Fire in the Earth System

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Fire – climate feedback

The newly established research group, Fire in the Earth System, will work on an improved understanding of the fire – climate feedback cycle and its contribution to the Earth’s climate sensitivity.

The fire in the Earth System group will make use of the MPI-M ESM to address the question how fire impacts the Earth System. While the MPI-M ESM includes already many of the important fire mediated climate relevant processes that will overall define the fire – climate feedback, there are a couple of processes that will need an improved representation. The Fire in the Earth System group will work on these various aspects in close cooperation with the ocean and atmosphere department (see also Outlook/ Work in progress).

Fire mediated processes in the Earth System

A fire mediates a number processes within the Earth System. The figure illustrates exemplary climate relevant impacts in the single compartment of the Earth System: (i) emissions of trace gases in the atmosphere (ii) modification of vegetation distribution (iii) redistributions of nutrients from the land to the ocean surface and (iv) deposition of dark soot on bright snow and ice surfaces.

Fire modeling

The simulation of the fire – climate feedback in an ESM will require a dynamic process based fire model. Such a fire model will be implemented into JSBACH the vegetation/land component of the MPI-M ESM.

Outlook / Work in progress

Processes that need an improved representation in the MPI-M ESM model to adequately represent the overall role of fire include (i) the consideration of plume injections of trace gas and aerosol emissions, (ii) the change in snow/ice albedo caused by soot deposition, (iii) the anthropogenic control of fires (ignition/suppression), and (iv) the use of fires as a tool to prepare land for agricultural usage. The Fire in the Earth System group is currently working on an explicit accounting of deforestation fires as a part of land cover change as well as an improved representation of the human – fire interaction within the fire parameterization. Fire injection heights and soot deposition on snow/ice will be addressed in PhD projects that will start in 2012.

Fire models can be compared to and evaluated with a range of observational based products including satellite data for the present day period as well as charcoal data reaching back to the last glacial maximum.

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References: