WIND TUNNEL MEASUREMENTS OF DISPERSION ABOVE COMPLEX TERRAIN AND A FIRST MODEL VALIDATION EXERCISE

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Wind Tunnel measurements are essential for a complete model evaluation process and very useful not only for developing and improving mathematical models, but also for model validation or comparison between different models to be used for a specific application.

The boundary layer developed wind tunnel of CRIACIV (http://windlab.ing.unifi.it/) is equipped with a system that allows tracer mean concentrations in gaseous samples measured basing on a Flame Ionization Detector (FID), recently up-graded to 24 samples of gas, to be taken from different positions inside the tunnel and analyzed on-line.

An 'enhanced buoyancy scaling relationship' was chosen in spite of a complete scaling relationship in order to have a more suitable wind speed value inside the wind tunnel with respect to the full scale value.

The small scale model was characterized by one stack with a physical height of 0,112 m (45 m at full scale scenario) and emissions represent buoyancy plumes by means of a less than air dense mixture (composed of helium and ethylene). The test field inside which the emission are transported and diffused correspond to an area of about 4.0 m length and about of 2.2 m width (at small scale).

The present work refers to the comparison of two different scenarios of ground conditions: flat one and complex one. The latter is characterized by the presence of a two dimensional hill of 1.125 m length having the same height of the stack.

Different concentration measurements, like ground and vertical profiles, were carried out at different positions downwind the sources, in order to analyze the spatial distribution of the tracer and in order to have a coherent reconstruction of the main diffusion parameters (like effective stack height, and both vertical and horizontal dispersion sigma functions).

Wind tunnel measurements of diffusion above both flat and complex terrain were compared against the SAFE_AIR II (Simulation of Air pollution From Emissions _ Above Inhomogeneous Regions, Version II) numerical model results. SAFE_AIR II code has been recently implemented at the Department of Physics of the University of Genova (Italy), it simulates the transport and diffusion of airborne pollutants above complex terrain at local and regional scale. The previous version of such dispersion code is included in the Model Database of the European Topic Centre on Air Quality of the European Environmental Agency (http://155.207.20.121/mds/search.php3) and has been selected by the Italian National Agency for Environmental Protection (ANPA; http://www.sinanet.anpa.it/aree/atmosfera/qaria/Progetti/GuidaWEB/default.htm).

The main improvements of SAFE_AIR II concern its meteorological part and the algorithms to simulate diffusion of pollutants. In particular, were implemented three different kind of of σ-functions which make use standard deviations of velocity fluctuations and Lagrangian time scales, that is to say which have a lesser degree of parameterization of the turbulence with respect the semi-empical σ-functions implemented in the previous version of the code. The model validation exercise mainly concerned this new aspect of the SAFE_AIR II code.