Weather induced variability of nitrogen exchange between the atmosphere and a grassland in the Hungarian Great Plain

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The presentation describes some of the preliminary results of the ecological research on nitrogen exchange in a grassland in central Hungary (Kiskunság National Park, Bugacpuszta). The changes in different climate parameters evidently affect not only N-deposition but also N-exchange and N-gas emissions through the processes of soil and plant metabolism. Measurements of nitrogen fluxes and basic meteorological parameters have been started above a semi-natural grassland ecosystem in 2002. Seasonal and long-term nitrogen exchange (both emission and deposition) is under climatic control. In the years of 2006 and 2007, the amount of the deposited N markedly decreased (by 27% and 15%, respectively) compared to the average of the earlier (2002–2004) years. The main source of the deposited N is NH_3. The ratio of dry to wet deposition varies between 1.5 and 2.3. In the dry year of 2007, emissions of N2O were four times lower compared to the average (90 mg N m^{-2} yr^{-1}) of the earlier years caused by the changes in weather conditions including lower precipitation and 1°C higher annual average temperature. In the year with higher precipitation (2010), N2O emissions increased again and reached 180 mg N m^{-2} yr^{-1} when the annual rainfall was twice the normal rate. It should be noted that soil water filled pore space (WFPS) cannot explain all of the variations in N2O fluxes. With increasing soil temperature, NO flux grows faster than N2O up to 20 °C until the role of other factors (e.g., water stress, nutrient supply, and other complex processes linked to heat stress) will determine the magnitude of metabolism. The relatively high soil N2O flux under 5 °C could come from the thawing period 2-3 months after wintertime which could resulting in high emission peaks for a few days with low soil temperature. It seems to be the case that soil temperature usually generates short term variability of trace gas exchange, whereas the magnitude of the biogenic emission is dominantly controlled by soil wetness, pH, and other site specific factors. The net N flux excluding grazing, manure, farm management, etc. ranged between 9.5 and 13 kg N m^{-2} yr^{-1}. Reduced N2O emission presents a potential negative feedback to emission; on the other hand, vegetation can become a net CO2 source in extremely dry years such as 2003 and 2007 as a positive feedback to climate change.