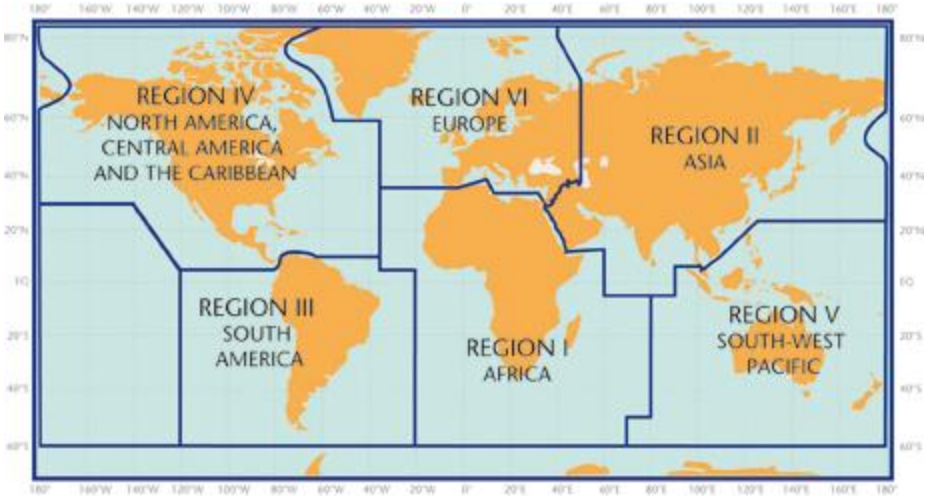


- Promote integrated dissemination services
- Support standardization of Direct Readout services
- Implement WIS standards and best practices
- Identify requirements for additional data to be disseminated

Regional Satellite Data Requirements

✓Regional approach to defining / maintaining satellite data user requirements (RRR-type)

✓In support of all WMO application areas



1. Establishes Regional Data Requirements Task Team (SG)
- Representative users
- Data providers
- WMO Secretariat

2. Gathering of needs and requirements for data/products
-Starting with inventory of available data/products
-Outcome of user surveys, questionnaires,etc
-Consultation of Centres of Excellence
-Personal experience

3. Assessment and prioritization of requirements
-Impact on applications and societal benefits
-Number/representativity of users
-Status of candidate products
-Quality/suitability of candidate data/productsc

4. Optimization of response to requirements
- Workshop with users and data providers
- Consideration of data distribution options and capabilities
- Guidance from CBS, WIS, IGDDS

5. Reporting on the outcome to CBS, RA, data providers
-Requirements for distribution of existing data
-Requests for modification and distribution of existing data/products
-Recommendations for development of new data/products
-Other recommendations (e.g training, user equipment)
-Proposals for further rolling review of data requirements

Education and Training
Capacity building

1. Virtual Laboratory for Education and Training in Satellite Meteorology

2. Need for a General Strategy for Ensuring User Readiness

- Lessons learned from Proving Ground?
- New Generations of Satellites: Himawari-8,9 (JMA); GEO-KOMPSAT (KMA), MTG (EUMETSAT)

Education and Training Capacity building

A global network of Centres of Excellence sponsored by satellite operators

- To provide training on meteorological and environmental satellite systems, data, products and applications;

- To foster research and the development of applications for societal benefit at the local level by the NMHS.

Key points of the VLab strategy

Virtual Laboratory for Education and Training in Satellite Meteorology:

- Partnership between space agencies and training centres;
- Distance and blended learning courses;
- Covering all WMO Regions and official languages;
- Regional Focus Groups (RFG); Event Weeks

- 65 courses in 2010/2011; >2000 participants
- Expanding scope: themes, partnership with COSPAR
- Sharing training resources: Virtual Resource Library, supported by Environmental Satellite Resource Center (UCAR COMET programme)
- POSTER SESSION WED 2 MAY

