The Copernicus Atmosphere Monitoring Service

Developing linkages with FAIRMODE

Atmosphere Monitoring

Copernicus EU

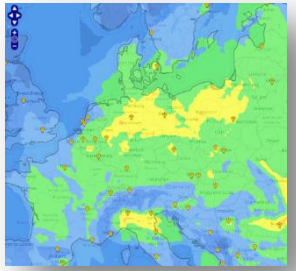
Copernicus EU

Copernicus EU

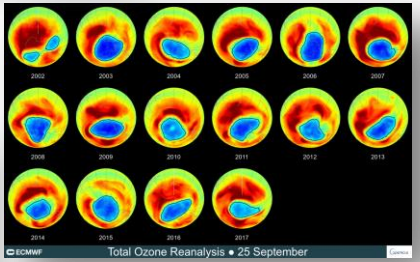
www.copernicus.eu

CAMS: COPERNICUS ATMOSPHERE MONITORING SERVICE

Atmosphere Monitoring

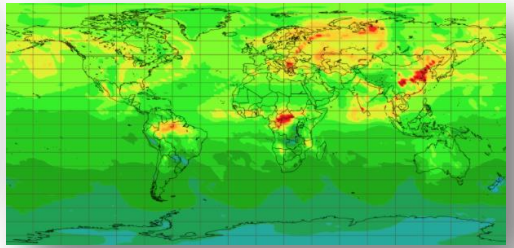


European Air Quality and products in support of policy users

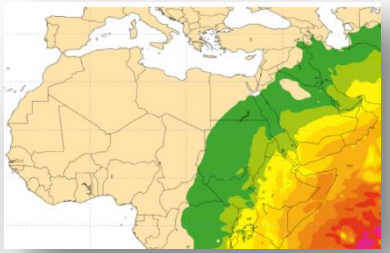


Ozone layer

Emissions and surface fluxes



Global analyses, forecasts and reanalyses



Solar radiation and UV index

Direct access to main daily global products at http://atmosphere.copernicus.eu/charts/cams

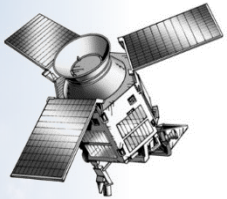
New one in progress!!

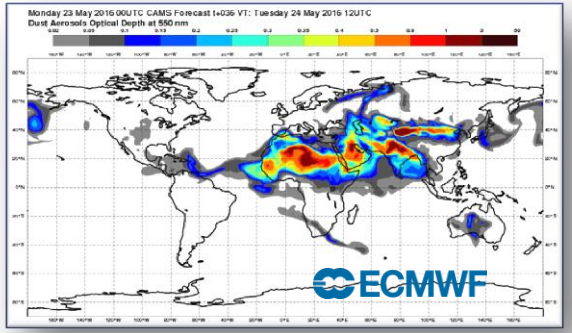
ECMWF Copernicus Europe's eyes on Earth European Commission

CAMS MAIN SERVICE CHAIN

Atmosphere Monitoring

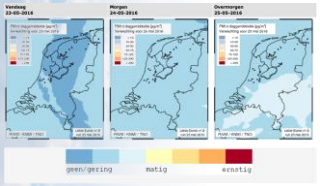
Space Agencies





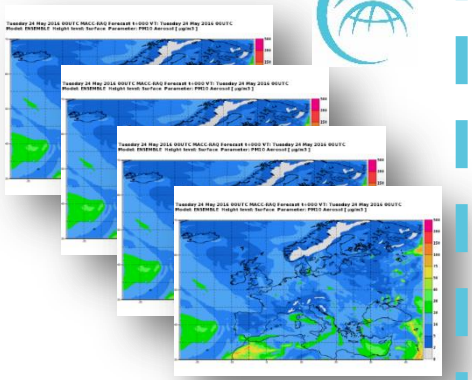
ECMWF Integrated Forecasting System (IFS)

In-situ observations



Users:
Env. Agencies
Academia
SMEs
Citizens
...

