ESTIMATION OF HYDROLOGIC PARAMETERS RELATED TO SOIL AND VEGETATION USING REMOTELY-SENSED DATA AND GIS - AN EXPERIENCE AT MOUNTAINOUS WATERSHEDS IN JAPAN –

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Distributed models are now indispensable for hydrologists to understand hydrologic environment considering basin-wide interactions among hydrologic processes in a variety of temporal/spatial scales. However, the distributed models are still regarded as difficult to apply to operational hydrologic problems because of the existence of many parameters. Here, a priori estimation of parameters related to land-atmosphere interactions, i.e. soil and vegetation system, are tried using GIS analysis. This is based upon the idea that real situations near ground surface are relatively easily reflected in GIS with in situ and/or remotely-sensed data.

This study focuses on hydrology in mountainous forest-covered watersheds in Japan and consists of two experiences there in long-term riverflow simulation and in flood (dam-reservoir inflow) forecasting.

In the long-term riverflow simulation study, a new version of PWRI distributed hydrologic model (PWRI model), a conceptual distributed model, was applied to two small mountainous forest-covered watersheds in the Kanto district, the Kusaki-dam watershed (254km2) and the Shiobara-dam watershed (120km2). The former watershed consists of old geologic condition and the latter has relatively new volcanic geology. The PWRI model seems a kind of tank model, but the land-atmosphere interactions are modeled on the basis of Noilhan and Planton (1989) scheme. The scheme requires some geophysical & biophysical parameters. LAI was estimated by Ishi et al. (1999) method with Landsat-TM images. The satellite images were also used to update land-use (forest cover) conditions. Soil hydraulic parameters were grouped into three categories based on soil map and sample data. Parameters for groundwater were set based on the system of the old version of PWRI model, which had been optimized for several Japanese rivers. Flow network was estimated by DEM. The long-term riverflow simulations of the two watersheds were both quite successful by just one-parameter tuning.

The flood forecasting study was made at the Shiobara-dam watershed with a physically-based Watershed Environmental Hydrology (WEHY) Model. The model requires not only the similar information such as topography, soil hydraulics, vegetation but also soil-depth distribution for each hillslope modeling computational unit (MCU). A soil-depth ranking matrix table was created on the basis of empirical knowledge about the relationship among soil-depth, topographical feature, slope, land use (vegetation type), the soil and in-situ soil depth measured at 36 points for each ranking-category of soil-depth. The flood simulations using the parameters were also successful. The method to estimate areal distribution of soil depth was tested at the Kusaki-dam watershed as well.

According to the results, the parameter estimation methods above are expected to be applicable at least to the regions around the Kanto district of Japan.