Update on WMO's Space-related Activities

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Outline

- WMO Space Programme
  - New challenges for space-based observing systems
  - Link with GEO / GEOSS
  - Data access / Geonetcast
  - Capacity building / Virtual Laboratory
- Space Weather

WMO Space Programme

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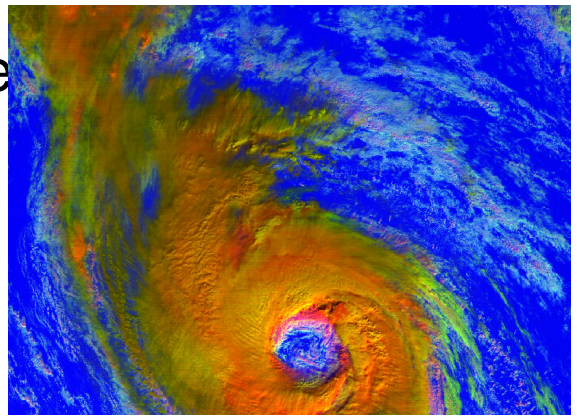
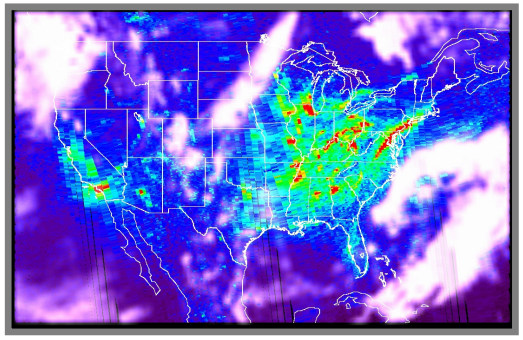
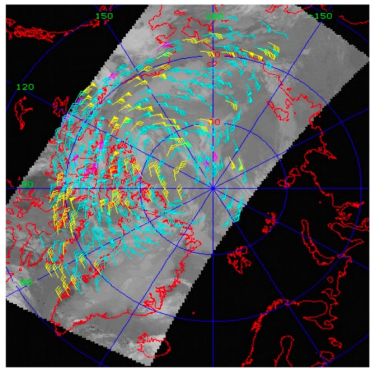
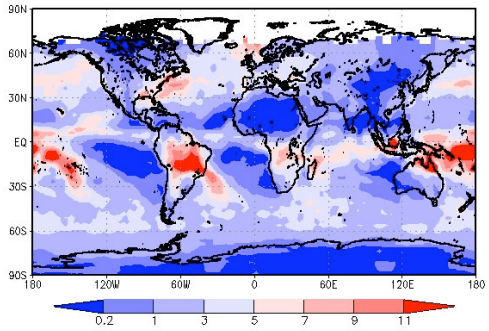
Satellites in support of WMO and co-sponsored programmes

- World Weather Watch and applications
  - NWP, Public Weather Services, Aero, Marine Agriculture
  - Tropical Cyclone Programme
- Hydrology and Water Resources
- Disaster Risk Reduction
- Atmospheric chemistry
  - Air quality, Climate
- Climate programmes
  - GCOS
  - WCRP (CLIC, GEWEX, SPARC, CLIVAR..)
  - WCP
- Telecommunications









WMO Space Programme

Three main areas

Enhance the space-based GOS

Satellite operators CGMS & CEOS

Users: all WMO & co-sponsored programmes

Enhance access to sat data

Enhance users' capability to benefit from satellites

Enhancing the space-based GOS

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Agencies contributing to the GOS

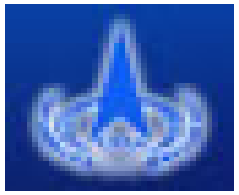

CMA

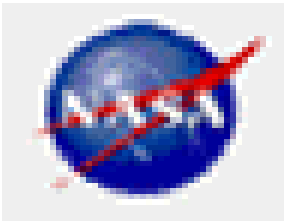

IMD


JMA


NOAA


ROSHYDROMET





A busy launch plan !

Status of current and planned CGMS Members satellites

Current low earth orbit (LEO) satellites contributing to the GOS

Information maintained by WMO Space Programme on behalf of CGMS

(This table was last updated on 20 November 2008)

