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# Climate impacts on ocean acidification in the North Sea and Baltic Sea: a modelling study

Ute Daewel (1), Corinna Schrum (1,2), and Dhanya Pushpadas (2)

(1) University of Bergen, Geophysical Institute, Bergen, Norway (ute.daewel@gfi.uib.no), (2) Nansen Environmental and Remote Sensing Center, Bergen, Norway

$CO_2$ increase in the atmosphere does not only potentially change the overall climate, but also increase the dissolved inorganic carbon (DIC) content in the ocean by ocean-atmosphere gas exchange leading to a decrease in oceanic ph (acidification). Hence, it has both direct (via acidification) and indirect (via changes in atmospheric fields) implications for marine ecosystems and their productivity. On the other hand, changes in primary production would likewise impact the DIC content and could potentially alter the process of acidification on different temporal scales (seasonal, inter-annual, and decadal).

Here, we extended the 3d coupled ecosystem model ECOSMO II by formulations for carbon chemistry and applied the model system to the North Sea and Baltic Sea in order to investigate ocean acidification in that specific region. We specifically aim in disentangling direct and indirect impacts of changes in atmospheric $CO_2$ on acidification. Therefore we will first, present results from a multi-decadal model hind cast (1948-2008) to describe the dynamics in ocean acidification with respect to the different time scales. Secondly, we apply downscaled products from General Circulation Models to project future climate impacts (2070-2100) on acidification. And thirdly, we will present results from cross-experiments, where we investigate the influence of future $CO_2$ increase under present day atmospheric condition and vice versa. These scenarios allow disentangling the direct and indirect impacts on the process of acidification comparative in the North Sea and Baltic Sea.