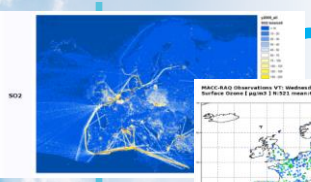
Regional multi-model ensemble (lead: Météo-France)
Policy Products (lead: INERIS)

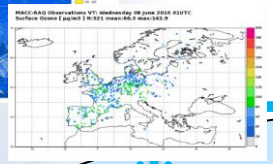


ECMWF Copernicus Europe's eyes on Earth European Commission

The Regional CAMS services for Europe

Atmosphere Monitoring

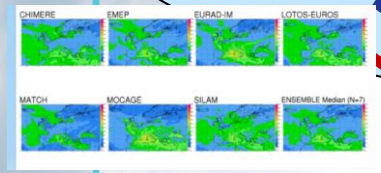


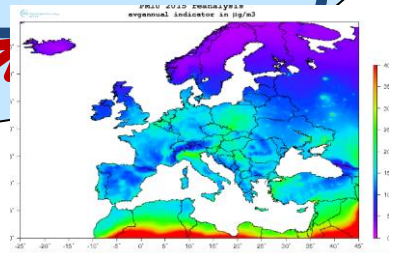


Global model products
Regional emissions
Observations

Daily production of air quality forecasts and Analyses (7 models & Ensemble)

Annual production of air quality reanalyses Interim (YY-1) & Validated (YY-2)





USERS

7 operational models

- CHIMERE (INERIS)
- EMEP (MET Norway)
- EURAD-IM (RIUUK)
- LOTOS-EUROS (KNMI/TNO)
- MATCH (SMHI)
- SILAM (FMI)
- MOCAGE (Meteo-France)

3 models under development

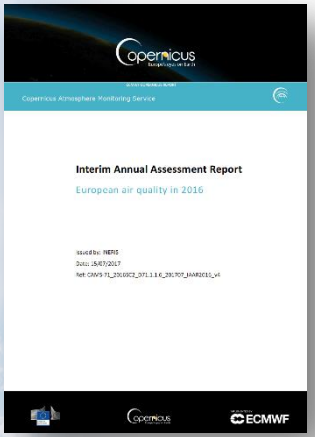
- AQUM (Met Office)
- DEHM (Aarhus Univ.)
- GEM-AQ (Warsaw Univ.)

Copernicus Europe's eyes on Earth

European Commission

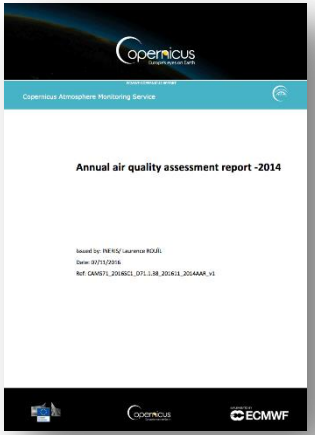
ANNUAL ASSESSMENT REPORTS

Atmosphere Monitoring



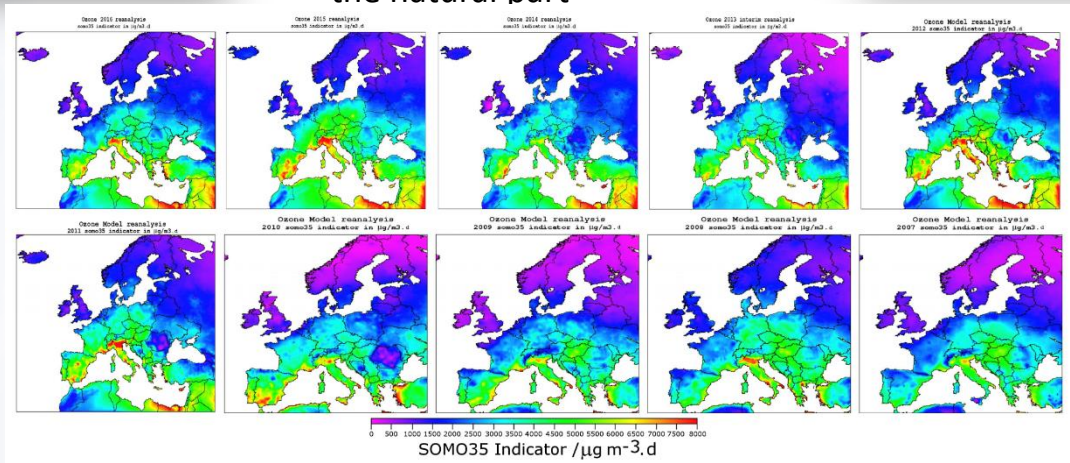
Reports on the European **annual interim reanalysis** (based on observations in an interim stage of validation)