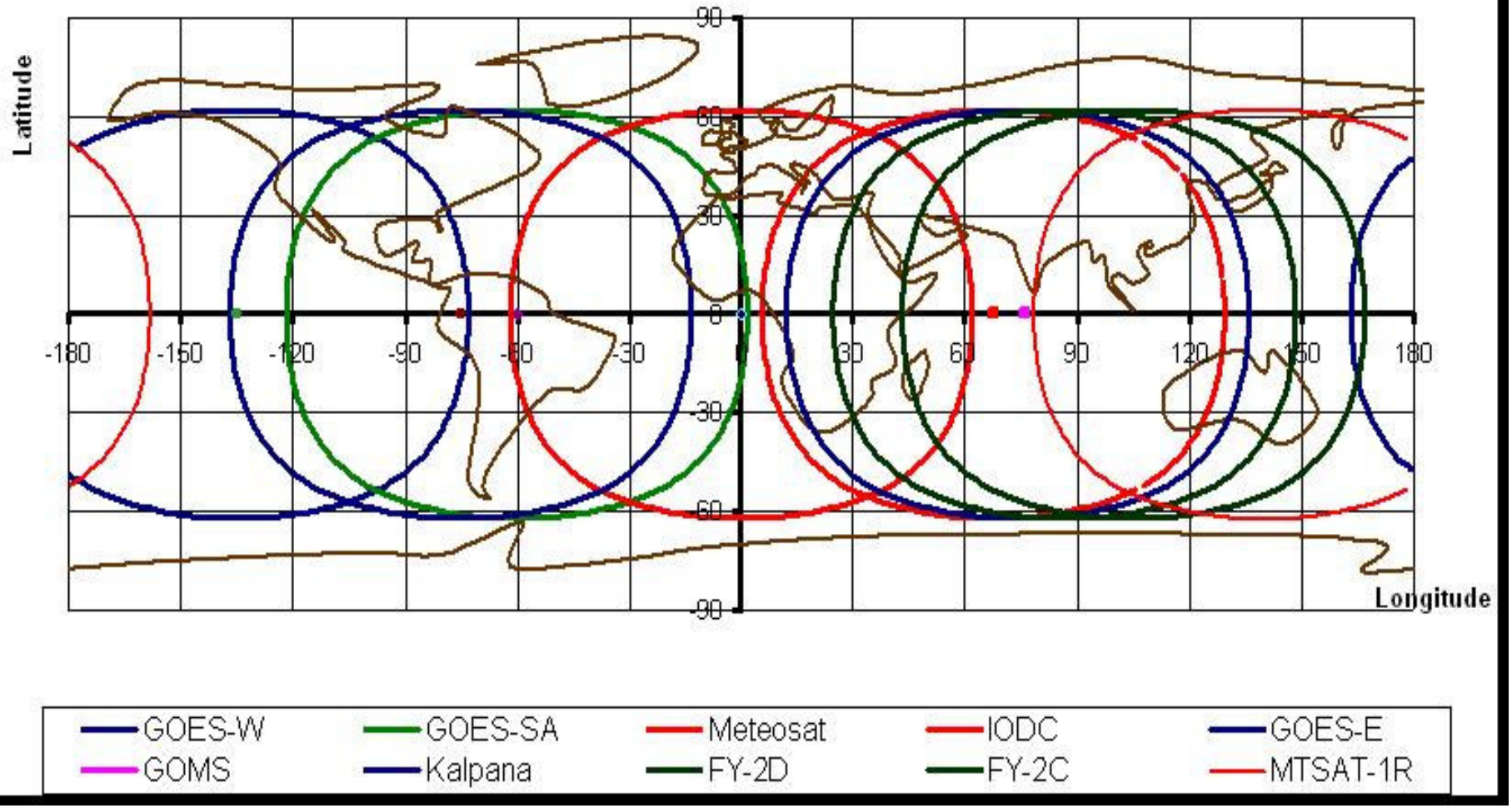
Jump to the table for	Future LEO satellites	Current GEO satellites	Future GEO satellites	Current R&D satellites	Future R&D satellites

Click on the satellite name in the table below to find more information (external links)

