Meteosat Third Generation (MTG)
UVS Mission

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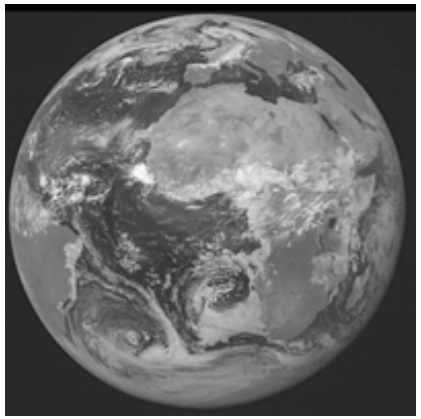
and
Jean-Loup Bézy, Donny Aminou, Paolo Bensi
ESA, Earth Observation Future Programmes Department

Community workshop on air quality remote sensing from space:
Defining an optimum observing strategy
February 21-23, 2006 Boulder, Colorado, USA.

Contact: stephen.tjemkes@eumetsat.int

Met-1: 9-12-77



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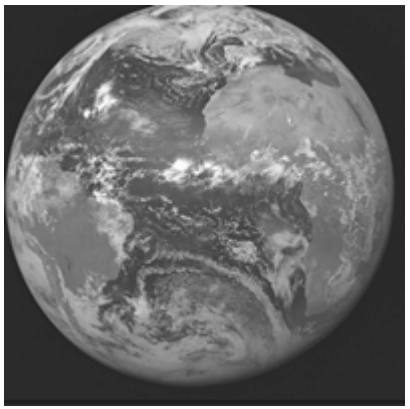
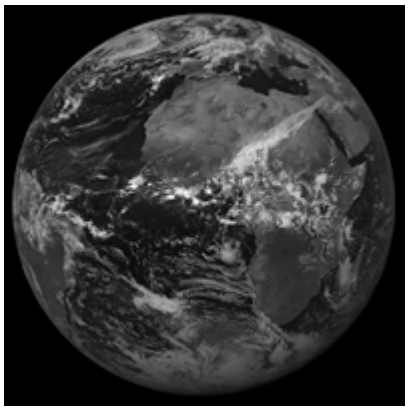


Met-3: 29-06-88



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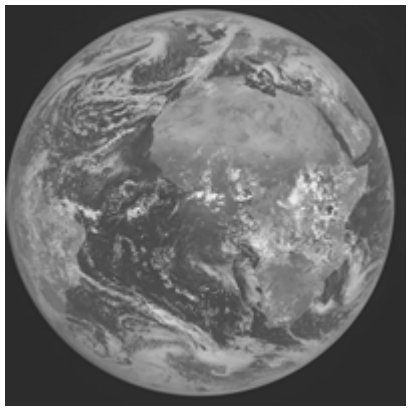

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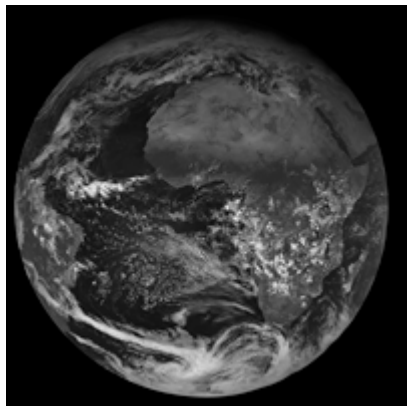
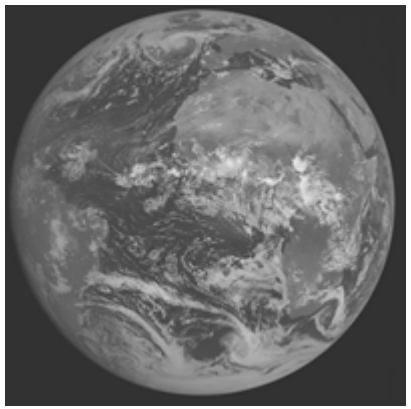


Met-6: 6-12-93

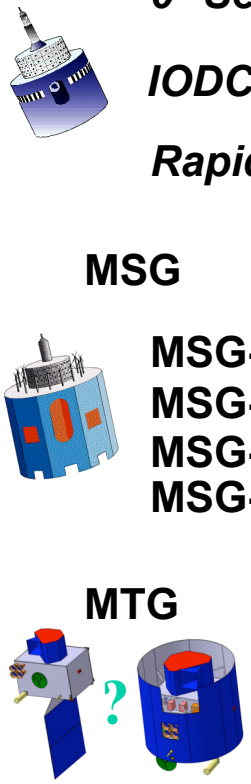


Met-7: 18-09-97

MSG-2: 24-01-06

29 years of Meteosat
Gallery of first images

Overview of EUMETSAT Geostationary Programmes



MTG Observational Missions

Among the five identified candidate observation missions to meet consolidated user requirements for operational products/services which depend on near real time geostationary satellite observations in 2015-2025:

