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Forecasting the weather
- ensemble techniques
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Large eddy simulation model of the ABL with thermal and humid stratification effects

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Prediction of pollutant dispersion in urban area is of crucial importance to assess quality of life of populations. At urban scales, local phenomena take place, governed by the building canopy, together with large scale motion driven by vertical stratification, air humidity and heat sources created in the canopy. This situation requires up-to-date tools able to reproduce the physics complexities. In the present work the large-eddy simulation technique is used to model the atmospheric turbulent boundary layer at urban scales. The model, LES-AIR, has been already developed and is able to take into account geometric complexities and thermal stratification. In the present work we show an improved version of the model where stratification and heat exchange associated to water moisture in air are considered.

In particular will be considered the transport of the potential temperature Θ and of the humidity content of the air parcel. Both will be treated as active scalars and their influence on the flow will be taken into account via the Boussinesq approximation. Moreover the Lift Condensation Level (LCL) will be computed run-time in order to incorporate the effects of the change of phase of water in the limit of pseudo-adiabatic processes.

The model is tested against real scale data. The data from the meteorological station situated in Campoformido (UD), Italy, are included into the definition of the boundary condition at the surface. The Monin-Obukhov similarity theory is invoked in order to properly compute the momentum, heat and water vapor fluxes. In particular the gradient method is adopted to compute the values at the surface from the linear interpolation of the hourly available quantities.

Different cases in different methodological situations are analyzed in order to enlighten the role of humidity in the atmospheric boundary layer. The results are discussed and compared to the vertical data available providing a good agreement.