Impact of Alkalinity fluxes from the Wadden Sea on the carbon cycle and the primary production in the North Sea

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Recent findings suggest that the Wadden Sea at the southeastern North Sea acts as a major source of total Alkalinity (A_T) (Thomas et al., subm.). This will affect the carbon cycling within the North Sea and is expected to have an impact on the overall primary production in pelagic and benthic systems. During summer the A_T release lowers the marine partial pressure of carbon dioxide (pCO_2) and the CO_2 release to the atmosphere, in particular in the southern bight of the North Sea. This A_T flux buffers the pH decline, induced by anthropogenic CO_2, as already observed in the area of the North Sea (Thomas et al., 2007). Yet, the extent to which the A_T flux from the tidal flat areas of the Wadden Sea can buffer pH and its response to the biological ecosystem has to be assessed.

The central objective is to relate the Wadden Sea's A_T flux to the pelagic and benthic environment, with emphasis on biogeochemical cycling of carbon in conjunction with other nutrients, such as nitrogen. With our modelling activity within BIOACID we specifically propose the following:

- We will use an existing ecosystem of the North Sea (ECOHAM) to extrapolate information's gathered from local observations to the entire North Sea.
- We will quantify the impact of the temporally resolved A_T flux from the Wadden Sea on the general North Sea carbon cycling.
- We will investigate to which extent this A_T flux affects the long-term trend with respect to the overall pH signal within the North Sea.
- The response of primary producers to pH changes will be addressed by extrapolating results from mesocosm and chemostat experiments in an attempt to crudely discriminate non-calcifying from calcifying primary producers.
- A future scenario model simulation will be performed and analysed with respect to critical ecological and biogeochemical regime shifts, as we impose an atmospheric partial pressure (pCO_2) of 1000 μatm.