# High resolution simulation of flow and turbulence in presence of buildings using the RAMS model

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Modelling atmospheric flows and pollutant dispersion in urban areas is a problem of unique characteristics. The complex configuration of the urban site produces small-scale fluid dynamics that superposes to the atmospheric mesoscale flow and turbulence.

Generally, CFD models are used to simulate the flow structure around buildings, obstacles or urban canyons. The main limitation of this methodology lays in the relative simplification of the larger scale meteorology and atmospheric physical processes.

In this work we propose a possible alternative approach starting from the regional scale, by using the latest version of the atmospheric model RAMS. Here, a Cartesian grid extending from sea level to the model top has been implemented and the so called ADaptive Aperture method is used for defining the presence of buildings and deal with arbitrarily steep and even overhanging topography. This version of RAMS enables simulation with very high resolution, in the order of metres.

This approach allows not only to include the boundary layer processes, the interaction with the surface and the soil, the radiation and the moist processes etc., but also to take advantage of the several capabilities, like data assimilation and nudging, offered by the atmospheric models. In recent years, a standard version of the $k$-$\varepsilon$ turbulence closure model was implemented and tested in RAMS and lately also the renormalization group (RNG) version of the $k$-$\varepsilon$ turbulence model has been introduced. This last is claimed to overcome the $k$-$\varepsilon$ deficiencies in the simulation of flow impingement and separation.

Test-simulations of the flow and turbulence were performed using both closure schemes for a reference case of a simple building configuration. Results for different meteorological conditions are presented and discussed. A preliminary comparison with the performance of a CFD model in the same case is also proposed. The effect of the closures on the dispersion of tracer particles was then evaluated through simulations using the HYPACT model.