Update on EUMETSAT satellite programmes

Presented to CGMS-42 plenary session, agenda item D.1
Overview - Planning of EUMETSAT satellite systems

**Mandatory Programmes**
- **Meteosat First Generation**
  - Meteosat-7
- **Meteosat Second Generation**
  - Meteosat-8
  - Meteosat-9
  - MSG-3/Meteosat-10
  - MSG-4/Meteosat-11*
- **Meteosat Third Generation**
  - MTG-I-1: Imagery
  - MTG-S-1: Sounding
  - MTG-I-2: Imagery
  - MTG-I-3: Imagery
  - MTG-S-2: Sounding
  - MTG-I-4: Imagery
- **Eumetsat Polar System (EPS)**
  - Metop-A
  - Metop-B
  - Metop-C
- **EPS-Second Generation (EPS-SG)**
  - Metop-SG: Sounding and Imagery
  - Metop-SG: Microwave Imagery

**Optional Programmes**
- **Jason**
  - Jason-2
  - Jason-3
- **Sentinel-6 (Jason-CS)**
CURRENT SATELLITES IN ORBIT

**METOP-A/B (98.7° incl.)**
- EUMETSAT POLAR SYSTEM/Initial Joint Polar System
- Mid-morning, sun synchronous orbit at 817km altitude

**METEOSAT-7 (57.5° EAST)**
- 1st generation
- INDIAN OCEAN DATA COVERAGE (IODC) (until end 2016)

**METEOSAT-9 (9.5° EAST)**
- 2nd generation
- RAPID SCAN SERVICE
- Prime Meteosat full disc imagery service over the European continent, Africa and parts of the Atlantic and Indian oceans every 15 minutes

**METEOSAT-8 (3.5° EAST)**
- 2nd generation
- BACKUP SERVICE
- Rapid scan service over Europe every 5 minutes

**METEOSAT-10 (0° LONGITUDE)**
- 2nd generation
- METEOSAT FULL DISC IMAGERY

**JASON-2 (63° incl.)**
- OCEAN SURFACE TOPOGRAPHY
- Non-synchronous low Earth orbit at 1,336km altitude
- Partnership with NASA/NOAA/CNES
CURRENT LEO SATELLITES – DUAL METOP OPERATIONS

Benefits of dual Metop operations : NWP

Northern Hemisphere
(increase of skill relative to NO-METOP baseline)

Southern Hemisphere
(increase of skill relative to NO-METOP baseline)

Z500 error reduction (m)

day-1  day-3  day-5

day-1  day-3  day-5
CURRENT LEO SATELLITES – DUAL METOP OPERATIONS

Dual Metop winds: Global coverage and quality improvement

Global winds

Improved polar winds
South Pole (QI>80)
NEAR FUTURE - GEO AND LEO SATELLITES

- **MSG-4** launch autumn 2015 (for in orbit storage)

- **Jason-3** launch (with NOAA, CNES, NASA) in March 2015

- **EUMETSAT** will operate **Copernicus Sentinel-3** (Marine Mission) after commissioning by ESA, early 2016

- **Metop-C** launch planned in 2018
Future satellites and programmes: Observations in 2019 – 2040

**MTG:** Approved, under development
*Sentinel-4 onboard MTG-I satellite*

**Jason-CS/Sentinel-6:**
Proposed, *to be approved in 2015*
*Phase B2 approved at ESA CMIN12*

**EPS-SG:** *to be approved in 2014*
*Metop-SG programme approved at ESA CMIN12*
*Sentinel-5 onboard Metop-SG approved at ESA CMIN12*
Meteosat Third Generation: MTG-I and MTG-S missions

- MTG-I imagery mission implemented by a two-satellite system:
  - Advanced imager (FCI)
    - Full disk imagery every 10 minutes in 16 spectral bands
    - Fast imaging of European weather every 2.5 minutes
  - New Lightning Imager (LI)

- MTG-S hyperspectral infrared (IRS) sounding mission:
  - 3D mapping of water vapour, temperature, O3 every 1 hour
  - Air quality monitoring and atmospheric chemistry (synergy with Copernicus Sentinel-4 Ultraviolet sounder)
MTG challenge: nowcasting with NWP
EPS Second Generation: Two series of co-orbiting satellites

- Metop-SG 1: optical imagery and sounding mission
- Metop-SG 2: microwave imaging mission

- Continuation of mid morning polar orbiting service in 2021-2042 (3+3 satellites)
IASI-NG, MWS & Sentinelle-5/Metop-SG A: The sounding mission

### IASI-NG Objectives
- T and Hu Profiles
- Trace gases (O₃, CO, CH₄, CO₂)
- Aerosols, volcanic ash
- Reference IR instrument for climate monitoring

### MWS Objectives
- T and HU profiles (all weather)
- Cloud liquid water total column

### Sentinel 5 Objectives
- O₃ profiles
- CO₂, SO₂, NO₂, H₂O, CO, CH₄, BrO, HCHO, OCHCHO

#### Radiometric performance & spectral resolution doubled
#### Improved Temperature and Moisture profiles (in PBL)
#### Chemistry: vertical profiles and new species

#### Addition of a window channel at 229 GHz: Cirrus cloud information
#### Spatial oversampling to further reduce noise: more accurate soundings

#### Horizontal resolution: 7 km
#### Extension of spectral range (NIR et SWIR): aerosols, CH₄ et CO in PBL
Coordination Group for Meteorological Satellites - CGMS

**Metop-SG-A Visible to IR imagery mission: MetImage and 3 MI**

- **MetImage objectives**
  - Clouds, incl. microphysics
  - Aerosols
  - AMVs (high latitudes)
  - Vegetation, snow, fires
  - Surface Temperature
  - 20 channels
  - Horizontal Resolution 250 - 500 m
  - Radiometric performances higher than AVHRR

- **3MI objectives**
  - Aerosols
  - Phase, altitude, optical properties of clouds
  - Albedo, radiative budget (BRDF)
  - Improvements wrt POLDER
    - Horizontal Resolution: 4 km
    - 11 channels, extension to SWIR: Better aerosol characterisation
    - Higher angular resolution (14 view angles)

Kaufman et al. (2002)
MicroWave Imager (MWI) & Ice-Cloud Imager (ICI) on Metop-SG

**MWI objectives**
- Precipitation and clouds
- Imagery and H2O profiles
- Sea ice, surface snow

19 channels (18.7 - 183 GHz)
- Continuity wrt SSMI/S
- Addition of sounding channels
  - Improve estimation of precipitation
  - Water vapour and clouds

**ICI objectives**
- Clouds (ice phase)
- Detection of snow

11 channels (183 – 664 GHz)
- First operational ice cloud imagery mission
- Meteorology and climate (Cirrus)
Meteosat Climate Data Record

Number of reprocessed AMVs

Number of operationally produced AMVs