Web-based User Information

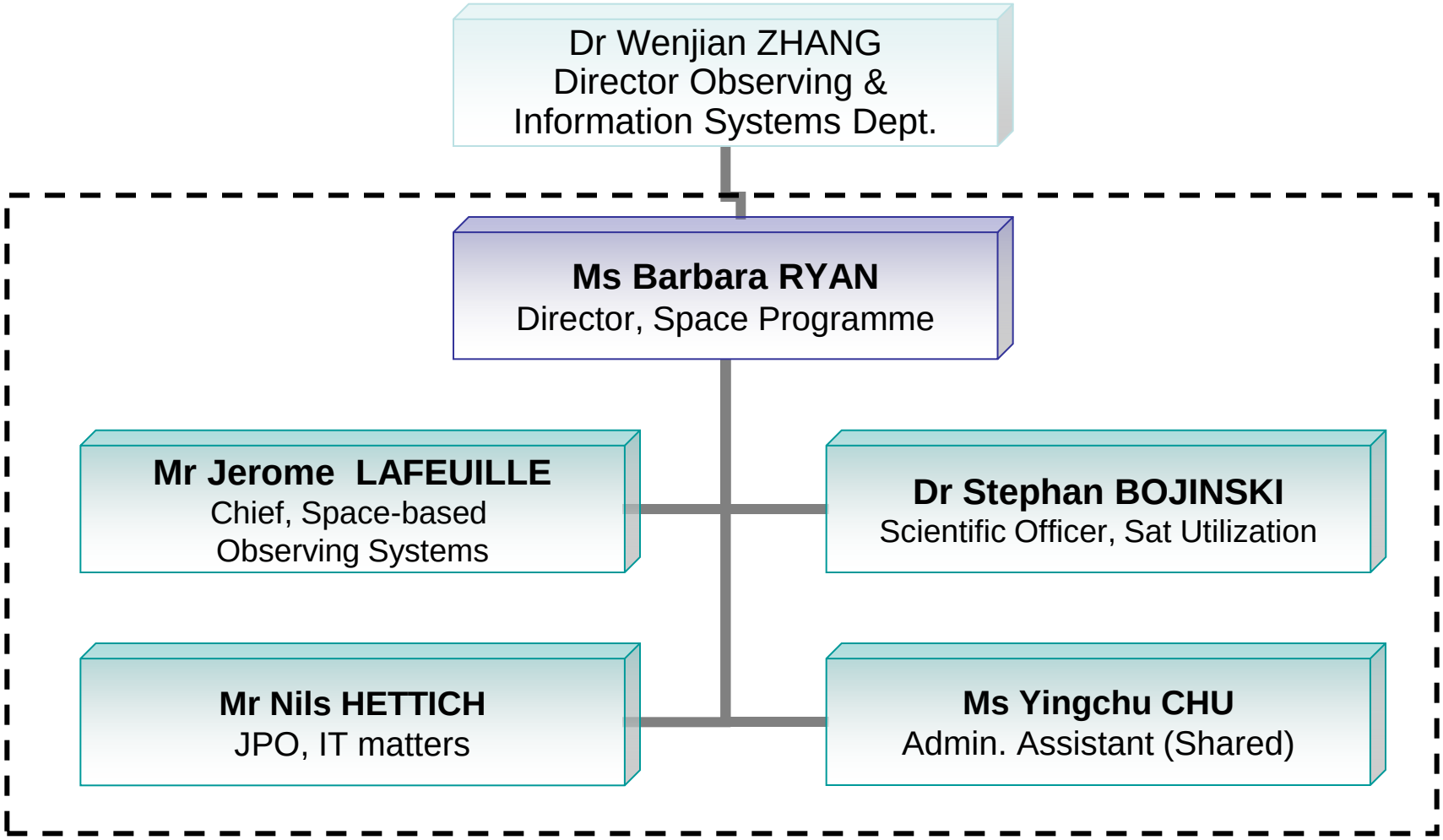
- http://www.wmo.int/sat
  - satellite status
    with links to data access information
  - Satellite Capabilities Database
  - Observation Requirements Database
  - Product Access Guide (in development)

- Virtual Laboratory :
  http://vlab.wmo.int

Concluding Remarks

- WMO Global Survey on the Use of Satellite Data: Release in May 2012 – Your Views Are Important
- General Strategy for User Readiness for New Generations of Satellites - Your Comments Are Welcome
- Upcoming WMO-EUMETSAT RGB Workshop: 17-19 Sept 2012, Seeheim (Germany)

