Geophysical Research Abstracts
Vol. 16, EGU2014-783-7, 2014
EGU General Assembly 2014

A model for water discharge based on energy consumption data (WATEN).

María Carmen Moyano (1,2), Lucía Tornos (1,2), and Luis Juana (1)

(1) Polytechnic University of Madrid, Madrid, Spain, (2) Centre for Hydrographic Studies, CEDEX, Madrid, Spain

As the need for water conservation is becoming a major water concern, a lumped model entitled WATEN has been proposed to analyse the water balance in the B-XII Irrigation Sector of the Lower Guadalquivir Irrigated Area, one of the largest irrigated areas in Spain. The aim of this work is to approach the hydrological study of an irrigation district lacking of robust data in such a manner that the water balance is performed from less to more process complexity.

WATEN parameters are the total and readily available moisture in the soil, a fix percentage for effective precipitation, and the irrigation efficiency. The Sector presents six different drainage pumping stations, with particular pumping groups and with no water flow measurement devices. Energy consumption depends on the working pumping stations and groups, and on the variable water level to discharge. Energy consumed in the drainage pumping stations has been used for calibration

The study has relied on two monthly series of data: the volume of drainage obtained from the model and the energy consumed in the pumping stations. A double mass analysis has permitted the detection of data tendencies. The two resulting series of data have been compared to assess model performance, particularly the Pearson's product moment correlation coefficient and the Nash-Sutcliffe coefficient of efficiency, e_2, determined for monthly data and for annual and monthly average data.

For model calibration, we have followed a classical approach based on objective functions optimization, and a robust approach based on Markov chain Monte Carlo simulation process, driven in a similar manner to genetic algorithms, entitled Parameters Estimation on Driven Trials (PEDT), and aiming to reduce computational requirements.

WATEN has been parameterised maintaining its physical and conceptual rationality. The study approach is outlined as a progressive introduction of data. In this manner, we can observe its effect on the studied objective functions, and visualize if new data adds significant improvements to model results. The model attained an average Nash-Sutcliffe coefficient $e_2 \cong 0.90$ between based on energy drainage observations and estimated drainage discharge.

The study has shown that the Sector crop evapotranspiration, is lower than the expected value in pristine conditions. This reduction would be more noticeable at the end of the summer months, attaining as far as a 40% reduction. Average drainage in the studied period, is about 3700 m^3/ha/year.

This methodology is thought to be the basis for similar worldwide studies comprising scarce-data irrigation districts with drainage discharge to receiving water bodies, and serve as a guide for future alike applications.