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Plain Language Summary: Atmospheric nitrous oxide (N_2O) contributes to global warming and stratospheric ozone depletion. Here we aim to better estimate the global and regional N_2O emissions from different sources using high-quality atmospheric observations, JAMSTEC's atmospheric chemistry-transport model (MIROC4-ACTM) and known (a priori) N_2O emissions due to natural soil, agricultural land, other human activities and sea-air exchange. Regional N_2O emissions are optimised by Bayesian inverse modelling for 84 partitions of the globe at monthly intervals for the period 1997-2019. Our best estimate global land and ocean emissions are 14.30±0.20 and 2.91±0.27 TgN yr^{-1}, respectively, for 2010-2019 (2010s), corresponding to N_2O lifetime of about 127 yr.

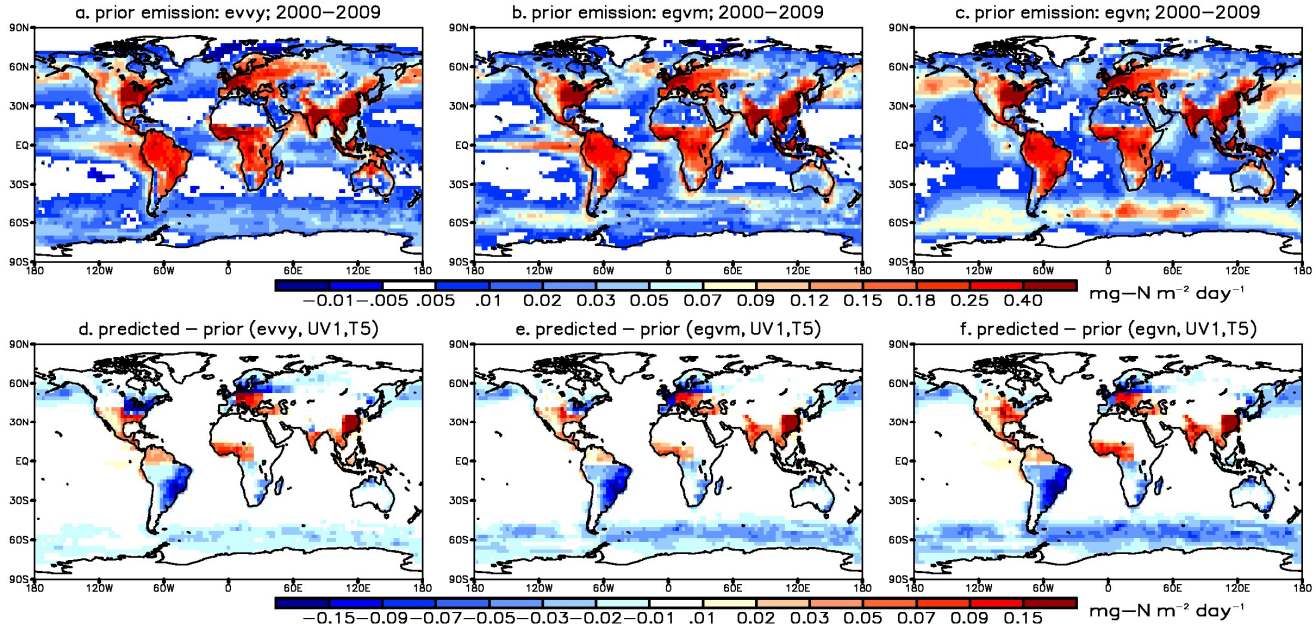

Figure 1. Maps of a priori N_2O emission distributions for 3 cases (top row), and the predicted increments by the inversions relative to a priori emissions (bottom row). The predicted increments for land regions are similar for all three inversion cases and but differ for the Southern Ocean region.

- Global land and ocean emission variabilities show significant correlation with El Niño Southern Oscillation (ENSO). Global land emissions increased by 10% in 2010s from 13 TgN yr^{-1} in 2000s.
- The most recent ocean emission estimation (Fig. 1a), with lower emissions in the Southern Ocean regions, fits better with that predicted by the inversions, i.e., lower increments (Fig. 1d).
- Regional land emissions show increases over much of the America, Central Africa, and Asia regions between the 2000s and 2010s. Only Europe and Japan recorded a slight decrease in N_2O emissions.