The state of the science on nitrogen deposition budgets and their use in critical loads assessments in Europe

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The deposition of reactive nitrogen compounds to terrestrial ecosystems may lead to changes in the diversity of the flora, freshwater eutrophication, acidification and enhanced emissions of N_2O and NO. To protect ecosystems from the effects of excess N r deposition the Critical Loads concept has been used extensively in Europe to identify areas at risk of these effects. Estimates of Nr deposition are generally provided by regional atmospheric dispersion, transport and deposition models, but seldom are the uncertainties in estimates of deposition quantified. In this presentation, current understanding of nitrogen deposition processes and uncertainties in the estimates are reviewed.

The science of nitrogen deposition estimates is complicated by the number and form of nitrogen compounds contributing to surface –atmosphere exchange processes and the difficulty in measuring each of the processes. The compounds involved in surface – atmosphere exchange include the gases, NO, NO_2, NHO_3, NH_3 and HONO, the particulate NO_3 and NH_4 and wet deposited $NH_4$and NO_3. Organic nitrogen also contributes to Nr deposition and will be discussed as a specific issue as the current understanding of organic nitrogen in the atmosphere is very limited and no emission inventories are available to simulate the process.

The measurement and interpretation of flux measurements of Nr compounds is discussed, as there remain important uncertainties in the mechanistic understanding of sources and sinks of some of the Nr compounds, notably HONO and the organic Nr. Even for NO_2, where the available literature suggests a simple process of uptake through stomata and no other significant deposition sink at the surface, the chemical conversion of NO within plant canopies obscures many field measurements.

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