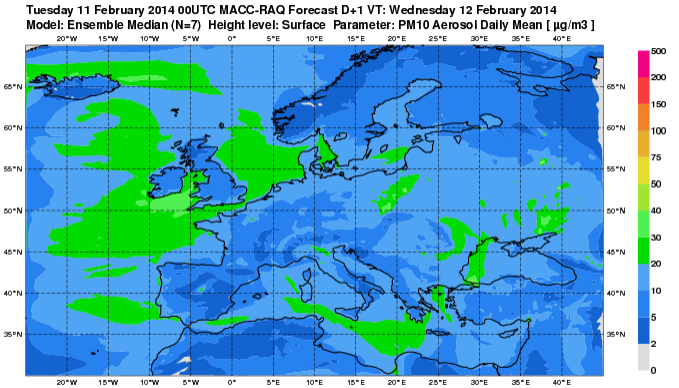

Air quality forecasting in Europe

Cross-cutting activities with working groups

F.Meleux

FAIRMODE
Forum for air quality modelling in Europe

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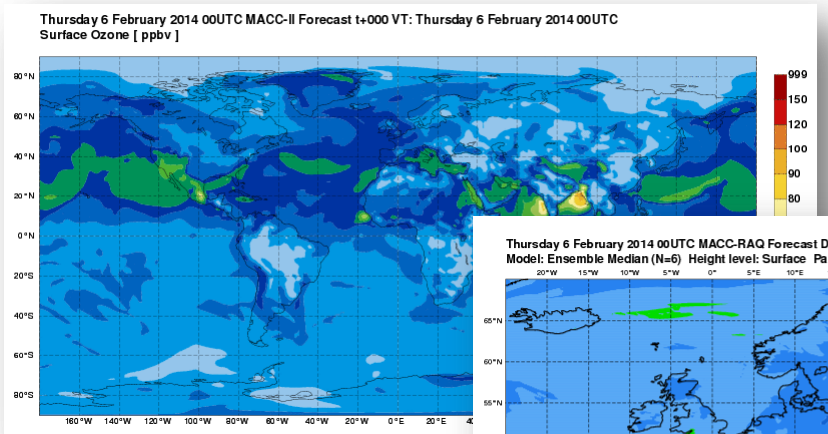
Objectives of air quality forecasting systems

- provide every day information related to the air quality levels
- targetted pollutants: O3,NO2,PM10,PM2.5

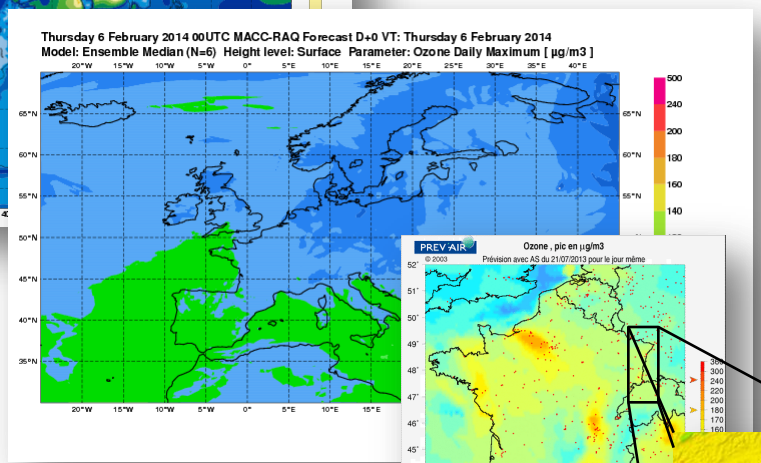
- In case of pollution episode:
  - Provide information to the public
  - Support to policy users
    - to identify the likely causes
    - to assess population exposure
    - to set-up the efficient measures (short term action plans)

Cascade of air quality forecasts at various scale

Global



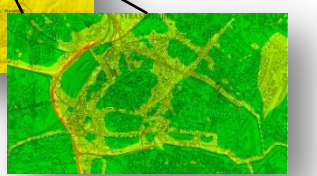
Europe



National

Local

Urban



it's now possible to bridge the scale
in forecast mode by nesting models
at various scale

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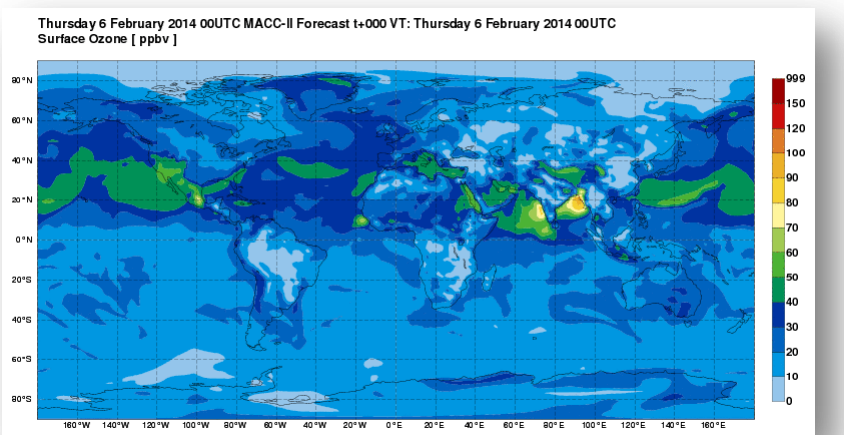
Global forecasts

Provide the long range transport of pollutants

- O3, NOx, HCHO, NH3, VOCs..., PM (Dust, Sea salt, BC/OC …)
- Low horizontal resolution (~ 80 x 80 km2)
- Boundary conditions to regional models
  - Large scale events (dust storm, biomass burning plumes…)
- Available every D-1 up to 5 days ahead



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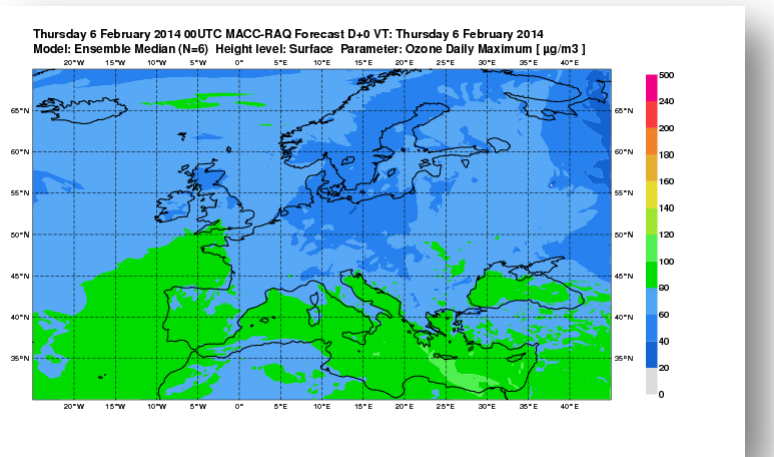
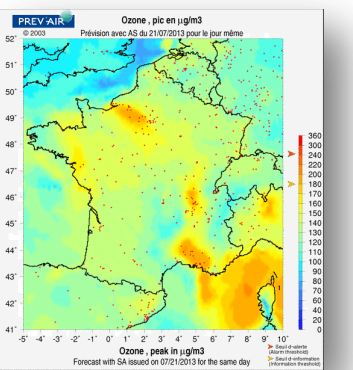
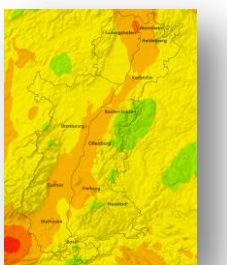
Regional platforms

- Provide background concentrations for O3,NO2,CO,SO2 and PMs (concentrations and chemical speciation) from D+0 to D+3
- Rely on chemical transport model used at different resolution to cover the European scale, the national scale and the local scale
  - High horizontal resolution (~ 10 x 10 km2; 5 x 5 km2; 2 x 2 km2)







