Multi-scale studies of advective transport across the sediment-water interface with radioactive tracer tools – some examples from coastal environments

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Many if not most aquatic systems are significantly impacted by groundwater discharge and hyporheic flow. A considerable research effort is today directed at the quantification of water and associated (bio)geochemical fluxes across the sediment-water interface to streams, lakes and the coast. A wide range of geophysical, geochemical and modelling approaches are used. Powerful integrative tools to determine fluxes on 'large' scale are radiochemical tracers such as radon. The application of such tracers to understanding sediment-water fluxes on meter-scale and ecosystem-scale will be illustrated on mangrove systems and coastal lagoons along the Mediterranean coastline, and limitations – in particular their inability to distinguish groundwater ('new' water) and hyporheic flow ('old' water) – will be discussed.

In tropical mangrove forests, tidal pumping of water through animal burrows, a major contributor to sediment-water fluxes, has been documented on both single-burrow and whole-of-forest scale. In Mediterranean coastal lagoons, groundwater discharge and wind-driven hyporheic exchange have been documented on a similar range of scales, suggesting that these processes may play a vital role in ecosystem functioning, on one hand through controlling lagoon salinity ('new' water), on the other hand through remobilisation of nutrients and contaminants from lagoon sediments ('old' water). Although geochemical tracer signatures are often similar in groundwater and hyporheic fluxes, when considering 'downstream' ecological effects a separation of these fluxes will be required.