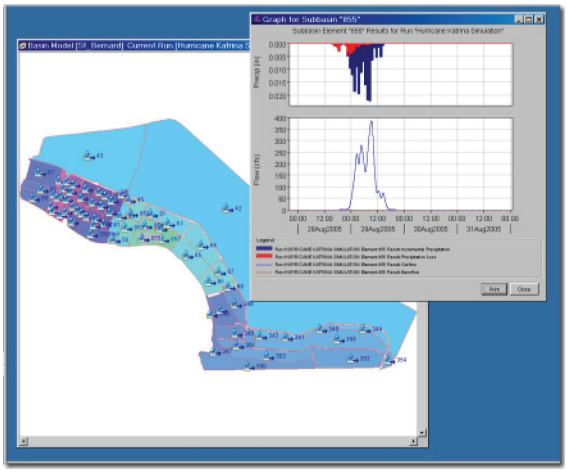
System-Wide Water Resources Program
SWWRP

Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS)



Description: The Hydrologic Modeling System is designed to simulate the precipitation-runoff processes of dendritic watershed systems. Its design allows applicability in a wide range of geographic areas for solving diverse problems including large river basin water supply and flood hydrology, and small urban or natural watershed runoff. The program is a generalized modeling system capable of representing many different watersheds. A model of the watershed is constructed by separating the hydrologic cycle into manageable pieces and constructing boundaries around the watershed of interest. In most cases, several model choices are available for representing each water pathway in the cycle. Each mathematical model included in the program is suitable in different environments and under different conditions. Making the correct choice requires knowledge of the watershed, the goals of the hydrologic study, and engineering judgment. The program features a completely integrated work environment including a database, data entry utilities, computation engine, and results reporting tools. A graphical user interface allows the seamless movement between the different parts of the program. Program functionality and appearance are the same across all supported platforms.

Application: The program is used by all Corps District and Division offices to design and operate projects, regulate floodplain activities, and for other purposes. Other Federal agencies, including Federal Emergency Management Agency (FEMA) and Federal Energy Regulatory Commission (FERC), use it to regulate floodplain activities and monitor water use. It is used by state and local governments for local or regional planning, by private architectural and engineering firms to conduct design work, and by university professors as a teaching tool. The modular flexibility of the program allows it to be applied in studies with a wide variety of goals in disparate types of watersheds. It has been applied in watersheds as small as an elevated highway interchange to as large as 20,000 square miles. Hydrographs produced by the program are used directly or in conjunction with other software for studies of water availability, urban drainage, flow forecasting, future urbanization impact, reservoir spillway design, flood damage reduction, floodplain regulation, and real-time systems operation. It can be used to simulate individual storm events or multidecadal continuous records.

Some recent notable projects include:

- Sacramento-San Joaquin – Comprehensive evaluation of system operation and alternative analysis
- Anacostia River – Flood damage reduction
- Rogue River – Real-time system operation with snowmelt

more . . .

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- Mill Creek – Flood damage reduction and environmental restoration
- Pistol Creek – Flood damage reduction
- Dworshak Reservoir – Seasonal system operation with snowmelt
- Los Angeles and Rio Hondo Rivers – Urban flood protection and floodplain regulation
- New Orleans Hurricane Katrina – Post-event interior flooding analysis
- Red River of the North – Real-time system operation with snowmelt

Benefits: HEC-HMS combines tools for representing the hydrology of natural watersheds with tools for representing highly developed urban watersheds and includes tools for representing engineered structures such as reservoirs, pump stations, and diversions. It is one of the only hydrologic simulation products ever to place such an equal value on both natural and urbanized watersheds. While it can simulate either a natural or urban watershed, it is one of the only available tools for working in watersheds with a mixture of conditions. It is also one of the only hydrologic simulation tools to include both event and continuous simulation capabilities. This flexibility allows a watershed model developed for one purpose, to be repurposed with a minimal amount of effort. For example, a watershed model developed for real-time system operation can be easily employed for regulation purposes. A watershed model developed for estimating flood damage reduction benefits can be easily expanded to consider environmental restoration goals. Finally, the extreme modular concept of the underlying program components allows for mission flexibility in the future. The addition of new methods for representing infiltration, new reservoir outlet structures, or any other component of the hydrologic cycle can be accomplished quickly and cheaply.

Benefits also accrue due to the widespread use of the program in the Corps, other Federal agencies, local government, and private sector. Many engineers are familiar with it and understand how it works. The large number of application projects has demonstrated that it can be used effectively as a common language for hydrology, especially on complex projects with many engineers contributing to model development.

Future Capabilities:

- New reservoir spillway and seepage options are under development.
- Land surface erosion and channel sediment transport will be added.
- Nutrient simulation (nitrogen and phosphorus) will be added to subbasins and reaches.
- New features will be added to the existing basin mapping capabilities.
- Results visualization will be enhanced with animations.
- A flexible report generation tool is under development.

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