- Produce analyse (D-1) resulting from a combination model-observations

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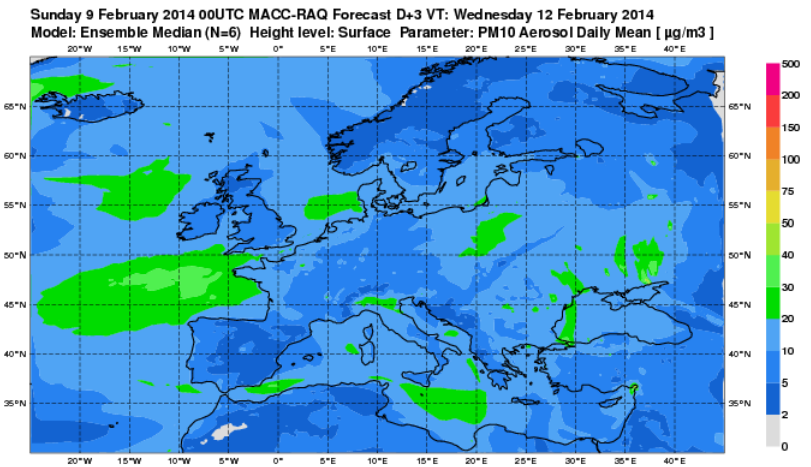
MACCII regional forecasts over Europe

- Based on an ensemble of 7 European models using the same input data (met, emissions, boundary conditions)

	Current geometry	*Assimilation method*
CHIMERE INERIS, CNRS	0.1 , L8, top : 500hpa	Optimal Interpolation
EMEP met.no	0.25 x0.125 , L20, top : 100hpa	Variational 3d-var
EURAD FRIUUK	15km, L23, top : 100hpa	Variational, 3d-var
L-EUROS TNO, KNMI	0.25 x0.125 , L4, top : 3.5km	Ensemble Kalman Filter
MATCH SMHI	0.2 , L40, top : 100hpa	Variational, 3d-var
MOCAGE MF, CERFACS	0.2 , L47, top : 5hpa	Variational, 3d-var
SILAM FMI	0.2 , L46/8, top : 100hpa	Variational, 4d-var



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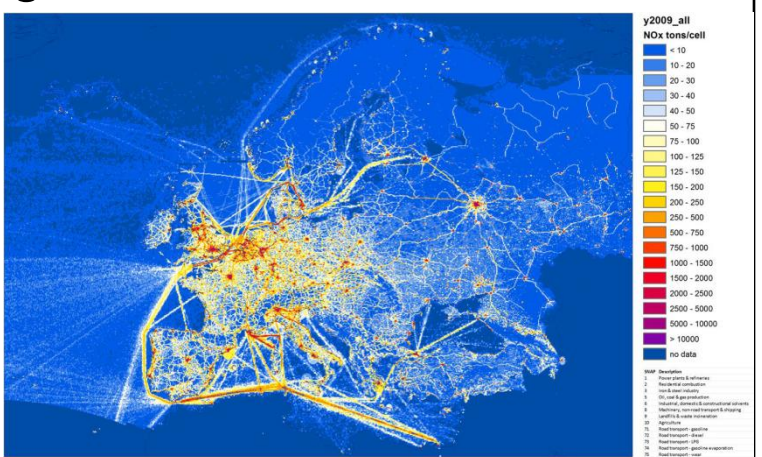
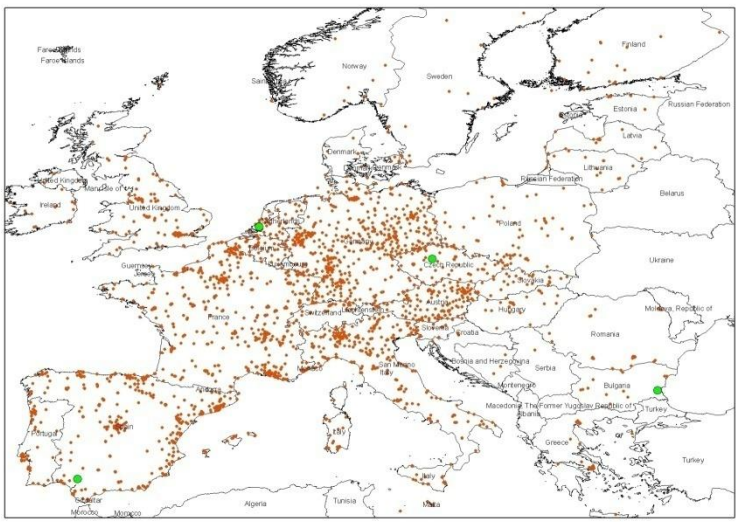
Input data for air quality forecasting

