UP 6: Lecture by Martin Heimann on carbon cycle

Time: Wednesday 14:00–14:45 Location: HE 101

Keynote Talk UP 6.1 Wed 14:00 HE 101

The global carbon cycle in the climate system: To which extent is it manageable? — •Martin Heimann — Max-Planck-Institute for Biogeochemistry, Jena, Germany

Only about ~50% of the anthropogenic emissions of the greenhouse gas carbon dioxide (CO2) from the burning of fossil fuels and cement production currently accumulates in the atmosphere. The remainder is taken up by carbon sinks in the ocean and on land. Hence the dynamics of these sinks are crucial for the future evolution of the atmospheric CO2 content and its climate impact. The global ocean CO2 sink is relatively well understood and can be quantified by several independent methods. The global land sink is caused by the difference between photosynthesis of the vegetation and respiration from plants and soils. It can be quantified as a remainder of the atmospheric budget, however, the underlying complex dynamics of the land vegetation and soils are still quite uncertain on a global scale. This limits our predictions of how these natural sinks will continue to operate in the future. Under high CO2 concentrations modest saturation effects in the ocean and on land are expected, which will be further exacerbated by detrimental effects from a warming climate (a.o. ocean outgassing, enhanced soil respiration). The fate of the land sink in the 21st century, however, will be dominated by direct and indirect anthropogenic impacts from changes in land use and management caused by an increasing world population with food demands and associated land reclamation. This leaves little room for land management activities specifically directed to sequester excess carbon e.g. large-scale afforestation, biomass burial, biochar formation or changes in soil tillage. Also, other proposed "geoengineering" options to foster carbon sinks (e.g. ocean fertilization), have a very limited potential for carbon sequestration in comparison to the expected emissions from fossil fuels during this century.