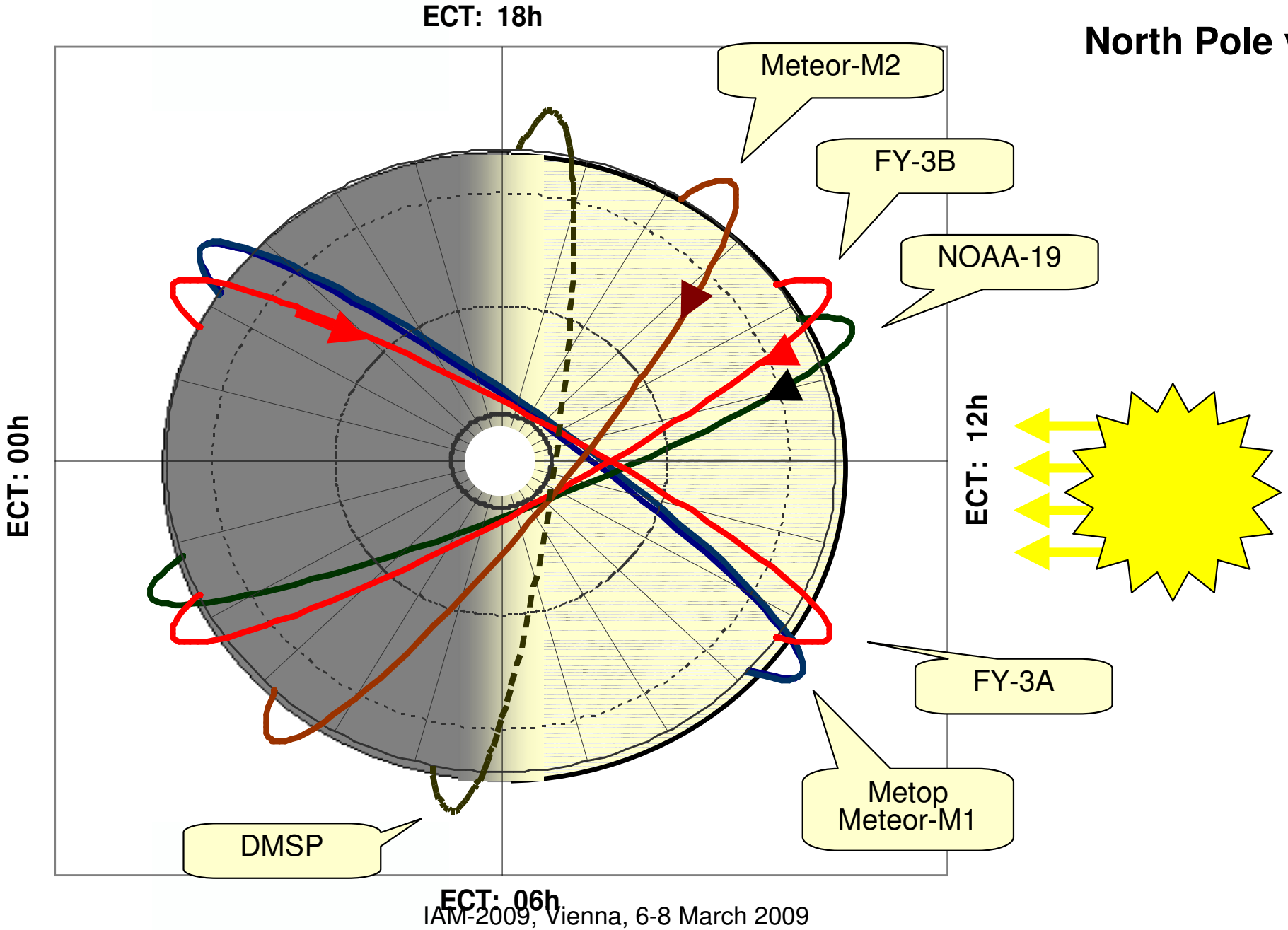
ascending

Orbit type ECT=Equator Crossing Time (for sun-synchronous orbits)	Satellites in orbit P=pre-operational Op=operational B=back-up or secondary L=limited availability	Operator	Equator Crossing Time (ECT) Ascending Node	Mean Altitude	Launch date	Status
Sun-synchronous "Morning" orbit ECT between (19:00-24:00) or (07:00-12:00)	FY-3A (P)	China/CMA	22:00	836 km	27/05/2008	VISR, MERSI, MWRI, MWTS, MWHS, IRAS, TOU/SBUS, ERM/SIM. Direct Broadcast
	NOAA-17 (B)	USA/NOAA	21:43	810 km	24/06/2002	AVHRR/3, HIR/3, AMSU-B, SBUV, SEM/2 functional. AMSU-A1 Failed.
	METOP-A (Op)	EUMETSAT	21:30	837 km	19/10/2006	Operational. HRPT and LRPT not functional. Dissemination via EUMETCast
	DMSP-F16 (OP)	USA/NOAA	20:04	850 km	18/10/2003	SSMIS . Defense satellite. Data available to civilian users through NOAA.
	DMSP-F15 (B)	USA/NOAA	19:37	850 km	12/12/1999	Defense satellite. SSMT2 non-functional. Data available to civilian users through NOAA.
Sun-synchronous "Early morning" orbit ECT between (17:00-19:00) or (05:00-07:00)	FY-1D (Op)	China/CMA	18:50	866 km	15/05/2002	Functional. VIRR, SEM. Direct Broadcast CHRPT
	DMSP-F13 (Op)	USA/NOAA	18:33	850 km	03/1995	Defense satellite. On orbit 13 years! Data available to civilian users through NOAA.
	DMSP-F17 (Op)	USA/NOAA	17:31	850 km	11/2006	SSMIS . Defense satellite. Data available to civilian users through NOAA.
	DMSP-F14 (B)	USA/NOAA	17:24	852 km	10/04/1997	Defense satellite. SSMT1 and SSMT2 (microwave temperature and humidity sounder) non-functional. Only 1 functional onboard recorder. Data available to civilian users through NOAA.
	NOAA-16 (B)	USA/NOAA	17:12	850 km	21/09/2000	Functional, no APT. Intermittent problems with AVHRR.
Sun-synchronous "Afternoon" orbit ECT between (12:00-17:00) and (00:00-05:00)	NOAA-15 (B)	USA/NOAA	16:55	807 km	05/1998	Functional Intermittent problems on AVHRR, AMSU-B & HIRS
	NOAA-18 (Op)	USA/NOAA	13:39	854 km	20/05/2005	AVHRR/3, AMSU-A, MHS, SBUV, SEM/2 Functional. Noise on HIRS long wave channels
Non sun-synchronous	JASON-2 (P) (Ocean Surface Topography Mission)	NASA/NOAA/ EUMETSAT/ CNES	(66° inclin.)	1336 km	20/06/2008	Follow-on of JASON-1 Sea surface topography measurement

CURRENT GEOSTATIONARY COVERAGE



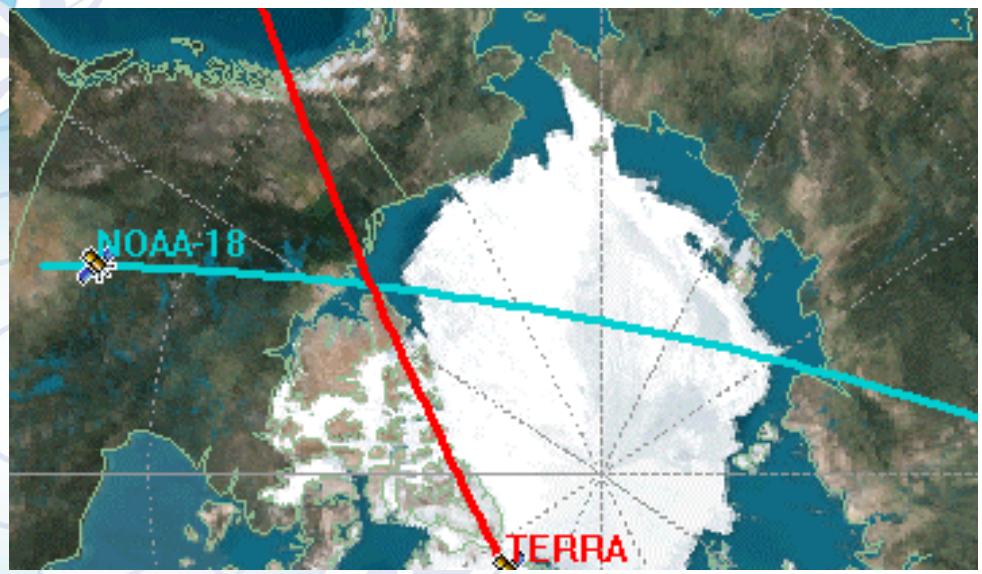
Equatorial Crossing Times of planned polar orbiting missions in 2010/2011



Global Space-based Inter-calibration System (GSICS)