- Focus on episodes for ozone
- Analysis to qualify the relative influence of various sources including the natural part



Reports on the European **annual reanalysis** (based on validated observations)

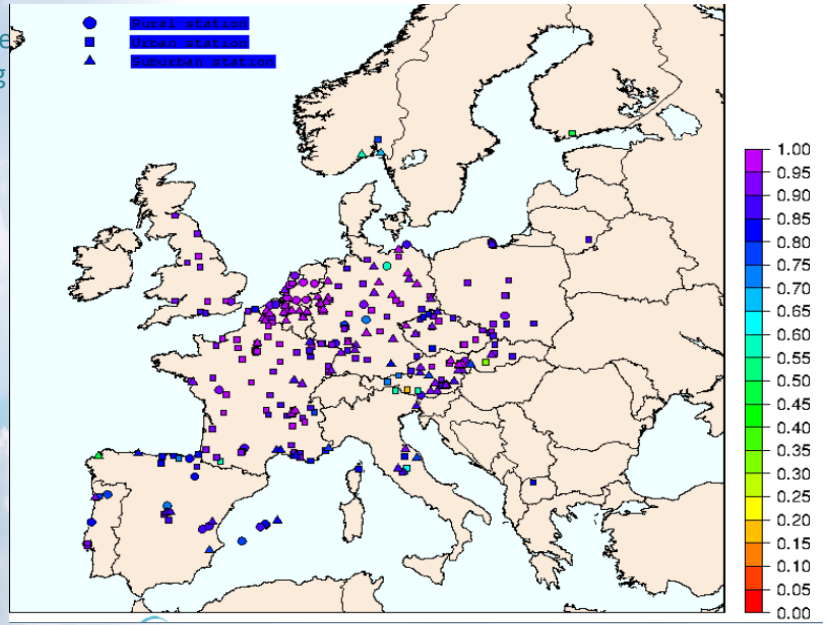
- Focus on air quality indicators as set in the air quality Directives or relevant for impact studies.
- Consistent with the EEA air quality report

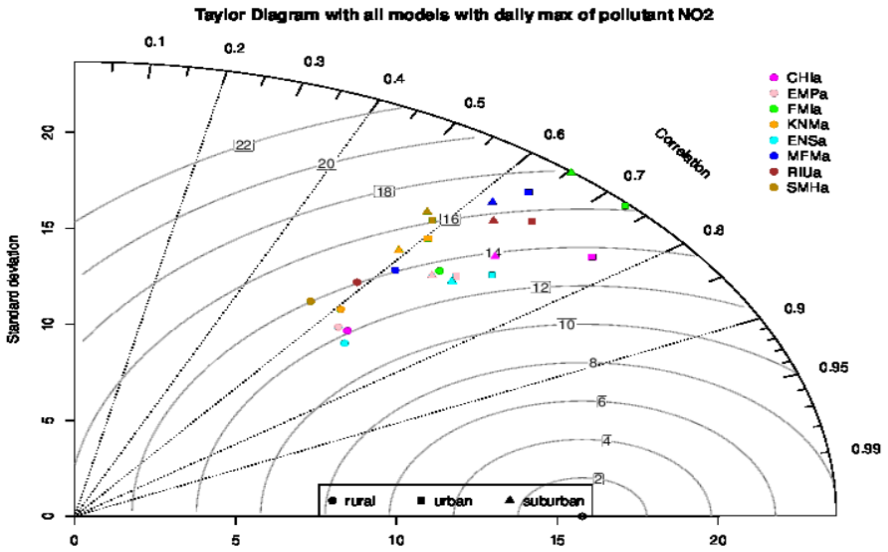


ECMWF Copernicus Europe's eyes on Earth European Commission

Atmosphere Monitoring

Assessments and forecats





- Valuable inputs for nested modelling chains
- A lot of experience on forecasting system that could be proposed in a cooperative framework
- **Planned in 2018-2019** : evaluation of the analyses and re-analyses with respect with to the Fairmode MQO

