

Watershed Model Review

The models being reviewed for possible use in simulating Butte County water resources issues are the USGS PRMS model, the MIKE-SHE model distributed by DHI which is the consulting arm of the Danish Hydraulics Institute, and the WEHY model developed by the California Hydrologic Research Laboratory.

The Precipitation Runoff Modeling System, or PRMS model, was developed by the United States Geological Survey (Leavesley et al. 1983). It is a conceptual, distributed parameter model capable of continuous simulations. There are over 50 modules used to describe hydrologic function which can be used in any combination in the construction of a model for a particular region. The PRMS model is a public domain model available on the world-wide-web and is designed to be run in Linux-based computers.

The MIKE-SHE model is a combination of the SHE Model developed by the Institute of Hydrology in the UK and the MIKE-11 model developed by DHI (Abbot et al., 1986; Bathurst, 1986; DHI, 2003). It is a physics-based model with both lumped and

distributed parameter capabilities and is capable of continuous simulations. Its modular format allows simulation of any or all components of the land phase of the hydrologic cycle. It is a proprietary model available for purchase from DHI via the world-wide-web.

The physically based watershed hydrology model, WEHY (watershed environmental hydrology) model (Kavvas et al. 2004; Chen et al. 2004a,b), represents a new approach to the modeling of hydrologic processes in order to account for the effect of heterogeneity within natural watersheds. Toward this purpose, the point location-scale conservation equations for various hydrologic processes have been upscaled in order to obtain their ensemble averaged forms at the scale of the computational grid areas. Over hillslopes these grid areas correspond to areas along a complete transect of a hillslope. The resulting upscaled conservation equations, although they are fundamentally one-dimensional, have the lateral source/sink terms that link them dynamically to other hydrologic component processes. In this manner, these upscaled equations possess the dynamic interaction feature of the standard point location-scale two dimensional hydrologic conservation equations. A significant computational economy is achieved by the capability of the upscaled equations to compute hydrologic flows over large transactional grid areas versus the necessity of computing hydrologic flows over small grid areas by point location-scale equations in order to account for the effect of environmental heterogeneity on flows. The model is used by the California Hydrologic Research Laboratory and can be run in either a Linux or Windows operating system.

For these three models, comparisons are made with respect to the processes identified in Table 1. The processes are broken down into three categories: groundwater processes, surface water processes, and interactive processes.