- Emissions:
  - Anthropogenic emissions inventories:
    - European EI ex:TNO (7x7 km2); national (1 x 1 km2)
    - Additional processing to modulate the emissions taking into account the impact of meteorological conditions
      - ex: domestic heating
  - Natural emissions calculated on-line by the chemical transport model (Biogenic emissions, dust emissions ...)
  - Support from the satellite observations to get near real time emissions (biomass burning)



AQ forecasts & observations

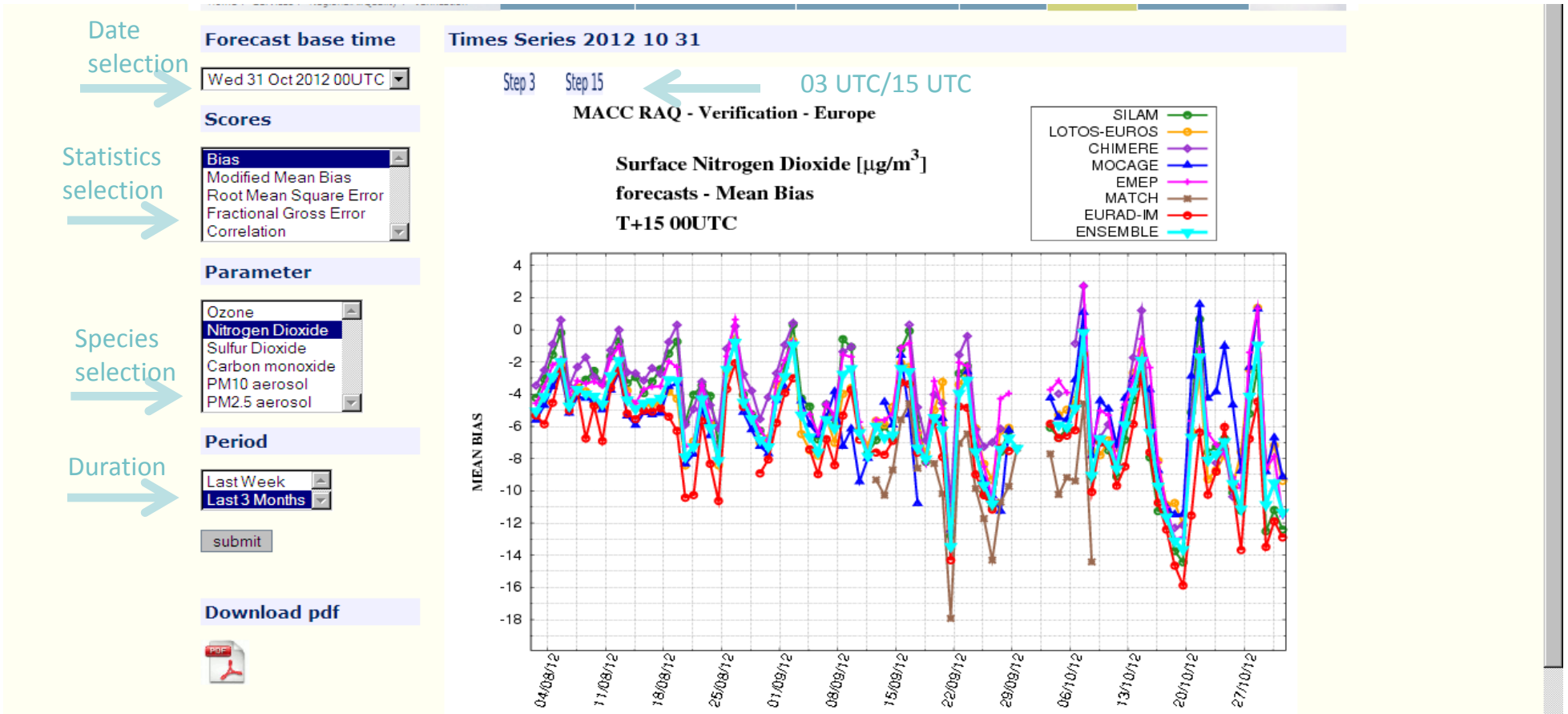
- Observation datasets are used:
  - for evaluating forecast performances
    - Near real time in-situ data from EEA



