An air quality forecasting system for a large industrial area in eastern Sicily

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One of the largest Italian industrialised regions is located on the eastern coast of Sicily, between the towns of Augusta and Siracusa. The large number of industrial facilities located in the area, including oil refineries, chemical industries and power generation plants, produces relevant emissions of different air pollutants and creates concern of local population for their possible health effects. The concentration of industries on the coastal land strip gives to the territory a semi-urbanised nature. The presence of a hill range parallel to the coastline and reaching 500 metres height complicates the atmospheric circulation structure, that is characterised by the relevant frequency of sea/land breezes, observed during both summer and winter. Primary pollutants episodes are sometimes caused by convective conditions, fumigation of elevated plumes during sea breeze and direct impact of plumes over the hills. During the last years the local air quality monitoring network has been integrated by a nowcasting system providing real-time air quality model simulations on the basis of diagnostic meteorological reconstruction and lagrangian particle model simulation of continuous industrial emissions. The good performances of the nowcasting modelling system and the positive experience of the EU funded 5th framework program FUMAPEX (fumapex.dmi.dk), for the construction of urban air quality forecasting system for Torino city, fostered the development of an air quality forecasting system for the considered urban area. The forecasting system is projected to provide CIPA (Consorzio Industriale per la Protezione dell'Ambiente) with information useful to support the prevention and management of air pollution episodes even through the definition of mitigation actions, and to inform local authorities and population before the possible episodes. The modelling system is based on the prognostic downscaling of weather forecast meteorological fields and on lagrangian dispersion simulation of industrial emissions. The modelling system configuration is based on three nested domains, the target space resolution of the meteorological model (RAMS) has been set to 1 km, to be sufficient to resolve the main features of local topography and coast, and to roughly define the structure of urban and industrial areas. The air quality model (SPRAY) runs with 500 metres horizontal resolution and considers emissions from 54 stacks. Larger scale meteorological forecast is provided by the model SKIRON, that is applied by the University of Athens on the whole Mediterranean basin (forecast.uoa.gr). The prototype modelling

system has been evaluated through its application to different air pollution episodes occurred during high pressure and strong easterly wind conditions, last winter. The reliability of predictions has been verified through the comparison with meteorological and air quality observations from the local monitoring network and comparing forecasted concentration fields with results from the nowcasting system. The comparison has been based on SO2 measurements, that can be considered weakly influenced by other emissions when high concentrations are observed. The influence on forecasted concentrations of space resolution of the meteorological fields has been investigated to verify the actual need to perform high resolution forecast. Local scale circulation has been described satisfactorily by RAMS for both episodes, while daily temperature near the coastline was underestimated probably due to the rough soil initialisation and to the measuring station position within the industrial area, at less than 2 kms from the sea shore, that can be hardly resolved by the meteorological model resolution. The air quality forecast reconstructed the concentration space distribution consistently with what simulated by the nowcasting system. An overestimation of maximum concentrations has been observed, possibly due to overestimation of surface wind speed or excess of atmospheric stability, limiting plume rise from elevated sources.