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Soil N_2O flux are affected by several soil variables such as temperature, water content and the availability of mineral nitrogen and labile organic carbon. The complex interactions between these factors as well as soil heterogeneity result in large spatial variations in soil N_2O fluxes.
Developing methodologies for quick spatial sampling of N_2O fluxes is thus of concern to improve our understanding of the variables controlling the heterogeneity of emissions. The main objective of this paper is to assess in a case study the spatial variability of N_2O fluxes at local and plot scales, to define methods for measuring the spatial variability of N_2O fluxes, determining its control factors and modelling it. A campaign was carried out in March 2011 in the Faux-Perche region in Central France. The plot had a gentle slope (1.6%) with hydromorphic loamy soils under winter barley. Soil N_2O fluxes were measured during two 1-day campaigns using a laboratory-built quantum cascade laser spectrometer coupled to a "fast box", i.e. a mobile closed chamber without base. During the first day, fluxes were measured in 7 x 4 points (150m along the main slope x 12m). On the second day, 48 measurements were made in a small area (2.4 x 3.2m) at the footslope to sample most (77 %) of the selected surface.

This sampling methodology enabled to study the spatial variability and control factors of emissions. No pattern was observed at the local scale but at the plot scale, fluxes showed a clear pattern along the main slope, related to soil moisture, nitrogen and carbon patterns.