  - for assimilation processing and forecast corrections
  - Supplementary databases (satellite, lidar, photometer ...) can be used for assimilation

AQ forecast evaluations on a daily basis

Quality of the forecasts (web products): daily verification against representative surface observations selected using Joly and Peuch (Atmos. Env. 2012) classification



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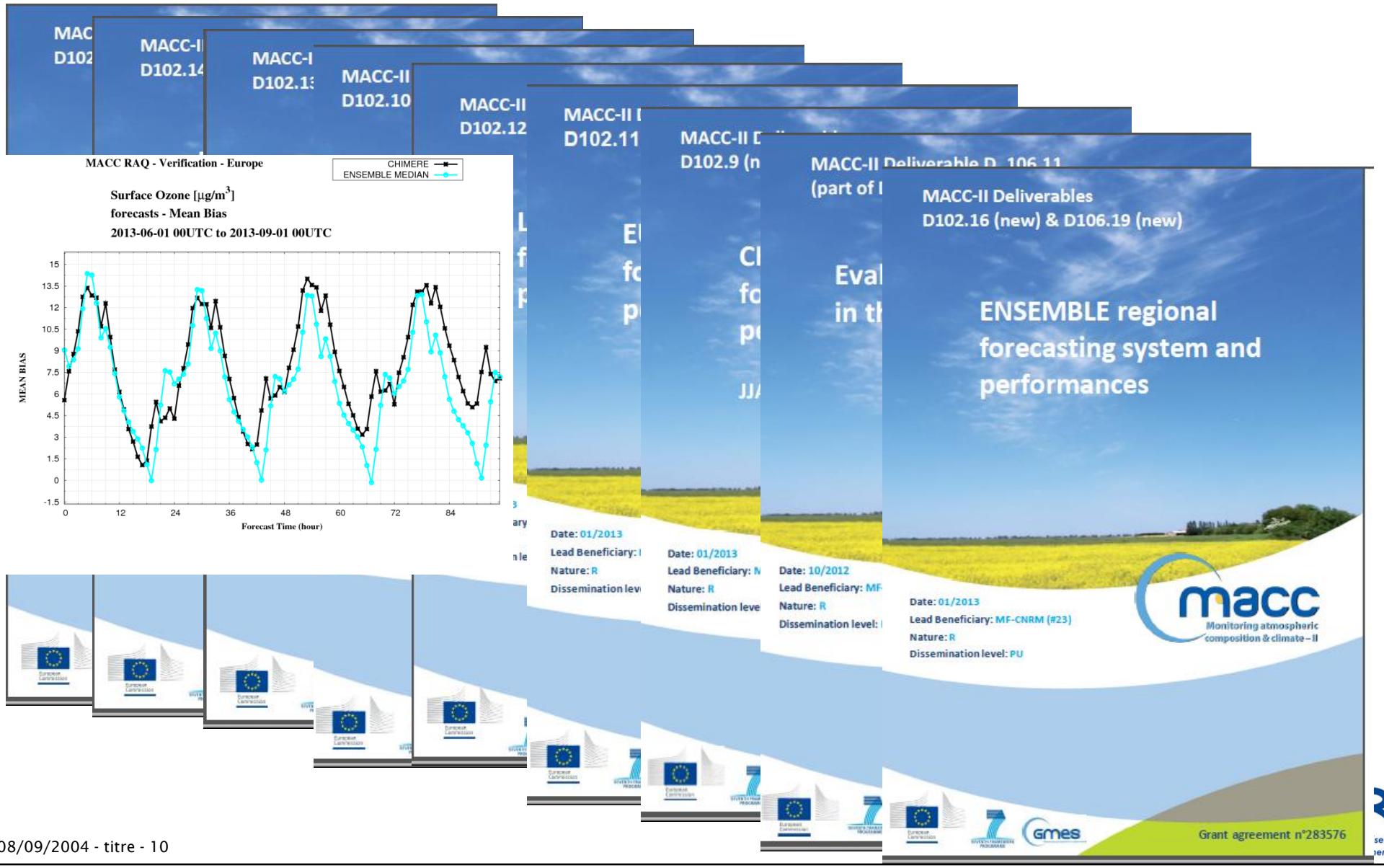
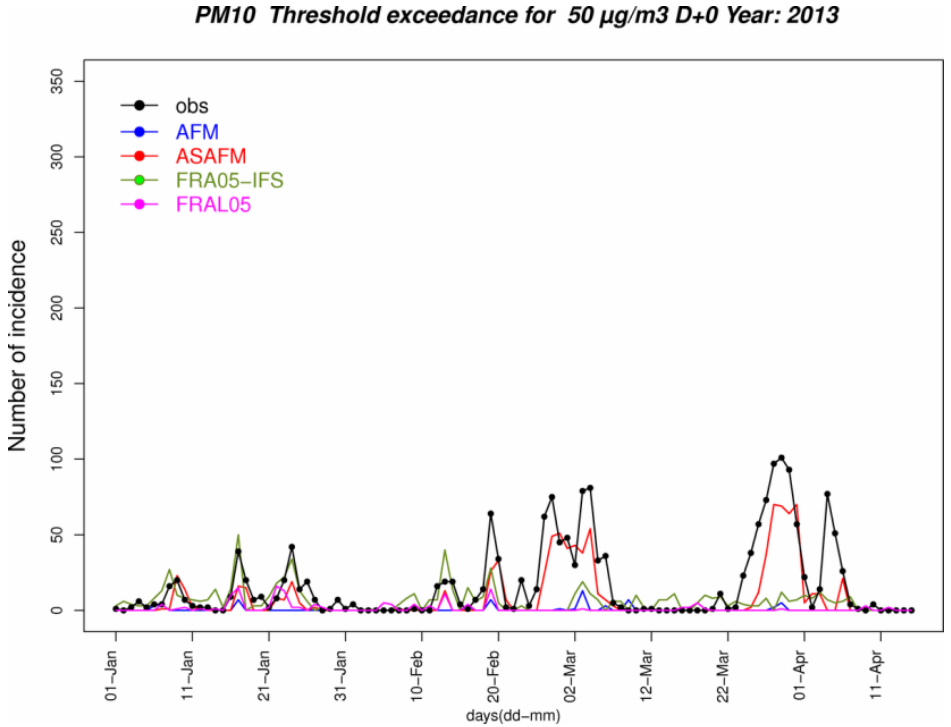
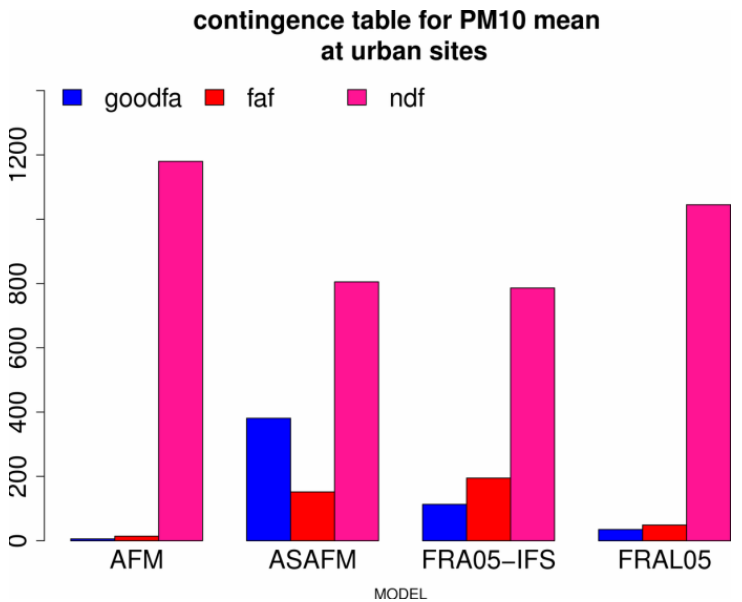
Additional statistical verification of model forecasts and ensemble done a posteriori: 6-monthly reports



