Geophysical Research Abstracts
Vol. 17, EGU2015-11915, 2015
EGU General Assembly 2015

The marine atmospheric boundary layer during the HyMeX-ASICS-MED campaign: characterization of coherent structures and impact on turbulent flux estimates

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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. The French ATR42 aircraft was operated to document the mean and turbulent structure of the atmospheric boundary layer (ABL) during strong wind conditions. The aircraft was equipped to measure turbulence fluctuations, thus allowing the computation of turbulence parameters. The flight strategy consisted of stacked horizontal legs oriented along and across the wind direction, in order to obtain information about the isotropy of the turbulent field and about coherent structures. Strong wind events were documented with 11 flights during which latent heat flux up to 600 W.m-2 were observed.
The structure of the turbulent field is analysed through the integral length scale and the wavelength of the spectrum peak of the vertical velocity which represent the size of the large and the most energetic eddies, respectively. It reveals a stretching of turbulent eddies along the mean wind. This kind of organized structures plays a major role by modulating the transfers inside the ABL. In particular, this non-isotropic behaviour alters the flux estimates from along-wind samples. This last point is critical because surface and entrainment fluxes, deduced from extrapolation of the flux profiles, are essential parameters to characterise the coupling between air-sea exchanges and the ABL structure.