CMA, CNES, EUMETSAT, JMA, KMA, NASA, NOAA, NIST

POLAR- POLAR intercalibration

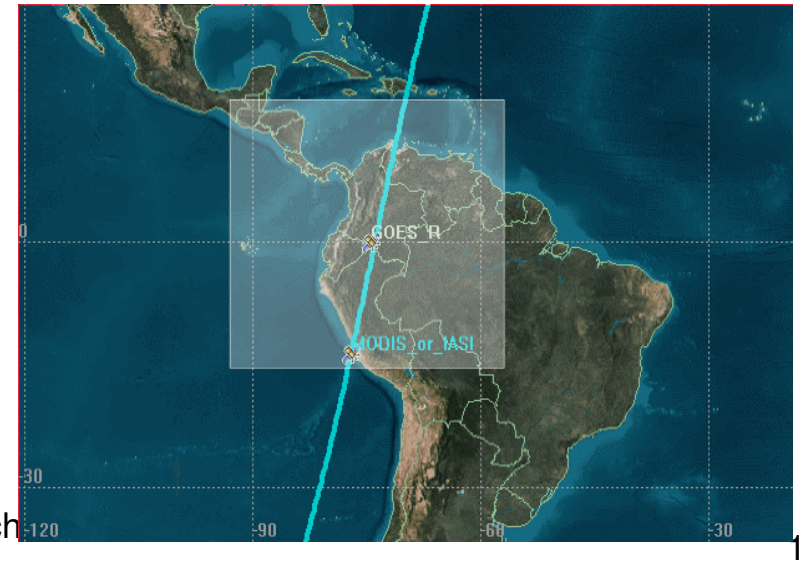


Simultaneous Nadir Overpass (SNO) inter-calibration method

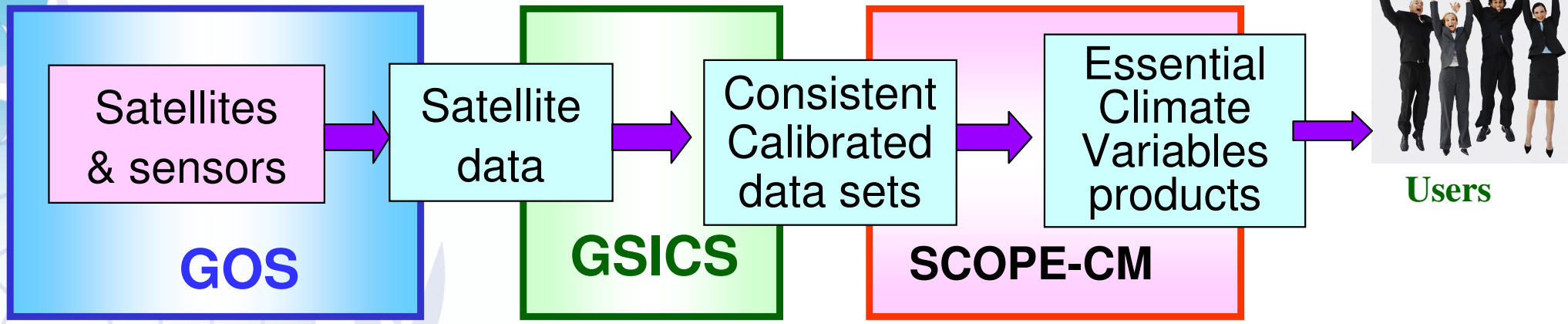
- *Images: courtesy of Mitch Goldberg, NOAA/NESDIS*

- **To ensure consistency of datasets from different missions and operators**
- **8 Organizations currently contributing (+WMO)**

