

Interaction between currents, meteorological and topographic forcings; the case study of Portofino Promotory (northern Ligurian shelf) in summer 2004



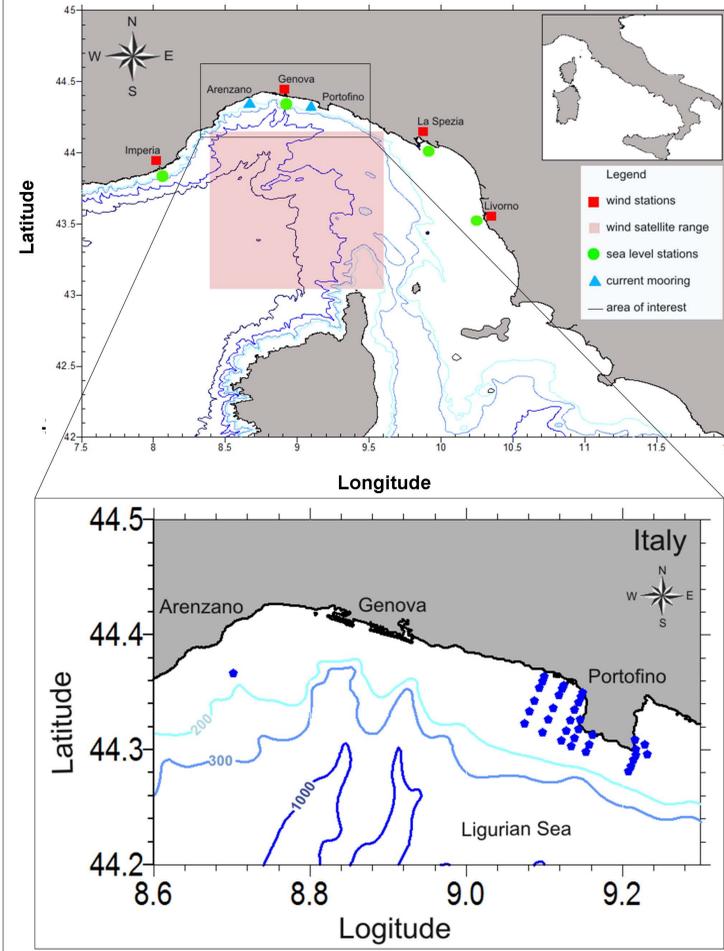
M. Locritani^{1,2}, A. Vetrano³, M. Rixen⁴, G.P. Gasparini³, P. Povero², J. Chiggiato⁴, C. Carmisciano¹
 1: Istituto Nazionale di Geofisica e Vulcanologia;
 2: Università di Genova;
 3: Consiglio Nazionale delle Ricerche – ISMAR-SP;
 4: NATO Undersea Research Centre



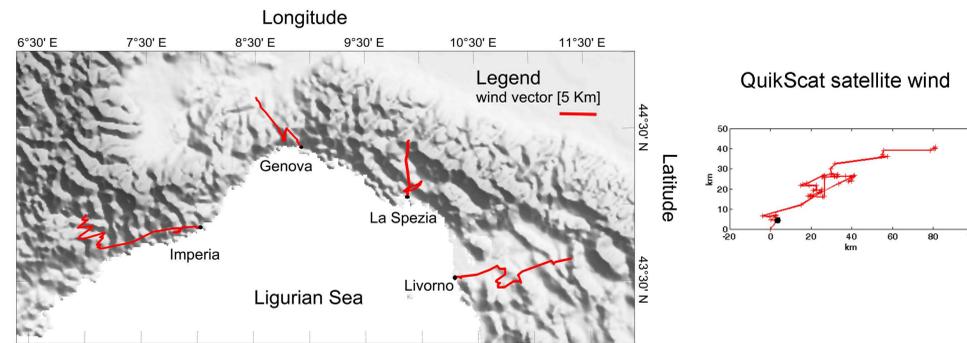
Abstract

The hydrological, current-meter, sea level and meteorological data were acquired in the northern Ligurian sea in summer 2004. Data have been taken by different kind of instruments and resolution. This work try to joint different sources to describe the coastal dynamic near the cape of Portofino and to define its relation with the general cyclonic circulation (represented by Arenzano current), the orography and the meteorological forces.

