Spatial variability of hydrochemical characteristics at the mouths of Moulouya and Kert rivers (Morocco)

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ABSTRACT

Hydrochemical processes in estuarine environments are strongly influenced by natural and anthropogenic factors, including fluvial inputs, marine intrusion, and climatic conditions. River mouths, as direct contact zones between continental and marine waters, play a crucial role in regulating water quality and maintaining the ecological balance of fluvial–marine transition systems.

This study aims to analyze and compare the spatial variability of water chemistry at the mouths of the Moulouya and Kert rivers, located in northeastern Morocco, in order to better understand the processes controlling water quality in these sensitive environments. Two sampling campaigns were conducted at each site during contrasting hydrological periods (wet and dry seasons). Water samples were collected from several stations within these contact zones and analyzed for key physicochemical parameters, including pH, salinity, temperature, and electrical conductivity, along with major cations (Ca^{2+}, Mg^{2+}, Na^{+}, and K^{+}) and strontium (Sr^{2+}), a useful tracer of freshwater–seawater mixing.

The results reveal marked spatial variability in hydrochemical properties between the two river mouths, with a clear influence of seasonal conditions. Higher concentrations of sodium and magnesium were observed near the marine interface, reflecting seawater intrusion, while calcium variations indicate contributions from lithological sources and water–rock interactions. Potassium shows moderate variability depending on local environmental conditions, whereas strontium is closely associated with mixing processes between freshwater and seawater.

The comparative analysis highlights distinct hydrochemical patterns between the two river mouths, controlled by hydrological dynamics, fluvial inputs, marine influence, and seasonal variability. These findings provide valuable insights into the functioning of river mouth systems and contribute to improving water quality assessment and management in semi-arid Mediterranean environments.

Keywords: Hydrochemistry, river mouths, spatial variability, water quality, major cations, seawater intrusion, Mediterranean region.