Water balance analysis of the Doki river and the Yoshii river basin, western Japan by the distributed model

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We developed a model to estimate the water balance which played role that was important to material transportation as an evaluation purpose of the environmental load from the land area in the Seto Inland Sea basin.

The water balance analysis model assumed it the grid type model which could visualize the spatial distribution in the target basin. The grid size is 1 km mesh. The target range is a first-grade river basin, and it is around several thousand square kilometers. The analysis is carried out at single age by a unit on a day.

I show a basic calculating formula of the water balance with each grid as follows.

summation (precipitation + agriculture water) = summation (evapotranspiration + runoff + infiltration)

I set two steps of tank models to each grid to evaluate this formula. The plural land use is mixed in the grid. Therefore I assumed the first step tank a parallel model according to the land use. It was assumed that the second step tank was unitary. I made the land use the division in a paddy field, upland field, the forest, a city, water area.

The connection between the grid set either of 8 circumference directions to a down stream grid. The runoff volume from the first step tank and the second step tank is handed to down stream Grid each. By the second step tank, I set acceptance acceptable amount depending on a slope. When the inflow from an upstream grid exceeds acceptable amount, I hand a surplus to the first step tank as amount of discharge. With the grid including the flow channel, the runoff from the first step tank assumes it the runoff to the river.

I applied this water balance analysis model to Doki river basin of Kagawa, the Yoshii river basin of Okayama, western Japan. An analysis period is 1995-2005 years.

I compared the water balance with the value of the unit area. The annual precipitation of the Doki river basin was 780-1860 mm, but, as for the evapotranspiration, 500-640 mm and the range were small. As for the runoff volume to the river, precipitation was reflected at 220-1150 mm. By the comparison with the streamflow, there were many estimates 130-200 mm.

In the Yoshii river basin, the evapotranspiration was 460-580 mm for 1110-1920 mm annual precipitation.

The runoff volume to the river was 490-1110 mm, and it was -220-60 mm for streamflow.

The differences between streamflow and estimate have to take the influence of the water intake of domestic water and the water for industrial use into account. In addition, including the adjustment of the coefficient, the improvement of the analysis model is more necessary.