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Hydrology and Earth System Sciences Discussions

Interactive comment on "Phreatic surface fluctuations within the tropical floodplain paddy field of the Yom River, Thailand" *by* S. Chuenchooklin et al.

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1: The aim of this article intended to explain the behavior of groundwater level in unconfined aquifer within specific floodplain in tropical monsoon zone. The case study was focused to the Yom River's floodplain in Phichit Province, Thailand. Because of this area (most farmland is paddy field) is normally inundated by river overflowing during monsoon season in September to October. In contrast during the drought period, there is lack of surface water to be survived crops especially for paddy. The groundwater source is alternately taken by farmer. The declining of groundwater table was seen in every year. The research was conducted as the following objectives. First objective was to study flood problem and find out the method with how to reduce flood over the farmland in such season. Second objective was to study the cultivation systems and crop water consumption in this area. It was found that most of farmland in this area

is paddy field and over consumption of water from groundwater source through many tube wells during drought period was shown. Those tube wells were ranged of 20 to 80 m in depth and the serviced area of each tube well of 4-6 hectares depended on the power engine installed at the top of tube well. The evidence showed that the trend of water table was recession and downward direction year by year. Fortunately, from the previous research showed that the geomorphic condition in this area was good enough with thin topsoil layer and very thick sand in subsoil layer getting from soil log data. Its soil condition might be able to reduce flood using infiltration processes to subsoil layers and to be stored as in the aquifer using appropriated methods. Those became to the third objective that the investigation of all parameters involved surface and subsurface flow through the existing ground condition must be studied and explained using simple water balance model as the explanation in this article given by the authors. All surface flow parameters involved in rainfall-runoff and flood hydrograph study over the catchments through existing topographic contours and cross sectional profiles need to be researched. Those included field infiltration experiments (as the points) and using the GIS technique to present the distributed result of point to aerial or contour of infiltration and seepage coefficients. The estimation of crop consuming water as the demand to be withdrawn from groundwater source during drought period was done using existing climatologically data in order to estimate crop evapotranspiration and time to crop coefficients. Flooding or ponding water above ground could be become the head of flux water to be penetrated the soil surface as seepage capacity. The groundwater level changes would be depended on the use of water and infiltrated water through deep percolation as well as lateral groundwater inflow and outflow coming in and going out the considered area. The objective of this article was aimed to show the existing condition of groundwater changes by river or flood condition through the observation data.

Further objective (final one) will be the development of mathematical model in order to explain the behaviors of subsurface flow by flooding as the conjunctive model.

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The result of phreatic surface level in this area was shown that it was influenced by surface water especially during flooded or inundated by the river through infiltration and deep percolation. The evidence was shown by using the comparison of actual data of daily phreatic surface level and surface water level in the river using real observation data was shown (Fig. 15). The 22 observation wells were drilled with 15-30 m in depth and installed with the pressure transducers and data loggers in order to record of groundwater data with 10 minute of time interval. The river stage was also observed using a pressure transducer and data logger with 30 minute of time interval. Both data in all figures were shown in daily.

2: In Fig. 6 explained the general configuration of floodplain system through the cross-sectional profile that connected to the river and groundwater zone. It included all parameters and variables involved in this area. The land nearby the riverside will be influenced by overflowing from the river across the natural levee. The middle part between the levee and highland will be the lowland as floodplain zone covered by alluvial soils which was the focus area as the study in the article. All smaller blocks (Thiessen's polygon) as shown in Fig. 5 were located in floodplain which used for studying the water balance as shown in the upper part in Fig. 6 and Fig. 7. The balance of such equation could also be used for computing recharge to the groundwater. During flooding period, there was no any plant grown in floodplain. Only some water was penetrating to the ground surface as infiltration and deep percolation as flux volume from subsoil to the phreatic surface level accordingly head or ponding depth above ground. The meaning of infiltration is the penetrating water from ponding water above ground to be stored in the ground surface (flux to the ground) but deep percolation is water moving from subsoil to the upper aquifer (flux to aquifer). The particular subsurface flow through unsaturated zone could be excluded to consider in this time but the relationship between surface water and groundwater level changing. The highland (but some occurrence year i.e. with Tr=100 year might be influenced by flood from the river too), paddy and upland crops are grown as rainfed cultivation area and second alternative water source is groundwater through the tube wells during drought period.

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3: Fig. 7 will be redrawn in the revised version. The surface flow model was set in the upper part in Fig. 7 (above the dash line).

Actually the "simple" is meaning only the budget equation. However, the involved parameters in such equation were having very complex phenomena and processes themselves. In the big catchments like this study area, it can be considered as the regional scale which all processes can be computed as the conceptual lump model. The more emphasized studying in each phenomenon could be done later. In further, the development of mathematical model explaining the recharge flux to the aquifer according to surface flow during flood condition will be presented.

4: Field observation data should be collected. Those included climatologically data, infiltration experiment, discharge measurement, monitoring of water table change, river water level and flood observation. Moreover, the model was followed by using water balance equation [1] which was already explained in the main article. No any software was developed in this time yet exception using spread sheet software assisted to compute all involved parameters. How the model implement, firstly, to estimate the water utilization volume for crop requirement (Vc in the middle part above the upper dash line in Fig. 7) and amount of groundwater withdrawal, the FAO's potential evapotranspiration (ETo) using combined Penman-Monteith's (P-M) equation (Doorenbos et al., 1977) would be applied. All parameters for P-M equation would be applied by using standard climatologically data which included daily solar radiation (sunshine hour), air temperature (maximum and minimum), humidity and wind speed data. Then ETc for each kind of crop during growing season in none flooded catchments could be estimated as ETo multiplied by crop coefficients (Kc) and divided by the efficiency of farm application at each growing stages which assumed to be the amount of groundwater consumed. However, the overall amount of water consuming for paddy not only water for crop consuming in growth period but also the amount of water use for land preparation (WLp) with time of land preparation (TLp) before starting to grown paddy should be considered in the model too. If shorter TLp, it was meant that WLp to be withdrawn

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from the source would be higher rate than longer TLp. If the area of land preparation practices (ALp) were started within the same time, the amount of water WLp would be greater than the rate of water supply from the sources or yield of groundwater result shortage of water from the sources or groundwater recession. In this study, it was assumed that the whole area were cultivated with broadcasting HYV's rice with the period of land preparation of 4 weeks, and rice growing season started from 2 weeks after land preparation practice was begun.

5: Yes, this article was intended to explain using original data of actual groundwater level changed and followed by flooding in the specific area. The computed flood areas and volumes had been presented as the topographic characteristic in Fig. 12. In this paper the estimation of flood recharge volume to groundwater was presented. The computing using water budget for each polygon showed that the averaged losses rate from paddy field percolated to the uppermost aquifer layer was high value of 2650 m3/d/km2. Annual infiltrated water in 2002 was totally 26 million m3 during inundated period over floodplain area (50.414 km2). The P-M's ETo was averaged to 4.1 mm/d which produced the total potential loss by this phenomenon and for dry seasonal crop water requirement computing of 34 million m3 with about 75% of gross area.

In this paper was an objective only to show the behavior of flood recharge to the groundwater using actual data. However, the development of mathematical model explaining the recharge flux to the aquifer according to surface flow during flood condition will be presented in the next paper soon.

6: It would be revised by the native speaker before submitting final publication in HESS.

7: Yes, thank you so much for your kind suggestions. Mathematical model for conjunctive surface and groundwater in this area will be developed and presented in near future.

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