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The marine atmospheric boundary layer during the HyMeX/ASICS-MED campaign: observations and simulations under strong wind conditions

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During winter, the north-western Mediterranean Sea is characterised by intense air-sea exchanges linked to regional strong winds (Mistral or Tramontana) which bring cold and dry continental air over a warmer sea.
The HyMeX/ASICS-MED field campaign, devoted to intense sea-atmosphere exchange and deep oceanic convection analysis took place in the Gulf of Lion during winter 2013.
This study uses aircraft observations and a numerical study to investigate the role of the marine boundary layer and its turbulence structure during strong wind conditions. The flight strategy consisted of stacked horizontal legs oriented along and across the wind direction, in order to obtain information about coherent structures of the atmospheric boundary layer. Strong wind events were well-documented with 11 flights during which latent heat fluxes as high as -600 W.m-2 were observed. A numerical study using the Meso-NH non-hydrostatic model is in progress. It enables us to study the representation of the boundary layer in a simple one-dimensional framework, constrained with surface fluxes but also with horizontal and vertical advection estimated from the AROME-WMED model, specially designed for this area with a horizontal resolution of 5,5km, and run in an operational mode during the campaign. A first simulation is designed based on observations of 11 March 2013, a strong wind case (25 m.s-1). This 1-D simulation is able to reproduce the boundary layer development observed this day. From this case, sensitivity tests are carried out to cover a large range of conditions in order to investigate the role of advection, surface temperature, heat fluxes and wind in the evolution of the boundary layer during the period.

The combination of simulations and observations allow us to further analyse those results linked to the impact of surface fluxes on atmospheric boundary layer characteristics.