The area of interest



Wind field in the Ligurian Sea



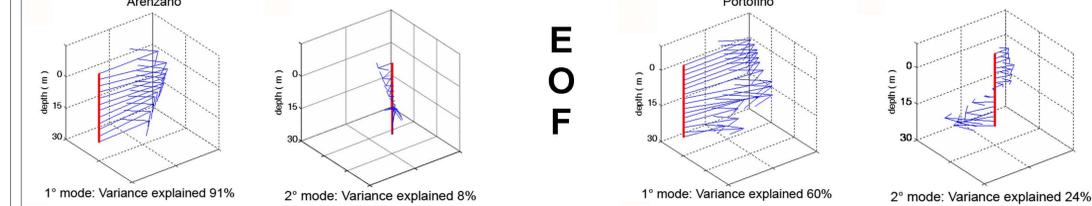
A detailed study about the coastal and general (QuikScat) wind, around the Ligurian Sea, has been performed in the summer period (July 1st to August 30th). The Livorno wind stress follows the QuikScat wind coming from South-West, while the Genova and La Spezia prevalent wind direction is coming from South-East and Imperia winds blows from East; this result suggests a cyclonical feature of the coastal wind field.

Current fields in Arenzano and Portofino marine areas

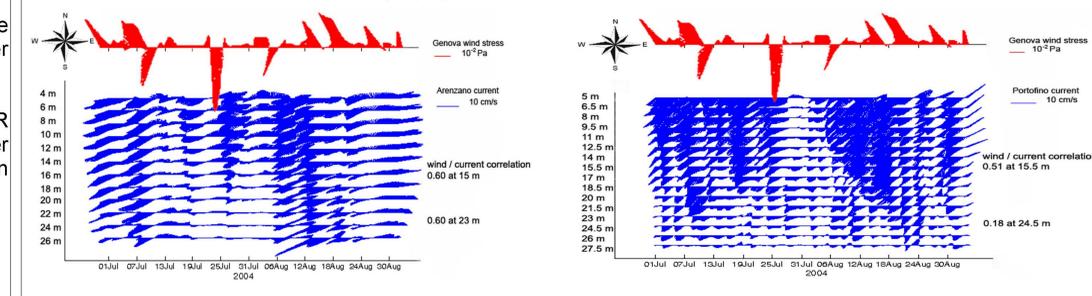


The current meter data acquired in Arenzano confirms the existence of a continuous coastal cyclonic stream that flows along the bathymetry, so we considered for this study, the Arenzano current as representative of the general flow. On the contrary, in the lee side of Portofino cape during the same period, the current moves offshore the promontory suggesting, in agreement of the previous numerical study, the presence of an anti-cyclonic eddy in the lee side of the cape.

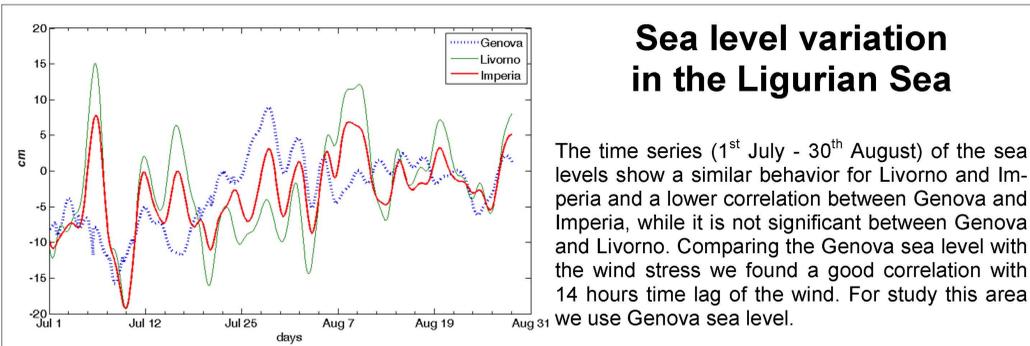
By the EOF analysis the Portofino current seems mainly baroclinic and Arenzano one mainly barotropic, this suggest the different influence of the local features.



