**P1.33** ESTIMATING SPATIAL AND TEMPORAL VARIATION OF EVAPOTRANSPIRATION IN SOUTH KOREA

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## 1. INTRODUCTION

Evapotranspiration (ET) is a critical component of the regional water and energy balance. Its spatial and temporal variation is of importance to diverse economic activities as well as management of terrestrial ecosystems. Actual ET could be measured with micrometeorological methods including eddy covariance technique but systematic measurements at regional scale are rare and difficult.

While derivation of regional ET from remotely sensed data has been studied extensively by many groups, the results are not always satisfactory. The frequency of overpasses in some satellites equipped with high spatial resolution sensors limits their uses in near- real time monitoring of ET. Geostationary satellites with the real-time monitoring capability have too low spatial resolution to meet most applications. Most of all, the satellite - derived ET data are diagnostic rather than prognostic in their nature. In many applications, the ET needs to be estimated under given climate scenarios but the ET from remotely sensed data may not be appropriate for this case. In practice, the regional ET is usually estimated from meteorological data at ground stations with remotely sensed land surface informations. When the ET is to be estimated for watershed scale at high spatial resolution in complex terrain like South Korea, the accuracy of the spatially interpolated meteorological data is critical to the success of this approach.

In this study, we present a GIS-based approach for the watershed scale ET modeling in complex terrain.

## 2. METHODS AND MATERIALS

### 2.1 *Model and Input Data*

A stand-alone version of the revised Simple Biosphere Model (SiB2) was used to estimate hourly latent heat of every grid cell within the domain of a given geographic area (Sellers et al., 1996). Inputs consist of time-invariant or seasonally changing data (data1) such as soil texture, biome type, NDVI etc. and the hourly atmospheric forcing fields (data2) prepared by spatially interpolating meteorological variables with appropriate topoclimate models (Chung and Yun, 2004). A spatial data management system for SiB2 operation was written to extract data1 and data2 for SiB2 from ArcGIS grids which contain both time variant and invariant spatial attributes of a given region.

### 2.2 *Model Application*

Land surface of a 6km by 6km area in Gyunggi province, South Korea was divided into a regular grid with 30m grid spacing and 7 synoptic weather station data, Landsat TM data, and digital soils data were used to prepare the input grids for SiB2 (Fig. 1).

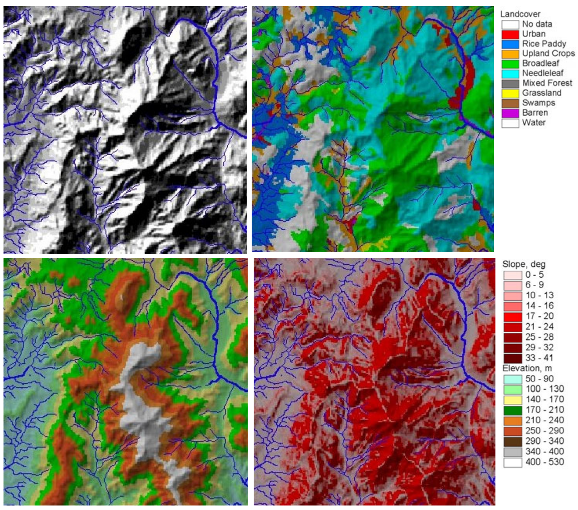


Fig. 1 Land surface characteristics of the study area as potential determinants of local climates : aspect(A), land cover(B), elevation(C) and slope(D).

### 2.3 *Model Valiadtion*

ET estimates at selected grid cells were validated against the actual measurement of water vapor flux by eddy covariance technique (Fig. 2). Model run started on 25 August 2001, when a saturated soil moisture condition was assumed by a heavy rainfall event, and continued until the end of March 2004. A flux footprint analysis was done at both sites in order to identify the grid cells representing the measured latent heat fluxes.

