Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07319, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-07319
EGU General Assembly 2008

Climate changes simulated by the IAP RAS global model with CO_2 and CH_4 exchange between climate system components

I.I. Mokhov, A.V. Eliseev, M.M. Arzhanov, P.F. Demchenko and S.N. Denisov
A.M. Obukhov Institute of Atmospheric Physics RAS (mokhov@ifaran.ru)

Global and regional climate changes are simulated with the climate model of intermediate complexity developed at the A.M. Obukhov Institute of Atmospheric Physics RAS (IAP RAS CM). Current model simulations display positive feedback due to changes in the CO_2 exchange between the atmosphere, ocean, land, and biosphere. Methane cycle is also expected to respond on and interact with climate changes. One possible mechanism of this is due to changes in CH_4 fluxes from wetlands under global warming. Large amount of wetlands is located in Northern Eurasia where climate models are projecting strong warming in the 21st century. Permafrost degradation under global warming is expected to contribute to potential role of wetlands. Most current climate models neglect interaction between climate and methane cycle. The IAP RAS CM includes modules for processes in soil and for global carbon cycle including methane cycle related with wetlands. Changes in non–wetland natural and anthropogenic emissions of methane as well as anthropogenic emissions of CO2 are prescribed in the IAP RAS simulations according to SRES A2, A1B, and B1 scenarios for the 21st century. Historical data are used for corresponding changes during 1860–2000. Respective changes in atmospheric concentration of $N_2 mathrm O$ are also taken into account.

The IAP RAS CM reasonably reproduces basic observed characteristics of the 20th century climate in the numerical experiments with greenhouse and sulphate anthropogenic forcing. Projected atmospheric CO2 concentration in year 2100 is 833 ppmv for scenario SRES A2, 710 ppmv for scenario SRES A1B, and 570 ppmv for sce-

nario SRES B1. Methane emissions by wetlands are projected to increase in the late 21st century up to one third (or even more) of the present–day value. The atmospheric CH4 concentration grows monotonically up to about 3900 ppbv under the scenario SRES á2. Under scenarios SRES A1B and SRES B1 this concentration increases till the mid–21st century reaching 2100–2400 ppbv and decreases afterwards. Interaction between processes in wetlands and methane cycle enhances atmospheric buildup of carbon dioxide by 20-30% and build up of methane by 10–20%. Change in the global surface air temperature in the late 21st century with respect to the preindustrial state from IAP RAS CM simulations is 2.1–3.4 K depending on the scenario of anthropogenic forcing. Coupling between climate and CO28211;fluxes enhances global warming by about 0.4. Interactive response of methane emissions by wetlands enhances global warming is much smaller.

A comparison is performed with the IAP RAS simulations including a more detailed module for soil thermal and hydrological processes but neglecting an interaction with methane cycle.