**Bottom-up Scaling of Net Ecosystem Exchange over North America and Evaluation with an Atmospheric Inversion Setup**

*David Turner, Oregon State University*

Diagnostic carbon cycle models produce estimates of net ecosystem production (NEP, the balance of net primary production and heterotrophic respiration) by integrating information from 1) satellite-based observations of land surface vegetation characteristics, 2) distributed meteorological data, and 3) eddy covariance flux tower observations of net ecosystem exchange (used in model parameterization). However, a full bottom-up accounting of net ecosystem exchange (NEE, the vertical carbon flux) that is suitable for integration with atmosphere-based inversion modeling also includes emissions from decomposition/respiration of harvested forest and agricultural products, $CO_2$ evasion from streams and rivers, and biomass burning. In this study, we produce a daily time step NEE for North America for the year 2004 that includes NEP as well as the additional emissions. This NEE product was run in the forward mode through the CarbonTracker inversion setup to evaluate its consistency with $CO_2$ concentration observations. The year 2004 was climatologically favorable for NEP over North America and the continental total was estimated at 1730 ± 370 TgC yr-1 (a carbon sink). Harvested product emissions (316 ± 80 TgC yr-1), river/stream evasion (158 ± 50 TgC yr-1), and fire emissions (142 ± 45TgC yr-1) counteract a large proportion (35 %) of the NEP sink. Geographic areas with strong carbon sinks included Midwest U.S. croplands, and forested regions of the Northeast, Southeast, and Pacific Northwest. The forward mode run with CarbonTracker produced good agreement between observed and simulated wintertime $CO_2$ concentrations aggregated over 8 measurement sites around North America, but overestimates of summertime concentrations that suggested an underestimation of summertime C uptake. Because terrestrial NEP is the dominant offset to fossil fuel emission over North America, a good understanding of its spatial and temporal variation ─ as well as the fate of the carbon it sequesters ─ is needed for a comprehensive view of the carbon cycle.