Copernicus Europe's eyes on Earth
European Commission

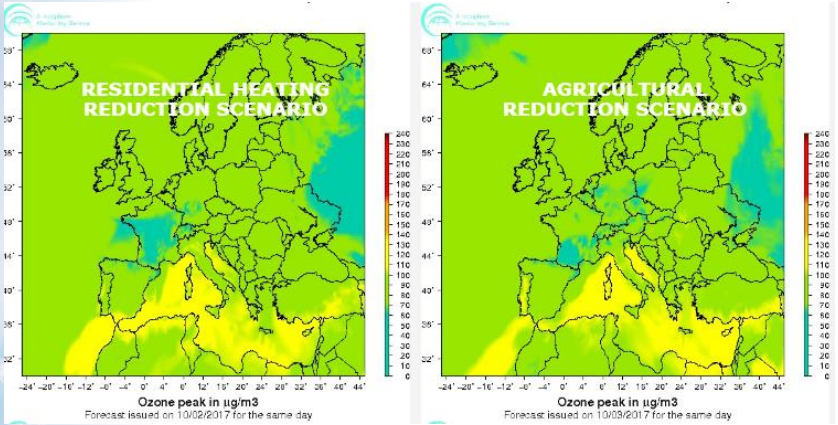
Atmosphere Monitoring

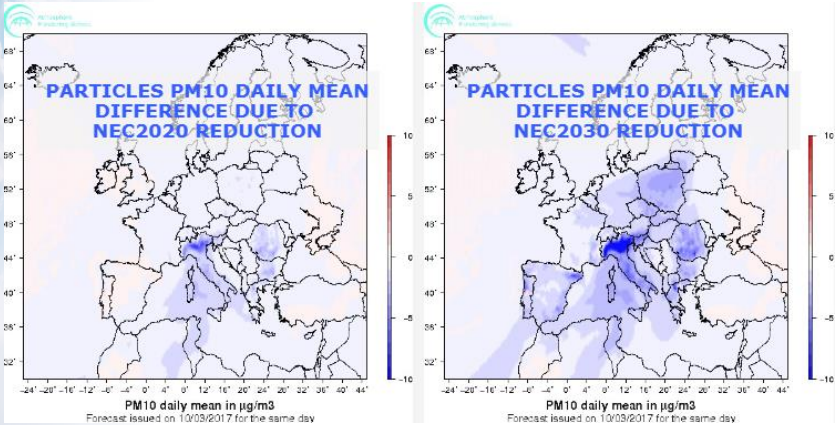
Source allocation – source apportionment products

- http://policy.atmosphere.copernicus.eu/index.html
- Day to day analysis (forecast mode)
- Better understanding of air pollution patterns and air pollution drivers when episodes occur
- Highlight the interlinkages between cities, national and regional air pollution
- Support to episode management and communication
- Two categories of products :
  - Impact of emissions reduction scenarios (“green scenario toolbox”)
  - Analysis of the contribution of local versus external sources to background air pollution levels in the cities

Current CAMS green scenarios toolbox

Atmosphere Monitoring





- Based on CHIMERE runs
- 3 days forecasts of emission reduction scenarios
- Allows to evaluate the impact of the main air pollution drivers for various types of situations and the impact of up-coming legislation

