

Title:

Development of a real-time hydrological cycle – rice growth coupled simulation system as a tool for farmers' decision making in an ungauged basin in Cambodia for the better agricultural water resources management

Authors:

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Abstract:

The entire country of Cambodia depends on agriculture for its economy. Rice is the staple food, making it the major agricultural product (roughly 80% of total national production). The target area of this study is western Cambodia, where rice production is the greatest in the country and most land is rainfed. Since most farmers rely only on their (non-science-based) experience, they would not adjust to changing rainfall and degraded water resources under climate change, so food security in the region would be seriously threatened (Monichoth et al., 2013). Under this condition, irrigation master plans are being considered by several ODA projects. This study aims to contribute to the design of such irrigation plans through the development of a real-time hydrological cycle – rice growth coupled simulation system. The purpose of the development of this system is to support decision making 1) for determining the necessary agricultural water resources and 2) for allocating limited water resources to various sectors. Rice growing condition as affected by water stress due to the water shortage is supposed to be shown for both of the cases with and without irrigation for several rainfall patterns.

A dynamically coupled model of a distributed hydrological model (WEB-DHM., Wang et al., 2009) and a rice growth model (SIMRIW-rainfed, Homma et al., 2009) has been developed with a simple irrigation model. The target basin, a small basin in western Cambodia, is basically an ungauged basin and the model was validated by soil moisture, LAI, dry matter production of the rice crop, and rice yield, using both intensive field observation and satellite observations. Calibrating hourly satellite precipitation dataset (GSMaP/NRT) using ground rain gauges, hydrological cycle (soil moisture at three layers, river discharge, irrigatable water amount, water level of each paddy field, water demand of each paddy field, etc.) and rice growth (LAI, developmental index of the rice crop, dry matter production of the rice crop, etc.) are being calculated on near real time basis and opened to the Cambodian governmental staff by a website with only 5-hour delay.

This system enables the Cambodian local government to virtually experience the effectiveness of irrigation and to get qualitative information for the examination on whether or how much they will investigate for irrigation.