An UV/Visible sounding (UVS) mission dedicated to atmospheric chemistry

Primary data products for operational AQ and AC applications

Data product	Horizontal resolution (km)	Vertical resolution (km)	Temporal Resolution (hr)	Accuracy	Coverage
O_3	20 (2)	BL+FT (2)	$1^{d(n)}$ (0.5)	20% (5%)	hemispheric
CO	10 (2)	T (2)	$2^{d(n)}$ (0.5)	10% (5%)	hemispheric
SO_2	10 (2)	T (2)	$1^{d(n)}$ (0.5)	50% (20%)	regional
HCHO	10 (2)	T (2)	$1^{d(n)}$ (0.5)	50% (10%)	regional
NO_2	10 (2)	T (2)	$1^{d(n)}$ (0.5)	50% (10%)	hemispheric
PAN	10 (2)	T (2)	$1^{d(n)}$ (0.5)	50% (10%)	hemispheric
AOT_f	5 (0.5)	T (BL+FT)	$1^{d(n)}$ (0.25)	0.05 (0.01)	regional/hemisph
AOT_c	5 (0.5)	T (BL+FT)	$1^{d(n)}$ (0.25)	0.05 (0.01)	regional/hemisph
Aer R_{eff}	5 (0.5)	T	$1^{d(n)}$ (0.25)	30% (10%)	regional/hemisph
SSA	5 (0.5)	T	$1^{d(n)}$ (0.25)	0.03 (0.01)	regional/hemisph

General Remarks

UV/Visible sounding mission is directly dedicated to atmospheric chemistry and air quality applications

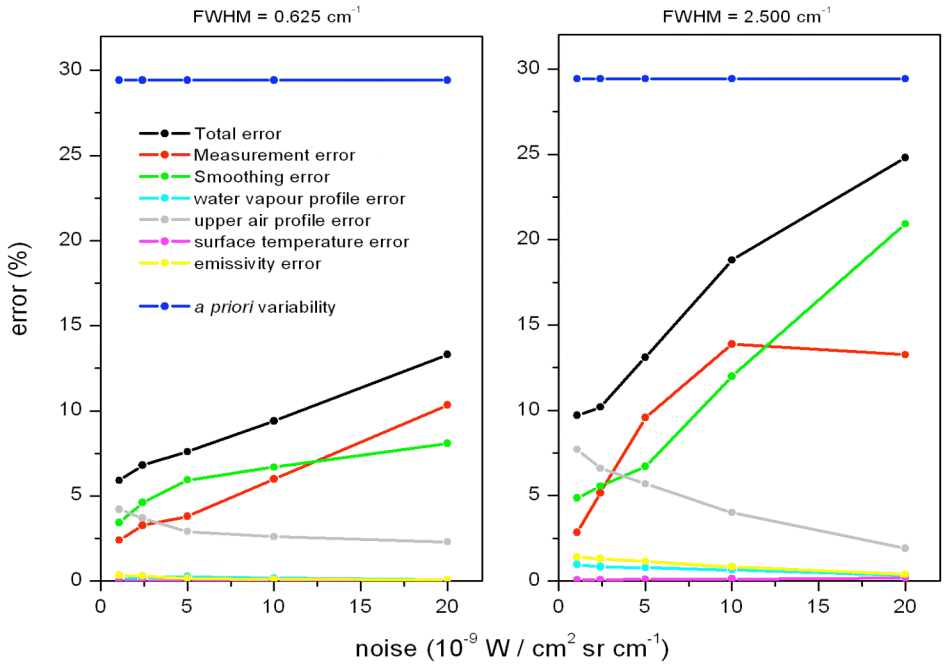
IRS sounding mission has potentials to meet selected user AQ/AC requirements (=> Poster by S. Turquety)

