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North Sea coastal peatlands – is a climate-smart revival possible?

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Coastal peatlands around the southern North Sea basin have been very widespread in the past, but centuries-long drainage and exploitation for agriculture and fuel has decreased the peatland area strongly. It has resulted in severe soil subsidence with adverse effects on flood safety and water quality, and large scale emission of CO_2. However, the remedy of rewetting of drained peatlands that is often proposed, has uncertain outcomes as it may reduce CO_2 emission, but enhance CH_4 emission, in some cases dramatically.

We present greenhouse gas balance examples from two peatland restoration experiments in the Netherlands. These are experiments with nature conservation as primary goal. These experiments show that the type of management of vegetation may have a very strong influence on the CH_4 emission. A nutrient-rich wetland dominated by *Typha sp.* showed sustained, high emission of CH_4 over many years. By contrast, a site where nutrient-rich topsoil was removed and a mesotrophic fen-like vegetation was established, showed very minor CH_4 emission. The high emissions at the *Typha* site appears to result from a recently deposited peat layer of very labile organic matter. A third control site with lower water table and agricultural grassland showed considerably higher CO_2 emission than the two nature conservation sites. The data from this site also shows the potential effects of climate extremes: an exceptionally warm and dry period in September 2016 showed an almost doubling of CO_2 emission with respect to normal summer conditions.

The future of coastal peatlands is attracting more attention from policy and spatial planning. Besides a return to (semi)natural peatland vegetation, there is a growing interest in agricultural products that allow a high water table (paludiculture). However, the effects of land use change on the peat greenhouse gas balance are very poorly known. This calls for more extensive quantification of the greenhouse gas balance under various management scenarios, which needs to be facilitated by cost-effective methods. At the sites presented here, we are experimenting with a combination of automated chamber measurements and development of a predictive model that combines hydrological modeling with modeling of the peat soil carbon balance and vegetation succession