Deriving surface currents, using a multi-source approach and variational inverse method.

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Sea surface currents (SSC) are central for understanding ocean upper dynamics and interactions. Currents transport heat, mass, create conditions for up- or downwelling systems and drive the content of the primary variables such as oxygen and chlorophyll. Thus, SSC is an important factor that conditions primary production and therefore, the whole biological interaction of the trophic chain. Surface currents play also a central role in dispersion of pollutants, for example in the case of oil spill models. Due to this, SSC are part of the Essentials Ocean Variables (EOVs, as defined by Global Ocean Observing System community), which confirms their importance to oceanography knowledge and research. As a consequence, analysis over large timescales and areas are precious for capturing variability and recurrent patterns of circulation.

Three different sources of information (Sea Surface Elevation, Drifters and HFRadars) are analysed together in the same framework and a complete gridded product is generated via a variational inverse method. The variational inverse method is called DIVAnd (Data-Interpolating Variational Analysis in n dimensions) and is based on a cost function which will penalize abrupt gradients in the analyses. The approach also considers dynamic constraints which are added to the cost function. We consider the presence of the coastline, the generally small horizontal divergence, Coriolis force, the surface pressure gradient, and temporal coherence of the system. The current work is dedicated to the Mediterranean Sea surface currents and to propose a 10 years' time series of the whole sea. The objective is to have an effective resolution of 7 km and a temporal resolution around 30 days. This work is shared as an open-source approach where any region of interest can be resolved.