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Seasonal variability of inflow and outflow regimes in the Gulf of Naples

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Since 2004 the Department of Environmental Sciences of the Parthenope University manages, on behalf of AMRA (the former Competence Center for the Analysis of Environmental Risks of the Campania Region), an HF radar system composed of three transceiving stations located along the Gulf's coasts, which provide hourly data of surface currents over the whole Gulf area with 1 km of resolution.
The radar system is part of a meteo-marine monitoring network; recently, in the framework of the EU-funded MED TOSCA (Tracking Oil Spills and Coastal Awareness Network) project, a modeling component was added to the network, based on the ROMS (Regional Ocean Modeling System) code.
A one year-long HF radar time series and ROMS outputs of surface currents are utilized to look into the seasonal variability of current patterns in the Gulf of Naples.
In particular, we focus on the net water inflow and outflow, i.e. on the exchange between the interior of the Gulf and the neighbouring Tyrrhenian Sea. This is done by computing the average surface current on a transect between the islands of Capri in the South and of Nisida in the North, which is considered as the boundary between the inner gulf and the open sea. First, a comparison between wind and HF radar data shows the crucial importance of the surface forcing on the upper circulation, dominated by breeze in late spring and summer and by more stable, offshore-oriented winds in fall and winter. Then, the analysis of the zonal component of currents allows to assess the existence of two different in-/outflow regimes associated with the above wind seasons: spring and summer show a tendency to stagnation inside the Gulf, whereas winter is characterized by a very effective water renewal mechanism. Results of ROMS simulations show a good agreement with such patterns.