Geophysical Research Abstracts
Vol. 13, EGU2011-11326, 2011
EGU General Assembly 2011

Vertical motion analysis through combined model, satellite and in situ data. Preliminary results of the MESCLA project

Ananda Pascual (1), Simón Ruiz (1), Bruno Buongiorno Nardelli (2), Stéphanie Guinehut (3), Yann Drillet (4), Sandrine Mulet (3), Marie-Hélène Rio (3), Francesco Bignami (3), Gilles Larnicol (3), and Joaquín Tintoré (1)

(1) IMEDEA(CSIB-UIB), TMOOS, Esporles, Spain (ananda.pascual@uib.es), (2) Istituto di Scienze dell'Atmosfera e del Clima, Roma, Italy, (3) Collecte Localisation Satellites, Toulouse, France, (4) Mercator-Ocean, Toulouse, France

Vertical motion associated with mesoscale and sub-mesoscale oceanic features is of fundamental importance for the exchanges of heat, fresh water and biogeochemical tracers between the surface and the ocean interior. Unfortunately, direct measurements of the vertical velocity are difficult to obtain for usual values (order 10's m/day). In fact, while the vertical component of ocean currents can be diagnosed in primitive equation numerical models simply solving the continuity equation, this technique is not applicable to direct observations. This is due, on one hand, to the few current measurements available, and, on the other hand, to the high error that would result from the computation of the divergence from measured horizontal velocities, that may include significant instrumental errors. It is impossible to use the continuity equation to estimate the vertical velocities from dynamic heights, as the geostrophic velocities are non-divergent by definition. Various indirect methodologies have thus been proposed to estimate vertical velocity from observed density and geostrophic velocity fields. The most used technique is based on the solution of the quasi-geostrophic Omega equation.

In the frame of the MESCLA project, a R&D proposal of the MyOcean EU FP7 project (more information on MESCLA will be given in the general presentation by Buongiorno Nardelli et al.), different estimates of the vertical velocities derived from observations will be computed, both starting from a purely observational approach and from the modelling approach, i.e. considering the analyses provided by numerical models which include data assimilation. The motivation for this double approach is that, while data assimilation is certainly crucial to obtain more accurate analyses and forecasts, especially at the shorter time scales, its results might still be significantly influenced by specific model configurations (e.g. forcing, parameterization of smaller scale processes and spatial resolution). Comparing the two approaches might thus help to better understand the vertical exchanges associated with mesoscale processes.

Preliminary results have focused in the Gulf Stream, a well known area characterized by intense mesoscale and sub-mesoscale variability, showing high sensitivity, both in terms of shape and intensity, to the spatial resolution of the model. Indeed, vertical velocities directly obtained from the 1/12º (PSY2V3R1) model are a factor of 2-3 larger the than the 1/4º (PSY3V2R2) version (maximum upward and downward motion of the order of 40-60 m day.1 versus 20-30 m day.1, respectively). The comparisons with QG vertical velocities reveal reasonable agreements for the eddy resolving simulation (PSY2V3R1) at a depth of 100 m, even if model QG's can values can be overestimated. Regarding the QG vertical velocities obtained from the purely observational approach (ARMOR fields with 1/4º resolution), they are of the same order of magnitude as PSY3V2R2 ones but the patterns shape and location are very different. Further steps include performing a thorough comparison and analysis of the vertical velocities estimation, as well as assessing the impact of spatial resolution, boundary conditions and sensitivity on the spatial dependence of Brunt-Vaisala frequency.