II. Abstract

Soils are the main contributor of N_2O emissions to the atmosphere. N_2O is a long-lived greenhouse gas with each molecule of N_2O having a direct global warming potential 298 times that of a single molecule of CO_2. Controls on N_2O emissions, including physical, chemical, and biological factors, can affect its production in the soil and its transport through the soil-atmosphere system. Soil O_2 is a key determinant of the microbial processes responsible for N_2O fluxes. Thus, identifying and quantifying sources of N_2O and O_2 in soils is an important aspect of accurately assessing the fluxes of N_2O to the environment. The high spatial and temporal variability of N_2O emissions from soils, however, has made it difficult to predict patterns of N_2O flux at the ecosystem scale. Considerable work has focused on measuring N_2O fluxes from the soil surface, with less attention given to the dynamics of N_2O in the subsoil. Landscape and topography also play a crucial role in N_2O distribution because of the control they exert on water availability, and consequently on O_2 availability. In order to evaluate the direct and indirect fluxes of N_2O to the atmosphere, understanding the fate of N_2O in the subsoil is essential. This is a proposal to mechanistically resolve the heterogeneity problem associated with modeling N_2O by measuring the depth distribution of N_2O and O_2 in soils along an established landscape gradient in a well-monitored ecosystem.