The MINNI air quality modeling system for the short-term forecast of concentrations of pollutants harmful to humans.

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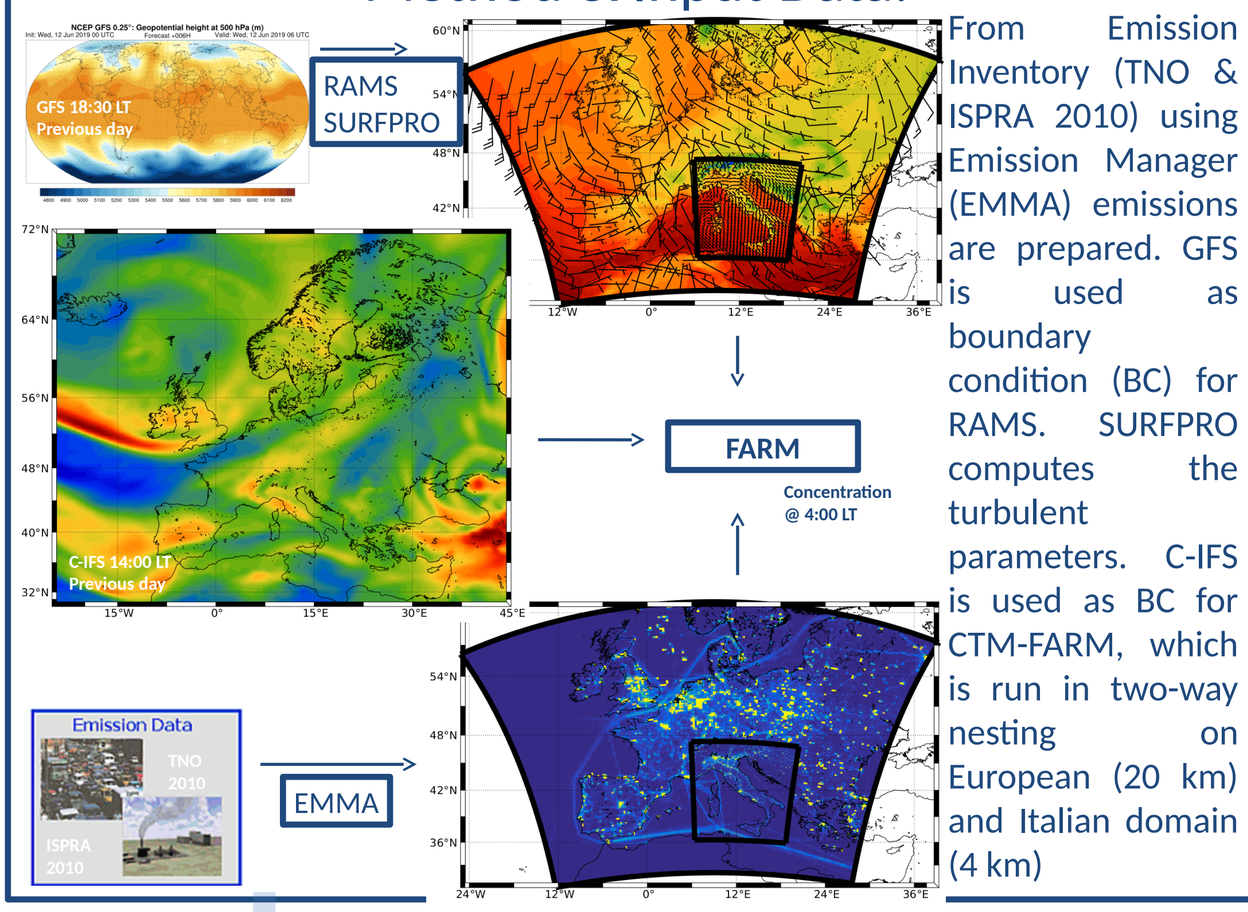
Introduction:

Air pollution impacts human health and environment. Despite the long time effort to reduce pollutant concentration air pollution is still a real concern for the authorities. There are two ways to face the problem: mitigation by means of emission reduction and adaptation minimizing the impact of air pollution. Operational air quality forecasting systems are instruments that, in addition to increase the scientific knowledge, follow the adaptation methodology. ENEA Air Pollution Laboratory, part of Model and Technology Division for Risk reduction, using the resources of Centro computazionale di RicErca sui Sistemi Complessi (CRESCO), has developed the operational Air Quality forecasting system FORAIR-IT. The documented experience gained in the development of the AQ national forecasting system enabled ENEA to enter in the European air quality forecasting services (CAMS_50) within the COPERNICUS program.