The WMO Space Programme Office



VLab Facts 2011

- Monthly online “Regional Focus Group” meetings by VLab Centres of Excellence
- 65 courses in the year 2010/2011
- >2000 participants
- Involving all 6 WMO Regions and 7 languages: English, French, Spanish, Portuguese, Russian, Arabic and Chinese
- VLab web site: **http://vlab.wmo.int**
- Common calendar of training events
- Newsletter

The VLab network

- Virtual Laboratory for Education and Training in Satellite Meteorology
- Partnership between space agencies and training centres;
- Covering all WMO Regions and official languages;
- Sharing training resources: Virtual Resource Library, supported by Environmental Satellite Resource Center (UCAR COMET programme)
- Classroom, distance and Blended learning courses;
- Regional Focus Groups (RFG);
- Event Weeks: e.g., Aviation week Caribbean 30 April – 4 May 2012
- Common tools for distant learning and course management

VLAB LINKS BETWEEN COES AND THEIR SUPPORTING SATELLITE OPERATORS

WMO coordination of Space Weather activities

- Initiated in 2008 upon request of ISES
- 14 countries and 6 international organizations involved in ICTSW (Inter-programme Coordination Team on Space Weather)
- Early achievements:
  - Developed a set of observational requirements recorded in database: http://www.wmo-sat.info/db
    - ➢ Next step : Review capabilities, identify gaps and define recommendations
  - Created a Space Weather Product Portal with ~30 product entries addressing: ionospheric, geomagnetic, energetic particles, solar and interplanetary **http**://www.wmo.int/sat

Strategy towards effective use of satellite data

- *Satellite observation capability*
- Data access systems
  - Dissemination services (IGDDS initiative)
  - User receiving / processing equipment and software tools
- Adapting the services to the needs
  - Formulate user requirements
  - Dialogue between users and providers to include new data/products
  - Developing and sharing products
- User awareness and training
  - Information on systems, products, access
  - Training on data/product access and applications

Space-based GOS trends and challenges

- Trends
  - The largely dominant data source for weather and climate modelling
  - Comprehensive and diversified to meet weather and climate requirements
  - Integrating « R&D » and « Operational » components

- Challenges
  - Continuity of essential climate measurements (e.g. O_3, GHG, radiative balance..)
  - Data quality and traceability for consistent climate records

