Royal charter: 25/26 October 1859
From observation to decision making: EUMETSAT’s role in the value adding chain

- Numerical Weather Prediction and other NMS Systems
- Observation systems & related services
- EMI: European Meteorological Infrastructure
  - Diagnostics
  - Forecasts
- Support to decision making
  - Advice
  - Warnings
- Decisions
- Public & private decision makers
- Socio-economic Benefits
- Citizens

Requirements
From observation to decision making: EUMETSAT’s role in the cookie factory?

Delivery and value

Numerical Weather Prediction and other NMS Systems

EMI: European Meteorological Infrastructure

Observation systems & related services

Diagnostics Forecasts

Support to decision making

Advice Warnings

Decisions

Public & private decision makers

Citizens

Socio-economic Benefits

Cookies – for non complex, highly repetitive tasks, and if you eat it wrong it shouldn’t kill you

Requirements The people serving, eating and preparing the cookies talk to each other?
Cookie factory: Happiness is an empty control room
2016-11-25 06Z – Dust RGB
Estimated benefits of EPS-SG programme based on very conservative assumptions (8% contribution)

<table>
<thead>
<tr>
<th>BENEFIT AREAS</th>
<th>SOCIO-ECONOMIC BENEFIT (over 20 years of EPS/Metop-SG)</th>
<th>MINIMUM</th>
<th>LIKELY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection of property and infrastructure</td>
<td>€1.5 billion</td>
<td>€6.0 billion</td>
<td></td>
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<tr>
<td>Added value to the European economy</td>
<td>€11.3 billion</td>
<td>€45.2 billion</td>
<td></td>
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<tr>
<td>Private use by European citizens30</td>
<td>€3.0 billion</td>
<td>€11.45 billion</td>
<td></td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>€16 billion</strong></td>
<td><strong>€63 billion</strong></td>
<td></td>
</tr>
</tbody>
</table>

Benefit to cost ratio of the EPS-SG programme (3.4 billion at 2012 e.c.) exceeds 20 and may even reach 60.
Loss of forecast skills in the event of satellite data loss

- Loss of METOP
- Loss of US Polar
- Loss of IJPS

Percentage loss of skill:
- 0%
- 5%
- 10%
- 15%
- 20%
- 25%
Hurricane Sandy

Five-day forecast of cyclone Sandy landfall on the US coast by the ECMWF global model, with (left) and without (right) ingestion of observations from polar orbiting satellites, compared to the operational analysis (best approximation of ground truth, centre).
Do we still need the pretty pictures ....

- In operations
- In talking to clients
- In teaching and learning

- The models and integrated products are pretty good ...
- Yes ... right thing ... right time
Scatterometer backscatter over Greenland changing dramatically from 8 and 11 July 2012. Imagery discriminates land (grey), summer melt (dark green), fast surface melt (red), refrozen melt (bright white) and non-melted (dark grey/blue). This event was likely due to extreme air surface temperature during those days.
EUMETSAT Data Centre

Yearly retrieval and ingestion data from 2003 to 2012.
Differences between clear sky infrared Brightness Temperatures at 6.2 µm (from the ISCCP DX data set) from successive Meteosat satellites and those calculated from night-time radiosonde data available each month. The difference (in Kelvin) is plotted as a function of time, showing the need to cross-calibrate data from successive missions. (Source: Remy Roca, LMD)
**Fundamental Climate Data Record (FCDR):**
a long-term data record of calibrated and quality-controlled sensor data designed to allow the generation of homogeneous products that are accurate and stable enough for climate monitoring.

**Thematic Climate Data Record (TCDR):**
a long-term data record of validated and quality-controlled geophysical variables derived from FCDRs.
Examples of available Climate Data Records

Photovoltaic solar electricity potential based on Meteosat solar irradiance climatology at the surface provided by CM SAF (Source CM SAF)
Probability of Sunny Days / Periods, Utrecht

Average: 25.4 % (Summer: 29.6 %)
Max. Probability: 04. August - 41.9 %
Average: 6.5 % (Summer: 8.9 %)
Max. Probability: 17. May - 19.4 %
Probability of Sunny Days / Periods, The Hague

Average: 29 % (Summer: 35.8 %)
Max. Probability: 04. August - 50.3 %
Average: 7.5 % (Summer: 10.6 %)
Max. Probability: 03. May - 27.1 %
EUMETSAT mission planning...
EPS Second Generation

- Primary mission: further improvement observational inputs to Numerical Weather Prediction models
- Significant improvements of other applications
  - Nowcasting at high latitudes
  - Marine meteorology and operational oceanography
  - Operational hydrology
  - Air quality monitoring
  - Climate monitoring
Meteosat Third Generation

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

- Hyperspectral infrared (IRS) sounding mission:
  - 3D mapping of water vapour, temperature, O3 every 1 hour
  - Air quality monitoring and atmospheric chemistry in synergy with GMES Sentinel-4 Ultraviolet Visible
From SEVIRI on MSG to FCI on MTG
From SEVIRI on MSG to FCI on MTG

solar channels provided in 0.5 km / 1.0 km resolution

thermal channels provided in 1 km / 2 km resolution
The 0.444 µm and the 0.51 µm channels will permit surpassing current aerosol retrievals especially over land – also an important contribution to air quality monitoring.

The 0.91 µm channel will provide during daytime total column precipitable water especially over land surfaces.

The 1.375 µm channel will improve detection of very thin cirrus clouds not seen by the current system introducing errors in all clear sky products.

The 2.26 µm channel will provide the capability for an improved retrieval of cloud microphysics.

The improved spatial resolution (1 km and 2 km) and the extended dynamical range (from 350 K to 450 K) of the 3.8 µm channel will firstly outperform the fire detection quality of MSG and secondly outbid the quality of products as Fire Radiative Energy (FRE) – a climate relevant product directly related to the CO₂ production of active fires.
The MTG LI measurements of total lightning will complement global measurements of ground based systems (e.g. ATDnet) improving the quality of information essential for air traffic routing and safety.

MTG-LI IC+CG lightning information to assess impact of climate change on thunderstorm activity by monitoring and long-term analysing lightning characteristics (coordination with NOAA’s GLM mission on GOES-R and GOES-S essential).

IC+CG information on a global scale as prerequisite for studying and monitoring the physical and chemical processes in the atmosphere regarding NOx, playing a key role in the ozone conversion process and acid rain generation.

IC+CG information on a global scale with known error-characteristic a prerequisite for: assimilation in regional models to improve very short range forecasts of convective events verification/validation of algorithms to nowcast (time and location) convective initiation.
The IRS (30 min repeat cycle over Europe) will fill large spatial and temporal voids in the 12-hour standard radiosonde observations and will provide time and space interpolation of moisture/temperature observations taken from the polar orbiting satellites.

The IRS derived information on tropospheric moisture structures and their variation in time is expected to lead to a better depiction of the hydrological cycle in models, potentially providing better precipitation forecast.

The IRS will provide information on vertically resolved atmospheric motion vectors with improved height assignment, which in particular is beneficial for the tropical areas having only a weak coupling between the dynamic and thermodynamic atmospheric fields.

The IRS will provide information to identify pre-convective situations supporting NWC applications to forecast convective initiation.

IRS will support forecasting pollution and monitoring of atmospheric minor constituents through its capability to provide estimates of diurnal variations of tropospheric contributions of atmospheric trace gases as O₃ and CO.
Getting ready for MTG .... dS

- Data flows
- Assimilation
- Product development
- Science
- Linkage between research and development
- Training and briefing ...