The Effects of Production, Consumption and Transport on N and O Isotope Composition of Nitrous Oxide in the Mojave Desert

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Deserts lie at the water-limited ends of life on Earth, and thus are likely to be sensitive to even small changes in human induced climate change. They also have unexpected impacts on the global greenhouse gas budgets. Here we show that along an elevation (and temperature and moisture) gradient, rates of soil nitrous oxide production decrease with decreasing elevation, and unexpectedly, at the lowest elevations and during times of most extreme water stress, become net sinks of atmospheric N_2O. This previously unrecognized small sink is hypothesized to be due to the recently recognized existence of a large group of non-denitrifying, N_2O-consuming aerobic organisms in soils. We report more than a year of soil N_2O (and CH_4, CO_2) concentrations and fluxes. To better understand the combined effect of the array of depth and time dependent processes that result in net N_2O fluxes and isotope compositions, we develop a production/consumption/transport model to probe the soil N_2O data. By using a combination of bulk N and O isotopes, and position specific N isotopes, we try to constrain the large gross source and sink fluxes that underlie the complex net chemical signals in soils, and how these processes respond to changes in climate.