Architecture for climate monitoring from space

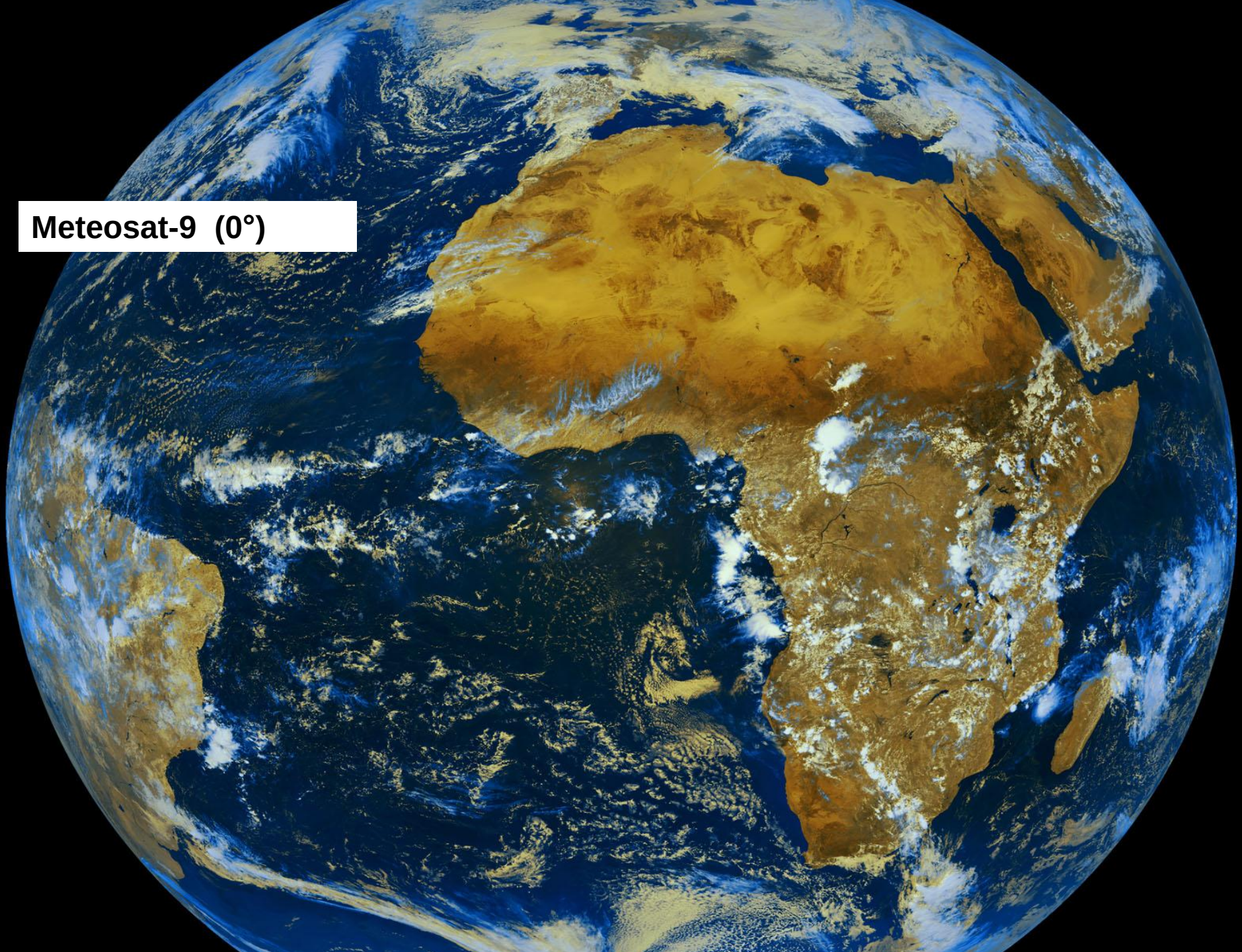
- A joint initiative of WMO, CGMS, CEOS in consultation with GCOS, WCRP, GEO

- To define a roadmap for an end-to-end system including
  - Observation capabilities
  - Sustained generation of climate datasets
  - Data stewardship

- In support of climate variability and climate change assessment, climate adaptation, and provision of climate services

Conclusions

- Thanks to all contributing satellite operators
- Global coordination proves essential
  - To avoid gaps and redundancies: optimize observation efforts
  - To ensure interoperability of datasets,
  - To harmonize products when relevant
  - To align on best practices
- Imperative to maintain and further develop the Space-based infrastructure for weather and climate monitoring in support of public safety and economic benefit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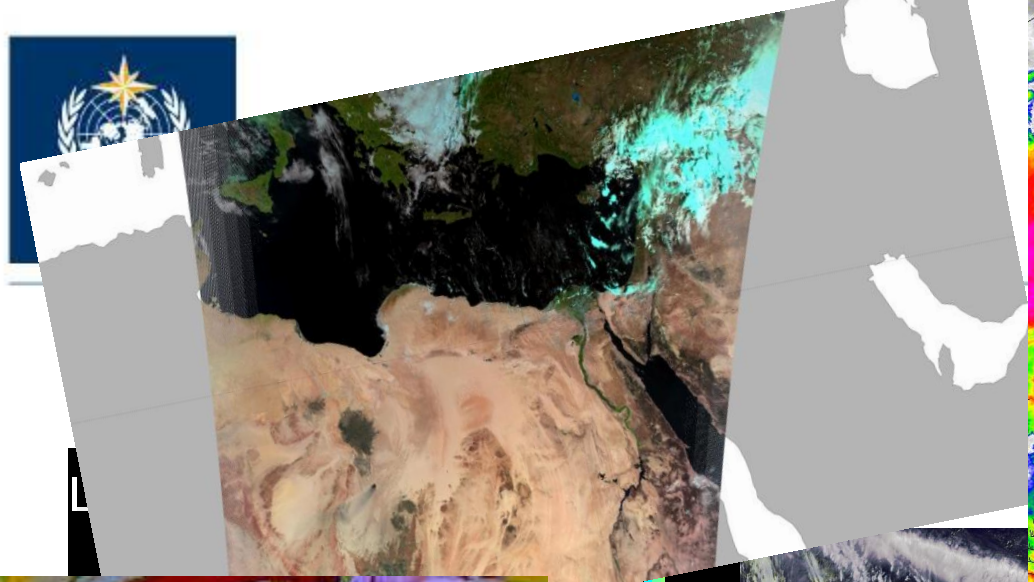

