EMS7/ECAM8 Abstracts,
Vol. 4, EMS2007-A-00202, 2007
7th EMS Annual Meeting / 8th ECAM

The ODAS Italia 1 buoy: an offshore laboratory for air-sea interaction studies

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Fixed offshore platforms are the only means for collecting continuous long time series of both marine and atmospheric surface parameters under all weather conditions. Therefore, they are essential instruments in order to achieve more insight on air-sea interactions phenomena, provide a reference for data collected by satellite and meet the need for validation of large atmospheric and marine system models.

This paper shows the most interesting results achieved by using the data collected from the ODAS Italia 1 buoy in the years 2000-2007.

It is a large spar buoy specifically designed as a stable measuring platform with negligible sensitivity to sea heave and height. The buoy is moored in the Ligurian Sea, at 37 nm far from the coast and on a 1300 meters deep seabed, without any shield for winds and waves. The buoy has a pole-body, about 50 meter long, with a small laboratory on its top. It is equipped by a set of meteorological and marine sensors. The data are both locally recorded and saved on an onboard memory and sent in near real time to the land by a phone link.

Data so far collected have been employed to investigate the temporal evolution of the upper ocean thermal structure and its relationship with the atmospheric forcings. In particular, the analysis reveals a good correlation between the annual behaviour of the thermal gradient in the marine layer from 10 to 30 m depth and the surface water vapour density, assessing it as a valuable climate indicator.

Furthermore, the continuous monitoring of the upper marine layers put in evidence

that the anomalous warming occurred during summer 2003, when the sea surface temperature of the Mediterranean Sea achieved the highest values of the last 50 years, was confined to the upper 10-15 m depth. In fact, by comparing it with the temperatures recorded in the summer before, the temperatures below this level did not show any relevant difference. The correspondent meteorological measurements obtained from the buoy showed that this may be ascribed to the persistence of calm condition which did not allow any vertical mixing process.

The effects of wind stress on the variability of the surface circulation were also investigated. Although the mean current is mainly directed northwest, the data reveals an interesting mesoscale variability. The vertical structure is characterized by highly correlated currents having the same pattern, with intensity decreasing with the depth. Most of the sub-daily variability is due to the inertial currents which occur at all the examined depths very often. The direction and the intensity of the current in the near surface layer (0-8 m) is sometimes different from those recorded in the layers below. Observations and model results indicate that the wind is able to modify significantly the currents only in the upper 14-15 m, thus explaining part of the observed differences.

The near-surface meteorology data from the buoy were also used to validate the outputs from the European Centre for Medium Range Weather Forecast (ECMWF) analysis. The comparison shows that the model reproduces well the baric field while significant differences result for the other variables, which are more affected by local conditions. Particularly, the model underestimates the wind intensity and overestimates both air temperature and specific humidity. This suggests that the observed discrepancies may be due to the poor resolution of the model that probably is not sufficient to appropriately discriminate between land and ocean surfaces in a small basin such as the Ligurian Sea and to take into account local peculiarities.