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Impact of anthropogenic land cover change on non-CO2, greenhouse gases, aerosols, and climate: Overview about planned studies

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The analysis and quantification of the interactions and feedbacks between the terrestrial biosphere, atmospheric composition, and climate are crucial to improve our understanding of past, current, and future climate change. While great progress has been made with respect to the importance of CO2 in the climate system, less attention has been paid to the numerous other atmospheric components that may also contribute to perturbations of climate in a substantial manner. These include for example the so-called short-lived greenhouse gases (GHG), tropospheric ozone, related species like the biogenic volatile compounds (including isoprene and terpene), the reactive nitrogen gases, as well as several types of aerosols. In addition to being key players in the climate system, these species contribute to air quality.

Our main objective is to investigate the influence of anthropogenic land cover change on natural emissions of non-CO2 trace gases and aerosols and their impact on key aspects of the atmosphere-climate system, including the oxidative capacity, the loading of aerosols, and climate itself. We plan a set of equilibrium simulations with the ECHAM5-HAMMOZ model (a chemistry-climate model which includes detailed and interactive modules for trace gas tropospheric chemistry, aerosol processes and aerosol cloud microphysics) coupled to a mixed layer ocean. Simulations will build upon the Millenium Experiment performed by MPI-M and DKRZ, which will allows us to quantify the impact of changing land cover use and change on the climate throughout the period from 1600 to nowadays.

We will present an overview about our work, which is part of the MAIOLICA (Modelling And experIments On Land-surface Interactions with atmospheric Chemistry and climAte) project.