Geophysical Research Abstracts
Vol. 19, EGU2017-12243, 2017
EGU General Assembly 2017

Reactive nitrogen fluxes and gas-aerosol interactions above a semi-natural forest in the Po Valley, Italy

Marsailidh Twigg (1), Chiara Di Marco (1), Ben Langford (1), Benjamin Loubet (2), Giacomo Gerosa (3), Angelo Finco (3), Mark Sutton (1), and Eiko Nemitz (1)

(1) Centre for Ecology and Hydrology, Bush Estate, Penicuik, United Kingdom (sail@ceh.ac.uk), (2) UMR ECOSYS, INRA, AgroParisTech, Université Paris -Saclay, 78850, Thiverval- Grignon, France, (3) Dipartimento di Matematica e Fisica "Niccolò Tartaglia", Università Cattolica del Sacro Cuore, via Musei 41, 25121 Brescia, Italy

The Po Valley, Italy, is known to be a nitrogen hotspot through the co-emissions of nitrogen oxides (NO_x) and ammonia (NH_3) due to intensive agriculture and industry within the region. Due to the regions poor air quality there have been a number of studies to understand the atmospheric composition and the tropospheric chemistry. Studies on the deposition of reactive N to the local ecosystems are however limited due to the complexities of measuring species such as NH_3. The following study presented took place above an oak-hornbeam forest "Bosco Fontana" near Mantova, situated in the Po Valley, Italy with the aim to determine the importance of individual N species to the dry deposition budget and understand the impact of the chemical interactions and changes in the gas-aerosol partioning.

Water soluble gases (NH_3, HONO and HNO_3) and their counter-part aerosol species (NH_4^+ and NO_3^-) were measured using an online wet chemistry instrument called the GRadient of Aerosols and Gases Online Registration (GRAEGOR, ECN, NL). The fluxes were calculated using a modified gradient method, with concentration measurements at 2 heights. In addition, NH_4^+ and NO_3^- species were also measured by eddy covariance using an aerosol mass spectrometer (AMS, Aerodyne Inc.). Eddy Covariance was also used to measure NO fluxes.

Nitric acid (HNO_3) as expected had the fastest deposition rate (V_d) of 18.80 mm s^{-1} of all the N species measured. The study however did demonstrate that the deposition of NH_4^+ and NO_3^- was greatly enhanced during the day due to the evaporation during deposition close to the surface of the canopy, which resulted in the V_d of HNO_3 to be reduced.

Overall, the largest deposition flux over the forest was from NH_3, with an average of -253.42 ng m^{-2} s^{-1}, which accounted for 75% of the total N deposition budget during the period presented. The aerosols (NH_4^+ and NO_3^-) combined accounted for 19% and HNO_3 contributed just 5% to the total N deposition budget. Taking this budget, measured over 2 weeks, an inferred annual budget of 75 Kg N ha^{-1} yr^{-1}, which is greater than previously measured at the same site using a throughfall method for N deposition.