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Variability and drivers of sediments organic carbon stock in the Arcachon Bay (France)

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Arcachon Bay (40 km² to 150 km² according to the tide) is an iconic ecosystem of the French Atlantic coast. It has been experiencing a major decline in seagrass (*Zostera noltei*) meadows coverage for several decades (Auby *et al.* 2011), leading to a net decline in its carbon sequestration potential (Ribaudo *et al.* 2016). Characterising and deciphering the variability of these carbon stocks is thus required in the context of meadows ecological restoration (Greiner *et al.* 2013).
In the context of the EU RestCoast project and the PROSPERE project, 15 sampling sites have been selected within Arcachon Bay (Fig. 1). For each site, two paired plots - with and without seagrass meadows- have been sampled. Each sediment sample (0-10 cm and 0-30 cm depths) has been characterised in terms of total and organic carbon contents, nitrogen content, bulk density and granulometry (with 5 spatial sub-replicates for C and N). As current speeds are expected to be key drivers of carbon storage of *Zostera* meadows (Dahl et al. 2016, 2018), the Delft-Flexible Mesh modelling suite, coupling waves formation and propagation with hydrodynamics, has been implemented. Hydrodynamics simulations have been used to estimate the distribution of water levels, current speeds, and emersion time at various time scales (tidal range, monthly, seasonal and annual) based on a 3 years (2016-2019) simulation.
Data analyses show an increase of organic carbon content with finer granulometry probably driven by sedimentation speed of exogenous sestonic organic matter (i.e. originating from the watersheds that feed the Arcachon Bay) as suggested by Greiner *et al.* (2016). Most paired plots present similar granulometry, which can be caused by bare substrate plots being positioned within the hydrodynamic influence area of the nearby seagrass meadows. This highlights the relevance of considering other drivers to disentangle the spatial variability of sediment organic matter drivers (Greiner *et al.* 2016). Several tests have been done to explain site variability with hydrodynamics simulations outputs.
The relationships between granulometry, carbon content and hydrodynamics drivers are discussed in the context of results upscaling at the Arcachon Bay scale and forecasting ecological restoration actions impacts on carbon storage.

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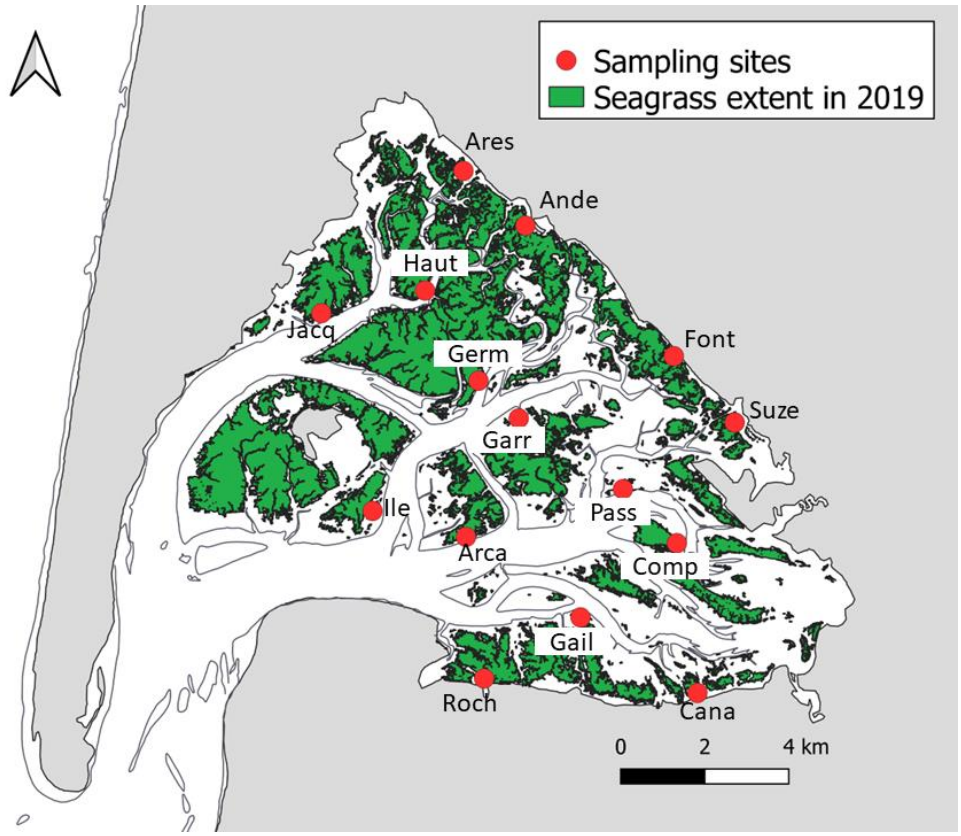

Fig. 1. Map of the Arcachon bay (France) with the location of the 15 selected sites.