Developing core GMES atmospheric environmental services

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European Centre for Medium-Range Weather Forecasts
• **MACC is an EU-funded project set up to:**
  – develop and establish pilot operation of systems for monitoring and forecasting atmospheric composition, under Europe’s GMES initiative

• **MACC builds on:**
  – EU-funded GMES preparatory project called GEMS
  – ESA-funded GMES Service Element project called PROMOTE

• **Partners comprise:**
  – 46 national entities from 18 European States, plus ECMWF and JRC

• **ECMWF is project coordinator**
Services related to the chemical and particulate content of the atmosphere

Weather services

GMES atmospheric environmental services

Environmental agencies

provide data & information on

Climate forcing by greenhouse gases and aerosols
Long-range pollutant transport
European air quality
Dust outbreaks
Solar energy
UV radiation

...
Services are mostly targeted at specialized users:

- Environmental agencies
- Weather services
- Other providers of downstream services
- Scientists
- Policy-makers
- Space agencies and other data providers
- ...
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But public interest in website on occasions!

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Computational approach

Input data

Weather, constituents, emissions, land and ocean conditions
Computational approach

**Input data**
- Weather,
- constituents, emissions,
- land and ocean conditions

**Model**
Computational approach

Input data

Model

Data assimilation
Computational approach

Input data

Model

Data assimilation

Forecast

Model G
Global system is based on the ECMWF Integrated Forecasting System (IFS) coupled with either the MOZART or the TM5 Chemical Transport Model.

Regional ensemble comprises a set of nationally developed models run over a common European domain.
Australian dust storm

Sydney, 23 September 2009

Aerosol optical depth
Surface ozone 15UTC 9 July 2010

H+39 EURAD

H+39 MOZART/IFS

H+39 CHIMERE

Forecasting European air quality

Bruxelles (50.84°N, 4.37°E)
Forecast Thursday 8 July 2010 00 UTC

Ozone [µg/m^3] N=7
threshold (max daily 8h mean) = 120 µg/m^3
2010 fires over Russia

2m temperature anomaly (°C) for July 2010

Fire Radiative Power (Wm⁻²) from SEVIRI and MODIS

PM10 (μg/m³) Virolahti, Finland

Aerosol optical depth due to black carbon and organic matter

Observed
2010 ozone hole

Area of the southern hemisphere with total ozone less than 220DU

10 hPa temperature (C)

12 UTC 30 July 2010

12 UTC 14 September 2010

12 UTC 30 July 2010

12 UTC 14 September 2010
Solar radiation

Check of potential of daily aerosol fields to improve estimates of solar irradiance for power generation

Forecast UV index

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First six months of routine CH$_4$ flux inversion

SCIAMACHY satellite data

Assimilated data

Prior modelled emissions

Adjusted emissions
Maps are provided at www.gmes-atmosphere.eu

Data are becoming available on public servers

- Data from previous GEMS project are available
- MACC reanalysis data for 2003 are available
- Near-real-time composition products will also be provided
- Constraints apply to near-real-time meteorological fields

Data will be supplied as part of the WMO Information System
Data are supplied to support international projects

- Measurement campaigns
- Boundary conditions for US/Europe air-quality model intercomparison
- Boundary conditions for WMO GURME projects
  - Delhi Commonwealth Games
  - Shanghai Expo
• Consolidate and improve analysis and forecasting systems
  – establish basic operational processes for near-real-time running
  – increase horizontal resolution to 80 km global, 25 km or less regional
  – refine other aspects of the analysis and forecasting systems

• Complete reanalysis for 2003-2010

• Monitor the quality of products on a systematic basis

• Supplement migrated production lines with new services

• Consolidate the interface with user communities

• Liaise with agencies on observational requirements

• Establish funding and governance for sustained operation
GEMS/MACC team at ECMWF

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Johannes Kaiser, Jean-Jacques Morcrette,
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Leonor Tarrason, NILU

Peter Bergamaschi (JRC) and all other team members