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Hydrologic Engineering Center

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# **Hydrologic Modeling System HEC-HMS**

## ***Release Notes***

Version 3.0.1  
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## Introduction

Version 3.0.0 of the Hydrologic Modeling System (HEC-HMS) was completed in December 2005 and released for general use shortly thereafter. For a number of reasons, it was necessary to completely replace the program interface. While the new program was carefully tested, the development team anticipated that such a major revision would inevitably lead to some problems or "bugs." The development team has continued careful and systematic testing of the program since the last release. The results of that testing in combination with reports from users has allowed the identification and repair of various problems. The result is this interim release; it does not include any new simulation capabilities. It is currently available for the Microsoft Windows<sup>®</sup> operating system and will soon also be available for the Sun Microsystems Solaris<sup>™</sup> operating system.

The *Technical Reference Manual* for Version 2.0 continues to accurately describe the mathematical models included in the program. New simulation capabilities have been added to the program and are not included in the manual. The manual is currently undergoing a major revision to expand documentation of existing mathematical models and fully describe the newly added models. The *Applications Guide* also continues to accurately describe how to apply the program to various engineering problems. However, the guide is undergoing revision to add guidance on how to use new features of the program to more efficiently solve problems.

The program has been designed to be easy to use. However, an understanding of how the program works is critical to producing accurate results. It is suggested that a new user read the *Quick Start Guide*. The guide briefly describes the basic features of the program in enough detail to begin using it. The guide also includes a step-by-step tutorial.

## Installation

The installation program and all documentation are available on the HEC website at <http://www.hec.usace.army.mil/>. This new release is installed independently of any previous versions of the program so you will need to remove Version 3.0.0 if you do not want to use it anymore. However, you may keep different versions of the program installed for parallel use or testing if you choose to do so. The new installation package is designed to be easy to use. It will take you through the steps of selecting a directory for the program files and making other settings. Use the following steps to install the program on the Microsoft Windows<sup>®</sup> operating system:

1. Download the installation package from the HEC website to a temporary folder on the computer. If the software was provided to you on a CD-ROM or other media, insert it in the appropriate drive.
2. Run the installation program. In Windows Explorer, double-click the icon for the installation program. You must have administrator privileges to run the installer.
3. Follow the on-screen prompts to install the program.

Instructions for installing the program on the Sun Microsystems Solaris<sup>™</sup> operating system can be found in Chapter 2 of the User's Manual.

## Changes in Capability

The use of time-series, paired data, and grid data stored in external Data Storage System (HEC-DSS) files has been restricted. Previously there were strong recommendations for the data type, data units, and pathname conventions. Continued testing has revealed that "strong recommendations" are not sufficient for maintaining good operation of the program. Consequently, the program now performs very specific checks on data before using it. Data that do not follow the guidelines cannot be used. Chapter 5 of the User's Manual has been updated to reflect the change in operation; it includes tables for each of the different types of data listing acceptable data type, data units, and pathname parts. Any data manually entered in the program already follows the requirements. Attempting to use data that does not follow the requirements will result in a stopped simulation and an error message identifying the source of the data, and the specific data incompatibility. Problems with data incompatibilities are best repaired by editing the data records with the HEC-DSSVue program.

The reservoir element uses an adaptive time stepping scheme as part of the "outflow structures" routing method. The scheme selected a time step so that the reservoir could not be drained in one step. Additional criteria based on the time derivative of reservoir storage have been added. These new criteria make the solution almost completely insensitive to the simulation time interval.

The time of concentration and storage coefficient for the ModClark transform method can now be selected in optimization trials.

## Problems Repaired Since the Last Release

Two problems with units affected snowmelt calculations. First, the units for the ATI meltrate paired data table were incorrect and resulted in problems when the unit system of the table did not match the unit system of the meteorologic model where it was used. The correct units are degF-day and inches per degF-day or degC-day and millimeters per degC-day. Second, the units of the initial meltrate ATI were not correct. The correct units are degF-day or degC-day.

Missing temperature data was not handled correctly in snowmelt calculations. If there was missing data for an elevation band, the temperature was assumed to be -17.78C (0F). It was determined that no temperature could be substituted for missing data and still achieve acceptable results. Therefore, missing temperature data will now cause a simulation to stop and an error message will list the data record that is incomplete.

