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MODELLING THE IMPACT OF A COAL-FIRED POWER PLANT, LOCATED IN SOUTHERN ITALY, FOR RISK ASSESSMENT PURPOSES

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INTRODUCTION

In this study a modelling system has been applied to evaluate the contribution of primary pollutants (NOx, SO2, PM10 and heavy metals) of different emitting sources, related to the coal-fired power plant activities located in the Brindisi area, in the southern Italy (Fig.1). In particular the primary PM10 and heavy metals (As, Cd, Ni, Pb) assessment represented a preliminary activity to the evaluation of the environmental exposure for the population living in Brindisi province. This evaluation will allow to carry out the first risk assessment for health damage related to power plant activities.
Within this area, eleven air quality monitoring stations has been considered (Fig. 2).

***Figure 1**: investigated area and simulation domain*

	Simulation GRID
SW point (UTM)	740.0 – 4455.0
Top domain height	5000m
Grid resolution	0.5km
Cell number X-Y	101* 131

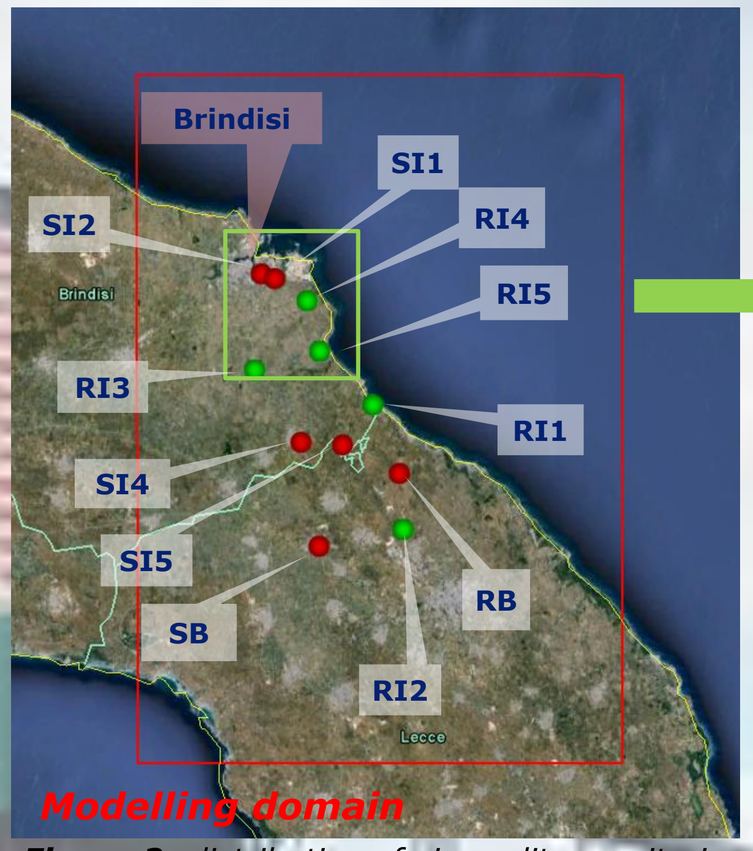


***Figure 2**: distribution of air quality monitoring stations within the modelling domain (red rectangle)*

SI	Suburban-Industrial	ARPA monitoring network
SB	Suburban-Background	ARPA monitoring network
RB	Rural-Background	ARPA monitoring network
RI	Rural-Industrial	ENEL monitoring network

