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Variability of nitrogen exchange between the atmosphere and a semi-natural grassland in Hungary

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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. Exchange dynamics of nitrogen compounds over Hungarian grassland (central Hungary, Kiskunság National Park, Bugacpuszta) ecosystems were analyzed based on field measurements and modeling approach. Measurements of i) nitrogen fluxes, ii) standard meteorological parameters and iii) surface energy budget components 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. Inter annual variations of N budget components and meteorological parameters are investigated. 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 N_2O 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. With increasing soil temperature, NO flux grows faster than N_2O up to 20°C until the role of other factors will determine the magnitude of metabolism. The relatively high soil N_2O flux could come from the thawing period in early spring which could resulting in high emission peaks for a few days period. It seems 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 $ha^{-1}yr^{-1}$ in period 2002–2010.