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Multidisciplinary approach to study surface-groundwater interaction in a coastal aquifer (Ravenna, Italy)

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Seawater intrusion in coastal aquifers is a worldwide problem caused by rising sea levels, subsidence, climate changes and exacerbated by aquifer overexploitation. The limited fresh groundwater resources are, however, important for domestic, agricultural and industrial purposes, mostly during the summer season, when the demand of fresh water is high and the saltwater intrusion is amplified because of the small thickness of fresh water lens. For this reason, the integrated management of water resources in coastal regions must be achieved taking into account the exchanges between surface water, such as channels, and groundwater.
This research is focused on the unconfined sandy-silt aquifer in the coastal plain of Ravenna (Italy). The site is located 5 km from the Adriatic coastline, but it is bordered, in the north-western side, by a salty channel that influence the underground circulation and its physico-chemical features. The channel is strictly related to the sea and so its water level is affected by tidal variation.
The main goals of this work is 1. to analyse the interactions between groundwater and a salty surface channel by means of classic hydrogeological investigations and 2. to characterize the hypersaline horizon in groundwater by means of new tools, such as high-resolution EC logs in different piezometers and multi-level samplings for geochemical and isotopic investigation.
First results show a complex surface-groundwater interaction in the north-western part of the area, where it is possible to define a “buffer zone”. In this zone, there is a continuous exchange between surface-subsurface water mostly caused by the variation of the level in the channel. As a matter of fact, it was observed a tidal-depending fluctuation of the level in the channel that causes, at least twice per day, the inversion of the hydraulic gradient. Moreover, the hypersaline horizon was characterized and its features are more related to the salinity of the channel instead of the sea water. The top of the hypersaline surface was also experimentally reconstructed and surprisingly its shape is independent from the groundwater head and also from the distance from the channel.