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# Estimation of covariance fields in the Ionian from P.O.E.M. Data

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We present an extensive analysis of hydrological data in the Northern Ionian Sea. This data set merges italian and greek data sets from the POEM-V-87 general circulation survey of september 1987 and covers the Northern Ionian Sea as shown in Fig. 1. The goal of this study is to calculate the covariance matrices for various physical fields such as temperature, salinity and dynamic height.

The data set consists of about 150 stations of CTD casts which were used to calculate the dynamic height profiles at 11 standard depths (5, 30, 75, 125, 175, 250, 400, 600, 800, 1100 and 1650 meters) referred to 2000 meters (or about the average depth of the region shown in Fig. 1). These standard depths were chosen because they reproduced the continuos dynamical mode eigenvalues for the first four modes whithin a few percent of accuracy ( first , second and third Rossby radii of deformation are 11.4 $km$, 5.8 $km$, 3.9 $km$ respectively).

The dynamic height covariance matrices show a well defined correlation scale which decreases with depth and is shaped elliptically, with the ratio of minor to major axis encreasing with depth. In Fig. 2 we show a $600 \times 600\ km^2$ domain of contoured covariance function for the 250 m level, in the middle of the Levantine Intermediate Water (LIW) layer. The data have been binned into $75 \times 75 km^2$ bins since the nominal station spacing is half a degree of latitude and longitude. The covariance function has a larger zonal than meridional scale at all levels below 30 meters indicating the presence of a large scale trend and the tendency for the motion to be highly correlated in the zonal direction. Despite this anisotropy we calculated the decorrelation scale, $a$, and decay scale, $b$, of the covariance function as if it was a perfect circle and decaying as a gaussian function. We estimated that $a = 150\ km$, $b = 100\ km$ at 5 and 30 m; $a = 120\ km$, $b = 80\ km$ at 75 m and $a = 90\ km$, $b = 60\ km$ at all the remaining levels. Furthermore we note that the covariance matrix shows secondary peaks at some of the LIW levels indicating the presence of multiple scales in the field.

Fig. 1

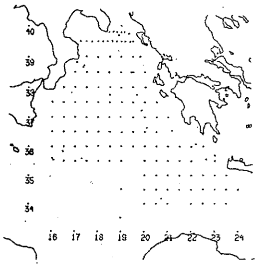
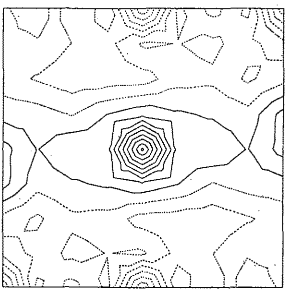



Fig. 2



The salinity, S, and temperature , T, covariance matrices are similar between themselves in the LIW and deep layers but not at the surface where the salinity shows a larger decorrelation scale with respect to the temperature field. Below 250 m. and above 600 m, the T and S covariance functions are elliptically shaped with the major axis oriented in the NE-SW direction while the dynamic height covariance has its major axis aligned in the zonal direction. This indicates that salinity and temperature effects are compensating at these levels where LIW is present. Below 600 m the T and S covariances become similar to the dynamic height ones, showing the alignement of their major axis in the zonal direction.