

RESEARCH ARTICLE

California Simulation of Evapotranspiration of Applied Water and Agricultural Energy Use in California

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Abstract

The California Simulation of Evapotranspiration of Applied Water (Cal-SIMETAW) model is a new tool developed by the California Department of Water Resources and the University of California, Davis to perform daily soil water balance and determine crop evapotranspiration (ET_c), evapotranspiration of applied water (ET_{aw}), and applied water (AW) for use in California water resources planning. ET_{aw} is a seasonal estimate of the water needed to irrigate a crop assuming 100% irrigation efficiency. The model accounts for soils, crop coefficients, rooting depths, seepage, etc. that influence crop water balance. It provides spatial soil and climate information and it uses historical crop and land-use category information to provide seasonal water balance estimates by combinations of detailed analysis unit and county (DAU/County) over California. The result is a large data base of ET_c and ET_{aw} that will be used to update information in the new California Water Plan (CWP). The application uses the daily climate data, i.e., maximum (T_x) and minimum (T_n) temperature and precipitation (P_{cp}), which were derived from monthly USDA-NRCS PRISM data (PRISM Group 2011) and daily US National Climate Data Center (NCDC) climate station data to cover California on a 4 km×4 km change grid spacing. The application uses daily weather data to determine reference evapotranspiration (ET_o), using the Hargreaves-Samani (HS) equation (Hargreaves and Samani 1982, 1985). Because the HS equation is based on temperature only, ET_o from the HS equation were compared with CIMIS ET_o at the same locations using available CIMIS data to determine correction factors to estimate CIMIS ET_o from the HS ET_o to account for spatial climate differences. Cal-SIMETAW also employs near real-time reference evapotranspiration (ET_o) information from Spatial CIMIS, which is a model that combines weather station data and remote sensing to provide a grid of ET_o information. A second database containing the available soil water holding capacity and soil depth information for all of California was also developed from the USDA-NRCS SSURGO database. The Cal-SIMETAW program also has the ability to generate daily weather data from monthly mean values for use in studying climate change scenarios and their possible impacts on water demand in the state. The key objective of this project is to improve the accuracy of water use estimates for the California Water Plan (CWP), which provides a comprehensive report on water supply, demand, and management in California. In this paper, we will discuss the model and how it determines ET_{aw} for use in water resources planning.

Key words: soil water balance, crop water requirements, weather generator, water resource planning, crop coefficient, energy use

INTRODUCTION

The daily soil water balance model California Simula-

tion of Evapotranspiration of Applied Water or Cal-SIMETAW was specifically designed to provide the best possible information on agricultural water demand for use in the California Water Plan, updated every five

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