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Assimilating glider data operationally in the CYCOFOS Levantine model

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Assimilating observed ocean state variables improves the forecast skill of oceanic flow models. Many forecast centers and institutions assimilate remotely-sensed observations such as sea level anomaly, sea surface temperature, and surface currents. For further improvement, in situ data from the ocean depths are assimilated, typically temperature and salinity profiles, as they are often available in near real time. In many regions, there are few available in situ observations, because of gaps in the observational system (most often ARGO profiling floats and expendable bathythermographs from ships of opportunity). If resources allow, it is preferable to use an autonomous, steerable platform, the ocean glider, to collect observations of specific processes and/or wide areas and long times in near real time for data assimilation. In this study, we illustrate the construction and operation of such an observing and data assimilating system in the Eastern Levantine basin of the Mediterranean. The existing POM-based model of the CYCOFOS-Cyprus Coastal Ocean Forecasting and Observing System is nested within a regional model of the Eastern Mediterranean (ALERMO), which is in turn nested within the operational MyOcean regional model of the Mediterranean (MFS). Each model is run daily, with assimilation of various data products. In this study, glider data were assimilated in the CYCOFOS model only, without influencing the coarser resolution models that provide the initial and boundary conditions. Every day, the model was run in hindcast mode for 1.5 days, during which innovations were computed based on available glider data. At the end of the hindcast, the data assimilation tool OceanVar (based on 3DVAR) calculated corrections to the temperature and salinity fields, which were introduced into the initial time steps of the forecast run of the current day. The forecast run continued for 4.5 days. The run was carried out from 1 December 2011 until 15 April 2012, during which time a single ocean glider carried out a pattern covering a large portion of the domain. Comparisons with a control run showed that the CYCOFOS model assimilating the gliders data could better capture the presence of the Cyprus warm core eddy when assimilating glider T-S profiles. Comparisons of glider-measured values of temperature and salinity with values predicted at that location 4 days prior as well as comparisons with other data sets when available (SST, SLA, MDT, XBT, drifters) show the improvement of the forecasting skill. The specific experiment illustrates the value of glider data when introduced in high-resolution models.