EUMETSAT Polar System – Second Generation

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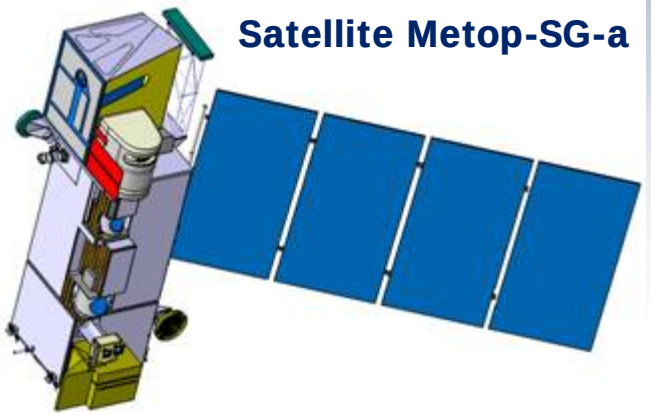
EUMETSAT

EPS-SG in-orbit configuration

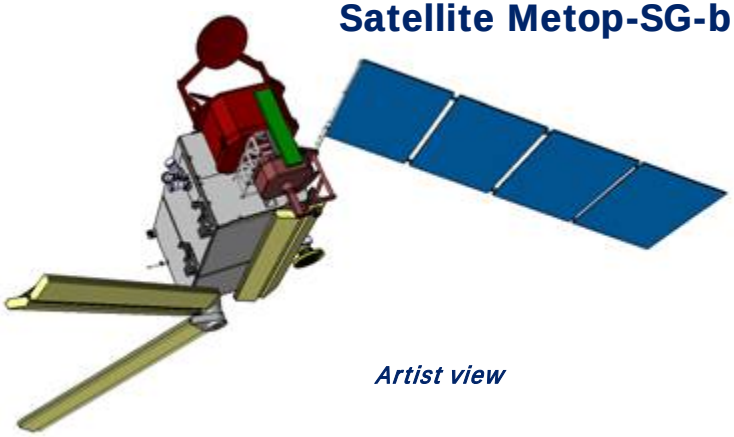
Satellite Metop-SG-a



Artist view

Satellite-a Payload	METimage IASI-NG MWS 3MI Sentinel-5 RO
Dry mass	~ 2500 kg
Launch mass	~ 2900 kg
Power	~ 2.2 kW
P/L data rate	~ 60 Mb/s

Satellite Metop-SG-b



Artist view

Satellite-b Payload	SCA MWI ARGOS-4 RO
Dry mass	~ 2000 kg
Launch mass	~ 2300 kg
Power	~ 1.6 kW
P/L data rate	~ 1.2 Mb/s

EPS-SG space segment
Two-Satellite Configuration

Overall lifetime
21 years

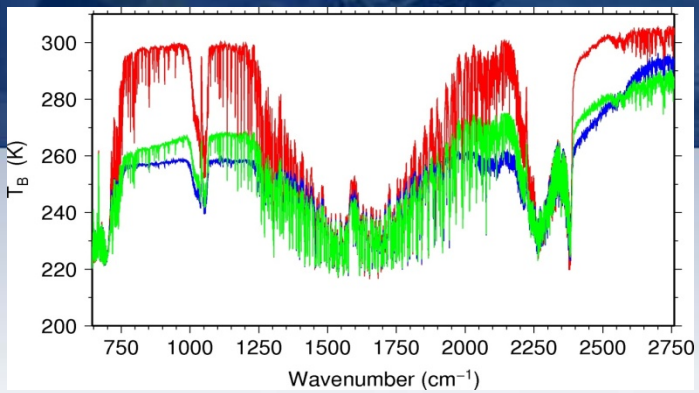
Earliest launch date (first satellite)
end 2020