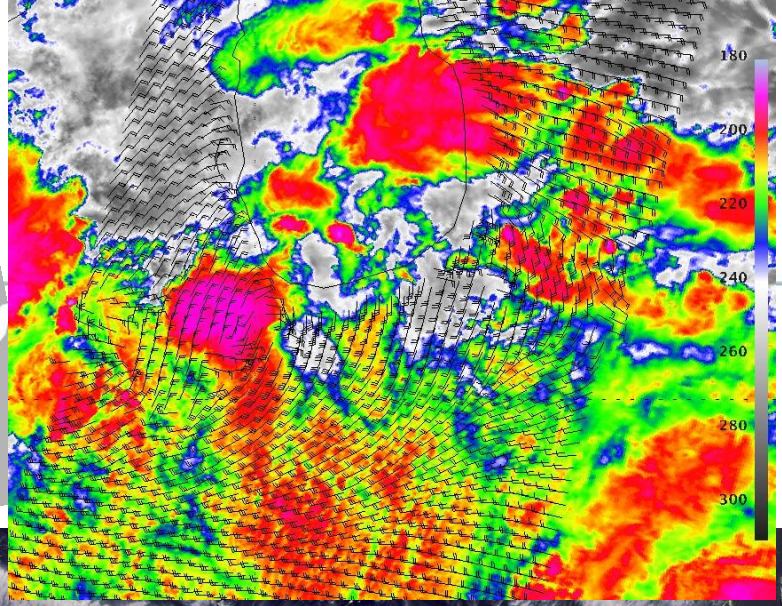
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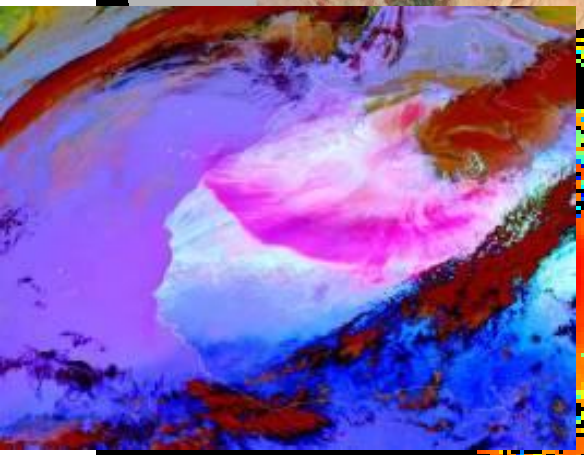