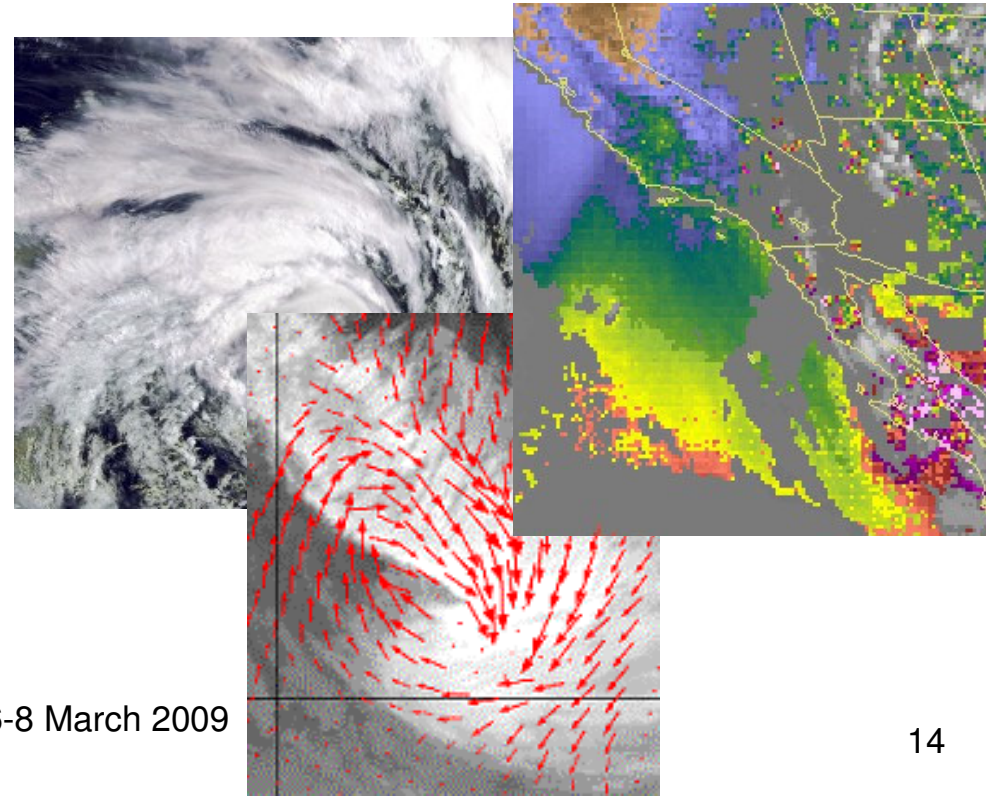
GEO versus Polar-orbiting



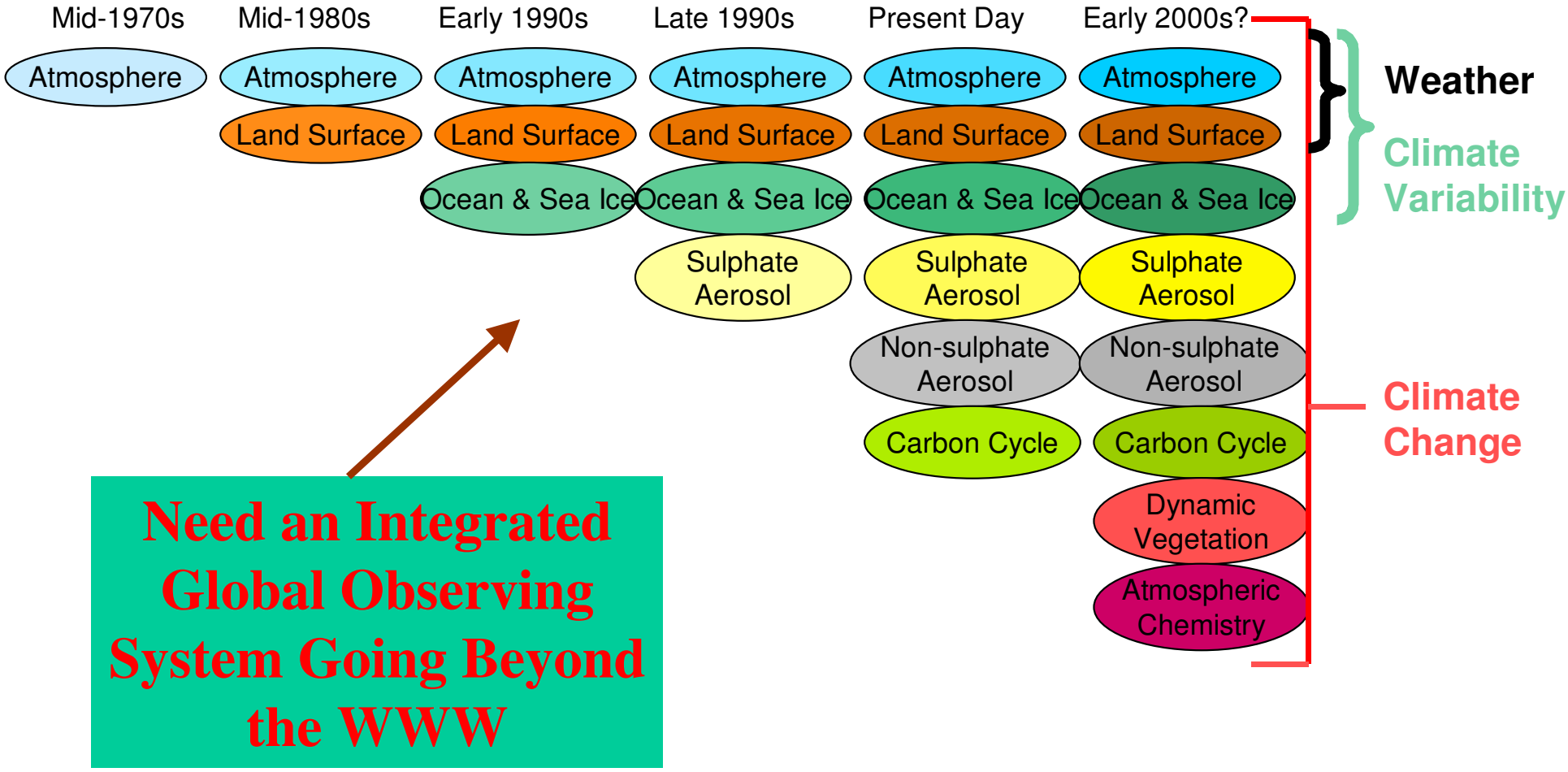
Specialized Centres for Operational Processing of Environmental Satellite Observation Data (SCOPE)



- For sustained generation of quality-controlled products
- Initial scope: Climate Monitoring (SCOPE-CM)



Overview of Weather and Climate Models and the Required Observations



Challenges for the GOS to 2025

- Core operational GEO missions
  - All with IR hyperspectral sounding, lightning detection
- Core operational LEO Imagery and IR-MW sounding
  - All with hyperspectral IR, on 3 sun-synchronous orbital planes

- Ocean surface topography
- Radio-Occultation Sounding
- Ocean Surface Wind
- Global Precipitation
- Earth Radiation Budget
- Atmospheric Composition
- Special imaging for ocean colour, vegetation
- Dual-angle view IR imagery

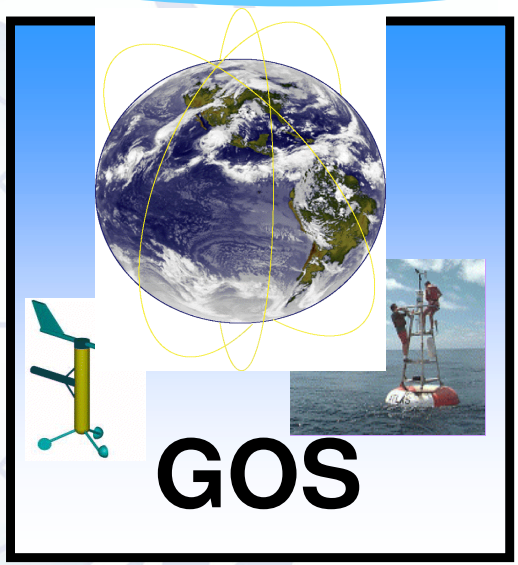
Observations performed so far on a R&D basis should be planned on an operational basis

