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Discussions

Interactive comment on "Variational assimilation of Lagrangian trajectories in the Mediterranean ocean Forecasting System" *by* J. A. U. Nilsson et al.

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Reply to Anonymous Referee #2 OSD 8, C933-934, 2012.

1) The Mediterranean OGCM will be described in more detail as requested.

2) The daily surface drifter and intermediate Argo float trajectory forecasts are computed "on-line" in the OceanVar trajectory model. This will be specified in Section 2.2, and the trajectory model will be described in an Appendix (solicited also by Referee#1).

3) In three-dimensional variational assimilation of vertical profiles of in-situ data, the corrections are introduced at the interpolated depths that should correspond to the

"nominal" depths of the sensors. This is how temperature and salinity profiles from Argo floats are assimilated at specific depths in the water column at time-dependent positions lon XX, lat YY. The uncertainties related to this nominal depth is introduced in the observational error matrix. Analogously, velocity field corrections due to observed drifter positions will be introduced at the drifter nominal depth at 15m (Gerin et al. 2009). These corrections can thereafter propagate in the vertical plane through the linear operator EOF's in background error covariance matrix (this will be briefly explained in the Appendix). Moreover, the 5th layer in the OCGM is centered around 15.48 m depth (upper limit 13.465m, lower limit 17.499m), thus proving the most representative level of the velocity fields along the drifter track, cf. Figs. 2, 3a, and 4 (quivered fields). In conclusion, it is true that the movements of the drifter (drogue centered at 15m) are representative of the velocity fields between 13-17 m depth, and by inferring the velocity field corrections at the nominal drifter parking depth of 15 m it is expected that the model field (both in the vertical and the horizontal plane) will be directly influenced in the vicinity of these assimilation points by the OceanVar software.

4) I will rephrase this sentence (on p. 2512, line 10).

5) The drifter data was post-processed according to the procedures due to Hansen and Poulain (1996). The raw drifter data was edited for e.g. spikes and outliers, and thereafter interpolated at 2-hour intervals (krieging). In order to exclude high-frequency inertial and tide signals, the data was 36-hour low-pass filtered (Gerin et al. 2009), and re-sampled at a daily rate. The MFS configuration, on the other hand, does not include tides, thus the modelled high frequency signals would be expected to be largely due to wind-induced inertial currents. The period of inertial currents depends on latitude and ranges between 17 hours in the northern parts of the Mediterranean to 24 hours in the south (the Levantine basin). Due to rather fortunate circumstances, the inertial period in the study area coincides with the 24-hour averaging period of the MFS forecasts, so it was assumed that the influence of inertial residuals in daily model fields would be minor. The point made by the referee is most important, it is crucial that the model

and observed data sets are pre-processed identically so that the results are comparable. If data assimilation of drifters were to be undertaken in another area (located at a different latitude), I would suggest that an internal low-pass filter be implemented in the OceanVar so that the on-line modelled trajectories are first filtered, then compared to the observations. The point of this manuscript was to present some new results showing that drifter assimilation yields a possibility to improve the quality of the surface velocity forecasts, however, it is of great importance that the influence of inertial currents on the model analyses be examined within the scope of a future study.

6) In fact, quasi-lagrangian trajectories would be the most accurate nomenclature due to the fact that both instruments are anchored to parking depths during the drifting periods. However, previous attempts to assimilate data sets from "freely" moving buoys have so far been categorized as "Lagrangian data assimilation" (nugding, optimal interpolation, Kalman filters, or here, 3DVAR), thus, for the sake of continuity, I will call the method that also here, but I will point out the name inconsistency in the Introduction of the manuscript.

Interactive comment on Ocean Sci. Discuss., 8, 2503, 2011.