Geophysical Research Abstracts
Vol. 15, EGU2013-11209-1, 2013
EGU General Assembly 2013

Seasonal cycle of oceanic mixed layer and upper-ocean heat fluxes in the Mediterranean Sea from in-situ observations.

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Heat fluxes across the ocean-atmosphere interface play a crucial role in the upper turbulent mixing. The depth reached by this turbulent mixing is indicated by an homogenization of seawater properties in the surface layer, and is defined as the Mixed Layer Depth (MLD). The thickness of the mixed layer determines also the heat content of the layer that directly interacts with the atmosphere. The seasonal variability of these air-sea fluxes is crucial in the calculation of heat budget. An improvement in the estimate of these fluxes is needed for a better understanding of the Mediterranean ocean circulation and climate, in particular in Regional Climate Models. There are few estimations of surface heat fluxes based on oceanic observations in the Mediterranean, and none of them are based on mixed layer observations. So, we proposed here new estimations of these upper-ocean heat fluxes based on mixed layer.

We present high resolution Mediterranean climatology (0.5°) of the mean MLD based on a comprehensive collection of temperature profiles of last 43 years (1969-2012). The database includes more than 150,000 profiles, merging CTD, XBT, ARGO Profiling floats, and gliders observations. This dataset is first used to describe the seasonal cycle of the mixed layer depth on the whole Mediterranean on a monthly climatological basis. Our analysis discriminates several regions with coherent behaviors, in particular the deep water formation sites, characterized by significant differences in the winter mixing intensity.

Heat storage rates (HSR) were calculated as the time rate of change of the heat content integrated from the surface down to a specific depth that is defined as the MLD plus an integration constant. Monthly climatology of net heat flux (NHF) from ERA-Interim reanalysis was balanced by the 1°x1° resolution heat storage rate climatology. Local heat budget balance and seasonal variability in the horizontal heat flux are then discussed by taking into account uncertainties, due to errors in monthly value estimation and to intra-annual and inter[U+2011]annual variability.