Spatial relationships of soil factors to GHGs at field scale

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Following a pilot study conducted in the Dairy North sub-catchment in summer 2015 consisting of 25 sample points for soil factors that are expected to spatially-correlate with Greenhouse gases (GHGs), the summer 2016 survey was conducted on a much finer resolution grid, resulting in 99 sample points. Via spatial statistical techniques, we are exploring ways to make accurate predictions of GHGs (N_2O) using soil factors as our predictors for a sheep-grazed field. Soil factors include: soil N, soil moisture, bulk density and pH. Soil cores at 0-10 cm depth were taken and dry-sieved to <63 μm to analyse the soil chemistry. Cylinder cores of known volume were collected to measure bulk density. White chambers were inserted in the ground for taking gas samples for N_2O analysis.

Noveen Guo marking the sampling points via GPS.
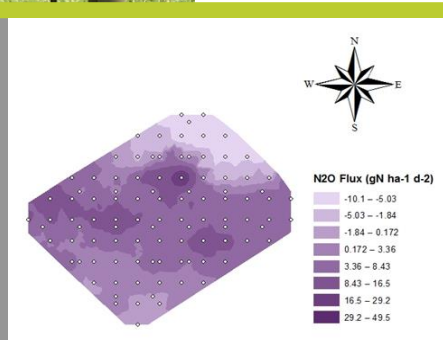
Spatial variability of N_2O measurements
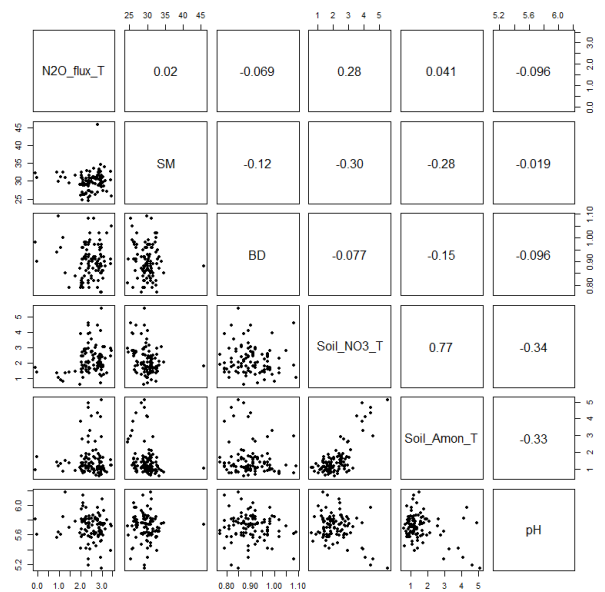
Relationships between parameters

Initial exploratory work has not provided significant results where the response to predictor variable correlations are weak resulting in a poor multiple regression fit with an R-squared of only 0.17 and an AIC of 182. However, on application of a spatial regression model (in this case Geographically Weighted Regression) the R-squared increased to 0.76 together with a decrease in AIC to 164 units.

This suggests that spatial effects are important (i.e. relationships are spatially-heterogenic) and also suggests the strong likelihood of a key missing predictor of N_2O, such as a livestock movement surface.

A kriging surface for N_2O is also given showing the sample configuration of the study data in the Dairy North sub-catchment of the North Wyke Farm Platform.