Geophysical Research Abstracts
Vol. 16, EGU2014-1112-2, 2014
EGU General Assembly 2014

A climatology of air-sea interactions at the Mediterranean LION and AZUR buoys

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The LION and AZUR buoys (respectively at 42.1°N 4.7°E and 43.4°N 7.8°E) provide an extended data set since respectively 1999 and 2001 to present for studying air-sea interactions in the northwestern Mediterranean basin. The two buoys are located where high wind events occur (resp. north western and north easterly gale winds), that force and condition deep oceanic winter convection in that region. A short-term climatology (resp. 13 and 11 years) of air-sea interactions has been developed, which includes classical meteo-oceanic parameters, but also waves period and significant wave heights and radiative fluxes. Moreover turbulent surface fluxes have been estimated from various bulk parameterizations, in order to estimate uncertainties on fluxes. An important dispersion of turbulent fluxes is found at high wind speeds according to the parameterization used, larger than taking into account the second order effects of cool skin, warm layer and waves.

An important annual cycle affects air temperatures (ATs), SSTs and turbulent fluxes at the two buoys. The annual cycle of ATs and SSTs can be well reconstructed from the first two annual harmonics, while for the turbulent heat fluxes the erratic occurrence of high and low flux events, well correlated with high/dry and low windy periods, strongly affect their annual and interannual cycles. The frequency of high surface heat fluxes and high wind stress is found highest during the autumn and winter months, despite the fact that north-westerly gale winds occur all year long at LION buoy. During calm weather period, ATs and SSTs experience an important diurnal cycle (on average 1 and 0.5°C respectively), that affect latent and sensible heat fluxes. Finally, an estimate of the interannual variability of the turbulent fluxes in Autumn and Winter is discussed, in order to characterize their potential role on deep ocean convection.