Capabilities of an infrared sounder (IRS) for ozone and CO monitoring

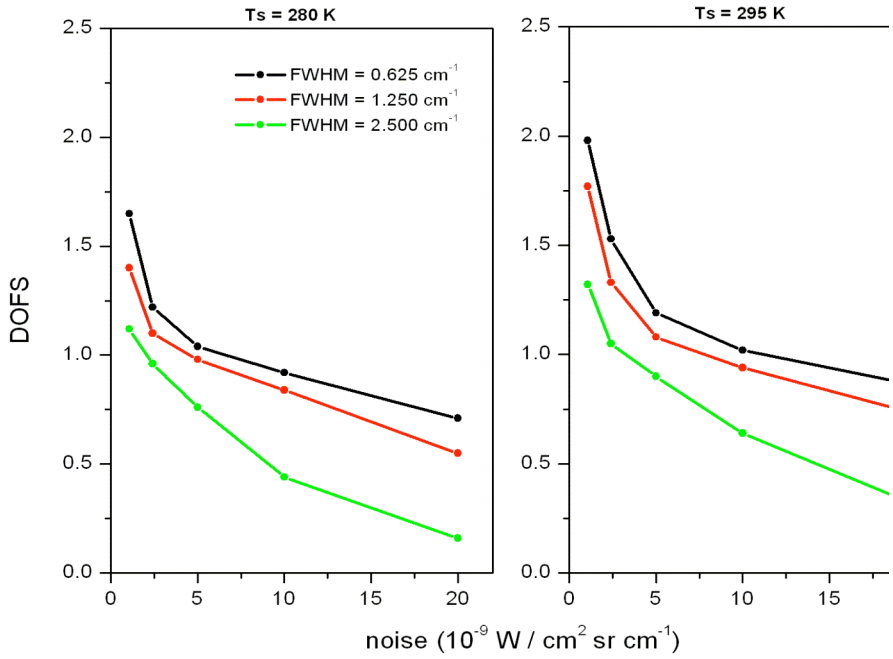
An analysis of the performance to be expected for CO and O3 retrieval with the following instrumental specifications:

- Spectral range: 660-2500 cm-1
- Spectral resolution: studies undertaken for resolutions from 0.625 cm-1 to 2.5 cm-1
- Radiometric noise: 0.1 K to 0.5 K @ 280 K

Impact of instrumental characteristics on CO accuracy



Impact of instrumental characteristics on CO DOF



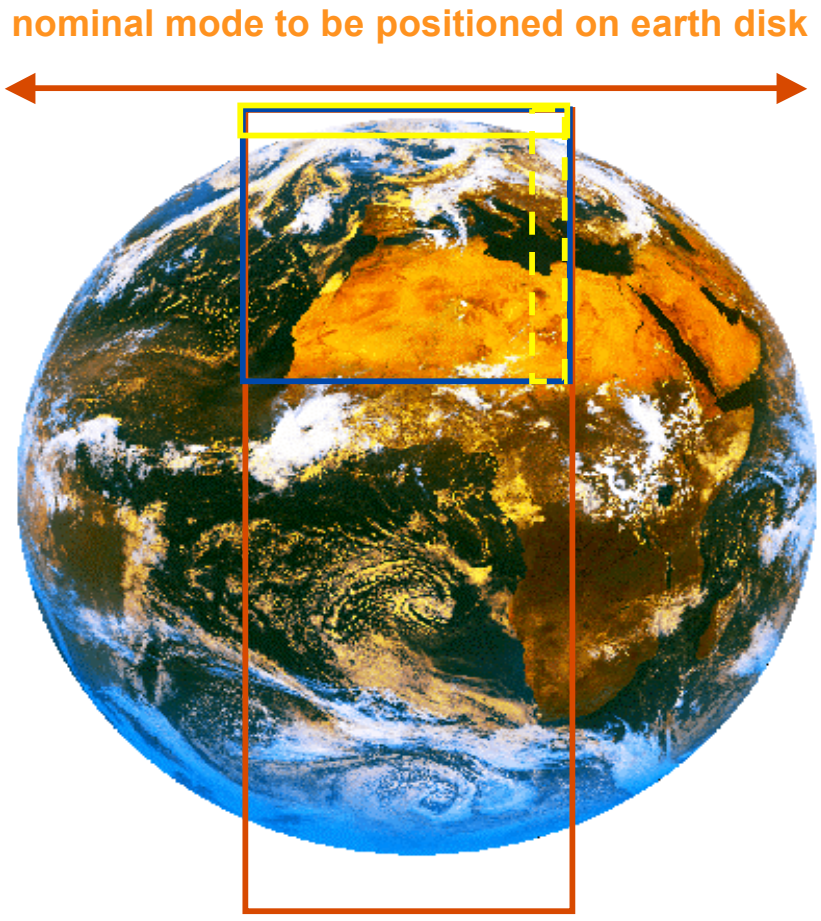
See poster Ozone and CO observation from future Eumetsat missions: IASI-METOP and IRS-MTG, Turquety et al.