Air quality forecasts: A support to policy user

Evaluation of the model forecasts in detecting threshold exceedances

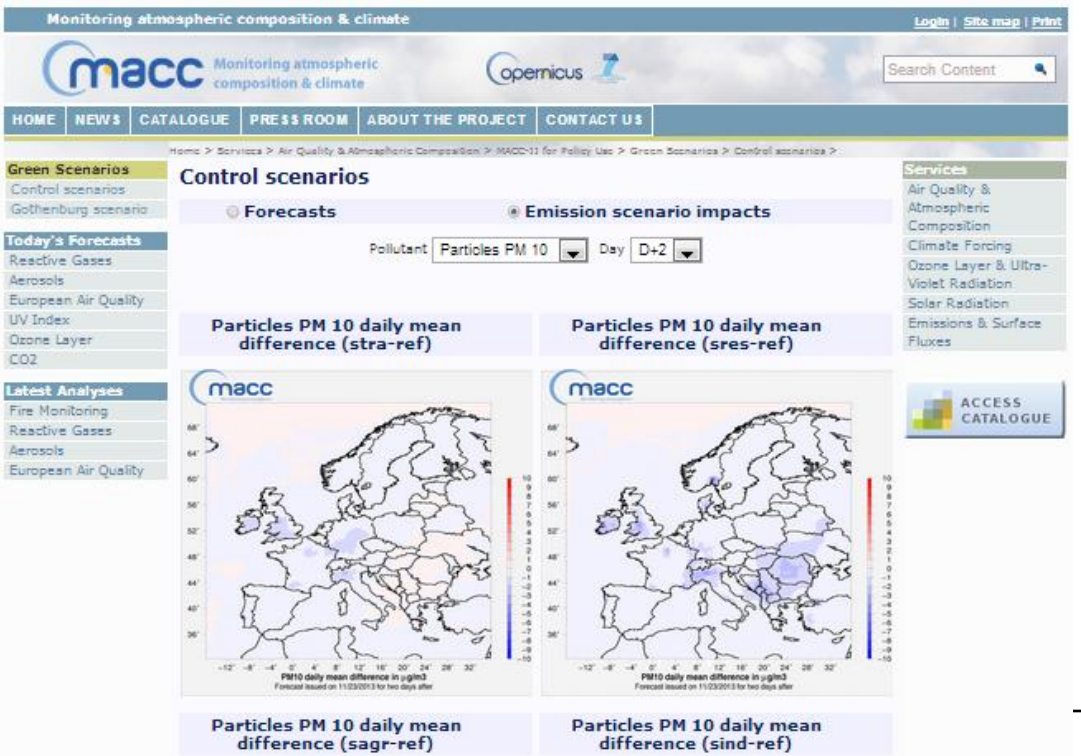




Air quality forecasts: A support to policy user

Green scenarios toolbox

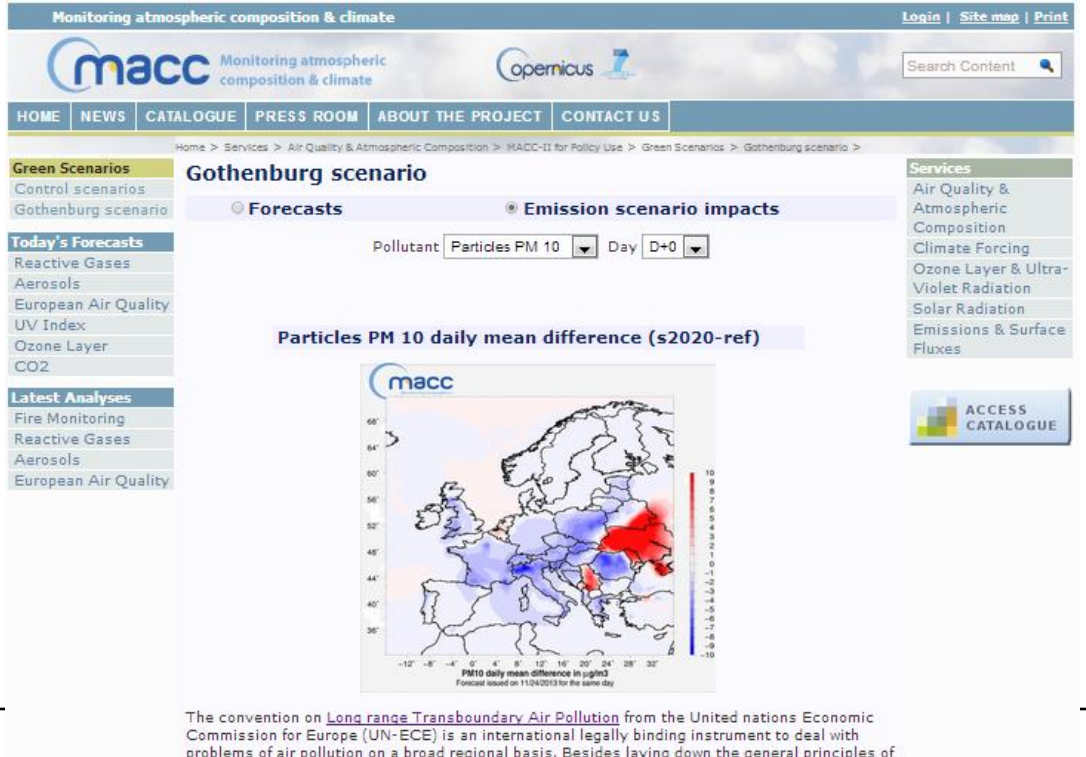
- help policy users in the design of relevant policy responses
- provide daily regular information on the expected effect that short term measures may have on the forecasted pollution episodes.
  - 4 Control scenarios: traffic; domestic heating; agricultural; industrial



