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Nitrous oxide emissions from soils in southern Poland under various tillage conditions.

Michal Galkowski, Damian Zieba, Klaudia Ciaciek, Jaroslaw Necki, and Kazimierz Rozanski

AGH University of Science and Technology, Faculty of Physics and Applied Computer Science, Dept. of Applied Nuclear Physics, Krakow, Poland (michal.galkowski@agh.edu.pl)

Due to close ties of nitrogen cycle with the production of food, appropriate mitigation policies need to be considered in order to reduce the impact of reactive N compounds on both human health and the environment. These policies strongly rely on quantitative information with respect to fluxes of reactive nitrogen compounds to the atmosphere and mechanisms controlling those fluxes on a various time and space scales. One of these compounds is nitrous oxide - currently the most important human-emitted ozone depleting substance and one of the most important greenhouse gases.

In this study, which is a part of broader, regional (Southern Poland) analysis of nitrous oxide circulation, we present the results of field measurements performed at the Institute of Plant Acclimatization and Husbandry (ZDHAR) in Grodkowice (Malopolska). Several representative sites have been selected for measurements of N_2O emissions during two campaigns – in spring (March) and autumn (October) 2014. The investigated crops were chosen to represent the regional agriculture and included wheat, canola and maize under various tillage conditions (with and without tilling), as well as an uncultivated grassland as a control site.

The static chamber method was chosen to quantify soil-atmosphere N_2O fluxes. Chamber enclosures have been performed every 3-5 days, depending on the conditions prevailing at the sites during the intermediate periods (e.g. rainfall or fertilization events). From each enclosure, five 50-ml air samples have been collected for subsequent analysis of nitrous oxide concentrations. Well-established gas chromatography methods, with a precision of a single N_2O measurement better than 0.5 ppb were employed. The measured concentrations were then used in a linear emission model to calculate N_2O fluxes. Other trace gases (CH_4, CO_2, SF_6) were also measured in each sample for quality control purposes.

Result for both campaigns show large variability of N2O emissions, with maximum fluxes in the order of 40 kg N-N_2O ha^{-1} yr^{-1}, driven mainly by availability of nitrogen in soil (fertilization events) and water (measurements of soil water content were performed and analysed). For fertilized sites, largest emissions value were observed several days after the rainfall events, while the control site remained stable throughout the campaign period and not exceeding 0.5 kg N-N_2O ha^{-1} yr^{-1}.