North Wyke Farm Platform

Case study no. 32

Relating soil properties to GHG emissions from grassland

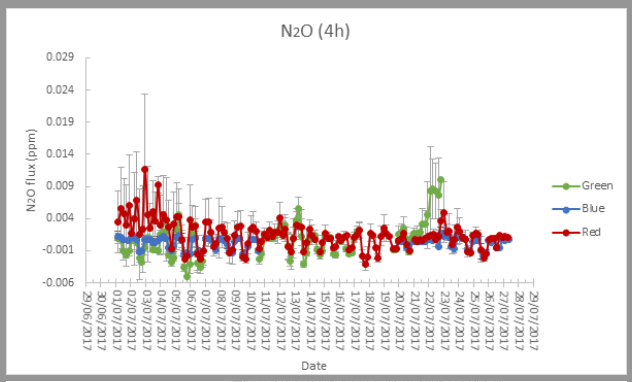
Lynn (Yuanxin) Chang, Nadine Loick, Laura Cardenas

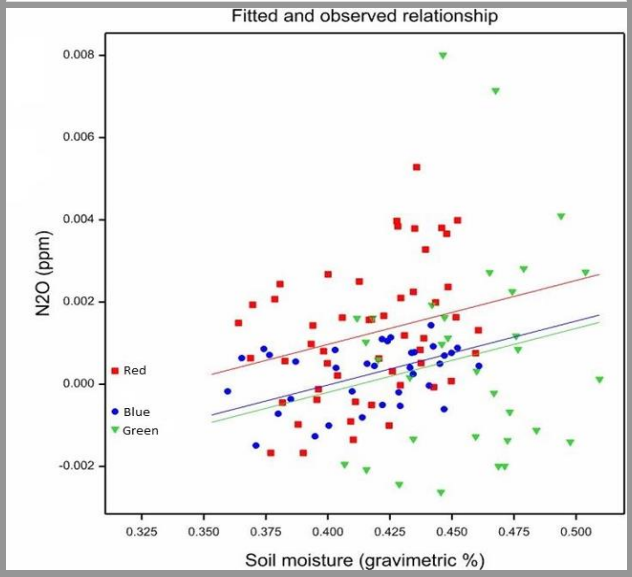
Soils are the predominant source of the greenhouse gases (GHG) nitrous oxide (N_2O) as well as carbon dioxide (CO_2). N_2O is considered the single most important depleting substance of stratospheric ozone with a global warming potential 298 times that of CO_2 for a 100-year timescale (IPCC, 2007). This study investigates the effects of soil properties (soil WFPS, soil temperature, ammonium and nitrate) on GHG emissions from a grassland at the North Wyke Farm Platform (NWFP) and analyses how environmental factors influence the underlying microbial processes such as nitrification and denitrification, which can produce or consume N_2O, and the relationship to soil properties.

In this study, the GHG fluxes, soil moisture and soil temperature were obtained from automated long term chamber (Li8100-104) measurements with continuous measurements from 1st July to 27th July 2017. In addition, soil properties such as nitrate concentration and ammonium concentration were derived from discrete soil sampling on the 3rd, 10th, 17th and 24th July 2017 via extraction with 2M KCl. Additionally, relationships between soil properties and greenhouse gas fluxes were analysed via linear regression.

Although the collection of soil data was restricted to the area where the chambers were located, the results of this study indicate that the soil moisture content is the main factor influencing N_2O emissions under the given, non-substrate limiting conditions. No other significant correlations could be found.

LiCor automated chamber systems deployed in Longlands fields (large picture), close-up of an automated chamber (insert)





N_2O emissions are similar in the three farmlets and indicate a diurnal pattern with fluxes decreasing during the day and increasing during the night (top graph)

Using 12 hourly intervals, Linear Regression analysis showed a positive relationship between N_2O fluxes and soil moisture (bottom graph).

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