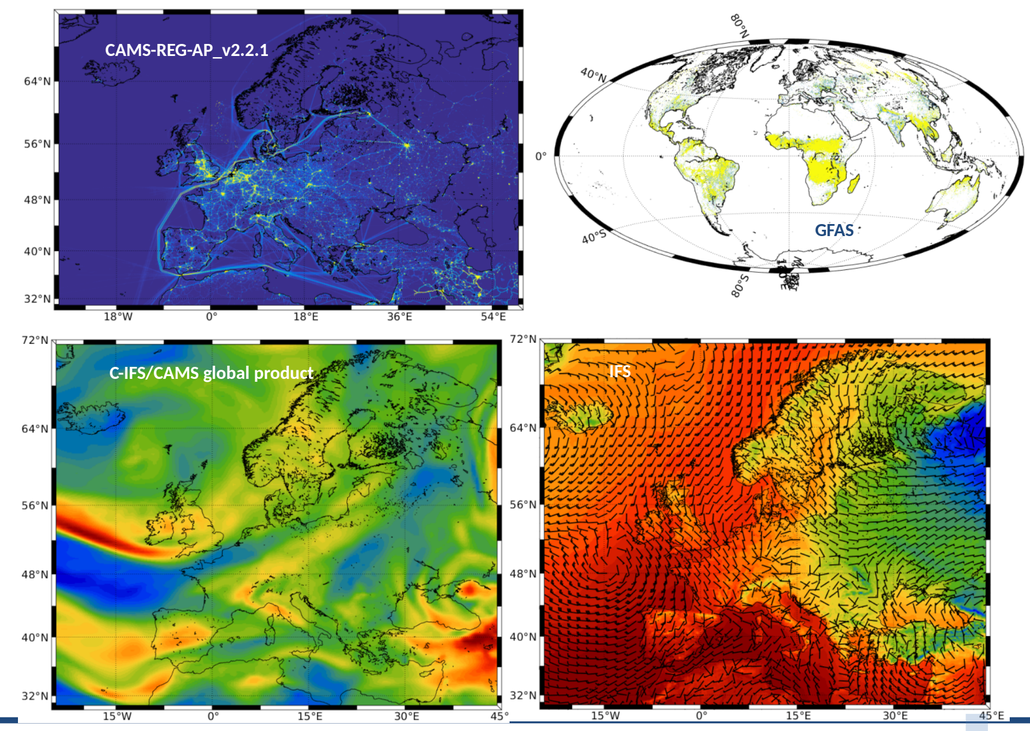
FORAIR-IT
Method & Input Data:



From Emission Inventory (TNO & ISPRA 2010) using Emission Manager (EMMA) emissions are prepared. GFS is used as boundary condition (BC) for RAMS. SURFPRO computes the turbulent parameters. C-IFS is used as BC for CTM-FARM, which is run in two-way nesting on European (20 km) and Italian domain (4 km)

MINNI-CAMS
Method & Input Data:

