Geophysical Research Abstracts, Vol. 8, 09907, 2006
SRef-ID: 1607-7962/gra/EGU06-A-09907

Optimization of Surface CO2 Fluxes Using Coupled Maximum Likelihood Ensemble Filter (MLEF) and Parameterized Chemistry Transport Model (PCTM)

R. S. Lokupitiya(1), **A. S. Denning**(1), D. Zupanski(2), K.R. Gurney(1), M. Zupanski(2)

(1) Department of Atmospheric Science, Colorado State University, (2) CIRA, Colorado State University

Inverse modeling is widely used to optimize surface CO2 fluxes using observed CO2 concentrations in the atmosphere. A number of methods have been employed in inverse problems in geophysical research. Toward this goal, we apply the Maximum Likelihood Ensemble Filter (MLEF) algorithm, developed at Colorado State University. This is a novel ensemble filter approach, defined taking into account the experience (in terms of advantages and disadvantages) from Variational Methods, the Iterated Kalman Filter, and the Ensemble Trasform Kalman Filter. The MLEF is used with an offline chemistry/transport model (PCTM) to optimize the surface fluxes.

Coupled MLEF-PCTM model showed promising results in high spatial resolution (2.5 longitude x 2 latitude). However it requires large number of observation sites to optimize the problem due to high number of degrees of freedom involved with this resolution. Availability of current observation sites is limited. To reduce the degrees of freedom, we ran the transport model with much coarser spatial resolution (10 longitude x 6 latitude), which involves 1116 unknowns per week. Artificially generated CO2 observations were sampled at CMDL flask locations by running the PCTM forward for four years with weekly averaged CO2 fluxes generated by a terrestrial biosphere model (SiB) and Takahashi ocean fluxes. CASA generated land flux map combined with a noisy ocean map was considered as the prior flux. Assimilation was done by using a 8-12 week flux moving window and observations were assimilated at the end of the window. Spatial and temporal covariances in the retrieved fluxes are estimated by the optimization scheme by propagating the forecast error covariance forward through

successive assimilation cycles. In the future, this technique will be implemented with real atmospheric observations.