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Model simulation of the atmosphere-plant-soil carbon exchange at AsiaFlux sites

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There are increasing number of flux measurement towers, by which atmosphere-biosphere exchange of energy, water, and trace gases is continuously measured by the eddy covariance method. Flux measurements in Asia constitute the AsiaFlux network including about 30 sites. We developed a process-based model of terrestrial carbon cycle on the basis of a simple model (Sim-CYCLE), and applied to AsiaFlux sites. First, this model was applied to a cool-temperate deciduous broad-leaved forest in Takayama, central Japan, which has the longest record of flux measurement in Asia since 1994. The carbon cycle model operates at daily time-step, and additionally, a canopy sub-scheme operates at 30-minute time-step to retrieve short-term fluctuations. The model simulation during the period from 1948 to 2004, driven by the NCEP/NCAR climate data, shows decadal forest growth including a disturbance effect. In the last decade of the simulation, average net ecosystem production was estimated as 218 g C/m2/yr (sink); this is satisfactorily close to the result of flux measurement by the National Institute of Advanced Industrial Science and Technology and Gifu University, Japan. However, interannual variability was slightly different from that in the flux measurement; the range of variability was smaller than that was actually observed. The model captured seasonal change of the temperate deciduous forest such as the onset and termination of growing period. In the Global Environmental Research Fund S-1 Project by the Ministry of the Environment, we are planning to apply the model as wide variety of AsiaFlux sites as possible.