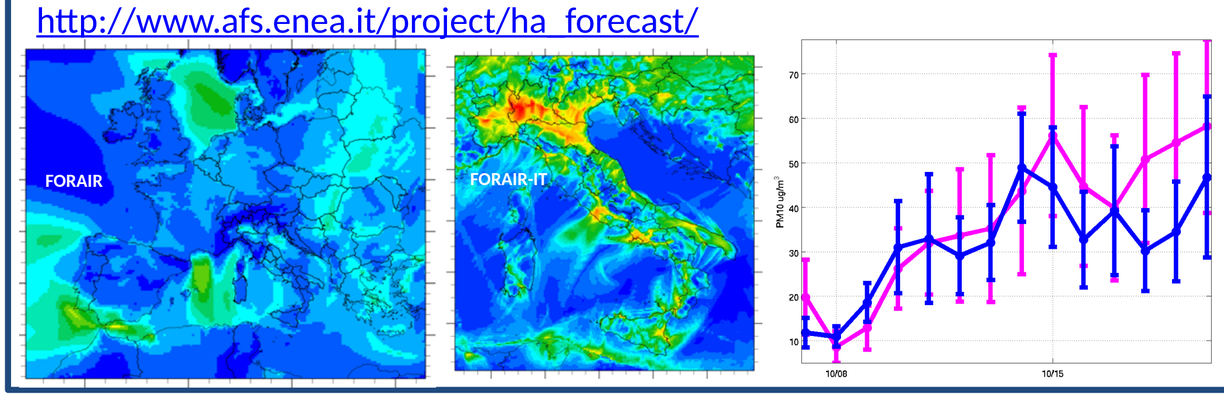
MINNI-CAMS is forced with IFS meteorology, CAMS-REG-AP_v2.2.1 emissions, GFAS fire emissions and C-IFS boundary conditions. It runs at 0.15x0.1° over European domain shown in lower panels.



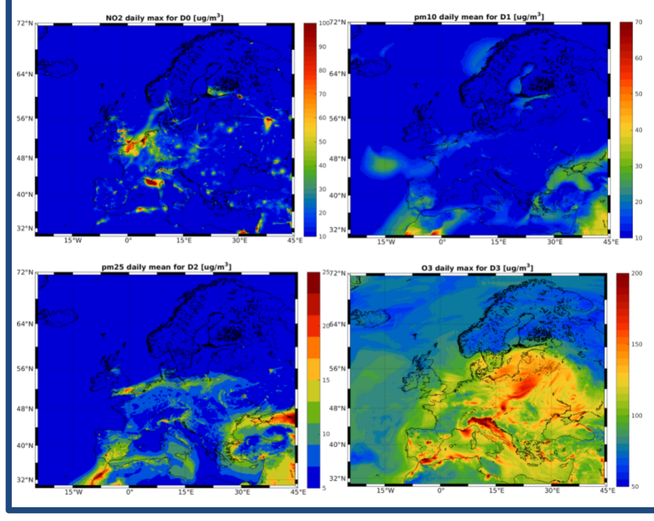
Chemical Transport Model (CTM) FARM	
Gas phase chemistry	SAPRC99
Aerosol size distribution	AERO3
Inorganic aerosols	ISORROPIA
Secondary organic aerosols	SORGAM
Aqueous phase chemistry	Sulphate
Dry deposition/sedimentation	Modelled following a resistance analogy approach (Wesely, 1989).
Mineral dust	Both erosion and resuspension is modelled following Vautard et al. (2005) where the soil suitable for mobilization is parameterized following Zender et al. (2003)
Sea Salt	Modelled following Zhang et al. (2005) approach
Initial values	Previous T+24 forecast
Biogenic emissions	MEGAN2.04
Assimilation module	Optimal Interpolation, Successive Correction Method, Nudging.

Results:

FORAIR-IT consists of 3-days forecasts of hourly concentration for all the regulated pollutants at daily basis. It is regularly validated with available observations. Concentrations are published at about 4:00 local time @ http://www.afs.enea.it/project/ha_forecast/



Results:



MINNI-CAMS will forecast, at daily basis, hourly concentrations of NO_2, CO, O_3, PM10, PM2.5, SO_2 for the current day and the 3 following days; Analysis of the previous day will be also produced.
Sensitivity experiments to different meteorological parameterizations have been conducted in order to choose the best set up.

Conclusions & Future Work:

- FORAIR-IT is operationally since 2017.
- FORAIR-IT will be upgraded with: new meteorological model WRF, new meteorological preprocessor and fire emissions.
- MINNI-CAMS is able to produce forecast using CAMS forcings over European domain.
- MINNI-CAMS will be evaluated against observations and CAMS50 regional ensamble.

Refesences:

Vautard, R., Bessagnet, B., Chin, M., Menut, L. On the contribution of natural Aeolian sources to particulate matter concentrations in Europe: Testing hypotheses with a modeling approach. *Atm. Env.* 39, 3291–3303 (2005).
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