



Influence of wind stress and the Isonzo/Soča River outflow on surface currents in the Gulf of Trieste

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Between October and November 2023, the Isonzo/Soča River catchment area experienced exceptionally intense rainfall. The strong precipitations acting on the hydrographic basin at the end of October and beginning of November led to exceptional increases in the Isonzo/Soča runoff into the Gulf of Trieste (GoT) (October 27 and November 3). It was observed that in the days before a precipitation event, a southerly wind with a strength of more than 3 m/s almost always affected the area. Concurrently, rising sea levels and coastal flooding were observed. The event is of particular significance as it was also accompanied by strong coastal storm and waves that caused severe damage to the coast.

The aim of this study is to investigate how the exceptional Isonzo outflow, together with the wind patterns associated with the meteorological event, influenced the ocean currents in the surrounding coastal region. To this end, the mechanisms and processes regulating the interaction between river discharges and ocean currents in the Gulf of Trieste were analysed through an integrated analysis combining hydrometric, meteorological and current data.

The prevailing winds in the GoT come from the north-eastern (Bora wind) and southern sectors (Sirocco and Libeccio winds). During Bora events, the usual cyclonic circulation is accentuated and the surface currents normally leave the GoT, while during strong southerly wind events the circulation becomes anticyclonic and the surface currents enter the GoT. In the case with a significant river outflow in combination with southerly winds the circulation is anticyclonic in the central part of the gulf and cyclonic in the northern part.

HFR sea surface current data confirmed that wind-induced Ekman transport appears to dominate the surface current dynamics in the GoT. Nevertheless, exceptionally intense outflows from the Isonzo, triggered by heavy precipitation and accompanied by southerly winds, can overlay the effects of wind-driven transport, leading to the dominance of river-induced circulation patterns in the GoT.