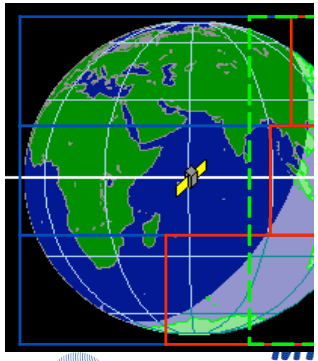
Key instrument requirements UVS Mission

Band	Spectral Domain[nm]	SNR	Resolution [nm]	sampling	Application
UVS-1A	290 – 295	150	0.4	6	O3
UVS-1B	295 – 302	150	0.4	6	
UVS-1C	302 – 310	150	0.4	6	
UVS-2	310 – 325	1200	0.4	6	SO2, O3
UVS-3	325 – 335	1500	0.4	6	O3
UVS-4	335 – 360	2000	0.4	6	HCHO
UVS-5	420 – 450	2500	0.4	6	NO2
UVS-6A	752.5 – 757.5	1000	5.0	3	Cloud and Aerosol
UVS-6B	762.0 – 770.0	2500	0.06	3	
UVS-6C	772.5 – 777.5	1000	5.0	3	

Coverage: 18° NS x 6° EW
Spatial resolution: 6 km at SSP (around 10 km over Europe)
Repeat Cycle: 30 min.

Preliminary Outcome
Possible Instrument Concept B



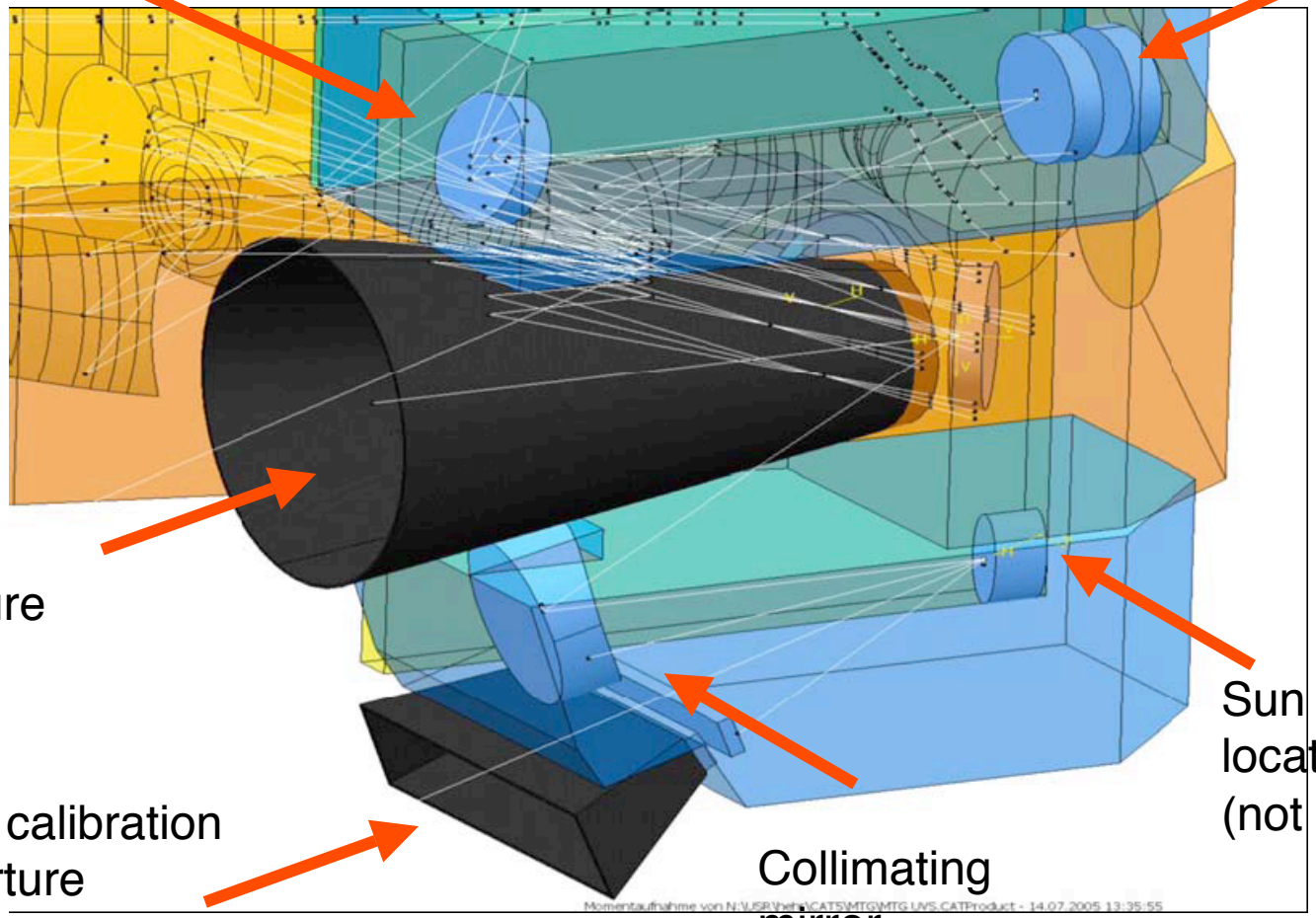


nominal mode special mode instrument field of view

Preliminary Outcome
Possible Instrument Concept B

Band	Central Wavelength [nm]	SNR Requirement	SNR Achieved	Compliance
UVS-1A	292.5	150	83	NC
UVS-1B	298.5	150	113	NC
UVS-1C	306.0	150	312	C
UVS-2	317.0	1200	1217	C
UVS-3	333.0	1500	1952	C
UVS-4	347.0	2000	2158	C
UVS-5	444.0	2500	2915	C
UVS-6A	755.0	1000	5000	C
UVS-6B	766.0	2500	1045	NC
UVS-6C	775.0	1000	5000	C

