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# Greenhouse gas balance of fen meadow landscapes using airborne flux measurements

**Ronald Hutjes**, Bart Kruijt, Wietse Franssen, and Laura van der Poel
Wageningen University, Water Systems and Global Change, Environmental Sciences, Wageningen, The Netherlands
(ronald.hutjes@wur.nl)

Drained organic soils are an important source of greenhouse gases worldwide. Also in the low lying areas of the Netherlands drainage of its organic soils, with the aim to enable more intensive usage of the land, leads to oxidation of organic material, significant carbon dioxide release and subsequent land subsidence. As part of climate mitigation policies the Dutch government seeks to reduce these emissions by about 25% in 2030. In support of these policies, the National Research programme on Greenhouse gas emissions from Fen meadow areas (in Dutch NOBV: https://www.nobveenweiden.nl/) aims to investigate the effects of various mitigation measures on total greenhouse gas balance of the targeted areas.

One approach, complementing multi-site ground based measurements using various techniques, is to use repeated airborne surveys to measure in-situ turbulent CO2 exchange. The push propellor aircraft is a SkyArrow 650 TCNS equipped with a BAT probe in combination with a Licor 7500 for eddy covariance fluxes of momentum, sensible and latent heat and CO2, augmented by onboard PAR and net radiation sensors. Survey altitude is 200ft/60m nominally, guaranteeing minimal flux divergence between surface and flight level for well-developed boundary layers. Covariances were spatially integrated over 2 km.

In 2020 and 2021 flights were made twice weekly, weather permitting, to cover three major fen meadow landscapes in the Netherlands: the so-called ‘Groene Hart’ area in the west between the cities of Amsterdam, Utrecht and Rotterdam, predominantly used for intensive dairy farming; the ‘Kop van Overijssel’ between Zwolle, Meppel and Vollenhove with large tracts of nature areas besides dairy farming; and finally the South West of the province of Fiesland between Heerenveen, Drachten and Sneek. Flight patterns were designed such that crosswind, parallel flight tracks, separated ~2km, made typical flux footprints overlapping ensuring full spatial coverage of the respective areas.

We will present first analyses and scaling of airborne flux data for each of the three regions in relation to explanatory variables from vegetation and soil characteristics, land and water management (EO and map based) and weather, using machine learning algorithms. Source partitioning based on high frequency airborne covariance data will be used to separate soil and vegetation fluxes. We aim to ultimately provide a data driven regional greenhouse gas balances for the different fen meadow areas of the Netherlands.