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The forest-atmosphere exchange of water/energy based on the concept of potential response characteristics

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Annual evapotranspiration (ET) from the forest is nearly equal to that from the lake, thus it is important to estimate the impact of forest activity on ET. Jarvis (1976) showed a stomatal conductance model which was driven by the meteolorogical condition. Modified Jarvis-type conductance model includes the functions of photosynthetically active radiation, vapor pressure deficit, leaf surface temperature and soil water content. Moreover, he pointed out the parameter set in the model should be different by species of tree.

We examined the stomatal conductance for the forests in northern Eurasia and Japan, and obtained one parameter set. It was determined according to the following process. First, for each function, we plotted ALL observed conductance and environmental data. Second, we fitted the Jarvis-type conductance model for these data. Finaly, we calculated parameters. That includes all of our observed forest information. We called these parameter sets 'potential response characteristics' parameters.

In this study, our objective is to simulate the water/energy exchange in other areas and to examine the ET charateristics. Using the potential response characteristics parameters and a one-dimentional land surface model (2LM, Yamazaki et al., 2004), we showed that it is possible to simulate the water/energy exchange in northern Eurasian and Japanese forests.

We select 12 sites of FLUXNET (3 of EUROFLUX, 5 of Ameriflux and 4 of Asiaflux) and analyze the tower-observed data. In the simulation we use 2LM which includes

three submodels: forest canopy, soil and snow cover. Input data are the meteorological conditions and output data are the sensible heat, latent heat and stomatal conductance etc.

For the latent heat flux, we find that the 2LM output is overestimated and the bowen ratio (the ratio of sensible/latent heat flux) is less than the observation. The simulated latent heat in 2LM suggests that LAI (Leaf Area Index) is larger. Therefore we convert LAI to effective one and re-culculate then the latent heat becomes smaller and near to the observed flux in many sites. We would like to discuss these improved results in detail in the poster.