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A NESTED AIR QUALITY PREDICTION MODELLING SYSTEM FOR URBAN SCALE: AN APPLICATION OVER SOUTHERN ITALY

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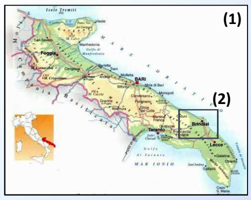
INTRODUCTION

The photochemical simulation of air quality level over Apulia region, in Southern Italy, was performed by using **FARM** photochemical model (Mircea et al., 2015) over a 316 km x 248 km domain, covering the entire region with a 4 km grid spacing. The comparison between simulation results and measured data, provided by the regional monitoring network, evidenced a good behaviour of the model (see poster H17-085), with tendency to underestimate the PM10 levels, possibly due to the adopted resolution, the uncertainties in emission inventories and the measurements representativeness.

In order to provide a more accurate description of local dispersion phenomena and to investigate the reasons of some discrepancies between measured and modelled concentration data, a simulation with an inner domain (with a horizontal resolution of 1 km) was performed. The fine simulation domain covers the Brindisi area, located in the south of the Apulia region (fig. 1, grid 2); this area is characterized by the presence of a very powerful coal fired plant and of widely used biomass burning for residential heating. The comparison between the two simulations results are discussed in this study.



Grid	Grid Spacing	Nx	Ny
1	4km	79	62
2	1km	60	48

Figure 1: The master (1) and nested (2) grids.

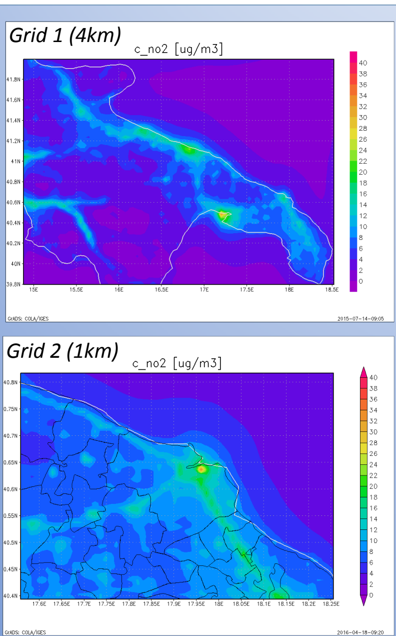


Figure 2: NO2 annual average concentration maps.

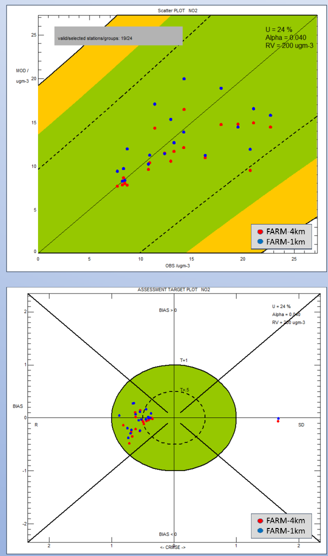


Figure 3: Scatterplot and target plot for comparing NO2 obs vs modelled FARM-4km and FARM-1km concentrations.

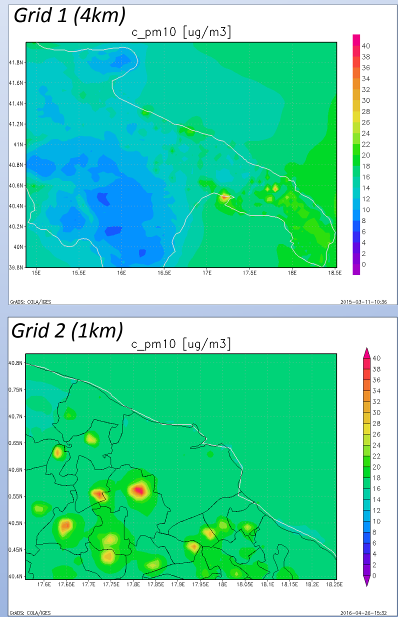


Figure 4: PM10 annual average concentration maps.

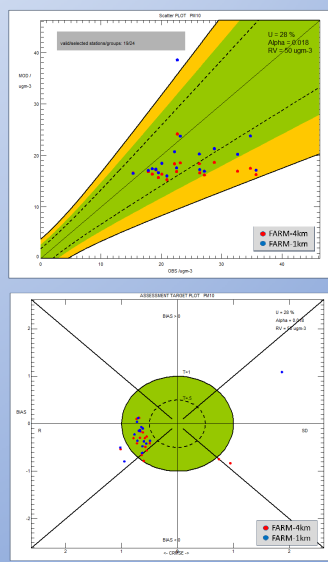


Figure 5: Scatterplot and target plot for comparing PM10 obs vs modelled FARM-4km and FARM-1km concentrations.

Table 1: Statistical indicators for NO2

NO2	FARM-4km	FARM-1km	FARM4-km	FARM-1km	FARM-4km	FARM-1km
	rural (N=3)		suburban (N=16)		urban (N=5)	
obs (µg m-3)	9.7	9.7	12.9	12.9	21.1	21.1
mod (µg m-3)	9.1	9.3	11.1	13.3	14.7	15.6
corr	0.5	0.5	0.4	0.4	0.5	0.5
RMSE (µg m-3)	8.4	9.1	15.1	15.8	16.5	17.3
IOA	0.7	0.7	0.6	0.6	0.7	0.7
NMB (%)	-6.0	-3.0	-10.2	8.1	-30.0	-26.0
FA2 (%)	63.9	55.9	59.6	61.3	62.3	60.8
NMSD (%)	18.7	28.1	-10.5	-2.9	-27.7	-21.5

Table 2: Statistical indicators for PM10

PM10	FARM-4km	FARM-1km	FARM-4km	FARM-1km	FARM-4km	FARM-1km
	rural (N=3)		suburban (N=16)		urban (N=5)	
obs (µg m-3)	22.3	22.3	26.0	26.0	18.7	18.7
mod (µg m-3)	15.9	16.6	17.9	21.3	16.9	17.1
corr	0.3	0.3	0.5	0.5	0.4	0.4
RMSE (µg m-3)	14.3	13.9	14.1	14.9	7.8	7.8
IOA	0.5	0.5	0.6	0.6	0.6	0.6
NMB (%)	-27.9	-24.3	-27.4	-13.9	-8.0	-7.0
FA2 (%)	80.6	83.7	76.8	80.8	90.5	91.6
NMSD (%)	-47.5	-50.2	-31.8	-3.7	-15.7	-14.9

RESULTS AND DISCUSSION

The comparison between coarse and finer grid resolution NO2 (fig. 2) and PM10 (fig. 4) concentration maps evidenced a better representation of pollutant distribution for the finer grid combined with an increase of average values, probably ascribed to a better spatial disaggregation of the emissions. DELTA Tool, an Interactive Data Language-based evaluation software, developed within FAIRMODE to support the application of the EU Air Quality Directive, has been used to evaluate the performances of the model at the two considered grid resolutions. The evaluation (fig. 3 and 5) was performed considering the monitoring stations, placed in the nested grid. As for NO2, the scatter plot showed a good matching between observation and model results for both resolutions and the target diagram showed that MQO was fulfilled at more than 90% of stations. Similar performances resulted for PM10 and a minor underestimation of PM10 levels was resulted for the finer resolution. In table 1 and 2 the comparison per monitoring station type is shown for some statistical indicators. The NO2 simulation with the finer resolution did not improved the results. For PM10 a improvement for inner grid is more evident, as regard the RMSQ, NMB and the FAC2 indicators. Results are probably influenced also by the typology and localization of the monitoring stations.