Two problems with the orifice pressure flow outlet in the reservoir element were addressed. First, the orifice outlet must be sufficiently submerged in order for the calculations to be accurate. A warning message has been added to provide feedback to the user when this condition is not met. The culvert outlet is a better choice for insufficiently or partially submerged outlets. Second, a check is now performed to make sure that the elevation of the orifice outlet is above the first value of the elevation-storage curve for the reservoir. An error message has been added to notify the user when the outlet is below the lowest elevation is the elevation-storage curve.

In some cases, an error message was generated that a precipitation data type was incorrect. The message is designed to specify the data type that was invalid. However, in this case the data type was left blank. The root cause of the problem was that the precipitation data was missing for the entire simulation time

window. The error message has been improved to differentiate between missing data and data with an incorrect data type.

The diversion element includes an optional parameter for limiting the diverted flow to a maximum volume. If this option was used, and if the maximum volume criteria was satisfied part way through a time interval, then the diverted flow for only that time interval would be incorrect. The calculation is now performed correctly.

One of the properties in the project *Component Editor* is the HEC-DSS file for storing computed results. The program would stop responding (crash) if the filename were changed and the newly specified file did not exist. Now the file is automatically created if it does not exist. The program no longer stops responding when the filename is changed. Furthermore, computed results were not correctly stored in the file after it was changed. All results are now correctly stored after the name of the output file is changed.

There were problems with global editor tables when pasting information from the clipboard. Extra rows that were not necessary would be added to the table. Subsequently the program would stop responding (crash). The tables have been fixed so they correctly operate with the clipboard. A similar problem was fixed with the table used to manually enter paired data.

Computed results are tracked so they can only be viewed if there have not been any changes to the underlying parameter data. This system worked well. However, if a project were sent by one user to a user in a different time zone, the results may not be viewable even though there were no parameter data changes. The results viewing system has been enhanced to work within and across time zones so that results can be viewed correctly.

Deleting a project with the "remove all files" option would not remove all of the files. All files are now deleted when this option is selected.

The SCS storm precipitation method requires that the simulation run use a time window length of 24 hours plus one time interval. For example, if the time interval is 5 minutes then the time window must have a minimum length of 24 hours plus 5 minutes. The error message issued when the time window did not meet these criteria was difficult to understand. The message has been clarified.

Unit hydrograph paired data tables did not correctly update when the time interval was changed. For example, a unit hydrograph might be entered with a time interval of 1 hour. If the time interval were then changed to 3 hours, the unit hydrograph data would become corrupted. A change in time interval is now performed correctly.

The length of time required to draw the basin map could be very long when using the HMS background format. While it was not noticeable for small map files, it could take 8 or more seconds with large maps. Drawing performance has been improved approximately 200% but very large map files could still take 2 or 3 seconds to draw. Drawing time can be improved by removing unnecessary resolution in the map file.

Some parameters for the head-discharge pump in the reservoir element did not change correctly when the unit system of the basin model was changed. All pump parameters now convert correctly.

The various depths in the frequency storm precipitation method were not saved under some conditions. If the region settings of the computer specify a decimal separator other than a period, the data would not be saved. The depth data is now saved correctly regardless of the decimal separator specified in the region settings.

The development of a piping breach was not entirely correct. The breach opened correctly in the first phase of development when pressure flow predominates in the piping opening. However, after the transition to weir flow, the opening did not develop smoothly. Instead there was a discontinuity in the progression of the side slopes. The breach now develops correctly during both phases of the overall breach development.

Some types of filename paths were not recognized for HEC-DSS files used with time-series, paired, and grid data. This only applied on computers using the Microsoft Windows<sup>®</sup> operating system and so-called UNC pathnames. For example, filename paths such as \\server\projects\data\flows.dss. All types of filename paths are now correctly accepted.

A number of problems importing HEC-1 files have been fixed: 1) PR/PT cards referencing a non-existent gage are handled appropriately, 2) data values on QI/PI/QO/QS cards are now saved with the correct units, 3) precipitation data on a PH card as part of a JD block are now processed correctly, 4) UK/RK data for kinematic wave transform is saved correctly, 5) a warning message is issued if the number of steps on a RS card is greater than one and it is a reservoir element, 6) the missing area on a RK card for a main channel is now automatically obtained from the subbasin area, 7) if only two RK cards are specified for a subbasin, they are now interpreted as the main channel and collector, and 8) a meteorologic model is now automatically set up to work with the accompanying basin model.

Parameter grid data for the gridded soil moisture accounting loss method was not converted correctly. The results would be incorrect if the unit system of the grid data did not match the unit system of the basin model. Grid data is now automatically converted as needed.

