Modelling convective plumes in the framework of a quasi-non-hydrostatic approach

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As the spatial resolution and the efficiency of diffusion schemes in regional and coastal models increase, vertical velocity of plumes should be taken into account in the case of winter, diurnal or karstic convection. Such processes drive obviously the deep convection in Mediterranean Sea but also participate to the surface mixed layer dynamics during the night or more operationally to the wastewater discharges near the floor.

Convection is commonly parametrized in ocean and regional hydrostatic model as an enhanced vertical mixing or convective adjustment schemes but the static instability resulting from the loss of buoyancy at ocean-atmosphere interface may lead to spurious overestimated and noisy vertical velocities. One the other hand, non-hydrostatic modelling is too heavy to be handled within a realistic simulation framework.

The introduction of the dynamic buoyancy to express selected terms of the vertical momentum balance in a hydrostatic code is a less costly and low-invasive way of simulating convective plumes. This quasi non-hydrostatic solution is first explored in an idealized configuration and compared to previous results and to full non-hydrostatic simulation before to be applied to realistic case of convection in Mediterranean Sea.