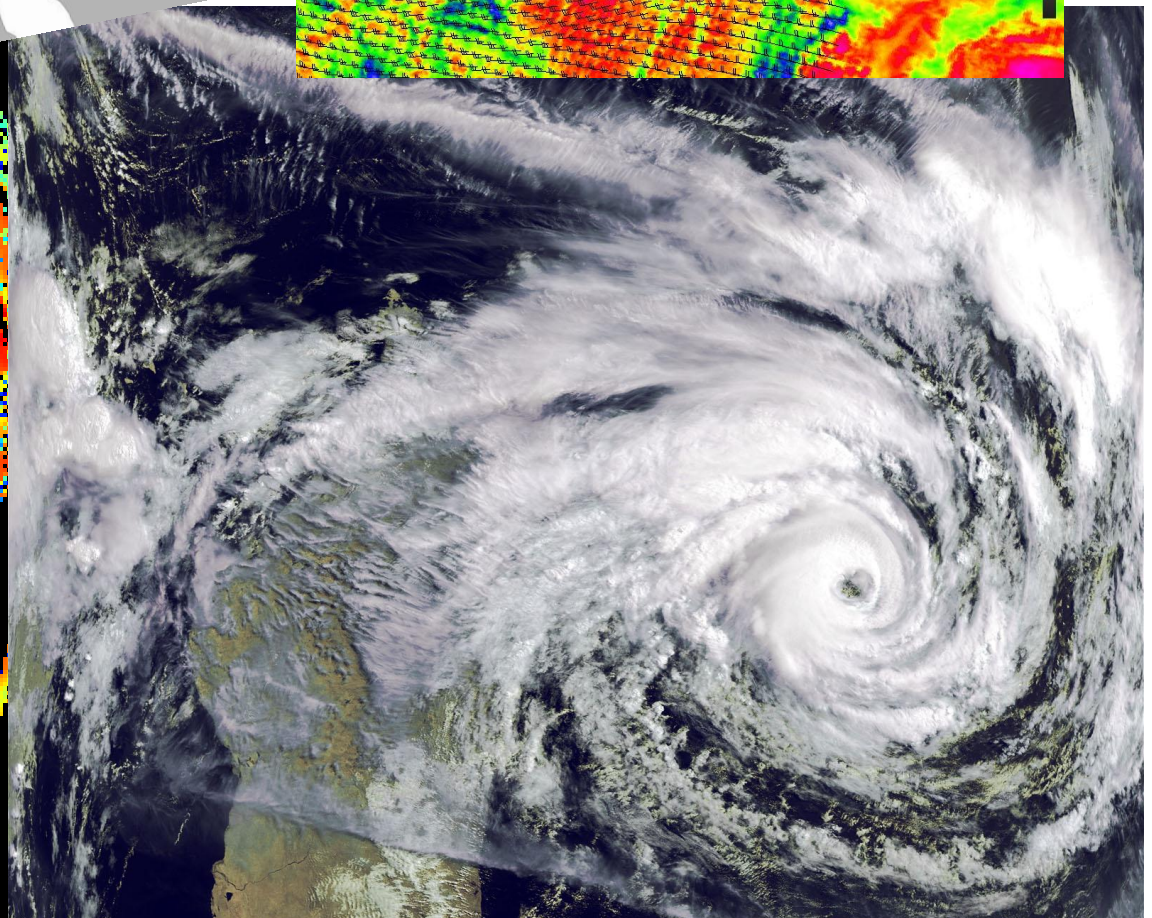

Regional aspects for RA I (2)
Recent regional initiative

- RA I Dissemination Expert Group (RA I DEG)
  - Established Sept 2010, then meeting in June 2011 and Oct 2012
  - Includes all CoE hosts and SWFDP focal point
  - Evaluates available products, provides feedback
  - Requires additional products
  - EUMETSAT is responding in adapting EUMETCast contents
    - 52 new products on EUMETCast-Africa since 2011
    - 21 further products planned by end of 2012
    - e.g. ASCAT-winds, SST, Fire, Cloud analysis, Soil moisture, NWP output

James Kongoti (Chairman)	Kenya
Etienne Kenne	Cameroon
Satyabhama Cahoolessur	Mauritius
Tahar Saouri	Maroc
Leon-Guy Razafindrakoto	Niger (ACMAD)
Emmanuel Kploguede	Niger (ASECNA/EAMAC)
Marianne Diop Kane	Senegal
Nico Kroese	South Africa

Draft Regional Satellite Data Requirements Procedure

✓CBS Expert Team on Satellite Utilization and Products (ET-SUP)

✓Regional approach to defining / maintaining satellite data user requirements for all WMO programmes

✓Builds on positive experience:
- RA I: Dissemination Expert Group
- RA III/IV: Requirements Task Team

✓New focus on RA II, RA V

✓Will be proposed as “recommended practice” to all regions

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Regional aspects for RA I (3)
Other regional activities

- Support to Applications: SWFDP Africa
  - VLab training support to SWFDP workshop (Nov 2011)
  - SWFDP requirements are addressed by RAIDEG
- VLab activities
  - 3 Centres of Excellence: Nairobi, Niamey, Pretoria
  - Potential new CoE in Casablanca
  - Monthly on-line briefings (Pretoria)
  - Thematic events (Dust week 2010, Aviation week 2011)
  - Training sessions in 2011/2012 (plans to be consolidated)
- EUMETSAT User Forum since 1995