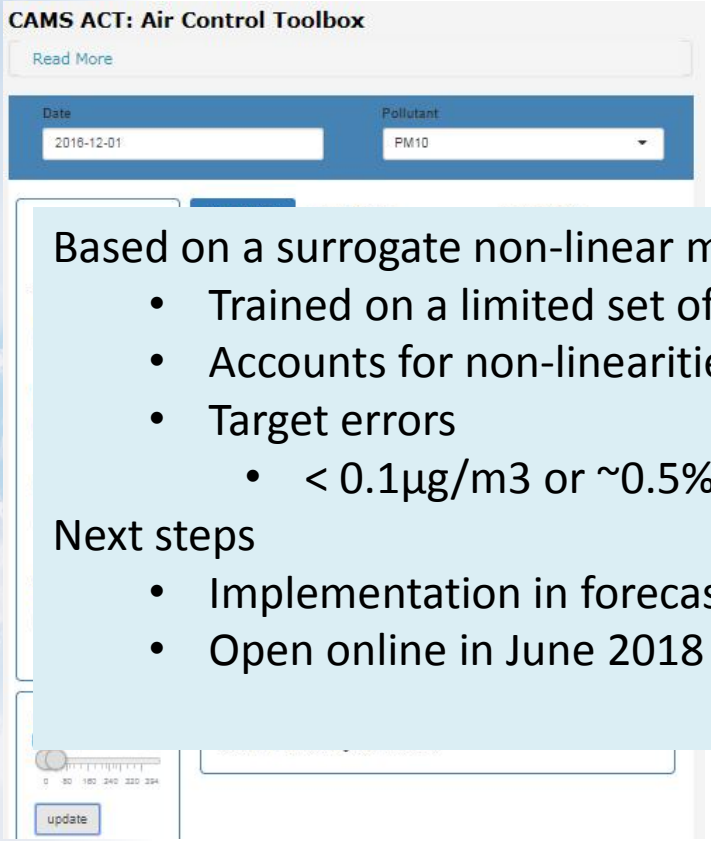
- 10 scenarios currently available
  - 2 References
  - 30% reduction for 4 activity sectors (Industrial, Residential Heating, Traffic, Agriculture) + 1 interactions
  - NEC2020, NEC2030, MTFR

