Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02360, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02360
EGU General Assembly 2008

Do forests have a common "potential" response of surface and/or stomatal conductance to environmental conditions?

T. Ohta (1, 2), K. Matsumoto (1, 3), H. Dolman (4), S. Hatta (5), T. Ito (1), T. Kobayashi (6), T. C. Maximov (7), H, Park (8), A. Sumida (9), T. Yamazaki (10), R. Yoshida (10)

(1) Nagoya University, Japan; (2) Japan Science and Technology Agency, Japan; (3) The Japan Society for the Promotion of Science, Japan; (4) Free University, The Netherlands; (5) Tomakomai National College of Technology, Japan; (6) Kagawa University, Japan; (7) IBPC, Russia; (8) JAMSTEC, Japan; (9) Hokkaido University, Japan; and (10) Tohoku University, Japan

E-mail: takeshi@agr.nagoya-u.ac.jp; Tel: +81-52-789-4059

Surface and stomatal conductance are important parameters in understanding water, energy, and carbon (WEC) cycles. Their physiological responses to environmental variables are usually considered to have typical features according to forest type and/or tree species. In land surface models, such responses are often represented by typical values reported from several field observations. However, there are some problems with the spatial representation of surface and stomatal conductance. Additionally, the ranges of environmental conditions differ widely among observation sites, and the physiological responses determined from *in situ* observations might be strongly affected by the ranges of environmental variables at each site.

We analyzed the responses of surface and stomatal conductance to environmental variables at several sites in climate zones that ranged from boreal forests in Siberia to warm-temperate and cool-temperate forests in Japan. Using a Jarvis-type conductance model, analyses were conducted for five forest stands in the three climate zones at the stand scale and for nine sites of six tree species in the same climate zones at the leaf

scale. When analyses were conducted separately for each site, the two scales showed very different physiological responses ("within-site" parameter). Soil moisture content (SWC) did not efficiently control the conductance in the within-site parameter. However, we could identify a common response of surface and stomatal conductance throughout all of the forest stands and all of the tree species at both scales by pooling all of the data from the obtained data sets ("pooled" parameter). In this case, SWC became an important factor in controlling the conductance. Moreover, there was no difference between the surface and stomatal conductance estimated using the within-site and pooled parameters.

The pooled parameter data set for the leaf scale was applied to a land surface model (2LM) and a hydrological cycle model in which the 2LM and a distributed runoff model were coupled. The 2LM produced good estimations of surface fluxes not only at the five study sites, but also for several EuroFlux, AmeriFlux, and AsiaFlux sites. A sensitivity analysis of the 2LM showed SWC to be important in determining the magnitude of surface fluxes in the pooled parameter, whereas maximal stomatal conductance strongly affected the fluxes in the within-site parameter. The former results agreed well with *in situ* phenomena.

The 2LM was extended to the Lena River basin (2,460,000 km^2) of eastern Siberia and was coupled with a distributed runoff model. Water balance and runoff characteristics from 1986 to 2003 could be represented using these models and the pooled parameter data set obtained at the leaf scale.

Our results suggest that the surface and stomatal physiological responses of forests or trees to environmental variables may converge to one common "potential" response. In other words, forests or trees might show the same response under the same environmental condition, irrespective of the forest type and/or tree species. We propose this idea as the concept of "potential" responses of surface and/or stomatal conductance.