

Simulation of precipitation runoff

Rainfall-runoff (R-R) modeling is the most effective tool for analyzing and forecasting of processes in hydrological cycle, which involve the extreme outflow from watersheds - flooding. The hydrological cycle could be described as a very complex system of environmental processes. The Rainfall-runoff model is the simplification of this complex. Using hydrological models allows to predict water levels and discharges for exact location in exact time. The early prediction enables early warning, which helps to save lives and property.



Successful operation of the R-R model requires information about:

- Meteorological inputs from the watershed (precipitation, temperature)
- Watershed parameters (digital maps, etc.)
- Hydrological system outputs (water outflow, etc.)

MicroStep-MIS has many years of experience in R-R modeling. Models are used primarily for the needs of National Hydrological Forecasting Services for the forecasting of the water levels. Other applications of the precipitation runoff model are:

- dam safety systems for the simulation of inflow to dams
- country management and Land planning studies
- compact warning system for urban areas

Various hydrologic models have been tested and used by MicroStep-MIS in last years:

- **HBV (Hydrologiska Byråns Vattenbalansavdelning):** The HBV model is a semi-distributed conceptual model. It uses subbasins as primary hydrological units, and within these an area-elevation distribution and a crude classification of land use (forest, open, lakes) are made. The HBV model consists of three main components: subroutines for snow accumulation and melt, subroutines for soil moisture accounting, response and river routing subroutines. It is applied in more than 30 countries worldwide.
- **HYPE (The Hydrological Predictions for the Environment):** HYPE model is a semi-distributed catchment model. The model code is open source and describes hydrological processes in different

subbasins, although the algorithms are not purely based on physical laws but of more conceptual nature. It is meant to be applied in a multi-basin manner to achieve high spatial distribution of flow paths in the landscape. Model does not have standard GUI. It is based on parametrisation of factors via text files.

- **HEC-HMS (Hydrologic Modeling System):** This model is designed to simulate the complete hydrologic processes of watersheds. The software includes many hydrologic analysis procedures such as event infiltration, unit hydrographs, and hydrologic routing. HEC-HMS also includes procedures for continuous simulation including evapo-transpiration, snowmelt, and soil moisture accounting. Advanced capabilities are also provided for gridded runoff simulation using the linear quasi-distributed runoff transform (ModClark).

All of above-mentioned models can be used for solving partial issues in water cycles, as well as complex monitoring

of outflow from the watershed, mainly for hydrological operational forecasting services needs. Various settings of models can be used for these purposes

- using of various weather forecasting systems (NWP) in one model run
- using of deterministic / ansamble meteorological inputs
- parallel run of various hydrological models
- automatic model run (automatic model suite) vs. manual model start with the possibility of manual change of input data
- model outputs in customised view
- free access to model DB for further usage of model outputs
- connectibility with other models f.e. HEC- HMS with HEC-RAS.

Using of all of above-mentioned combinations is possible. Together, they create solid and exhausting hydrological forecasting system, usable in all conditions, in all environments and for all occasions.

