Geophysical Research Abstracts
Vol. 15, EGU2013-3720, 2013
EGU General Assembly 2013

Integrating Water Table Fluctuation Method and Groundwater Numerical Modeling on the Estimation of Regional Recharge Quantity of Pingtung Plain

Yu-Wen Chen (1), Jui-Ping Tsai (1), Liang-Cheng Chang (1), Yun-Chih Wang (1), You-Cheng Chen (1), Chung-Jung Chiang (2), Chih-Chao Huang (2), and Jui-Er Chen (2)

(1) Department of the Civil Engineering, National Chiao Tung University, Hsinchu city, Taiwan (bsjacky@gmail.com), (2) Central Geological Survey, MOEA, New Taipei City, Taiwan

[authoryear, preprint, review, square, colon, fleqn, final, 3p,12pt, times]elsarticle

amssymb multirow titlesec titletoc fancyhdr amsmath, amssymb, amsthm graphicx rotating, threeparttable, booktabs natbib setspace longtable, lscape[pdflatex,bookmarks,unicode,colorlinks=true]hyperref

CJKutf8 CJKnumb

EGU 2013

UTF8bkai UTF8bkai

label1]Yu-Wen Chencor1bsjacky@gmail.com label1]Jui-Ping Tsai label2]Liang-Cheng Chang label3]Yun-Chih Wang label4]You-Cheng Chen label5]Chung-Jung Chiang label6]Chih-Chao Huang label7]Jui-Er Chen

[label1]Post-Doctoral Researcher, Department of the Civil Engineering, National Chiao Tung University [label2]Professor, Department of the Civil Engineering, National Chiao Tung University [label3]Assistant, Department of the Civil Engineering, National Chiao Tung University [label4]PhD student, Department of the Civil Engineering, National Chiao Tung University

[label5]Deputy Director, Central Geological Survey, MOEA [label6]Division Chief, Central Geological Survey, MOEA [label7]Technician, Central Geological Survey, MOEA

[cor1]Department of the Civil Engineering, National Chiao Tung University, 1001 University Rd., Hsinchu city, Taiwan 300, R.O.C.

Abstract

Pingtung Plain is one of the most important groundwater areas in Taiwan. Because of the over usage of groundwater resource, several kinds of environmental impacts and natural hazards such as land subsidences and seawater intrusions have happened near the coast area of Pingtung Plain. To avoid the environmental impacts, an accurate quantification estimation of groundwater recharge is crucial for the planning of sustainable management for groundwater resources. Traditionally, groundwater numerical modeling is the most popular approach to estimate the quantity of regional recharge. Based on the assignment of different boundary conditions in numerical modeling, the spatial distribution of pumping can be accurately determined. However, because the construction process and the calculation of groundwater numerical modeling is more complex and the computational burden of numerical modeling is large, the length of the time step of numerical modeling for regional groundwater system traditionally is a month or a season which is much longer than the lengths of precipitation events. Because the low sampling frequency is like a kind of low pass filter might ignore the impact of precipitation events, a monthly numerical model is difficult to simulate the increasing quantity of groundwater storage during or after a precipitation event. Besides, because the increasing quantity of groundwater storage is the combined effect of pumping and recharge, also called net recharge, the recharge and pumping quantities are very difficult to be separated only using a numerical model. To overcome the disadvantage of numerical modeling for separating the recharge and pumping, a Water-Table Fluctuation (WTF) method can determine these two terms based on the fluctuations of groundwater levels or storage from different periods, such as draught period and flooding period. For example, because the quantity of recharge during draught period is rare enough to be ignored, the fluctuation of system information can be used to determine the potential decline quantity include pumping quantity and loss quantity. In this study, daily groundwater levels are also used in WTF to avoid the impact of low sampling frequency mentioned above. Therefore, this study propose a hybrid architecture which integrates the water balance results of

WTF and numerical modeling to estimate the the annual quantities of recharge, pumping and loss for Pingtung plain.

In this study, the integrated result demonstrate the groundwater balance analysis of Pingtung plain from 1999 to 2010. The averages of annual pumping for F1, F2 and F3-1 respectively are 133, 440 and 412 million tons and the average pumpage for the entire system is 985 million tons. The loss quantity of entire system is about 825 to 1393 million tons. The recharge quantity is about 1270 to 2124 million tons, the average quantity of recharge is 1765 million tons and the relationship between the accumulated quantities of recharge and precipitation for each precipitation event is positive based on a linear regression analysis. The linear regression model demonstrates that if every 100 (mm) of precipitation may cause 62 million tons recharge. The proposed hybrid architecture have the ability to demonstrate the status of water balance before, during and after precipitation events. The loss quantity is about the 63% of the quantity of vertical recharge and, therefore, the quantity of effective recharge is about the 37% of the quantity of vertical recharge.

Water-Table Fluctuation, Groundwater Numerical Modeling, MODFLOW, Pingtung Plain and Groundwater Recharge