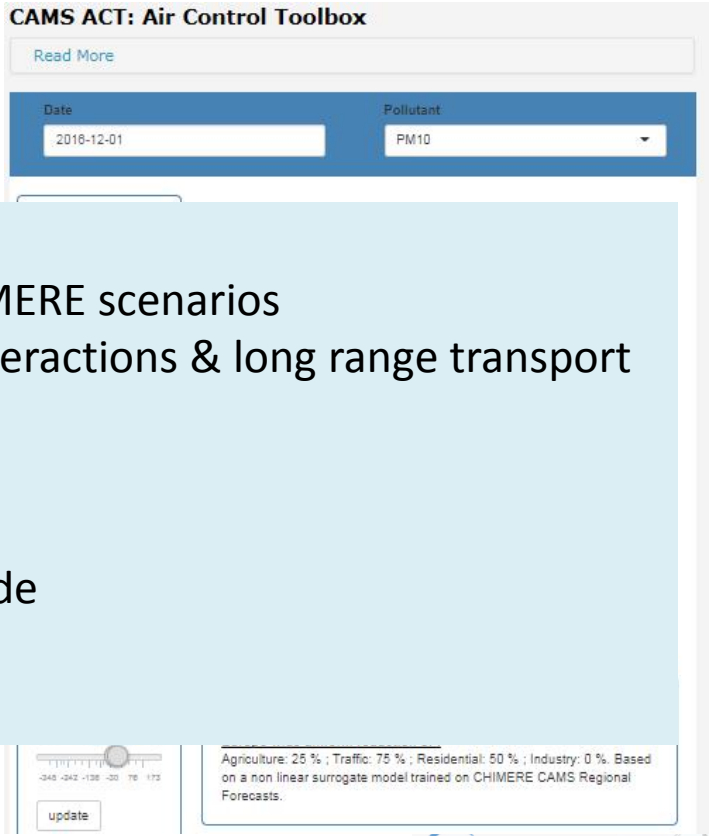
Copernicus Europe's eyes on Earth

European Commission

The future interactive toolbox

Atmosphere Monitoring





Based on a surrogate non-linear model

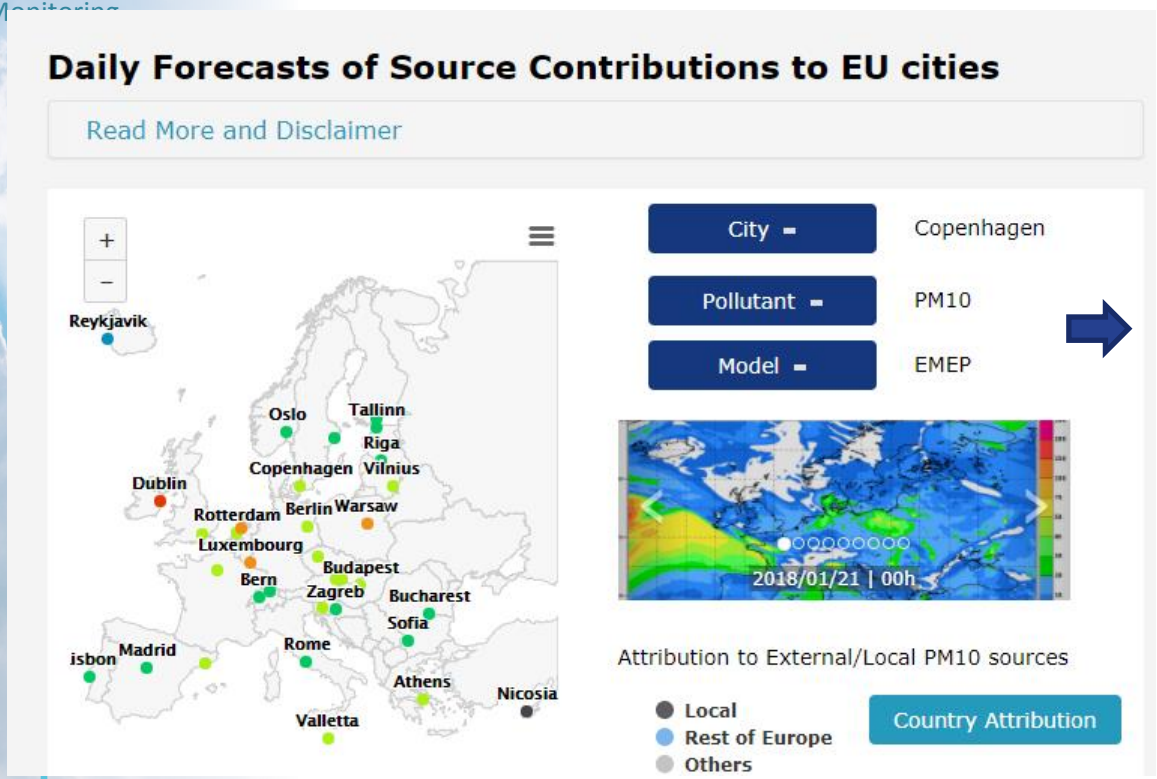
- Trained on a limited set of CHIMERE scenarios
- Accounts for non-linearities, interactions & long range transport
- Target errors
  - < 0.1µg/m3 or ~0.5%

Next steps

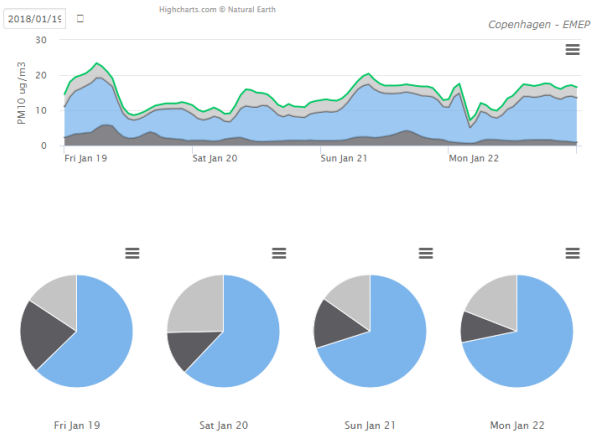
- Implementation in forecast mode
- Open online in June 2018

