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Source and sink strengths of terrestrial biosphere for CO_2 and N2O under future climate

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Future climate depends not only on the emissions from fossil fuel burning, but also on the sink and source strengths of the oceans and the terrestrial biosphere for all greenhouse gases (GHGs). The three most important natural GHGs triggering climate change are carbon dioxide (CO_2), methane (CH4) and nitrous oxide (N2O). Without drastic reduction of anthropogenic CO_2 emissions, climate change is expected to get even more significant during the 21st century. This will in particular lead to modified surface temperatures and precipitation patterns, which in turn will affect C and N turnover processes in the terrestrial biosphere and the natural terrestrial release and uptake of GHGs. In addition to the climatic changes, increased CO_2 concentration in the atmosphere is likely to promote plant growth. The magnitude of the resulting additional C sequestration will be dependent on nutrient availability, which in turn will be influenced by increased biomass productivity. Availability of N will also affect microbial processes responsible for soil respiration and N2O emissions.
Earth system models (ESMs) are a useful tool to examine these interactions on a global perspective. In our study we apply JSBACH-CN, the land component of the MPI-ESM, which was recently extended by a submodel for the terrestrial nitrogen cycle coupled to the existing carbon dynamics. The impact of future changes in CO_2 concentration, temperature and precipitation pattern on CO_2 and N2O release are examined with scenario simulation experiments.