Air quality forecasts: A support to policy user

Green scenarios toolbox

- help policy users in the design of relevant policy responses
- provide daily regular information on the expected effect that short term measures may have on the forecasted pollution episodes.
  - 1 policy scenario: Gothenburg protocol



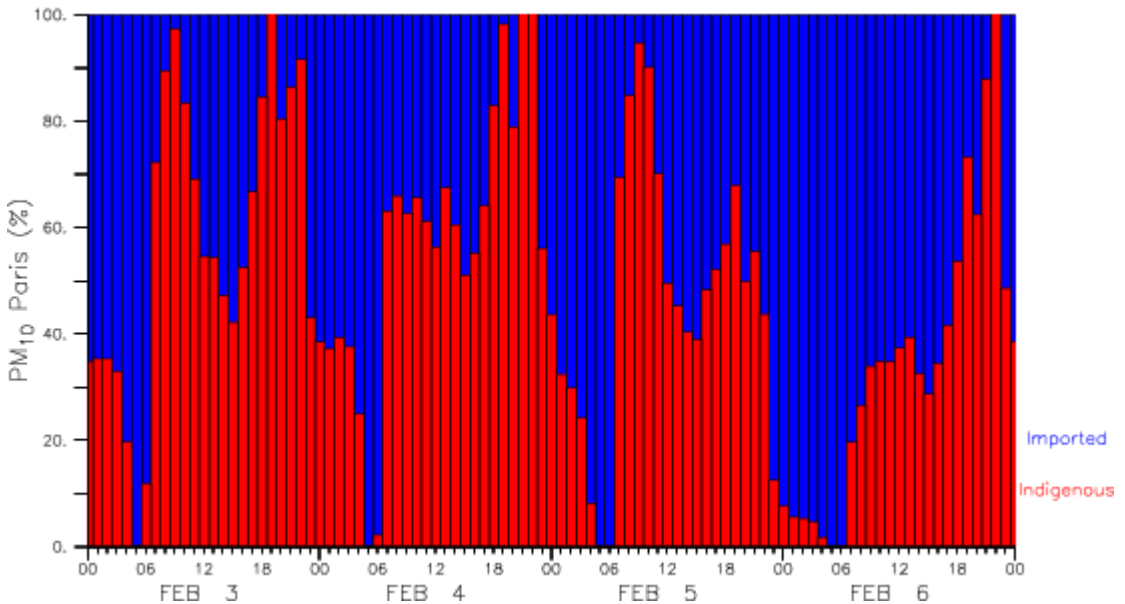
Air quality forecasts: A support to policy user

Source-receptor calculations

Two type of calculations, either country or regional

This regional SR daily run assess the contributions of local sources versus remote sources to the PM10 concentrations.

- Paris, Oslo



Fairmode

Objectives:

- **add supplementary evaluation process associated to forecast products**
  - Assessment:
    - What are the best indicators to evaluate the skill of a forecast model?
      - Persistence of the model capability along the forecast duration
      - Specific indicators for threshold exceedances (MQO)
  - Emissions:
    - Implementation in the model of forecasting emissions?
  - Planning
    - How forecasts of control scenarios can be used ?