***Figure 3**: localization of emission sources (green rectangle in Fig.2)*

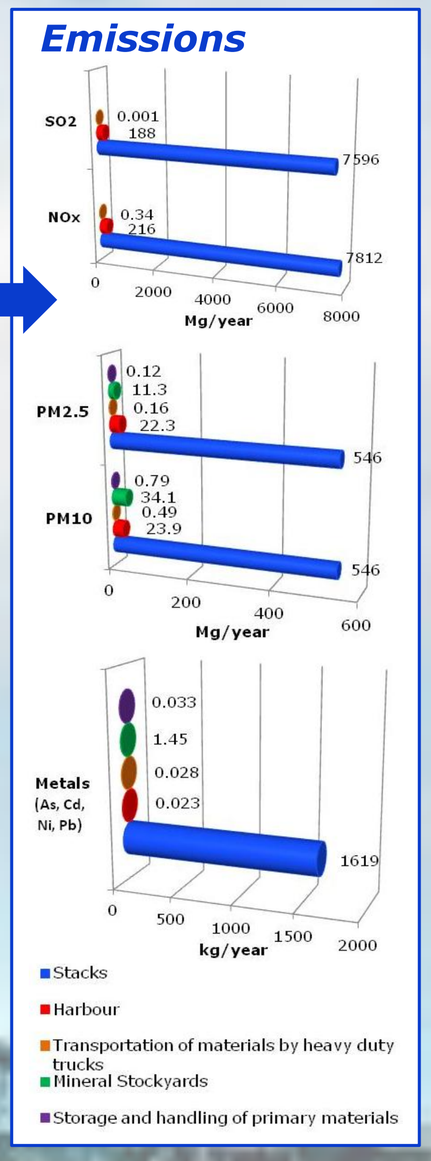


***Figure 4**: Total yearly emissions*

METHODOLOGY

The simulations were conducted for the 2010 year by using the SWIFT, SURFPRO and SPRAY models. In particular the Lagrangian particles dispersion model SPRAY has been applied to provide an accurate local distribution of the **primary** pollutants in the atmosphere in non-homogeneous and non-stationary conditions. Different emissions belonging to the power plant activities were modelled including hourly stack emissions, emissions produced by the storage and handling of primary materials in the stockyards (i.e. coal), emissions related to transportation of materials by heavy duty trucks, emissions related to the hotelling of ships in the port area (Fig. 3). Figure 4 shows these emissions derived from the Emission Monitoring System for stacks , and from the 2010 regional atmospheric emission inventory, built up on the basis of INEMAR (INventario di EMissioni in Aria), for the other sources. Stack emissions represent the greater contribution for all pollutants.

RESULTS

A quantitative source apportionment for primary and regulatory pollutants has been performed (Fig. 5), showing the major contribution due to stack emissions in all monitoring stations and especially for metals, followed by harbour activities and mineral stockyards.

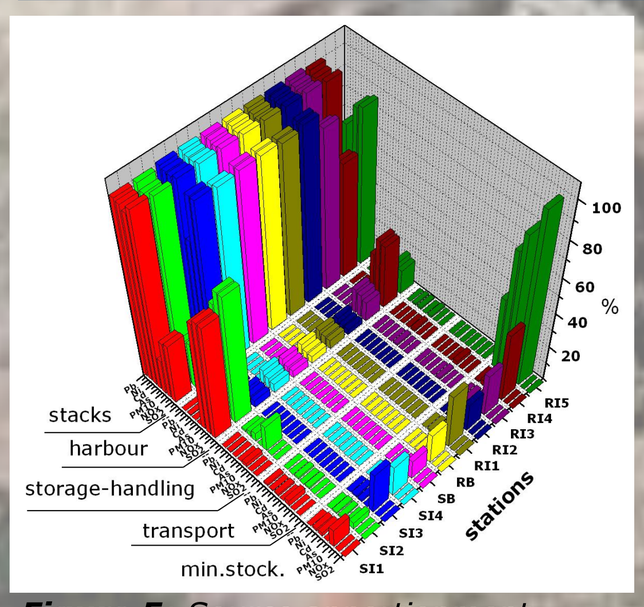


***Figure 5**: Source apportionment*

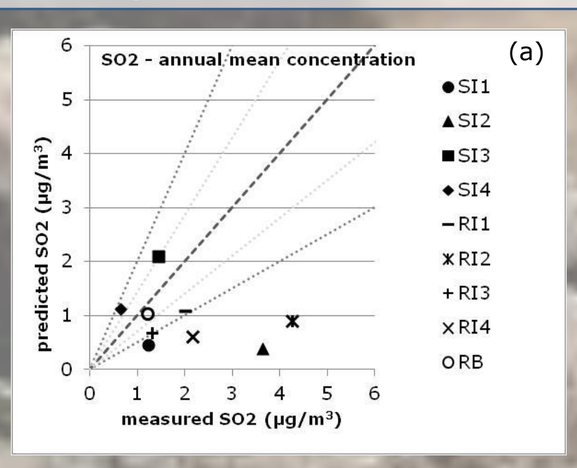
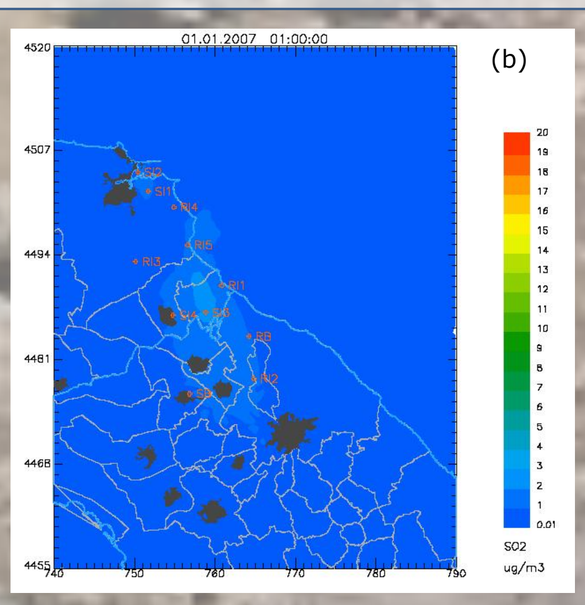


***Figure 6 :** (a) scatter plot of SO2 meas. vs mod. concentrations and (b) SO2 annual average concentration map*



An analysis of simulation results versus local network monitoring data has revealed a good agreement between predicted and observed annual mean SO2 concentration (Fig. 6a), more evident for stations that are located along the plume dispersion axis (Fig. 6b).