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Man-made fires over agricultural areas. Which importance they have for the global carbon cycle?

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The terrestrial global coupled carbon and water cycles, as driven by, and influencing the climate, can be simulated by Dynamic Global Vegetation Models (DGVMs). Carbon is emitted to the atmosphere mainly through heterotrophic respiration, followed by fires. Fire features a disturbance, that plays an important role for the dynamic of the natural vegetation and models estimate a global annual carbon emission of 3.5-5 PgC for a world covered by natural potential vegetation. Agricultural areas (croplands and pastures) are now accounted for within DGVMs. The Lund-Potsdam-Jena model for managed Land (LPJmL, Bondeau et al. 2006) simulates the effects of land-use (e.g. crop growth and harvest, crop residues processing) and land-use change (e.g. deforestation) on the terrestrial carbon cycle. A large uncertainty remains on the fate of crops residues that can be burned, used for animals, left over the field, or ploughed into the soil. Different managements impact both soil carbon and carbon emission. We use global spatial data on biofuel use and open field burning of agricultural residues, estimated by Yevich and Logan (2003), to parameterise at the regional level within LPJmL the amount of agricultural residues burned. The model simulates therefore the carbon emissions from fire (CO2, CO, CH4, VOC, NOx and TPM) of the actual vegetation (natural plus agricultural), their changes over time due to land use change, and their changes due to policy and management change. Using the LPJmL DGVM we are able to account for interannual carbon emissions from burning agricultural residue that account for a significant but poorly understood portion of global fire emissions. We show results on the spatial and temporal changes of fire emissions from agricultural areas, in relation with fire emissions from natural vegetation, and we compare with data from the literature.