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Simulating regional-scale soil nitrous oxide emissions in Scotland

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Nitrous oxide (N₂O) is a major greenhouse gas whose largest anthropogenic source is the addition of nitrogenous fertilisers to cultivated soils. The development and application of mechanistic models of soil biogeochemistry contributes significantly to the effort to understand and quantify those N₂O fluxes. Soil biogeochemistry models are complex and can be particularly difficult to evaluate because N₂O measurements are usually sporadic and contain large uncertainties. Therefore, large-scale simulations with such models can be demanding. The majority of model-based studies focus on small spatial scales (i.e. field, catchment) despite the fact that simulations at larger scales are those that offer more applicable and policy-relevant results. In this context, this presentation will provide a picture of N₂O emissions from the arable soils of Scotland, including an appraisal of the uncertainty around them. The regional estimates are a product of a PhD project that uses a biogeochemical model (Landscape-DNDC) and benefits from extensive field data and detailed soil and crop geo-datasets. The study resulted in a N₂O emission factor (EF) that is significantly smaller than the generic IPCC EF but is inline with the recently estimated UK-specific EF. The presentation will also provide an overview of the model's evaluation and calibration that preceded the regional simulations.

Keywords: Nitrous oxide; Landscape-DNDC; regional simulations; arable soils; Scotland