1st TERRABITES Symposium
Hamburg, Germany, 9-11 February 2010
TERRABITES-27

Simulation of long-term interactions between the biosphere, atmospheric composition and global climate within the project MAIOLICA

A. Stenke (1), T. Peter (1), E. Rozanov (2), M. Schraner (1), and A. Wolf (3)

(1) Institute for Atmospheric and Climate Science, ETH Zurich, Switzerland, (2) PMOD/WRC, Davos, Switzerland, (3) Institute of Terrestrial Ecosystems, ETH Zurich, Switzerland

The project MAIOLICA investigates the interactions and feedbacks among the terrestrial biosphere, atmospheric composition and climate at different spatial scales, applying various experimental and modeling approaches. One objective of the project is to quantify the influence of land cover changes on the development of the global climate, focusing on the impact of changing biospheric emissions on the chemical composition of the atmosphere. Furthermore, feedback processes among the biosphere, atmosphere and climate on the global scale will be investigated. For this purpose we use an atmospheric chemistry-climate model (CCM) coupled to a biogeochemistry scheme. This coupled CCM consists of an extended version of the chemistry-climate model SOCOL employing full tropospheric and stratospheric chemistry, and the dynamic global vegetation model (DGVM) LPJ. Our investigations focus on the atmospheric methane distribution and its temporal evolution. Methane emissions from various natural and anthropogenic sources are considered in the model simulations. To take into account methane emissions from wetlands the model includes a simple scheme based on soil moisture, soil temperature and soil organic matter content. Net methane emissions from inundated areas are calculated as a function of the total heterotrophic respiration which indicates the amount of carbon released into the atmosphere by microbial decomposition of organic matter. Heterotrophic respiration data are provided by LPJ. To better determine the relative contribution of individual methane sources and sink processes to the methane distribution, two additional tracer, the carbon isotopes ^{12}C-(CH_4) and ^{13}C-(CH_4), were implemented in the model. The coupled model will be applied for the simulation of the climate and chemistry in the 20^{th} and 21^{st} centuries. We intend to perform two 200-years long ensemble runs with off-line and on-line biogeochemistry. The off-line runs will be driven by observed/projected sea surface temperatures and sea ice coverage, GHGs, ozone-depleting substances, aerosol surface area density and spectral solar irradiance. In the on-line runs the GHGs will in part be provided by the DGVM.