Geophysical Research Abstracts
Vol. 15, EGU2013-832-1, 2013
EGU General Assembly 2013

N2O - direct versus indirect effects on emissions

Sophie Zechmeister-Boltenstern (1) and Barbara Kitzler (2)

(1) University of Natural Resources and Life Sciences Vienna, Austria (sophie.zechmeister@boku.ac.at), (2) Federal Office and Research Centre for Forests, Vienna, Austria (barbara.kitzler@bfw.gv.at)

The concentration of N2O in the atmosphere is much lower than that of CO_2, but it is an important GHG because on an equivalent mass basis, N2O has c. 300 times the global warming potential of CO_2. In addition to being a strong GHG, N2O is the primary stratospheric ozone depleting substance. The dominant sources of N2O are closely related to microbial production processes in soils, sediments and water bodies. Agricultural emissions due to N fertilizer use and manure management (4.3-5.8 Tg N2O-N yr-1) and emissions from natural soils (6-7 Tg N2O-N yr-1) are already representing 56-70% of all global N2O sources.

The main agricultural sources of nitrous oxide include emissions from soils after application of inorganic and organic forms of nitrogen (N) as synthetic fertilizers, crop residues, manures or composts. Livestock operations also result in emissions from urine and faeces deposited on soils during grazing. In addition to the direct sources of N2O, there are also indirect ones that include N deposited onto land surfaces following ammonia and NO_x volatilization, and nitrate leached from agricultural land in drainage water which, on passing into aquifers or into surface waters and their sediments, can be partially transformed to N2O (Smith et al., 2012).

For inventories a default emission factor (EF) of 1.0 % of N fertilizer application has been fixed. The default indirect EFs are 1.0 % of N deposited from the atmosphere, and 0.75 % of N lost to watercourses by leaching or runoff. Depending on fertilizer type and environmental conditions field measurements reveal emission factors which deviate largely from the theoretical values.

As soil moisture and temperature are major drivers of N2O emissions, warming and precipitation changes strongly affect the emission of N2O. More difficult is the prediction of climate extremes and their feedback on N2O which may occur via soil processes as well as limitations for plant growth and N uptake. Based on examples of recent research dealing with landuse, N-deposition, forest and river management, drought and fire, we will sort out the importance and uncertainties of anticipated impacts of global change on future N2O fluxes.