Preliminary outcome
A possible Concept B



Fold Mirror

Ratio-ing Radiometer

Nadir aperture

Sun diffuser and location of lamps (not shown)

Sun calibration aperture

Collimating mirror

Key parameters industrial analysis

Parameter	Concept A	Concept B
Spatial Resolution	6 km	6 km
Aperture (mm)	50 x 157	102 x 153
Detector Array	UV enhanced CCD	CCD or APS
Mass (kg)	95 - 114	139
Volume (m3)	1.03 x 0.88 x 0.94	1.1 x 1.0 x 0.25
Power (W)	88 - 105.6	84
Data Rate (Mbps)	11.7	21.2
Note:	No UVS - 6	

Close out of Pre-Phase A: UVS 1A-B

- Problem: SNR requirements difficult to meet (pre-phase A)
- Background: Core product is tropospheric ozone, which can be retrieved from Huggings band observations
- These needs to be corrected of stratospheric ozone, which can be monitored using observations in Hartley band (UVS 1)

Are these observations the sole source of this information or can we use alternatives such that we can descope (or delete) UVS 1A/B?

Synergy with MTG - IRS

Data from e.g. NWP

....

Close out of Pre-Phase A: Oxygen A band

- Problem: Combination of high SNR (2500) and high spectral resolution (1 cm-1 , 0.06 nm) difficult to meet (pre-phase A)
- Observations can be used to retrieve height information of aerosol properties (Siddans et al. 2006)

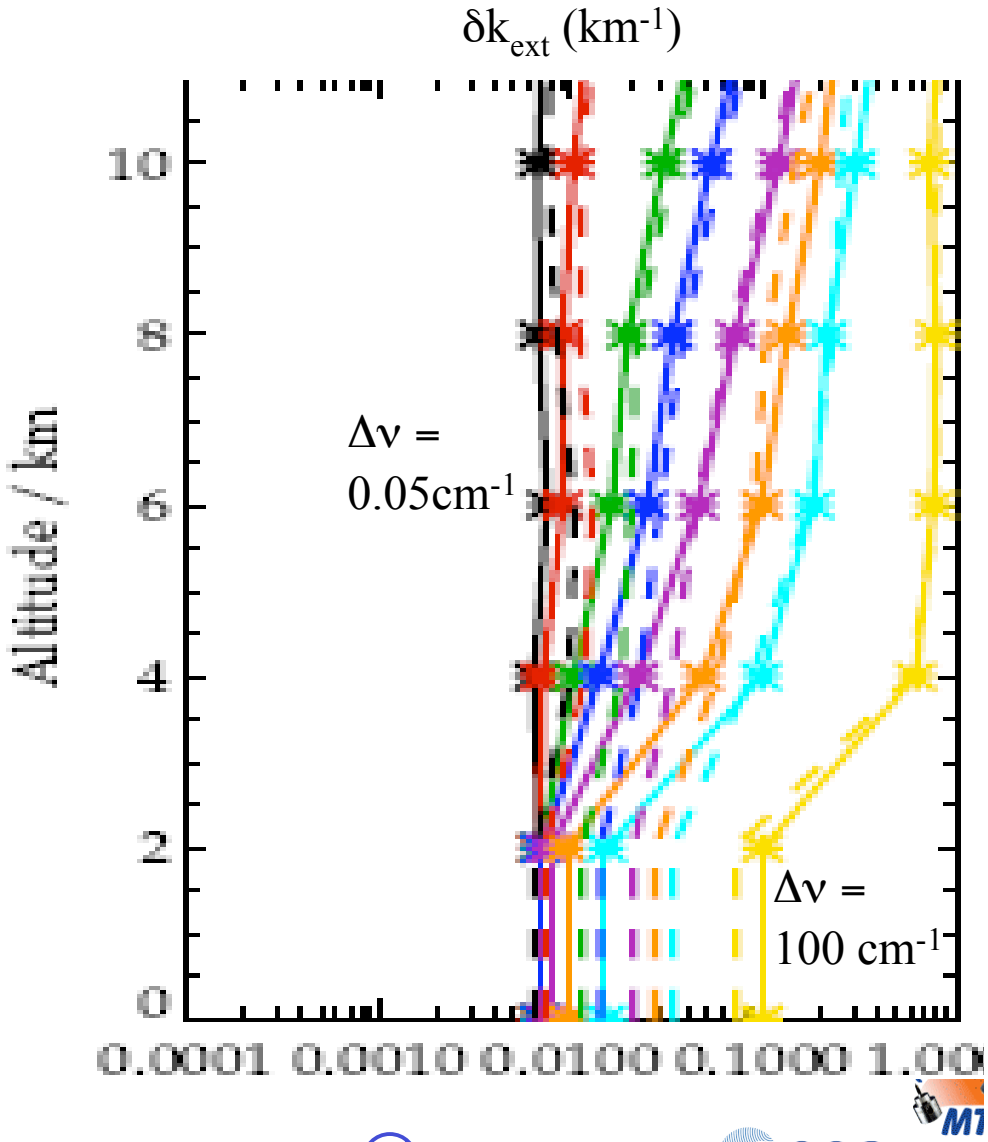
Tropospheric Aerosol Profile Retrieval : Simulation for O_2 A-band (764nm)

