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Continental and marine surficial water – groundwater interactions: the case of the southern coastland of Venice (Italy)

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Worldwide lagoons and coastal wetlands have drawn much attention in the last decades since the high ecological relevance of lagoons and wetlands especially in view of the expected global changes. An important issue that has arisen is the need to improve the knowledge on the continental and marine surficial water–groundwater interactions in transitional coastal environments. Borehole electrical conductivity measurements, vertical electric soundings, electrical resistivity tomography and time-domain electromagnetic investigations are usually performed to characterize the saline interface and its evolution in coastlands. Direct measurements such as seepage meters, benthic chambers, and surface water enrichments in natural isotopic tracers are often done to assess submarine groundwater discharge in wetlands, lagoons and offshore. Nevertheless, a clear and comprehensive image of the mainland–lagoon–sea hydrogeology in a continuous framework is far from being achieved because inland and offshore surveys are generally carried out separately and by different methodologies. In addition, an in-depth and extent investigation in lagoon shallows, marshes, rivers and reclamation canals are precluded or at least hardly and locally done. Therefore, investigating continental and marine surficial water - groundwater interaction, i.e. salt-freshwater exchange, in a unique, consistent, and homogeneous framework is still a challenge.
The airborne electromagnetics (AEM) survey is a suitable technique that allows overcoming many constrains intrinsic to the in situ surveys and cover “simultaneously” heterogeneous environments, such as those of the transitional coastal zones, which include wetlands, lagoons, littorals, estuaries and sea, hardly accessible by traditional methods (Teatini et al., 2011).
The Venice coastland (Italy) is an example of heterogeneous transitional coastal zone, which includes low-laying farmland, lagoon, estuary, delta and littoral environments where the hydrology is often anthropogenically driven, especially in the mainland (Da Lio et al., 2015).
This study describes the results obtained by an AEM survey carried out in the southern Venice coastland (Italy) aimed at characterize the continental and marine surficial water–groundwater interactions. The AEM survey allowed to depict a clear image of the fresh water–saltwater interactions along mainland- agoon-littoral-sea profiles, up to 20 km long. Results revealed that continental groundwater extend underneath the lagoon basin where below a 10-20 m thick of Holocene deposits, freshwater occur down to 70 m depth. The integrated analysis of AEM, seismic and borehole data show that buried morpho-geological structures, such as paleochannels and over-consolidated clay units control the saline infiltration from the lagoon bottom into the aquifer system.

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References
Da Lio C., Carol E., Kruse E., Teatini P., Tosi L. 2015. Saltwater contamination in the managed low-lying farmland of the Venice coast, Italy: An assessment of vulnerability. Science of the Total Environment, 533, 356-369.
Teatini P., Tosi L., Viezzoli A., Baradello L., Zecchin M., Silvestri S. 2011. Understanding the hydrogeology of the Venice Lagoon subsurface with airborne electromagnetics. Journal of Hydrology, 411, 342-354.