Atmosphere Monitoring

Source-receptor allocation services

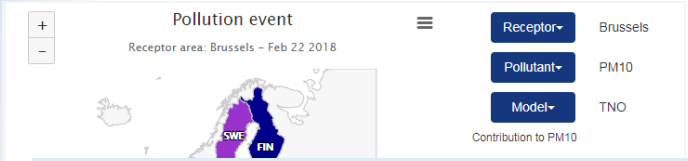


- Based on the EMEP model
- Daily production in forecast mode
- 34 cities covered



Country S/R calculations for episodes

Atmosphere Monitoring

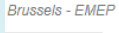


Based on EMEP and LOTOS-EUROS models

- Two different approaches tested and compared (brute force and labelling)
- Increase robustness and scientific understanding
- Sensitivity to the model parametrisations and the city definition

Next steps

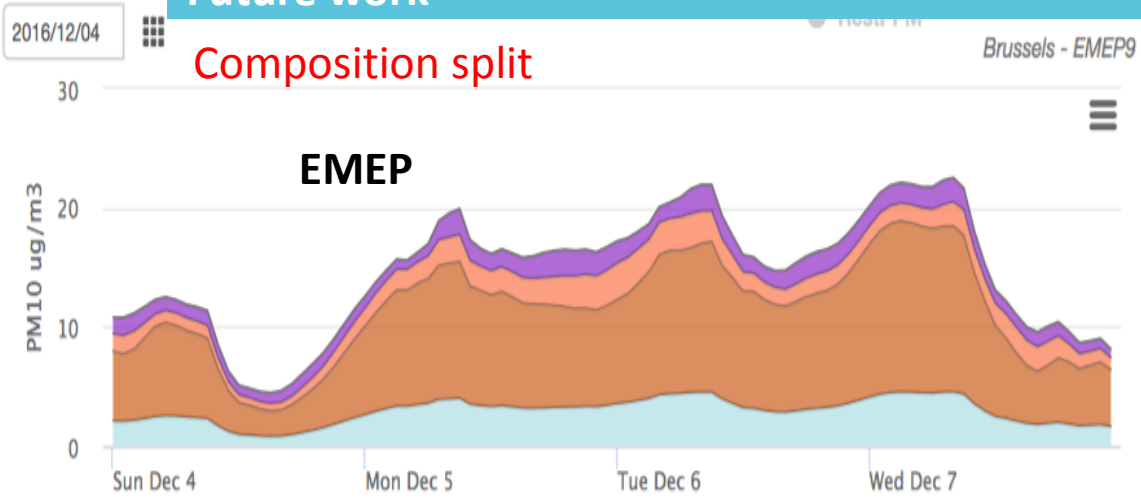
- Further work on evaluation : twin sites, use of fields campaigns with tracers …
- Application to the PM chemical composition

