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Monitoring greenhouse gas fluxes in an array of Dutch natural peatlands and fen meadows using mobile Eddy covariance.

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Natural peatlands and fen meadows have the potential to sequester CO_2 from the atmosphere but can also
form a major source of CH_4 emissions. However, their flux dynamics, showing the diurnal and annual
variation of GHG exchange depend on site characteristics such as soil/peat type, water dynamics and
management practices. It is thus essential, that carbon fluxes of different locations are individually
quantified in order to assess if, from a climate perspective, CO_2 uptake outweighs CH_4 emission for these
areas.

We deployed five movable eddy covariance measurement stations to chart dynamics of CO_2 and CH_4 fluxes
in an array of peat soil sites. The fluxes are measured directly, alternating every few weeks between the
different sites. One aim of the study is to examine the feasibility of these moveable stations, as they may
reduce the relatively high investment costs of EC measurements per site. We show that moveable stations
are feasible from a practical point of view, as the stations can be relocated relatively easily within the time
span of a few hour.

The resulting carbon budgets provide insight into an array of site specific GHG exchanges over typically
small temporal and spatial scales. Meteorological observations are permanently performed at all selected

locations as well, along with other supportive measurements such as soil/water temperature, moisture and
water level.

Since the measurement stations alternate between locations, robust gap filling methods are needed to
obtain a complete picture of the variability of the flux dynamics over the entire year for each location. The
main objective of this study is to identify most suitable and robust gap filling methods. As such
measurements from the permanent meteorological stations serve to force several gap-filling methods such
as interpolation based on observed ecosystem responses, the look up table approach and more established
methods. We also investigate in the use of more process-based empirical models as the gaps between
measurement periods are longer. Results show that the mobile eddy covariance approach does allow
identification of significant differences in GHG flux between sites as well as meaningful aggregation to
annual budgets.

Ultimately, enabling the monitoring at more locations than with static systems may serve as a basis for
policy makers and land managers to shape nature conservation or agricultural practices that achieve a net
mitigation of greenhouse warming potential.