Orbit
Metop orbit @ 09:30 LTDN

Phasing of Sat-a and Sat-b
180°

EUMETSAT

IASI-NG
High-Resolution Infrared Sounding



Objectives

- Temperature/humidity profile at high vertical resolution
- Clouds, trace gases (O_3, CO, CH_4, CO_2,...)
- Sea/land/ice surface temperature
- Aerosols, Volcanic Ash

Heritage

IASI, AIRS

Baseline performance

as IASI

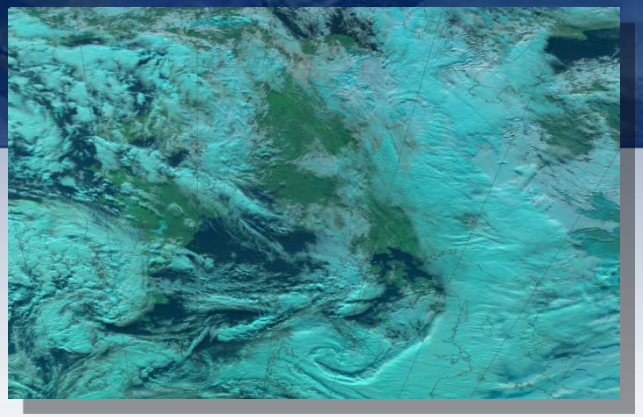
Implementation

Phase-A studies of IASI-NG by CNES

Breakthrough

- **Doubling of radiometric resolution of IASI for the benefit of weather forecast**
  - 75% more information in temperature profiling, particularly PBL
  - 30 % more information in water vapour profiling
- **Doubling of spectral resolution of IASI for the benefit of atmospheric chemistry**
  - Quantification of trace gases which are currently only detected
  - Vertical resolution of trace gases instead of columnar amounts only

METimage
VIS/IR Imaging



Objectives

- Hi-res cloud products, incl. microphysics
- Aerosols
- Polar AMVs
- Vegetation, snow, fire
- Sea/ice/land surface temperature
- Support to sounding missions

Heritage

AVHRR, MODIS

Baseline performance

VIIRS, MODIS

Consistency with VIIRS for common channels

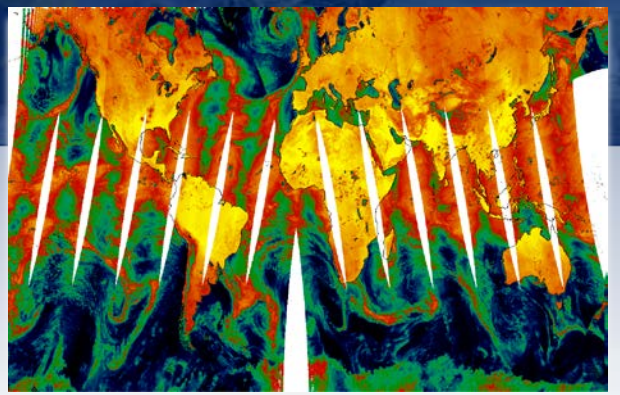
Implementation

development of *METimage* by DLR

Breakthrough

- **Far more spectral channels (≥ 20) than AVHRR for the benefit of measuring more variables**
- **Higher spatial resolution (250 - 500 m):**
  - more complete coverage through greater likelihood to measure surface variables in partly cloud conditions
- **Better radiometric resolution for more accurate quantification of many variables**

MWS
Microwave Sounding



Objectives

- Temperature/humidity profiles in clear and cloudy air
- Cloud liquid water total column
- Imagery: precipitation

