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Feeling bogged down about climate change mitigation? Insights from a new high resolution peatland-bog model validated at two Dutch monitoring sites.

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Increasing the global carbon sink is one of two options to mitigate CO_2 and CH4 increases in the atmosphere (the other is emissions reductions at the source). Peatlands release carbon to the atmosphere when disturbed by natural or human causes and absorb carbon when vegetation and soil organic matter accumulate after rewetting or natural revegetation. However, rewetting of drained peatlands is frequently not considered as a climate mitigation strategy due to the enhanced methane emissions that accompany newly formed anaerobic peatland environments. We hypothesise that at most sites, this trend will be temporal but long-term, lasting for tens of years post re-wetting before stabilisation takes place.

This study investigates the ability of rewetted peatland sites to act as either a source or sink for atmospheric methane and carbon dioxide under climate change.

The hydrology of a peatland is fundamental to its functioning. Therefore, the use of a full water balance table has the potential to simulate greenhouse gas fluxes to a greater degree of certainty. MODFLOW is the internationally most widely used ground and surface water model and is freely available to the scientific community. This is the first time that a gridded peatland process based model has been constructed at a spatial resolution as high as 25m x 25m. This new high-resolution model allows for investigation into the complex biophysical and hydrological factors that are necessary to reliably estimate atmospheric greenhouse gas fluxes in a peatland ecosystem.

We assess the model's skill against observations collected at two monitoring sites of differing soil properties and vegetation in the Netherlands. These results discuss site-specific suitability of peatland regeneration, useful for climate change mitigation activities. Aside from the insight into transient atmosphere-peatland carbon fluxes, this work is a stepping stone towards more robust model coupling and greater spatial coverage.