DYNAMIC ASSESSMENT OF WATER RESOURCES IN THE YELLOW RIVER BASIN USING RS/GIS AND WEP-L MODEL

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The main purpose is to study evolutionary laws of water resources in the Yellow River Basin under the impact of human activities using GIS/RS and WEP-L MODEL. Traditional approach of water resources assessment (UNESCO, 1998) has a lot of limitations for the purpose because: 1) it can not reflect the impacts of land cover changes on water resources, 2) it assesses surface water and groundwater separately though they are strongly interactive, and 3) it assesses water resources only in forms of surface water and groundwater but excluding soil moisture consumed by vegetation. However, physically-based hydrological models has potentialities for the task with the aid of RS/GIS. Firstly, basin subdivision, land cover classification and spatial interpolations of water uses in the basin were carried out using DEM, RS data and GIS. The basin was subdivided into 8485 sub-watersheds and 38720 contour bands, land cover and vegetation information of four periods were obtained using Landsat TM data and AVHRR data, and water uses were interpolated into every 1km grid cell. Secondly, on the basis of WEP model (Jia et al., 2001) which combines the merits of distributed watershed hydrologic models and land surface processes models, we developed WEP-L (Water and Energy transfer Processes in Large river basins) model in which "natural-artificial" dualistic water cycle system are modeled in a coupling way. In the WEP-L model, contour bands inside sub-watersheds are used as computation units and the mosaic approach is adopted to reflect the heterogeneity of land covers inside a computation unit. In this way, the model can avoid possible serious distortions of flow modeling, which may occur if coarser grid cells are used as computation units. Variable time steps from 1hour to 1day are adopted in the model in accordance with the different time scales of various hydrologic processes, which has improved the computation efficiency and ensures rational description of hydrologic dynamics. Lastly, continuous simulations of 45-year (1956 ~ 2000) were carried out for correspondent land cover conditions. Model verification was performed by comparing simulated discharges with observed monthly and daily discharges at main gauge stations. The water resources assessment results under present land covers conditions were compared with those under historical land covers conditions. By contrast, it is shown that the quantity and compositions of water resources changed distinctly under the impact of intensive human activities. The two main findings are: 1) the surface water resources reduced but the ground water resources which is unrepeatable with the surface water resources increased under the impact of human activities; 2) the special water resources reduced but the general water resources increased accompanied with increase of the effective evaporation namely effective utilization of precipitation. The research achievement can be referenced for comprehensive management and the water safety

strategy planning of the Yellow River Basin.

Keywords: WEP-L model; Distributed hydrological model; GIS; RS; Water resources assessment; Yellow River; Land cover change; Water use

REFERENCES

Jia, Y., Ni, G., Kawahara, Y. and Suetsugi, T. (2001). "Development of WEP Model and Its Application to an Urban Watershed". *Hydrological Processes*, 15(11), 2175-2194.

UNESCO (1998). *Guidelines for Conducting Water Resources Assessment*. A contribution to IHP-IV project M-1-1(a), prepared by Milorad Miloradov and Prvoslav Marjanovic.