



The [ECOSPHERE research group](#) aims to study aquatic and valley ecosystems that are continuously challenged by natural and anthropogenic stressors. The research focuses on acquiring fundamental and applied knowledge at different levels of structural and functional organisation in order to underpin environmental management decisions.

MASTER THESIS SUBJECT 2026-2027

Salinity and inundation in a changing estuary: analyzing long-term monitoring data of the Scheldt

Research group: ECOSPHERE

Hosting laboratory: CDE – building C

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(A) Drone image of the Paulina salt marsh along the Scheldt estuary, (B) Salinity gradient of the Scheldt estuary (source: Scheldemonitor, www.scheldemonitor.org).

- This topic mostly contains ☒ literature study, ☐ lab work, ☐ field work, ☐ experimental work, ☒ GIS, ☐ numerical modelling, ☒ other: data analysis (R/Python)
- Possession of driver's license B is ☐ needed, ☐ recommended, ☒ not needed

Summary

Tidal marshes along the Scheldt estuary span a gradient from salt marshes near the North Sea to freshwater marshes upstream of Antwerp. These ecosystems are recognized as *blue carbon* systems that store substantial amounts of carbon in their soils, making them important for climate mitigation. They also provide other essential ecosystem services, including flood protection and biodiversity conservation.

Climate change is altering estuarine hydrodynamics. Sea-level rise can drive saltwater intrusion further upstream, shifting the boundaries between salt, brackish and fresh water. At the same time, higher water levels increase the frequency and duration of tidal marsh inundation. Drier summers with lower river discharge are expected to further strengthen salt intrusion. These changes have important implications for the ecosystem services that tidal marshes provide. Salinity and inundation determine vegetation, sedimentation and decomposition of organic matter, partly through their effects on the soil microbial communities. These processes also regulate methane emissions from marsh soils, which can substantially affect the net climate mitigation potential of tidal marshes.

To predict how these services will change, we first need to know how salinity and inundation vary and change along the estuary. Along the Scheldt, they fluctuate on several time scales:

- ⇒ **Tidal:** Salinity and water level change within every tidal cycle and between spring and neap tides.
- ⇒ **Seasonal and interannual:** Salt water moves upstream when river discharge is low in dry summers and is pushed back in wet winters. A higher sea level lets salt water penetrate further at the same discharge.
- ⇒ **Long-term:** sea-level rise gradually raises water levels and shifts the average salinity regime upstream.

This **thesis aims** to quantify salinity fluctuations along the Scheldt estuary and their underlying drivers across timescales, while assessing changes in high-water levels and marsh inundation.

These objectives will be addressed through a data-driven approach, using existing datasets such as the OMES monitoring of the Scheldt (since 1995), continuous tidal water level and conductivity records of the Flemish and Dutch monitoring networks, and river discharge data. You will compile and quality-check these time series, separate tidal, seasonal and long-term components, and use statistical models (e.g. generalized additive models) to quantify trends and the effects of discharge, tide and sea level.

To conclude, this study will provide a quantitative picture of how salinity and inundation vary and change along the Scheldt, an essential basis to predict the future of tidal marshes in response to sea-level rise. For you, it offers the perfect preparation for graduating as a biologist with strong skills in data analysis, statistics and environmental change dynamics.

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