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A first estimate of the feedback between climate change and atmospheric N_2O concentration

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Previous studies have suggested that future climate change may have a negative impact on oceanic and terrestrial carbon cycle. This has fostered research to quantify the magnitude of the climate-carbon feedback. Climate change leads to a reduction of carbon sinks, an increase in the atmospheric CO_2 growth rate, and hence a larger climate change.

Here we adopt a similar conceptual approach to estimate the climate-N_2O feedback. We use the ORCHIDEE model for the land and the PISCES model for the ocean biogeochemistry. A nitrogen model based on CENTURY for organic matter and on DNDC for inorganic matter is implemented in ORCHIDEE. The model computes nitrogen fluxes as function of climate, soil moisture, nitrogen and carbon pool sizes, and nitrogen inputs. PISCES computes N_2O fluxes following Suntharalingam et al. approach in which N_2O production terms are function of oxygen concentration.

We forced the two models with climate taken from IPCC simulations of the 20^{th} and 21^{th} century performed by the IPSL General Circulation Model. Terrestrial and oceanic emissions of N_2O as well as atmospheric N_2O concentrations under changing climate are then estimated. We then estimate the radiative forcing and the warming/cooling effect due to the climate-N_2O feedback.