- Land Surface Imaging
- Synthetic Aperture Radar
- Space Weather instruments

Integrating new missions

The GOS as a component of GEOSS

WMO: Focus on Weather-Water-Climate and applications



Other observing systems

systems

systems

GEO 9 SBAs

- Weather
- Climate
- Water
- Disasters
- Agriculture
- Health
- Energy
- Biodiversity
- Ecosystems

Ensuring timely access to satellite data and products

Access still limited for many WMO Members

Challenges of new satellite generation

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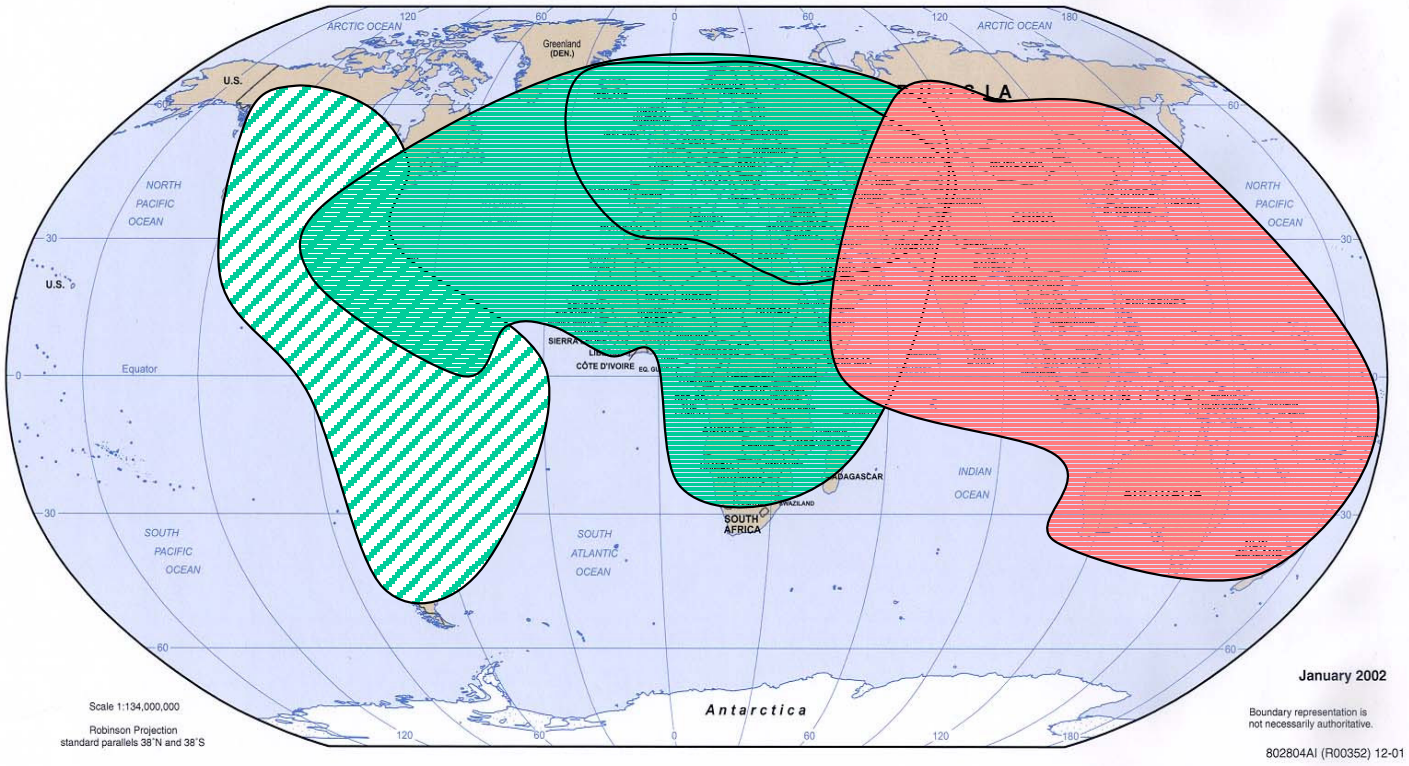
IGDDS/GEONETCast DVB-S status

- EUMETSAT, NOAA, CMA, ROSHYDROMET
- Data exchange among service providers
- Possibility to disseminate locally generated products
- Training channel of Geonetcast



User support activities

- Training / capacity building in least dev. countries
- User information
- Enquiry on the use of satellite by Members

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New 5-year Strategy of the Virtual Laboratory for Training in Satellite Meteorology

