XVII[th] World Congress of the International Commission of Agricultural and Biosystems Engineering (CIGR)

Hosted by the Canadian Society for Bioengineering (CSBE/SCGAB)
Québec City, Canada June 13-17, 2010

IMPACT ASSESSMENT OF CLIMATE CHANGE ON IRRIGATION BY A DISTRIBUTED WATER CIRCULATION MODEL

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CSBE101332 – Presented at Section I: Land and Water Engineering Conference

ABSTRACT The paper summarizes the impact assessment of climate change on irrigation carried out by using a distributed hydrological model for the Mekong (7,950,000km^2) and Sekikawa (1,140km^2) River basins, which are representative examples for large international and irrigation domined river basins, respectively. At first, we proposed a distributed water circulation model incorporating variations in agricultural water use, so that the model provides useful information on paddy cropping area, actual water intakes for irrigation, actual evapotranspiration, soil moisture and runoff at arbitrary times and points in the basin. It was initially applied to the Mekong River Basin, in which we compared discharges and actual evapotranspiration estimated by the model with the observed data. The comparisons revealed a high degree of reliability and usefulness of the model. The model was then strengthened with snowing/melting and dam operation models developed and combined with the model mentioned above for the Sekikawa river basin in Japan. Eventually, the model proved to be a useful tool for evaluating the effects of human activity on agricultural water and for predicting these effects of climate change on agricultural water use in the future. Secondly, the estimation of future climate condition by MRI-CGCM2.3.2 and MIROC3_2_HIRES was inputted into the above model and the results obtained are as follows: 1) Bias corrections are necessary to assimilate probability distributions between the observed and recreated (GCM/RCM) meteorological data series. 2) Snowmelt runoff decreases in early spring, minimum flows decrease from May through September, and maximum flows increase after June, due to global warming. 3) Actual agricultural intake at the “Itakura” head works decreases especially during puddling periods due to the above decrease in snowmelt runoff, 3) Although cropping areas of rain-fed paddies increase due to the increase of rainfall, these areas will experience drought decreases in the future (2046-2065, 2081-2100) compared to the present period (1981-2000).

Keywords: Climate change, distributed water circulation model, impact assessment, irrigation, agricultural water