MACC-II: working towards the Copernicus Atmosphere Service

INSPIRE current and future implementation

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An example to start

http://atmosphere.copernicus.eu

Air quality forecasts for football World Cup

The air quality modelling team at TNO in the Netherlands is taking advantage of the 2014 Football World Cup to test drive their operational air quality forecasting system over the Brazilian East Coast. TNO is a partner in MACC-II and contributes in collaboration with KNMI to the MACC-II regional model ensemble with the LOTOS-EUROS air quality model.

Within the framework of the Brazilian Air Quality (BRAQ) project a 4 day air quality forecast has been set up for Brazil providing information on concentrations of ozone, nitrogen dioxide and particulate matter.

The MACC-II global forecasting system provides the boundary conditions for the LOTOS-EUROS regional model and wildfire emissions estimated by Assimilation System Expert Input for the air as well as more accessible through the individual hosting cities are also available.
TNO (NL) World Cup Air Quality Service...
... powered by MACC-II
The MACC-II core production system of systems in a nutshell

- **Observations Acquisition & Processing, Forest Fire Emissions Estimation**
- **Observations & Emissions**
  - Global Data Assimilation and Forecasting System for Atmospheric Composition
  - Global Forecasts and Analyses
  - Verification, Dissemination, Users Support and Interaction
- **Chemical Boundary Conditions & Meteorology**
- **European Air Quality models**
- **Regional Ensemble Forecasts and Analysis**
- **Satellite and In-situ observations of atmospheric composition**
- **INPUT DATA ACQUISITION**
- **PRODUCT DISSEMINATION**

Users can provide feedback through the "Products & Feedback" process.
The global observing system for atmospheric composition

- Ground-based stations
- Airplanes
- Satellites
- Trains
- Ships
- Balloons

…
A range of satellite observations for atmospheric composition

SO$_2$, GOME-2, SACS, BIRA/DLR/EUMETSAT

CO$_2$, GOSAT, ACOS/JAXA/NIES

Aerosol Optical Depth, MODIS, NASA

NO$_2$, OMI, KNMI/NASA
Use of satellite data @ECMWF (~80 instruments today)
http://atmosphere.copernicus.eu

Online catalogue, quicklooks and data
(244 individual products)

European Air Quality

Global atmospheric composition

Radiation and ozone layer

Surface fluxes: greenhouse gases, fires, emissions
Aerosol climatologies do not allow correct representation of direct normal irradiance distribution.

Copernicus applications: enabling growth and job creation.
- Metadata solves the interoperability problem; aids discovery, access and retrieval
- Where possible metadata should be created along with the data, i.e. metadata should be considered an integral part of the data product
- **Major challenge:** lack of controlled vocabulary
WMO Information System (WIS)

“The WIS is the single coordinated global infrastructure responsible for the telecommunications and data management functions. It is the pillar of the WMO strategy for managing and moving weather, climate and water information in the 21st century.”
MACC-II Product Metadata Example

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**INSPIRE Validation Result**


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**ECMWF MACC-IFS-MOZ 5 days near real-time forecasts of global ozone**

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**Spatial data set**

- **Spatial Data Theme**: Atmospheric conditions (Atmospheric conditions)
- **Topic Category**: Climatology / Meteorology / Atmosphere

**Resource Title**

ECMWF MACC-IFS-MOZ 5 days near real-time forecasts of global ozone

**Resource Abstract**

This service provides pre-operational daily forecasts up to 5 days of ozone using the chemistry of the MOZART model. The product includes total column ozone and ozone mixing ratios at 60 model levels. There are two forecasts per day, with base times of 00:00UTC (5-day forecast) and 12:00UTC (1-day forecast). Forecast steps are available at 3-hourly intervals and the spatial resolution is 0.75x0.75 degree. The forecast fields are generated in GRIB.
Metadata Sharing worldwide using the WIS
Metadata Sharing worldwide using the WIS (cont.)

Copernicus Atmosphere Service European-scale air quality nitrogen dioxide analysis by the EURAD model

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Geographic bounding box:

- **North bound**: 70.00000
- **West bound**: -25.00000
- **East bound**: 45.00000
Conclusions

- MACC-II delivers products on the regional and global scales and is in readiness for the operational phase of Copernicus, expected to start in April 2015.
- MACC-II has a truly European dimension and is a key cost-effective and value adding element in the (distributed) service chain from the acquisition of observations to the service of a wide range of users.
- The Copernicus data policy promotes the access, use and sharing of information and data on a full, free and open basis.
- The number of registered users is of a few thousands, with a couple hundred accessing routinely information and data (power users). And this is growing (fast).
- Compliance with INSPIRE was taken on-board from the start as a constraint), but this is paying off now as data exchanges (volume, variety) reach maturity and “handicraft” / ad hoc solutions are no longer options.
- Many challenges are addressed in the context of Copernicus: data variety, NRT aspects, lack of controlled vocabulary... Some aspects are transverse (role of the EEA, building upon the FP7 GMES In Situ Coordination project) and some aspects are specific.
- The global dimension is important also and WIS is instrumental towards this goal.
Website: http://atmosphere.copernicus.eu
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Copernicus Atmosphere