CONAE

NOAA

Colorado State University CIRA

UBA

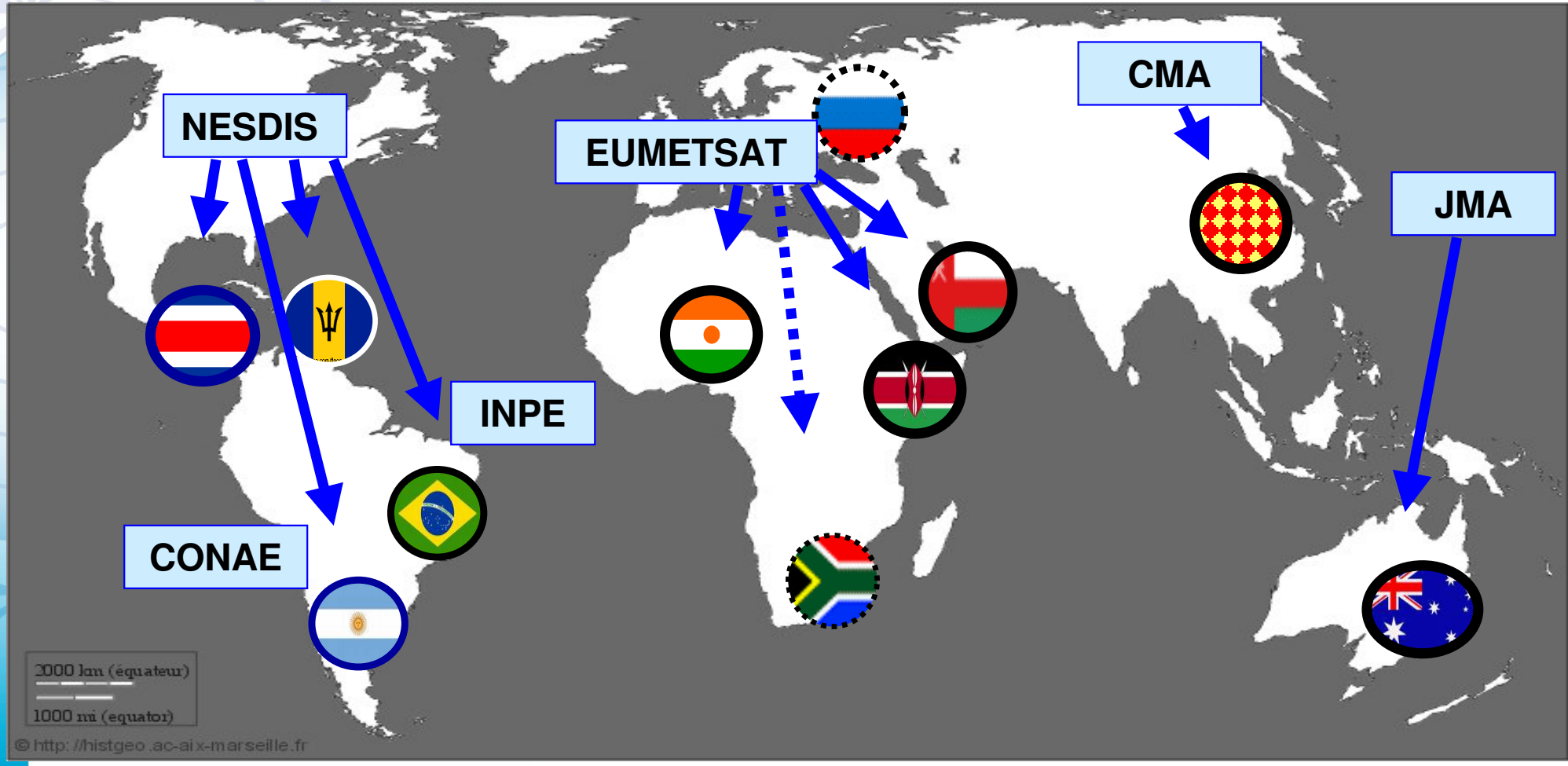
INPE

eumetsat

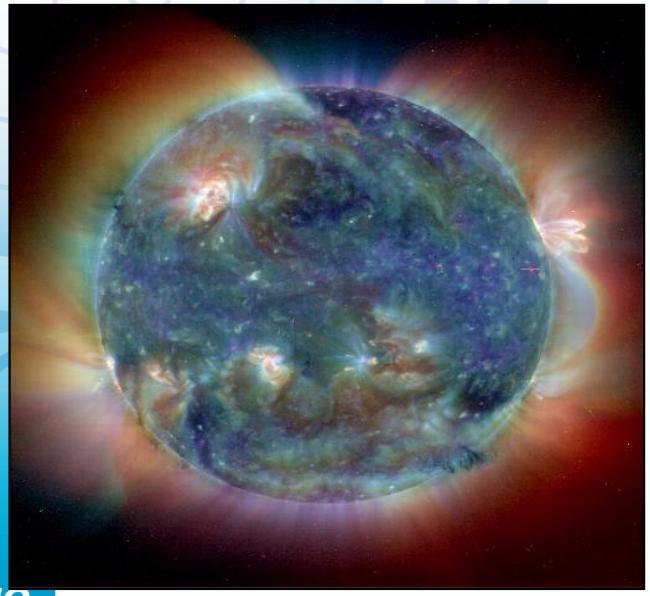
COMET®
Cooperative Program for Operational Meteorology, Educa

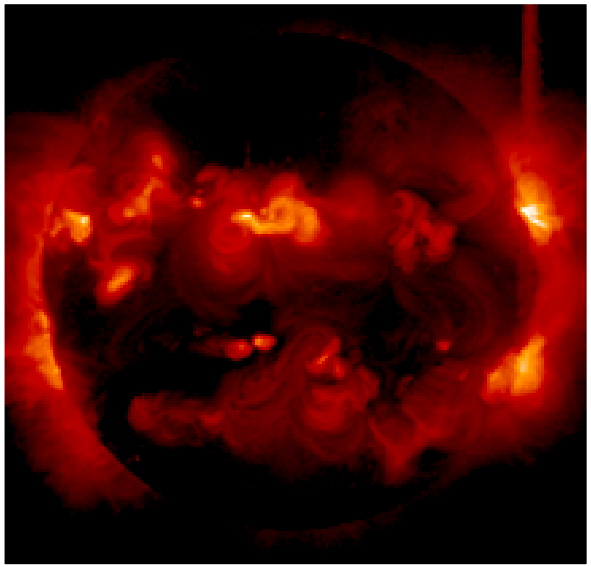
New Centres of Excellence for Training within the Virtual Laboratory

