Geophysical Research Abstracts, Vol. 8, 07864, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07864

Mesoscale simulations of CO2 during the CERES campaign using a coupled biosphere-atmosphere model

R. Ahmadov (1), C. Gerbig (1), S. Körner (1), B. Neininger (2) and the CERES team

(1) Max-Planck Institute for Biogeochemistry, Germany (rahmadov@bgc-jena.mpg.de; cgerbig@bgc-jena.mpg.de; Stefan.Koerner@bgc-jena.mpg.de), (2) MetAir, Switzerland (bruno.neininger@metair.ch)

Atmospheric measurements of CO2 from global networks, mostly consisting of remote sites, have long been used in combination with inverse analysis to retrieve information on biosphere-atmosphere exchange. In order to retrieve information on regional scales, networks are currently implemented over the continents. However, the location of the measurement sites close to variable sources and often in meteorologically complex areas, for example affected by sea-land breeze, or valley-mountain circulations, makes the representation in models difficult. Such effects, which are usually on the subgrid scale of current generation transport models used in inversions, need to be studied with high resolution mesoscale simulations that include CO2 in order to bridge the gap between the measurements and inversion models. The CERES experiment (CarboEurope Regional Experiment Strategy) was performed in les Landes, South-West France, May-June 2005 by several European research organizations. The main goal of CERES was to perform measurements within and above boundary layer and to couple those via modeling/data assimilation framework to the flux measurements at the surface and within the boundary layer. We applied the WRF (Weather Research and Forecast) model from NCAR to simulate the distribution of CO2 as a passive tracer (transport by advection, turbulence, and convection). Initial concentration and boundary conditions for CO2 are taken from LMDZ model from Laboratoire de Météorologie Dynamique. Anthropogenic emissions are included into WRF model from hourly emission inventory from Institute of Energy Economics and the Rational Use of Energy (IER), University of Stuttgart that is available in 10 km resolution for European region. To account for CO2 uptake and emission from different biomes we use the Vegetation Photosynthesis and Respiration Model (VPRM)

model recently developed at Harvard University. VPRM estimates hourly CO2 fluxes - Net Ecosystem Exchange (NEE) as the sum of respiration and photosynthesis, and provides these to WRF. It uses Land Surface Water Index (LSWI) and Enhanced Vegetation Index (EVI) from MODIS satellite data, and hourly temperature as well as PAR (photosynthetically active radiation) from the WRF model. In addition VPRM uses 3 parameters for each vegetation class, which are optimized using observation and model data. The modeled domain has a horizontal resolution 2x2 km. As initial and boundary meteorological fields for WRF ECMWF analysis data are used. For WRF simulations we chose the physics parameterizations schemes such as Lin et al. (6-classes) for microphysics, RRT and Goddard for longwave and shortwave radiation respectively, YSU for planetary boundary layer, Similarity Theory for surface layer and NOAH land-surface model (4 soil layers, with soil moisture). Since the resolution is high enough for explicitly simulating convective fluxes, no cumulus parameterization is used. Within CERES it is planned to intercompare results from different models (RAMS, MESO-NH etc.) run by different research groups for the two "golden" days of the experiment - 27.05.05 and 06.06.05 (clear sky and light winds). Such comparison will allow evaluating advantages and disadvantages of different meteorological and biospheric models, advection and parameterization schemes etc. We will present some results from our modeling framework for meteorological variables and CO2 concentration distribution. In addition we will show the comparison against CERES observational data, and discuss future perspectives of using such modeling systems in global and regional carbon research.