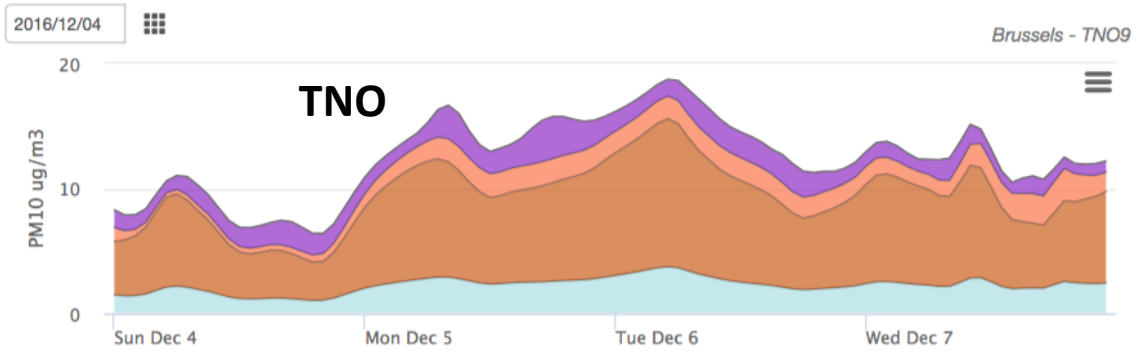


ECMWF Copernicus Europe's eyes on Earth European Commission

Future work

Composition split





Brussels
4-7 Dec 2016

PM10
Chemical
Composition
evolution hourly

for comparable
Components

Atmosphere Monitoring

Possible collaboration with FAIRMODE

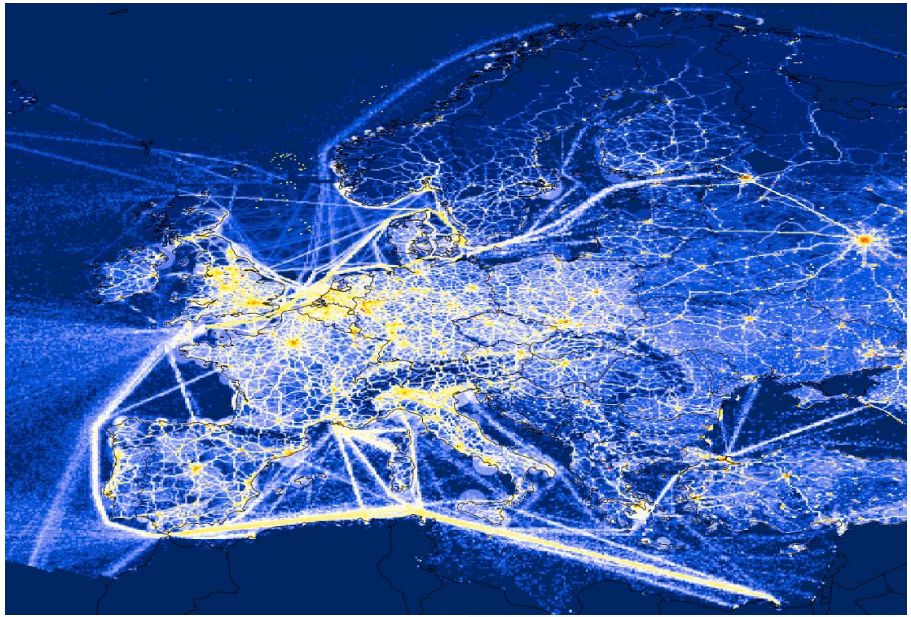
- New tools focused on day to day analysis and episodes
- Support for policy decision and communication in case of episode and analysis/understanding of various air pollution patterns in Europe
  - Variability of the influence of activity sectors
  - Linkages between local and transboundary air pollution
- Planning is not the objective of these tools but they can provide a “first guest” for qualifying exceedances
- Collaborative work
  - On the evaluation of the results: feedback from “informed users” would be very welcome
  - On the interpretation of their results in the light of FAIRMODE recommendations

CAMS Emission inventories

Atmosphere Monitoring

- Current regional emission inventories for regional models : 2011
- In coming weeks release of updated datasets
  - 2015 in March 2018
  - 2016 in March 2019
- Input for CAMS AQ forecasts over Europe + reanalyses
- Input for national AQ forecasts and research
- Benchmark with other initiatives

Example gridded ~ 7 x 7 km TNO-MACC_III emissions data
NOx emissions in 2009 for all sectors



Copernicus Europe's eyes on Earth
European Commission

Atmosphere Monitoring

CAMS emission inventories

- A lot of work to improve accuracy of reported emissions. Few examples:
- Gap filling
  - Example of large point sources (Energy) : Creating dataset of all plants/facilities in sector 1A1a Public power and heat production including emissions, fuel type and coordinates, for years 2000 – 2015.
    Datasets available: E-PRTR; LCP; Platts WEPP; CARMA
- Science based emission factors (residential wood burning)
- International shipping : AIS based spatial distribution
- A lot of work foreseen on temporal profiles and natural sources
- Use of inverse modelling approaches to assess emissions

- Collaboration with FAIRMODE :
  - Intercomparison with other emission inventories
  - Feedback on inaccuracies or uncertainties of current emission inventories
  - Improvement of the spatial distribution of emissions thanks to local proxies
  - Networking with EMEP/NECD reporting which focuses on « official » data elaborated by the national experts

atmosphere.copernicus.eu

Copernicus Europe's eyes on Earth

European Commission

ECMWF

Copernicus EU

Copernicus EU

Copernicus EU

www.copernicus.eu