Conclusions

- Initiatives and opportunities at every level of the chain:
  satellite > dissemination > products > information and training
- Limited awareness of available satellite observation data/products
- Important mechanisms to be acknowledged/utilized
  - User Forum
  - VLab – regional focus group
  - RA I DEG
  - Pilot/demonstration projects
  - Web-based services *e.g. future Product Access Guide (ET-SUP)*


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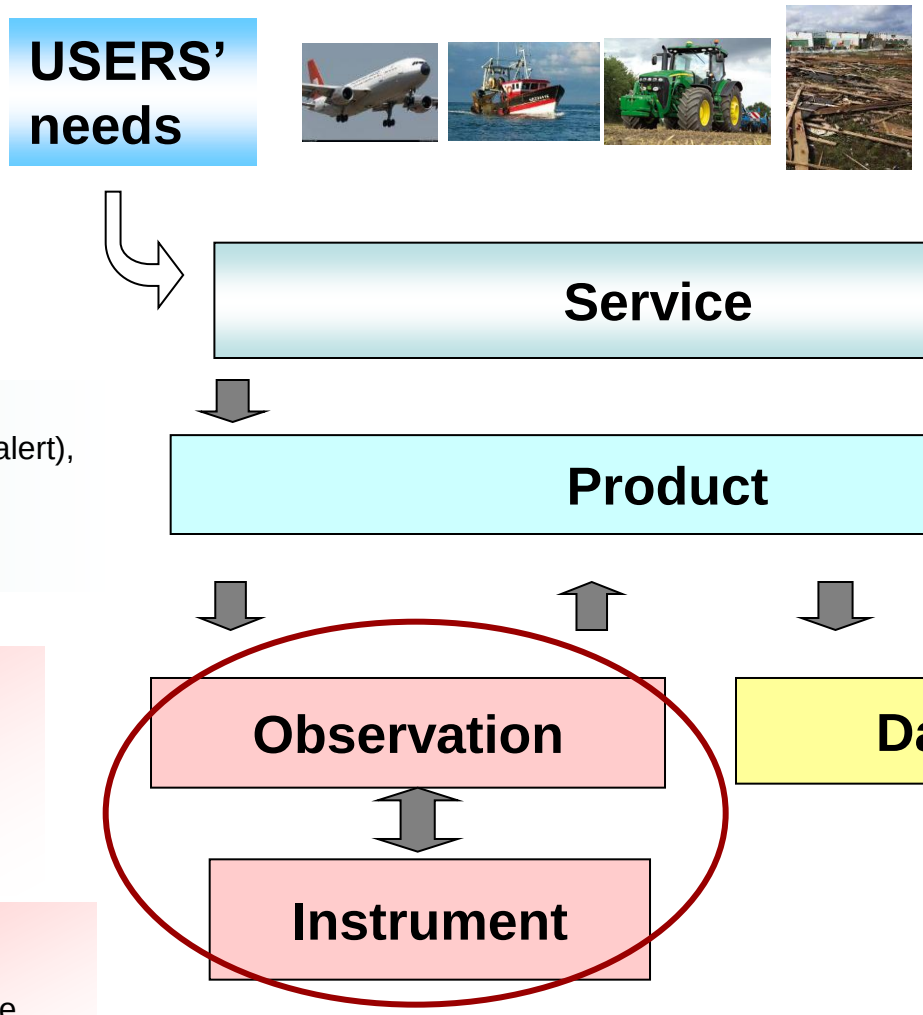
Different layers of requirements



How user requirements are specified

- For each application x each relevant variable x each applicable layer:

Requirement = (
- Uncertainty
- Horizontal Resolution
- Vertical Resolution
- Temporal Resolution *(Observing cycle)*
- Timeliness *(Maximum delay)*

Confidence

Approval date stamp
)

- For each of these 5 criteria
  - "min" (or threshold) : value below which observations are worthless
  - "max" (or goal) : value beyond which improvement gives no additional value
  - "breakthrough" (or optimum) : proposed target for significant progress, optimal cost/benefit