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Evaluation of the water balance, nitrogen loading, and phosphorus loading in the Okayama basin using a distributed model

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In order to evaluate the environmental impact to the Seto Inland Sea, I built the basin GIS of the first-grade river of Okayama Prefecture. I developed the distribution model which computes a water balance and a nutrition salt loading dose simply using the basin GIS data.
This model is a mesh type model with easy comprehension of the spatial distribution in a basin. Mesh size is 1 km and calculates a single year per day. The inputs of a water balance are precipitation and agricultural water. Outputs are evapotranspiration, an outflow, and infiltration. The tank model was used for the water balance in order to make soil water content reflect. I set the two-layer tank model which consists of a surface and underground to each mesh. I used the 1st layer of tank as the parallel type according to land use, and it made the 2nd layer a single structure. Land use classification is five, a paddy field, an upland field, a forest, an urban area, and a water area.
The loading dose corresponded to the source of load of the land system, the life system, and a livestock system. Land system load sets up a standard loading dose according to land use, and generates it according to an outflow. Life system load is computed from a load factor, population, a sewer improvement rate, and an extraction ratio. Livestock system load is computed from a load factor, livestock number of heads, and an extraction ratio about a cow and a pig. Such loads are discharged in the same amount via a drainage canal every day.
The temperature, precipitation and wind speed data in AMeDAS observatories, and the relative humidity data of ground meteorological observing stations are used for meteorological data. Therefore, this model corresponds also to amount-of-precipitation-analyzed-by-radar-AMeDAS data. The area according to land use and the number of livestock of each mesh were presumed from the agricultural-and-forestry-industries census and the land use subdivision mesh of digital national land information.
I performed this model under the climate condition in 2000 to 2005 for the Yoshii river basin. As a result, although the amount of outflows in a river mouth mesh was following in footsteps of variation of a river flow rate, its response is low and it cannot respond to a peak discharge. The amounts of outflows were 0.90-1.26 to the annual river flow rate. Therefore, the amounts has insufficient fitting.
The amount of infiltration to underground is large in the basin of the upper stream where Chugoku Mountains and the paddy field of a northern part with much precipitation spread. The paddy field was evaluated as a recharge region. Moreover, the loading dose was strongly affected by the influence from a paddy field and an upland field.
I can use this model in order to compare spatial distribution, an annual variation, etc. relatively. However, this model still has the insufficient accuracy of a water balance and a loading dose, and a future improvement is required.

Keywords: distributed model, river basin, water balance, nitrogen load, phosphorus load, GIS