Monthly Regional Estimates of the Global N_2O Surface Flux from 1997-2001

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Measurements from 48 surface sites in the CMDL Cooperative Air Sampling Network and the three-dimensional transport model TM3 were used in a Bayesian inverse modeling framework to estimate monthly averaged surface fluxes of nitrous oxide from 1997 through 2001. Fluxes were estimated for semi-hemispherical regions (90°S to 30°S, 30°S to equator, equator to 30°N, 30°N to 90°N) and also for 22 continental-scale regions (11 land and 11 ocean) defined by the recent TransCom3 CO_2 inverse modeling project.

Relative to past flux estimates and to the International Geosphere-Biosphere Programme's (IGBP) Global Emissions Inventory Activity (GEIA) global gridded inventory (used here as an a priori emissions estimate), we calculate a lower flux from the Southern Hemisphere oceans and a higher flux from tropical land and ocean regions, particularly from the equator to 30°N. Also, while we treated a priori emissions as constant throughout the year, the inferred fluxes show significant seasonality for several regions. We have also found an intriguing relationship between the inferred N_2O flux from the Eastern Tropical Pacific and measured sea surface temperature, possibly related to variability in ocean upwelling on seasonal and El Niño/Southern Oscillation (ENSO) timescales (Figure 1).

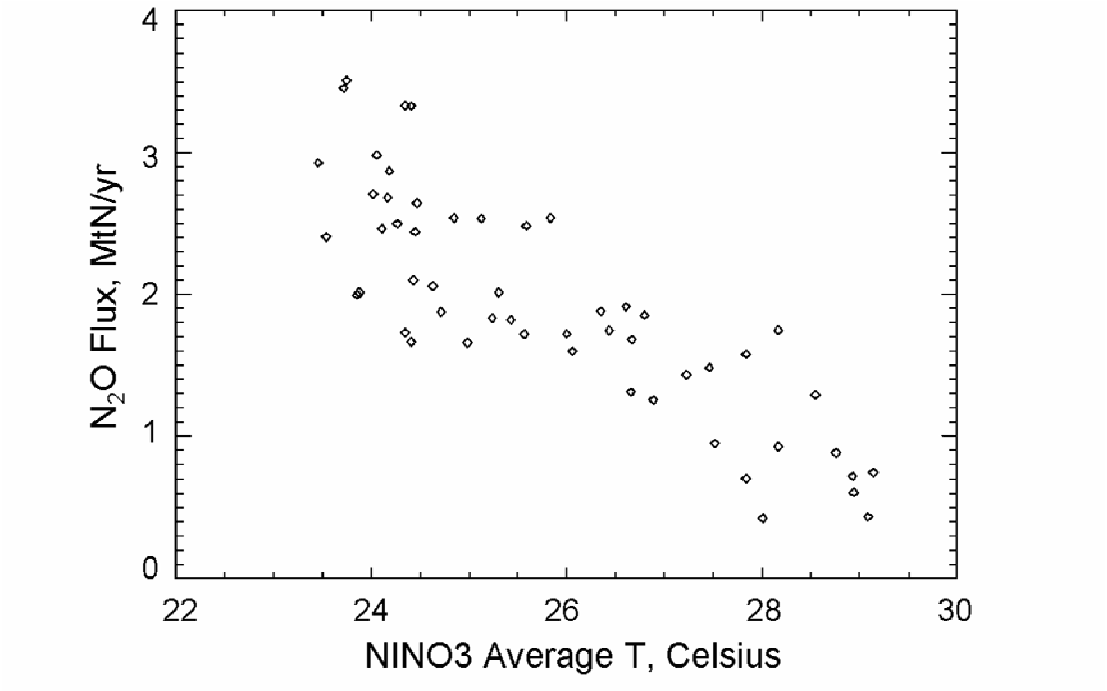

Figure 1. 1997-2001 relationship between the inferred monthly N_2O flux from the Eastern Tropical Pacific Ocean (~90°W to 160°W, 15°S to 15°N) and monthly averaged sea surface temperature of the NINO3 region (90°W to 150°W, 5°S to 5°N) from the NOAA Climate Prediction Center.