ESTIMATING LAND SURFACE ENERGY AND WATER FLUXES BY USING THE LAND DATA ASSIMILATION SYSTEM DEVELOPED AT THE UNIVERSITY OF TOKYO (LDASUT)

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ABSTRACT

Land surface processes, through which the exchanges of water, energy and carbon between the land surface and the atmosphere are realized, affect the weather and climate remarkably. Climate simulations are especially sensitive to the diurnal and seasonal cycle of surface energy balance [1]. Land surface energy budgets are also very important in hydrological and ecological modeling. The energy flux can be measured in a patch scale with some special instruments such as triaxial sonic anemometers, krypton hygrometers and fine-wire thermocouples. It also can be estimated in a region scale from satellite observations when the infrared images and ancillary data are available. Land surface models (LSMs) are developed to predict the temporal and spatial pattern of land surface variables [2,3], but prediction qualities are usually not so good, due to model initialization, parameter and forcing errors, and inadequate model physics and/or resolution [4,5]. Land Data Assimilation System (LDAS), developed by merging observation information (from ground-based stations, satellites and so on) into dynamic models (i.e. LSMs), is highly expected to provide surface energy and water flux estimates with a high quality and adequate coverage and resolution.

This paper reports an application of an LDAS developed in the University of Tokyo (LDASUT) [6] on the Wenjiang site of JICA project, where a PBL tower is built, for the period from January to March, 2008. The objectives of this study are: (1) to evaluate LDASUT in vegetated land surface using in-situ observation, (2) to check the feasibility to estimate areal land surface variables reliably with using LDASUT driven by spatially-distributed forcing data.

In this study, LDASUT was first driven by in-situ observed micrometeorological data, and simulated energy fluxes were compared to hourly direct measurements; simulated soil moisture content was compared to the in-situ soil moisture observation at the depth of 4 cm. The results show that LDAS can generally simulate those variables well and thus the capability of LDAS is validated.

In order to check the possibility of applying LDAS globally and simulating surface energy and water budget worldwide, two sets of model output data: Japan Meteorology Agency (JMA) Model Output Local Time Series (MOLTS) data and Modified JMA MOLTS data, were used as the driven data of LDAS. Performance of LDAS was not so good when it was driven by the original JMA MOLTS data, but it was improved after we modified MOLTS data with some simple linear regression equations. This result demonstrated the feasibility to simulate land surface fluxes reliably with LDAS driven by model outputs.

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