Geophysical Research Abstracts
Vol. 18, EGU2016-12470, 2016
EGU General Assembly 2016

Impact study of the Argo array definition in the Mediterranean Sea based on satellite altimetry gridded data

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The existing Argo network provides essential data in near real time to constrain monitoring and forecasting centers and strongly complements the observations of the ocean surface from space. The comparison of Sea Level Anomalies (SLA) provided by satellite altimeters with in-situ Dynamic Heights Anomalies (DHA) derived from the temperature and salinity profiles of Argo floats contribute to better characterize the error budget associated with the altimeter observations.

In this work, performed in the frame of the E-AIMS FP7 European Project, we focus on the Argo observing system in the Mediterranean Sea and its impact on SLA fields provided by satellite altimetry measurements in the basin. Namely, we focus on the sensitivity of specific SLA gridded merged products provided by AVISO in the Mediterranean to the reference depth (400 or 900 dbar) selected in the computation of the Argo Dynamic Height (DH) as an integration of the Argo T/S profiles through the water column. This reference depth will have impact on the number of valid Argo profiles and therefore on their temporal sampling and the coverage by the network used to compare with altimeter data. To compare both datasets, altimeter grids and synthetic climatologies used to compute DHA were spatially and temporally interpolated at the position and time of each in-situ Argo profile by a mapping method based on an optimal interpolation scheme. The analysis was conducted in the entire Mediterranean Sea and different sub-regions of the basin. The second part of this work is devoted to investigate which configuration in terms of spatial sampling of the Argo array in the Mediterranean will properly reproduce the mesoscale dynamics in this basin, which is comprehensively captured by new standards of specific altimeter products for this region. To do that, several Observing System Simulation Experiments (OSSEs) were conducted assuming that altimetry data computed from AVISO specific reanalysis gridded merged product for the Mediterranean as the “true” field.

The choice of the reference depth of Argo profiles impacts the number of valid profiles used to compute DHA and therefore the spatial coverage by the network. Results show that the impact of the reference level in the computation of Argo DH is statistically significant since the standard deviation of the differences between DH computed from Altimetry and Argo data referred to reference depth of 400 dbar and 900 dbar are quite different (4.85 and 5.11 cm, respectively). Therefore, 400 dbar should be taken as reference depth to compute DHA from Argo data in the Mediterranean. On the contrary, similar scores are obtained when shallow floats are not included in the computation (4.85 cm against 4.87 cm). In any case, we must highlight that all the studies show significant correlations (95 %) higher than 0.70 between Altimetry and Argo data with a STD for the differences between both datasets of around 4.90 cm. Furthermore, the sub-basin study shows improved statistics for the eastern sub-basin for DHA referred to 400 dbar while minimum values are obtained for the western sub-basin when computing DHA referred to 900 dbar. On the other hand, results about the OSSEs suggest that maintaining an array of Argo floats of 100×100 km, the variance of the large-scale signal and most of the mesoscale features of SLA fields are recovered. Therefore, the network coverage should be enlarged in the Mediterranean in order to achieve at least this spatial resolution.