Heritage

AMSU-A, MHS

Baseline performance

- as AMSU/A, MHS

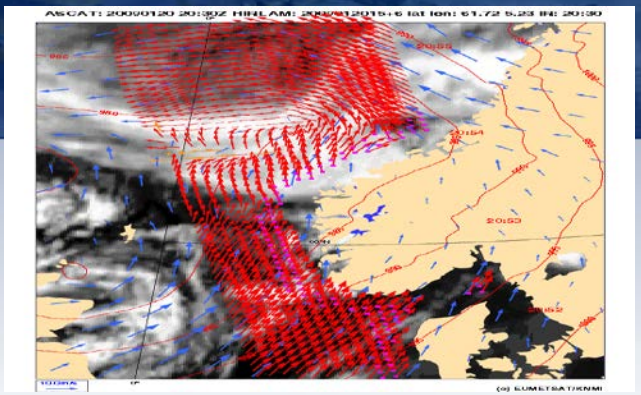
Implementation

- Development by ESA

Breakthrough

- **Addition of a quasi-window channel at 229 GHz (recommended by ITSC-11)**
  - Cirrus cloud information
- **Addition of sounding channels**
  - **+ 2 channels at 53-54 GHz**
  - **+ 3 channels at 183.31 GHz**
  - More information on temperature and water vapour profiles

SCA
Scatterometry



Objectives

- Ocean surface wind vectors
- soil moisture
- snow equivalent water
- sea-ice type

Heritage

ASCAT

Baseline performance

as ASCAT

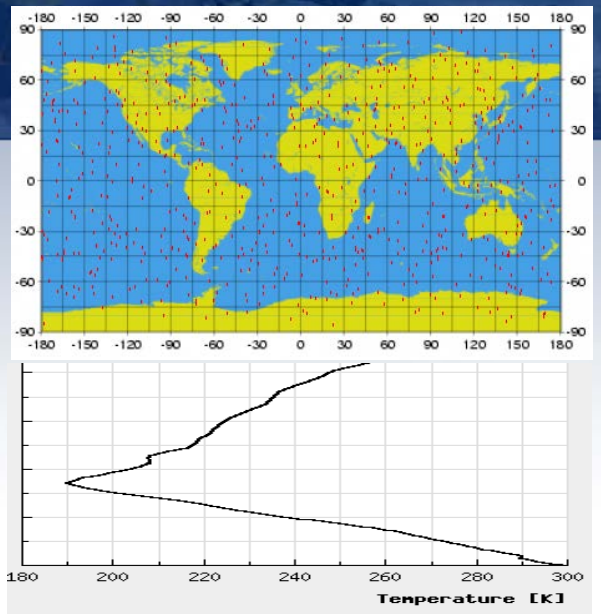
Implementation

ESA development

Breakthrough

- **Increase of spatial resolution to 25 km**
  - Better approach of coast lines
- **Increase of swath width to >1100 km**
  - Enhanced coverage
- **Addition of VH polarisation**
  - Covers higher wind speeds without saturation, will benefit observation of tropical and extra-tropical storms

RO
Radio Occultation Sounding



Objectives

- Refractivity profiles at high vert. resolution
- Temperature / humidity profiles
- PBL top and tropopause height
- Ionospheric electron content

Heritage

GRAS, COSMIC

Baseline performance

- as GRAS (instrument)

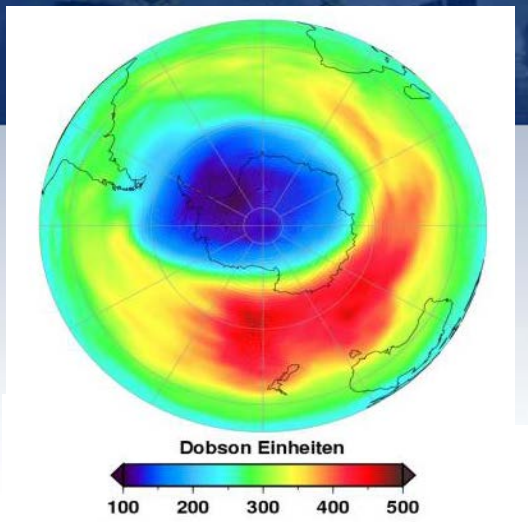
Implementation

- Development by ESA

Breakthrough

- **Tracking of GPS and Galileo satellites to double the number of occultation measurements**
- **Equipment of both Metop-SG satellites with RO in case of a dual satellite configuration**

