



## **Distributed Snow Process Model**

### **Technology**

The Distributed Snow Process Model (DSPM) enables snowmelt to be factored into estimates of watershed runoff for operational water control and hydrologic studies. The model, developed by ERDC's Cold Regions Research and Engineering Laboratory (CRREL), has been incorporated into the Hydrologic Engineer Center's Hydrologic Modeling System (HEC-HMS), which is widely used by Corps of Engineers Districts to simulate precipitation runoff.

DSPM estimates snowmelt in any sub-area of watershed using the SSARR\_grid snow process model. Sub-area is usually defined as a spatial grid cell of arbitrary size, although the grid cells usually are 1 or 2 km<sup>2</sup> in size. The SSARR\_grid model was extracted from the original SSARR model using the "Snow-Band" snowmelt computation, which estimates liquid water available at the soil surface for a sub-area for one-time step. The model is a temperature index model that accounts for cold content and liquid water content of the snow. The melt factor can be a constant, or a function of the antecedent temperature or time of year.

### **Problem**

Water derived from snowmelt is an extremely important resource in many areas of the world, including the United States. It is important that the Corps and others who estimate watershed runoff incorporate snowmelt modeling in their distributed hydrologic models. Previous versions of HEC-HMS provided a variety of options for simulating precipitation runoff processes, but did not have the type of physically based snowmelt process model to simulate snowmelt for operational water control and hydrologic studies in areas where snow is a part of the hydrologic cycle.

### **Expected Cost To Implement**

Implementation cost is low. HEC-HMS is distributed free to Corps Districts and includes its own graphical user interface, integrated hydrologic analysis components, data storage and management capabilities, and graphics and reporting facilities.

### **Benefits/Savings**

Corps Districts and their customers now can provide accurate estimates of snowmelt-related runoff. This capability supports the Corps Civil Works and Military missions in water resources management. DSPM and Gage Analyst have been used in studies for the Corps of Engineers, including Rouge River in Oregon, the Sacramento and San Joaquin River Basins Comprehensive Study, and the Dworshak Basin Study in Idaho.

### **Status**

DSPM has been incorporated into HEC-HMS, Version 3.0. Input data for the model are generally measured at discrete points throughout the watershed, but estimates of input data are required to be distributed throughout the watershed. This requires spatially interpolating point measurements over the entire watershed. ERDC-CRREL has developed a suite of object-orientated tools that include orographic, elevation, and other terrain effects in the development of the gridded interpolations and comparisons to historic events, including Snow-Compare, Gage Analyst, and Storm Transform.

### **ERDC POC(s)**

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### **Distribution Sources**

The Hydrologic Engineering Center distributes HEC-HMS to the Corps via its Web site, <http://www.hec.usace.army.mil/>.

**Available Documentation**

Documentation for HEC-HMS is available via the Hydrologic Engineering Center, <http://www.hec.usace.army.mil/software/hec-hms/hechms-document.html>.

**Available Training**

PROSPECT course number 35AHC01a, Advanced HEC-HMS (Control number 369, tuition \$1800) ([http://pdsc.usace.army.mil/CourseListDetails1.asp?Cntrl\\_num=369](http://pdsc.usace.army.mil/CourseListDetails1.asp?Cntrl_num=369)) demonstrates the application of DSPM.

**Available Support**

The Hydrologic Engineering Center provides technical support to Corps Districts for HEC-HMS applications. Water control, hydropower, and water quality technical support is available through the Water Operations Technical Support Program (WOTS) (<http://www.wes.army.mil/el/wots/dtar.html>). The ERDC POC can advise on technical issues associated with snowmelt modeling.

