Construction of the hydrological model of the Amur River basin which incorporates dissolved iron production mechanism

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Recent studies show that dissolved iron plays an important role to maintain the biological productivity of the Sea of Okhotsk, and it is suppose that one of the important sources of dissolved iron is fresh water of the Amur River. During the last several decades, agricultural activity and forest logging has drastically changed the land use in the basin. Thus, the objective of this study is to make a model to simulate dissolved iron flux of the Amur River and to assess the effect of land use change of the Amur River basin on the dissolved iron productivity.

The model consists of runoff routing module, discharge module and dissolved iron production module. The whole river basin is divided into 0.5 x 0.5 grid. Discharge from each grid is routed along the TRIP by routing module. Each grid can be seen as one basin, and each grid is again subdivided into 0.01 x 0.01 grid. In each subdivided grid, runoff and dissolved iron concentration is calculated. Runoff module is based on TOPMODEL concept. Saturation degree of each subdivided grid is calculated by runoff module, and this value is used to calculate dissolved iron concentration of each subdivided grid combined with topographic index a/tanb and land use type.

An optimum parameter set which can simulate the discharge of the basin was searched by trial and error. While the result proved that the model can simulate seasonal trend of discharge fairly well, there were two problems which must be improved. In the calculated value, peak discharge was underestimated and the timing of peak was faster than the observed value. Thus, parameter fitting was done at the several points in the basin. In addition, runoff velocity which was fixed constant was changed to vary according to the slope of each grid. As a result, prediction accuracy was improved. The result of iron concentration in winter season was relatively good, but the increasing trend during the summer season can not be simulated. After incorporating the effect of surface ponding at flat areas such as wetlands and the effect of flooding near the river course, increasing trend of summer season were appeared. However, discrepancy between calculated and observed value was yet large. From the observation of long term change of iron concentration in the basin, it is suggested that other factors such as temperature and agricultural activity must be considered.