Resolution:

0.05 cm^{-1} 0.1 cm^{-1} 0.5 cm^{-1} 1 cm^{-1}
2.5 cm^{-1} 5 cm^{-1} 10 cm^{-1} 100 cm^{-1}

A priori error = 1.0 km^{-1}

Full lines= 0.05 albedo
Dashed = 0.8 albedo



CCLRC Rutherford Appleton Laboratory

EUMETSAT esa

Close out of Pre-Phase A: Oxygen A band

- Critical point are the robustness of the user requirements for this.
  - MTG tables (Lelieveld, 2003)
  - IGACO tables (2004)
  - Capacity tables (2004)

Aerosol information for operational AQ applications

- Operational AQ/AC applications are emerging
- Hence user requirements for space borne observations are developing.

Close out of Pre-Phase A: Oxygen A band

- How do operational AQ/AC application benefit from near real time observations of aerosol extinction information at
  - full disc, high temporal (30 min),
  - course spatial (10x10 km), and
  - course vertical resolution (2km)
- Did we properly capture the requirements?
  - Relax spatial/temporal resolution over ocean?
  - Increased spatial/temporal resolution over land?

Aerosol information for operational AQ applications

- Hope to get feedback from
  - Experiments/Pilot Projects like IDEA, PROMOTE
  - This meeting
  - New OSSE study (P. Builtjes) where 3 D aerosol information will be assimilated in a forecast model to test sensitivity of AQ forecast to aerosol input data

Summary

- Analysis by industry of UVS-instrument requirement showed no blocking issues
- The instrument concepts appears to be affordable
- EUMETSAT Users might be willing to reconsider the priority ranking of the MTG-missions

Spare Slides I

References available from www.eumetsat.int

Geostationary satellite observations for monitoring atmospheric composition and chemistry application	J. Lelieveld	2003
Feasibility of trace gas measurements from geostationary orbit using VIS/UV radiances	D.M. O'Brien and A. Picket Heaps	2003
Capabilities of a UV-Vis instrument in geostationary orbit to meet user requirements for atmospheric composition and operational chemistry applications	H. Bovensmann, K.U Eichmann, S. Noel, V. Rozanov, M. Vountas and J. Burrows	2003
Capabilities of Infrared Sounding for Monitoring for Atmospheric Composition and Chemistry Applications	C. Clerbaux, P.-F. Coheur, S. Turquety and J. Hadji-Lazaro	2003
Review of MTG-UVS mission requirements for atmospheric composition and operational chemistry applications	R. Siddans and B.J. Kerridge	2004
CO measurements from MTG IRS and UVS missions	P.-F. Coheur, B. Barret, C. Clerbaux, J. Hadji-Lazaro, M. Kruglanski, A.C. Vandaele and D. O'Brien	2005
Feasibility of measuring tropospheric CO from geostationary orbit using high resolution SWIR radiances	D.M. O'Brien	2005

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January 25, 2006

European Commission and EUMETSAT forge stronger ties on Environment

Today EUMETSAT and the European Commission have agreed on their cooperative roles and responsibilities in relation to Earth Observation and the Global Monitoring for Environment and Security (GMES).

