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NO, NO2, N2O, CO2 and CH4 fluxes from soils under different land use: temperature sensitivity and effects of soil moisture

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Biological processes involved in the production and release, as well as deposition and consumption of nitrogen oxides, carbon dioxide and methane in soils are strongly dependent on moisture and temperature. However, these dependencies may differ in soils under different land use such as forests, grassland, arable fields and wetlands. In order to understand and model exchange processes of these gases in a more reliable way we conducted a series of laboratory experiments on 13 soils from the European Level III site network of the NitroEurope integrated project. The exchange of NO, NO2, N2O, CO2 and CH4 between soil cores and atmosphere was measured in a two-factorial experimental design, the undisturbed soil cores were kept under different conditions with respect to temperature (5°, 10°, 15° and 20°C) and soil moisture (20%, 40%, 60% and 80% WFPS (water filled pore space)). Twenty-four replicate soil cores from each sampling site were incubated for one hour for N2O, CO2 and CH4 determination, followed by at least nine hours continuous NOx measuring. Grassland soils showed larger N2O and CO2 emissions than other land use types, whereas forest soils released most NO. Soils from sites with very low N-input, such as found in Finland, showed hardly any nitrogen oxides emissions, which also were insensitive to temperature and moisture alterations. All other soils reacted on increasing temperatures by increasing gas emissions. Nitric oxide emissions were largest at 20% WFPS, whereas maximum N2O emissions occurred at 80% WFPS and maximum CO2 emissions around 40% WFPS. Methane consumption prevailed up to 100% WFPS. After comparison with field emissions the results will be incorporated into process-oriented models to improve the prediction of trace gas emissions across Europe.