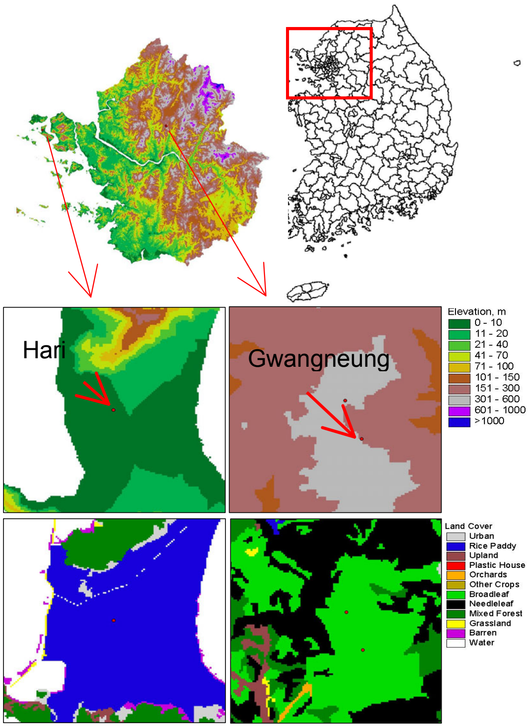


Fig. 2. Locations of 2 validation sites, one in a rice paddy and the other in a broadleaf deciduous forest. Inserts are the elevation (middle) and the land cover feature (bottom), respectively.

## 3. RESULTS AND DISCUSSION

ET estimates at the 30m x 30m grid cells identified by the flux footprint analysis were compared with the latent heat fluxes measured by KOFLUX towers (Fig. 3). Data for the periods of June 27 - July 4 and August 18 - 26 in 2002 are presented. While the raw data from the rice paddy site were used in this analysis, "gap-filled" data were used for the forest site where the measurement environment was not so good. Even though there is a significant overestimation in the higher region, the overall goodness of fit is reasonable (0.7 for the coefficients of determination).

Fig. 4 shows the estimated ET over the study area at 09:00, 12:00, 15:00 and 18:00 LST on 31 July 2003.

## ACKNOWLEDGEMENTS

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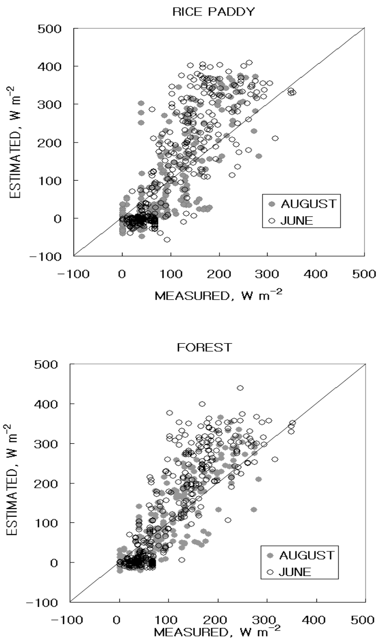


Fig. 3 Goodness of fit test for the spatially estimated evapotranspiration over land covers of a rice paddy (top) and a forest (bottom) with the measured flux data.

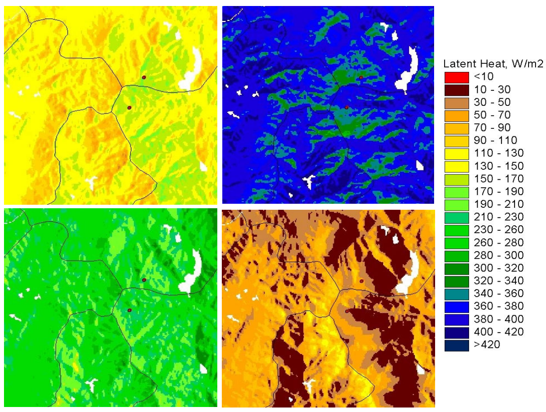


Fig. 4 Actual evapotranspiration grids for the study area of 6 by 6 km at a 30m resolution reconstructed from the SiB2 output data at 09:00(A), 12:00(B), 15:00(C) and 18:00(D) on 31 July 2003.

## REFERENCES

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