Comparing the wind stress of Genova and the current it is evident that when the wind blows towards South the current intensity decreases in both sites. The correlation analysis shows a maximum value for Genova wind stress and Arenzano current (time-lag of 24 hours), and a decreasing lower value with depth for the Portofino current (time-lag 1 hour). Moreover it was found a good correlation for Arenzano current at 25 m, and for Portofino current at 18 m of depth. This result evidences a larger influence of the wind in the Arenzano current with respect to the Portofino one, nevertheless both currents seem influenced by the same wind event. Previously the wind influenced Portofino current and some hours later this effect is propagated to Arenzano one.



Sea level variation in the Ligurian Sea

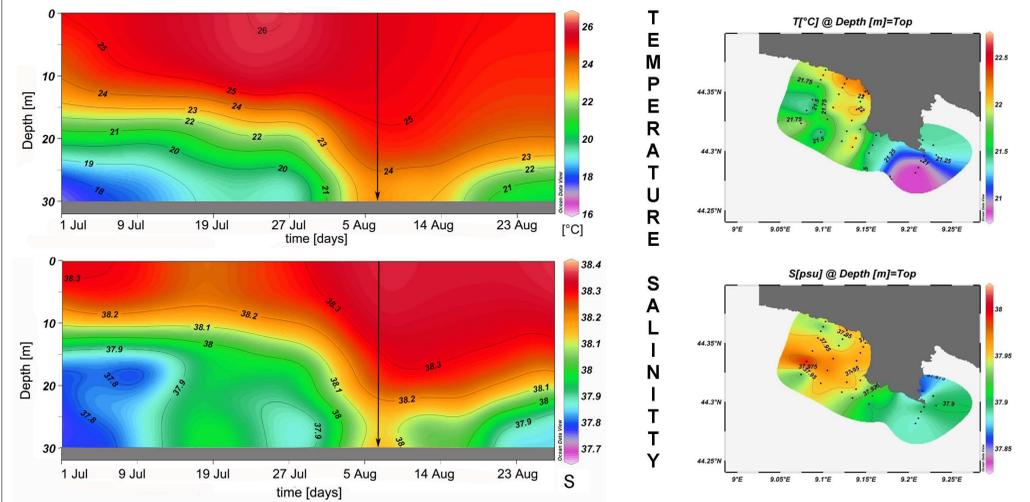


The time series (1st July - 30th August) of the sea levels show a similar behavior for Livorno and Imperia and a lower correlation between Genova and Imperia, while it is not significant between Genova and Livorno. Comparing the Genova sea level with the wind stress we found a good correlation with 14 hours time lag of the wind. For study this area we use Genova sea level.

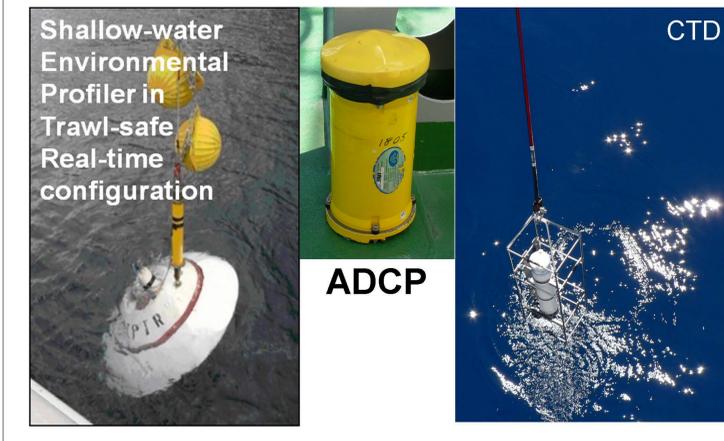
Hydrological features in Portofino

The hydrological cruise performed in 9th August 2004 clearly evidences the presence of two different surface water masses around Portofino cape: a cold and fresh water eastward and a slightly saltier and warmer water westward.

The time series of hydrological data, acquired between 1st July and 30th August in correspondence of SEPTR position, indicate a typical summer stratification and an homogeneous layer of warm and salty surface water that gets deeper with time, progressively influencing the entire water column (mid-August). This suggests an intrusion of a different water mass.



Instruments



Conclusion

The integrated study of the wind stress (acquired in four coastal stations around Ligurian sea during 2004) and the current-meter data demonstrates that both currents take part of general circulation of Ligurian Sea, but Arenzano current results mainly influenced by the meteorological forces and Portofino by the peculiar orography of the promontory, that contributes to generate a small-scale anti-cyclonic eddy in the western side of the cape.

Reference

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