There were two problems with tailwater stage in the reservoir element. First, previously computed tailwater stages were used after switching the reservoir to use the "none" tailwater method, resulting in incorrect results. The tailwater stage is now computed correctly after changing the method. Second, missing tailwater stage data was assumed to be zero, which usually led to incorrect results. A simulation now stops with an error message when missing data is encountered.

## Future Plans

A new baseflow method is under development based on the nonlinear Boussinesq flow assumptions. It is similar to the existing recession method except that the parameters are physically measurable in the watershed. The new method will make it much easier to develop baseflow estimates in ungaged watersheds.

New reservoir spillway options are under development. Control gates will be added to both ogee and broad-crested spillways. Options will be provided for vertical lift gates (sluice gates) and also radial gates (tainter gates). Controls will be provided so that gate operations can be simulated.

Land surface erosion and channel sediment transport is under development. Initially one simple method will be provided for simulating land surface erosion as part of subbasin calculations. Eventually more complex methods will be added to the subbasin. A simplified channel transport capability will be added to reach elements. It will handle erosion and deposition within the channel in addition to transport down the channel, all in a simplified approach appropriate for hydrologic simulation. It is not anticipated to include a movable bed.

A frequency curve analysis tool will be added to assist in developing curves from a family of events. The tool assumes that events have been developed for specific exceedance probabilities using the frequency storm. The user will be able to select the simulation run or depth-area analysis that represents each exceedance probability. By also selecting analysis locations, frequency curves will be automatically developed for those locations using the peak flow data.

Several features for the basin map are already under development. An alignment will be added for specifying the location and stationing of streams. Using it will be optional, but it will facilitate laying out reach elements and integrating with other HEC software. Tools will also be added for controlling the drawing properties of background maps. Finally, display of gridded input (such as precipitation) and gridded parameters (such as SCS curve numbers) will be added to the map.

Results visualization will also be improved. Drawing properties for graphs will be customizable. Access to the line styles, background patterns, axis scales, titles, and other components of a graph will all be customizable. Furthermore, where results are currently not available if they need to be recomputed, it will be possible to view old results but they will be labeled as out-of-date. Finally, additional results for the depth-area analysis will be added.

A flexible report generation tool is underdevelopment. It will be able to produce reports of basin model and meteorologic model input data, as well as simulation run results. The reports will be based on a generalized format that can be easily customized both in the data displayed and the formatting used to display it.

## Documentation

The *Hydrologic Modeling System HEC-HMS: Quick Start Guide* provides a brief description of the program for new users. It describes the different parts of the interface and the basic steps necessary to obtain simulation results. A tutorial takes the user through the creation of a new project and shows how to obtain results.

The *Hydrologic Modeling System HEC-HMS: User's Manual* contains extensive information on installing and using the program. Details on the use of each of the features and capabilities in the program are included.

## Support Policy

Technical support for program users within the Corps of Engineers is provided through an annual subscription service. Subscribing offices can expect full support from HEC staff in the routine application of the program. Users are strongly urged to consult with HEC staff on the technical feasibility of using the program before beginning a project with unique requirements such as grid cell hydrology, snow melt, or continuous simulation. Extended support for large or

complex projects can be arranged under a separate reimbursable project agreement.

Support can not be provided to users outside the Corps of Engineers. Domestic and foreign vendors are available that provide fee-for-service support similar to the support provided to subscribing Corps offices. Such service agreements are between the user and the vendor and do not include HEC staff. Vendors do contact HEC on behalf of their users when unusual problems or errors are encountered. A list of vendors can be found at <http://www.hec.usace.army.mil/>.

Reporting of suspected program errors is unrestricted and we will reply to all correspondence concerning such errors. We are continuously working to improve the program and possible bugs should always be reported. Reports should include a written description of the steps that lead to the problem and the effects that result from it. If we cannot reproduce the reported problem, we may ask you to send a copy of your project.

Request support or report program errors through the following channels:

- Call 530.756.1104, 7:30 am to 4:30 pm PT Monday through Friday.
- Fax 530.756.8250 any time.
- Write to U.S. Army Corps of Engineers, Institute for Water Resources, Hydrologic Engineering Center, 609 Second Street, Davis, CA 95616 USA.
- Send email to [hec.hms@usace.army.mil](mailto:hec.hms@usace.army.mil) on the internet.
- Visit our web site at <http://www.hec.usace.army.mil>.