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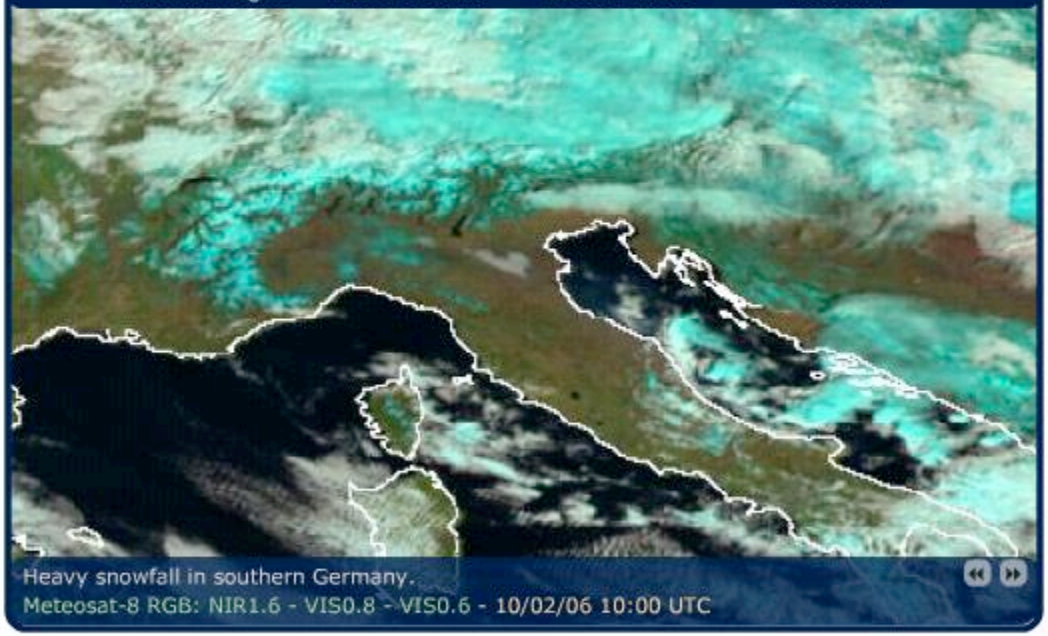

Heavy snowfall in southern Germany.
Meteosat-8 RGB: NIR1.6 - VIS0.8 - VIS0.6 - 10/02/06 10:00 UTC

SERVICE STATUS INDICATOR

Legend | Detached

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Met-5	63°E	(IODC)
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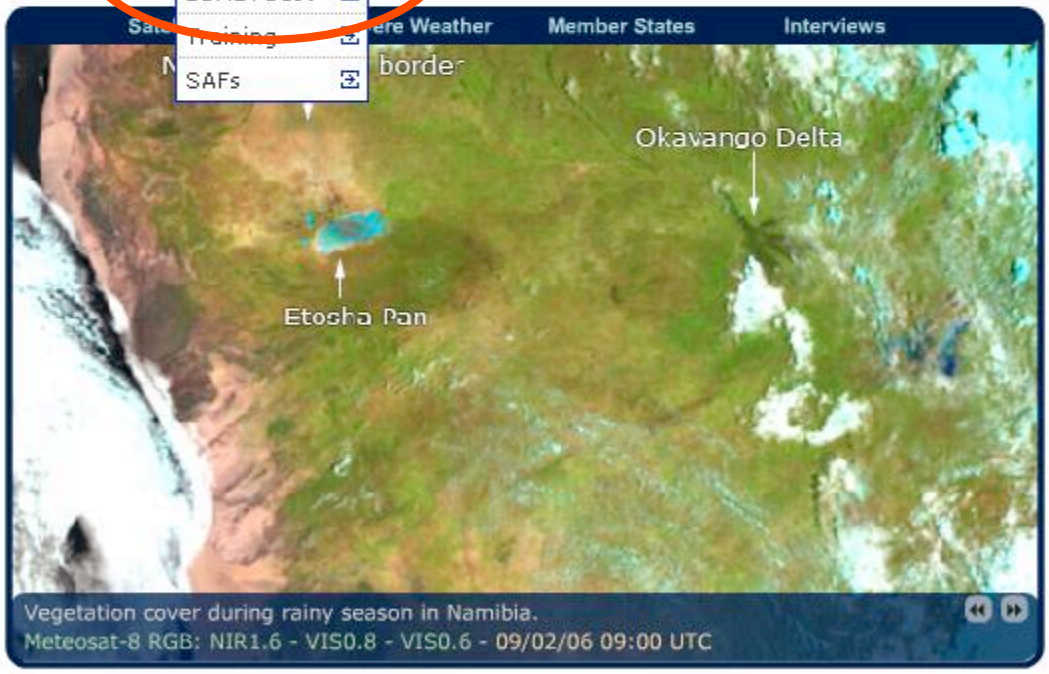

Vegetation cover during rainy season in Namibia.
Meteosat-8 RGB: NIR1.6 - VIS0.8 - VIS0.6 - 09/02/06 09:00 UTC

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First GERB image from MSG-2.
GERB shortwave (left) and total (right) - 31/01/06 14:30 UTC

