**Spatial integration of Regional Carbon Balance in Amazonia**

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We have completed a five-year investigation of land-atmospheric CO2 exchange over Amazon Basin. During the project time span, we have implemented and evaluated a new version of ecophysiology model SiB that is capable of realistically representing seasonal drought in surface fluxes of carbon, energy, and water. Significant modifications have been made to the calculation of soil water stress on photosysthesis, and with the radiative transfer module. The improved SiB3 parameterizations are able to reproduce the observed inter-annual variations and seasonality in net ecosystem exchange, sensible, and latent heat fluxes reasonably well. The linkage of SiB model with Regional Atmospheric Modeling System (RAMS) has been completed, and the coupled modeling system has been applied to Tapajos region to simulate mesoscale circulations and atmospheric CO2 variations during the dry season 2001 Santarem field campaign. The model is able to capture the observed meteorology and CO2, as well as surface fluxes of CO2, H, and LE, for the 15-day simulation time period. The mechanically forced low-level convergence proves to have significant impact on observed ecosystem carbon fluxes, and should be taken into account if tower fluxes are to be generalized to a large region. The impact of CO2 evasion from the Tapajos River has also been evaluated by performing numerical sensitivity experiments with and without river CO2 effluxes. The results show that the river CO2 effluxes increase carbon uptake over vegetated land due to short-term CO2 fertilization effects. The Amazon Basin stays a carbon sink despite of the river CO2 evasion. However, to study the long-term effects of atmospheric CO2 enrichment, a more sophisticated ecosystem model that can account for nitrogen limitation may lead to a different conclusion. As part of the BARCA field experiment, we compared aircraft and flux tower sampling strategies using SiBRAMS and LPDM trajectory model, and recommend that continuous tower based high precision [CO2] measurements can reduce uncertainty in global atmospheric inversions and therefore in our understanding of the global carbon budget. Finally, our fine-resolution SiBRAMS Amazon simulations, combined with emulated satellite tracks, are utilized to estimate spatial and temporal representation errors in inversions of orbiting carbon observatory (OCO) CO2 retrievals. Image

Full Proposal

Final Report

Publications

Students