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# Circulation in the Gulf of Trieste: measurements and model results

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The scope of the study is to present the exchange of water mass between the Gulf of Trieste and the Adriatic Sea. For this a time series analysis of currents for the period 2003-2006, which were measured by the coastal oceanographic buoy (http://buoy.mbss.org) was conducted. Moreover, a comparison between these data and results obtained from a numerical model of circulation in the Gulf was performed to validate model results.

Current-meter data were retrieved from the ADCP instrument placed below the coastal buoy. Data collected in bins of a thickness of 1 m were vertically averaged over layers of thickness of 4 m. From a de-tided time series of currents in five layers seasonal principal axes of velocity variance were calculated together with the seasonal mean velocities. Validation of model results with experimental data required adjustments of the time series. Time series which resulted from measurements were adjusted to a time scale of a perpetual year applied in the model, which is composed of 360 days, while the time series of the model, which runs in a sigma-coordinate system, were interpolated to z-levels that correspond to the centres of the layers of the experimental results (2 m, 6 m, 10 m, 14 m and 18 m).

The principal axes analysis of the experimental data revealed the following:

During winter the major axis in the first cell (1-4m depth) near the surface is oriented along the axis of the Gulf (SW-NE). Averaged winter velocities show an outflow from the Gulf in each year 2003-2006. This is mainly a consequence of the Bora wind (NE wind) which is the main driving mechanism during this season. However, in all other four cells at depth (5-21m) a compensating current is present that directs the water mass in the Gulf.

During spring a strong outflow is again present in the top-most layer in all years. Even though the Bora wind is less frequent in spring than in winter it still has a significant impact on the surface layer. In all other layers at depth the mean velocity in all years generally shows an inflow. The direction of the major axes of variance also prevails in a direction along the Gulf.

In summer the principle axes of current velocity variance are similar for all five cells and are aligned with the Gulf's axis. A mean outflow current is present in the surface layer (first cell) for the years 2005 and 2006. However, for the first two years (2003-2004) an inflow current is present. This could be explained by relatively calm (and very warm) summers in 2003 and 2004. In all the other four depth cells a mean inflow current is present and decreases with depth.

During autumn currents differ significantly from those in summer: the mean outflow current is present in the surface layer in the years 2003-2004. Otherwise, in all other depth cells (6-21m) a mean inflow current is present.

Comparison of experimental data with model results shows that in the surface layer the model results generally agree well with measurements. There is generally an outflow throughout the year in the surface layer. However, results from the model show a much stronger outflow in the late summer period (August-September), which is a few times larger than that of the measurements. In the second layer (depths 5-9 m) below the surface results are completely unmatched. While the model shows mainly an outflow, the analysis of measurements shows that there is generally an inflow throughout the whole year. In the third layer model results qualitatively agree with measurements for the first half of the year, when there is an inflow current. However, in the second half of the year results from the model again show an outflow current, while measurements revealed an inflow. In the fourth and fifth layers (10-18 m) model results qualitatively agree with the measurements and they show a prevalent inflow in the Gulf.

References:

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