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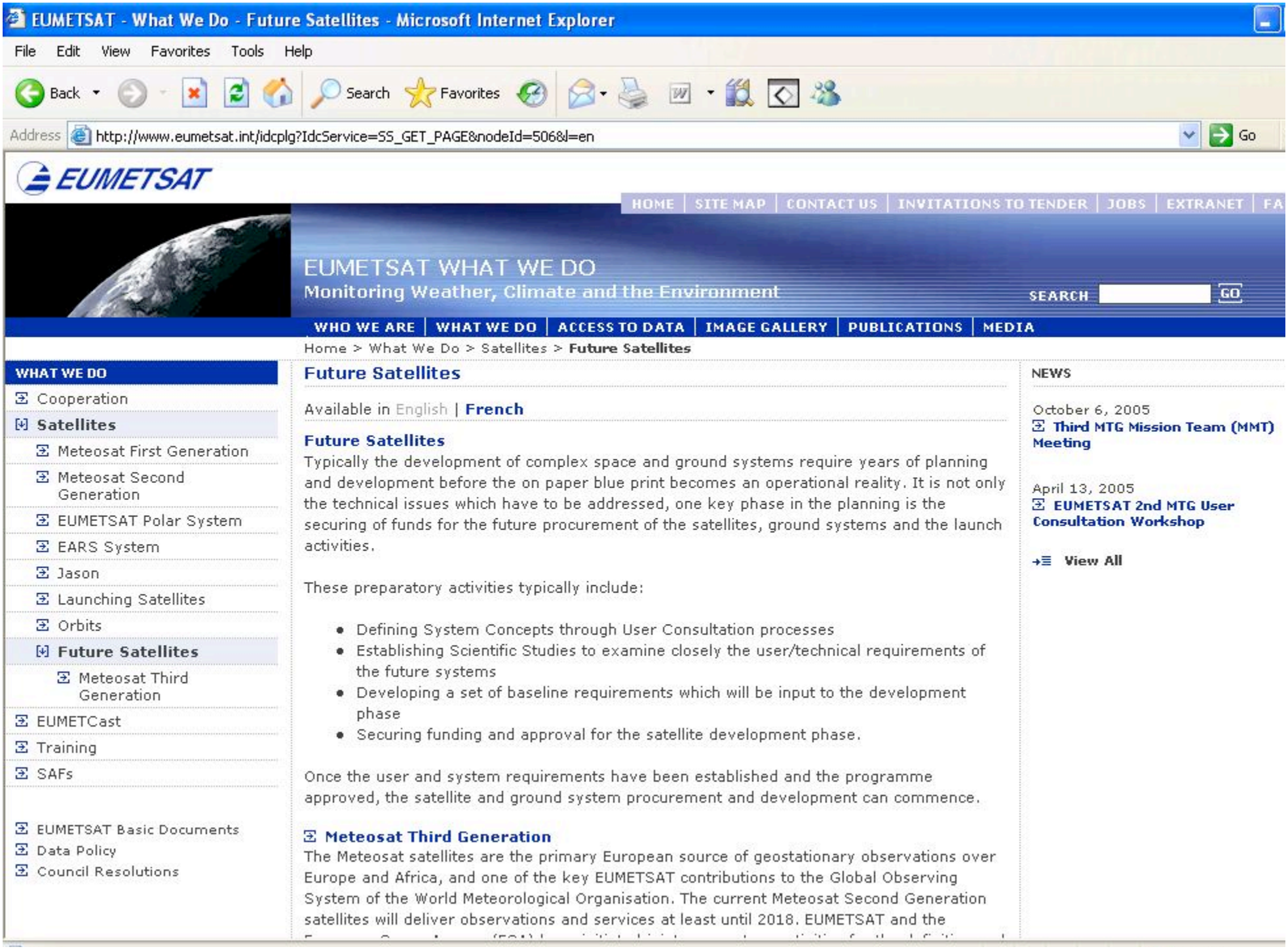
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Future Satellites
Typically the development of complex space and ground systems require years of planning and development before the on paper blue print becomes an operational reality. It is not only the technical issues which have to be addressed, one key phase in the planning is the securing of funds for the future procurement of the satellites, ground systems and the launch activities.
These preparatory activities typically include:
Defining System Concepts through User Consultation processes
Establishing Scientific Studies to examine closely the user/technical requirements of the future systems
Developing a set of baseline requirements which will be input to the development phase
Securing funding and approval for the satellite development phase.
Once the user and system requirements have been established and the programme approved, the satellite and ground system procurement and development can commence.
Meteosat Third Generation
The Meteosat satellites are the primary European source of geostationary observations over Europe and Africa, and one of the key EUMETSAT contributions to the Global Observing System of the World Meteorological Organisation. The current Meteosat Second Generation satellites will deliver observations and services at least until 2018. EUMETSAT and the
NEWS
October 6, 2005
Third MTG Mission Team (MMT) Meeting
April 13, 2005
EUMETSAT 2nd MTG User Consultation Workshop
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Thank you

- Further information
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  - www.eumetsat.int