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Effects of climate change on air pollution impacts and response strategies for European ecosystems

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ÉCLAIRE

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Effects of climate change on air pollution impacts and response strategies for European ecosystems
INTEGRATING IMPACTS OF AIR POLLUTION AND CLIMATE CHANGE ON ECOSYSTEMS

☒ S1: Emissions and Exchange Processes

Flux measurements of NOx in arable soil under dripping fertilization condition

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Abstract

Nitric oxide (NO) is one of highly reactive gases in the troposphere. It is known that arable soils might be the predominant NO source especially in those rural regions, where influence of fossil fuel combustion is rather low. Thus agricultural NO emissions may play a significant role in surface layer atmosphere ozone chemistry in local scale. The aim of this study is to discuss appropriate design of measurements, characterize magnitude of NOx exchange during the long-term measurements, identify the main controlling factors for agricultural land, located on southern chernozems (black soils) in South of Ukraine. Undoubtedly that 'right' design of measurements is the half a deal for representative results. Thus we started from default (ordinary) scheme of inter-row location of measurement chambers, but is not so representative for those lands with deep-in-soil dripping irrigation. That is why to increase quality of representativeness we decided to install 3 chambers into in-row position and 2 chambers left in inter-row location. We have found only slight differences in NO fluxes, apparently because the soil has already been saturated by N from dripping fertilization before changing design. Detailed management and climatic data have been discussed in parallel to characterize behavior/response of NOx fluxes. Several time episodes with high NO emission peaks triggered by different factors have been considered. First series of soil NO peaks induced by series of dripping fertilization (475.8 mm of irrigated water with 69.4 kg N ha-1) have been observed in May 2013. The maximum peak was 62.93 µg N m-2 h-1 with attenuation period of around 5 days. Second series of high NO emissions were found in the end of August (with a peak of 58.22 µg N m-2 h-1 and 3 days of attenuation period) and in the middle of September (with a peak of 88.35 µg N m-2 h-1 and ca. 10 days of attenuation period). Classical patterns of slight rain induced emission after long drying period have been described for at those times. Obviously the highest response was found in September, because at that time soil has been already reached by plant organic residues. Magnitudes of NO2 depositions have been also considered, slight NO2 emission episodes have been likely to be associated with low ambient NO2 concentrations and could be described by compensation point approach.