

# **Simulation of CO<sub>2</sub>, Latent and Sensible Heat Exchanges over a Tropical Monsoon Forest in Both Rainy and Dry Seasons with Multi-layer Model**

**Katsunori TANAKA**

*Frontier Research System for Global Change*

*Seavans North BLDG. 7F 1-2-1 Shibaura Minato-ku Tokyo 105-6791 Japan*

**Masakazu SUZUKI**

*Graduate School of Agricultural and Life Sciences, University of Tokyo*

*1-1-1 Yayoi, Bunkyo-ku, Tokyo 113-8657, Japan*

**Hideki TAKIZAWA**

*College of Bioresource Sciences, Nihon University*

*1866, Kameino, Fujisawa-shi, Kanagawa 252-8510 Japan*

**Nipon TANGTHAM**

*Faculty of Forestry, Kasetsart University*

*Chatuchak, Bangkok, 10900 Thailand*

## **Abstract**

The final aim of this study is to understand the process of land surface and to apply the knowledge to the land surface model. Here, the study was carried out, focussing on the process of gas exchanges between plant community and the atmosphere.

A multi-layer model for exchanges of latent heat, sensible heat and CO<sub>2</sub> has been developed (Tanaka, 2000). It was coupled with both the canopy interception process and the water budget process on leaves, so that the exchanges during and after rainfall can be simulated. In order to test the model, data set in Kog-Ma experimental site, which is one of target areas in GAME-Tropics, were used. The observation site is a tropical monsoon forest and experiences the dry season and the rainy season within a year. Therefore, it is convenient especially to test the model coupled with both processes in rainy season. In the site, the measurements of boundary conditions –radiation, air temperature, humidity, wind velocity and so on- have been carried out since 1997, and the exchanges of latent heat, sensible heat and CO<sub>2</sub> were measured using eddy correlation technique in several weeks a year, which include rainy and dry seasons. This eddy correlation system could directly measure the exchanges.

The intensive observation results were applied to the developed model. The model simulation showed that it could simulate the exchanges of CO<sub>2</sub>, latent heat and sensible heat over the canopy in both the rainy season and the dry season. Within the model, it is supposed that photosynthesis and transpiration occur, in case that the bottom-side of leaves is dry even if the topside is wet during and after rainfall events. Both measured and simulated CO<sub>2</sub> exchange during and after the second rainfall event on 29 May 1998 showed CO<sub>2</sub> absorption by a plant community.

Moreover, exchanges of latent heat, sensible heat, and CO<sub>2</sub> were also simulated on the other days in 1998 and 1999, when the exchanges were not measured, and the exchanges throughout 2 years were estimated. Seasonal variation of the gas exchanges could be discussed.