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Nitrous oxide (N2O) fluxes from soils under different land use in Brazil

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Cropland area has been expanded in Brazil and by now the agricultural sector has been calculated as the major emitter of nitrous oxide (N2O). This state was preceded by the conversion of natural ecosystems, which inevitably causes changes in the carbon and nitrogen cycle of the soil. However, detailed model and measurement approaches are lacking for sound national estimates. Here we present data from model driven measurement campaigns from different ecosystems and the results of a review of available data on annual N2O fluxes. Contrary to expectations, emissions from agricultural land (1.13 kg N ha-1 yr-1) tended to be even lower than from rainforest (2.29 kg N ha-1 yr-1). At the same time, N-fertilization did not lead to a relevant increase in annual N2O emissions. Moreover, pastures showed an age-related decrease in emissions; median annual emissions from young pastures ($\leq$ 10 years) were 2.52 kg N ha-1, whereas old pastures (> 10 years) emitted 0.90 kg N ha-1 yr-1. Since N2O is known to react very sensitive to changes (for example dry-wet changes, our measurement campaigns concentrated on the transitional period from dry to wet season, as predicted by our model simulations. For spatial explanation, model simulations were made for selected locations in the Brazilian state Mato Grosso, where agriculture is practiced since more than two decades. In accordance with the measurement and literature results, modelled emissions maize-soybean and cotton-soybean rotations were lower than from areas fallow areas. At the same time, the location and soil type, respectively, turned out to be an important factor when trying to quantify extensive emission budgets. Although existing models perform quite well based on monthly measurements, better adaptation is inevitable with regard to the possibility of more precise predictions. This requires spatial and temporal higher resolved monitoring, in order to involve soil types, which have so far not been considered sufficiently, and capture short-term effects from precipitation and fertilizer events. Still, for this presentation, we present our present spatial extrapolations for Mato Grosso.