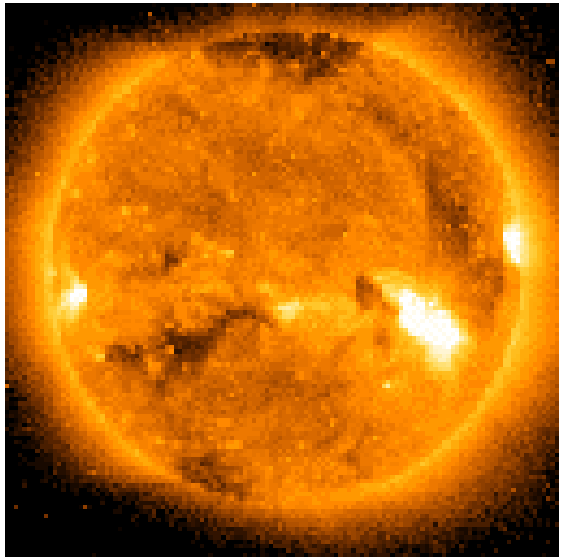
Sponsored by space agencies



Space Weather







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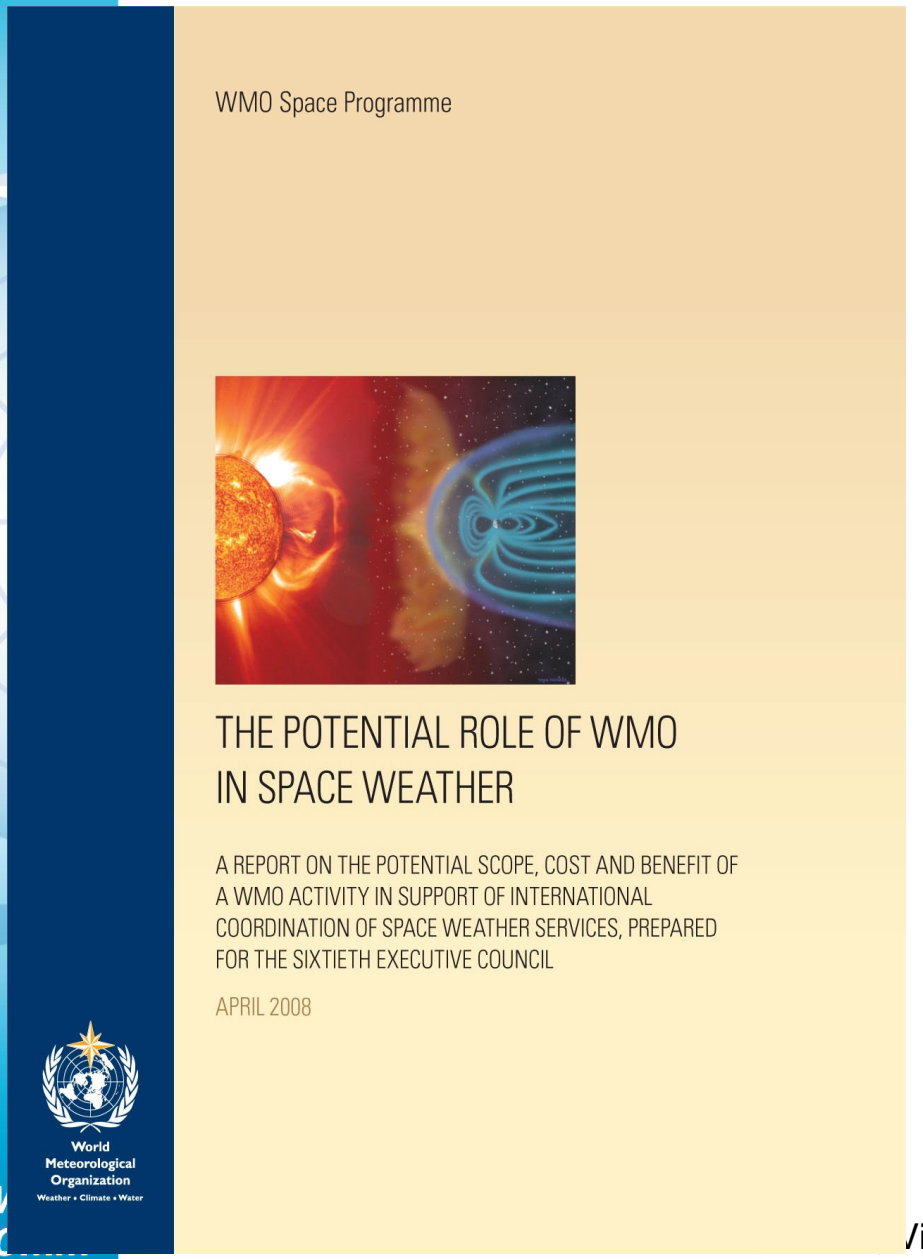
Report to the WMO Exec.Council

Potential role of WMO in Space Weather



- In response to WMO Congress and Consultative Meeting on space policy
- Drafted in cooperation with ISES (April 2008)
- Describes economic impact
- Potential scope, cost and benefit of WMO coordination
- Analysis suggests high benefit / cost

www.wmo.int/pages/prog/sat/Refdocuments.html#SpaceWeather

Relevance for WMO

Space Weather events….

- affect meteorological / environmental satellites
- are monitored by meteorological (and other) satellites
- affect meteorological communications
- affect some climate variables
- potential for synergy between Space Weather and meteorological warnings e.g. to aviation

✓ Work plans to be developed by Commission for Basic Systems (CBS) and Commission for Aeronautical Meteorology (CAeM)

✓ Cooperation with ISES, UN-COPUOS, ICAO, ITU, IMO

Thank you for your attention