Geophysical Research Abstracts
Vol. 14, EGU2012-12023, 2012
EGU General Assembly 2012

Diva software, a tool for European regional seas and Ocean climatologies production

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Diva (Data-Interpolating Variational Analysis) is a software based on a method designed to perform data-gridding (or analysis) tasks, with the assets of taking into account the intrinsic nature of oceanographic data, i.e., the uncertainty on the in situ measurements and the anisotropy due to advection and irregular coastlines and topography. The Variational Inverse Method (VIM, Brasseur et al., 1996) implemented in Diva consists in minimizing a variational principle which accounts for the differences between the observations and the reconstructed field, the influence of the gradients and variability of the reconstructed field. The resolution of the numerical problem is based on finite-element method, which allows a great numerical efficiency and the consideration of complicated contours. Along with the analysis, Diva provides also error fields (Brankart and Brasseur, 1998; Rixen et al., 2000) based on the data coverage and noise.

Diva is used for the production of climatologies in the pan–European network SeaDataNet. SeaDataNet is connecting the existing marine data centres of more than 30 countries and set up a data management infrastructure consisting of a standardized distributed system. The consortium has elaborated integrated products, using common procedures and methods. Among these, it uses the Diva software as reference tool for climatologies computation for various European regional seas, the Atlantic and the global ocean.

During the first phase of the SeaDataNet project, a number of additional tools were developed to make easier the climatologies production for the users. Among these tools: the advection constraint during the field reconstruction through the specification of a velocity field on a regular grid, forcing the analysis to align with the velocity vectors;

- the Generalized Cross Validation for the determination of analysis parameters (signal-to-noise ratio);
- the creation of contours at selected depths;
- the detection of possible outliers;
- the hydrostatic constraint for eliminating the potential hydrostatic instabilities arisen from the combined analysis of temperature and salinity data in several horizontal planes independently;
- the specification of a variable correlation length over the domain, allowing one to consider different scales of interest according to the location;
- the computation of the error field based on the real correlation function of the considered data;
- the generation of semi-normed reference fields.

Collaboration with Diva users (marine data centres) permitted the identification of a variety of problems that can occur in the Diva analysis due to numerical computations and/or data types (i.e. negative concentrations for certain data sets of bio-chemical and nutrient data). To solve these problems, new options were designed and implemented additional for Diva computation algorithms. Among these new options the user has the possibility to:

- avoid negative values performing analyses based on transformed data (i.e. anamorphosis transformation),
- avoid unrealistic and/or negative concentrations due to small number of data using semi-normed reference field generated with data sets from other layers, to perform a layer analysis,
- filter vertically the background (mean data) or reference fields for vertical field coherence.

Diva analysis tools and options, as well as Climatologies validation tools will be presented, with a demonstration of efficiency of the new Diva options using bio-chemical and physical data, through samples of climatologies for different regions of the Mediterranean sea.