Sentinel 5
Nadir Viewing UV/VIS/NIR/SWIR Sounding



Objectives

- Ozone profile and column
- Columns of CO_2,SO_2, NO_2, H_2O, CO, CH_4
- Aerosol optical depth
- Columns of BrO, HCHO, OCHCHO
- Volcanic Plumes

Heritage

GOME-2, SCIAMACHY, OMI

Implementation

GMES Sentinel-5 to be embarked on Metop-SG, ESA development synchronised with EPS-SG

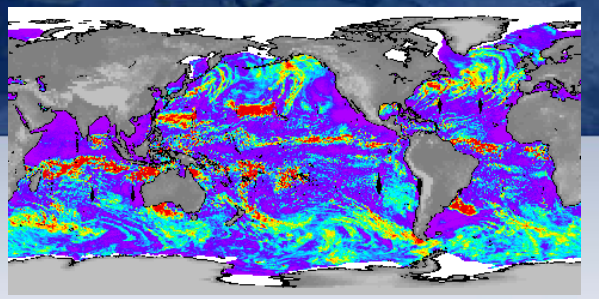
Breakthrough

- **Drastically increased spatial resolution (7 km)**
  - for the benefit of air quality monitoring
- **Extended spectral range into the near and shortwave infrared regions**
  - to measure aerosols as well as methane and carbon monoxide in the PBL

MWI
Microwave Imaging

Objectives of a new mission

- Precipitation and cloud products
- Water vapour profiles and imagery
- Sea-ice, snow, sea surface wind



RSS (2011)

Cloud Liquid Column

mm

Heritage

SSM/I(S), AMSR-E

Baseline performance

4 spectral channels as SSM/I (18.7 – 89 GHz)

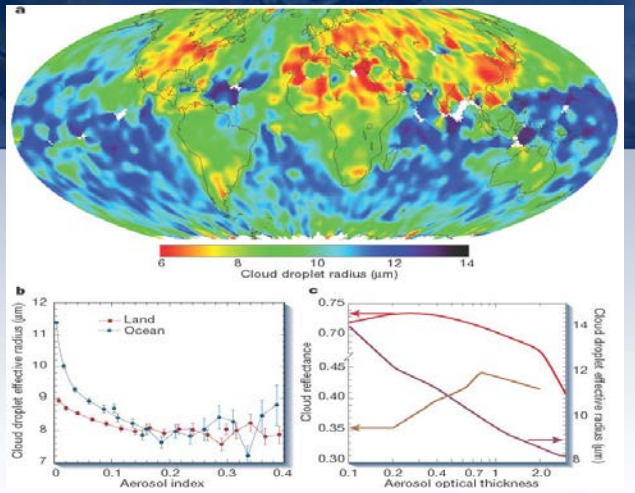
Implementation

Development by ESA

Breakthrough: 19 channels

- **Continuity of key microwave imager channels for weather forecast**
- **Inclusion of dedicated sounding channels**
  - Enhanced precipitation measurements through inclusion of dedicated sounding channels
- **Extension towards 183 GHz**
  - water-vapour and cloud profiling

3MI: Multi-Viewing Multi-Channel Multi-Polarisation Imaging



Kaufman et al. (2002)

Objectives of a new mission

- Aerosol – optical thickness, particle size, type, height, absorption
- Volcanic Ash
- Cloud phase, height, optical depth
- Surface albedo

Heritage

POLDER
PARASOL

Baseline performance

as POLDER

Implementation

Development by ESA

Breakthrough:

- **Enhanced spatial resolution (4 km)**
  - Improves separation of cloudy areas
- **9-10 spectral channels, extending into the SWIR**
  - Better aerosol characterisation
- **Higher angular resolution (14 views)**
  - Better phase function characterisation

Next Steps

- Completion of Preliminary Requirements Reviews (End of Phase A)
  - Done at system level
  - Space and Ground segments to follow
- Start of Phase B in Summer 2012
- Decision about ESA Metop-SG programme in Autumn 2012
- Decision about EUMETSAT EPS-SG programme in 2014