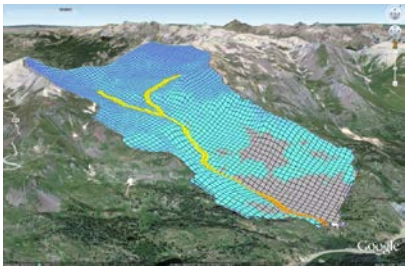
US Army Corps of Engineers
Engineer Research and Development Center

Enhancement of Snow and Frozen Ground in GSSHA and HMS

Need



Example snow simulation at Senator Beck Basin in Colorado

More accurate snow, frozen ground, and resultant streamflow capabilities were required within USACE hydrologic models GSSHA and HEC-HMS.

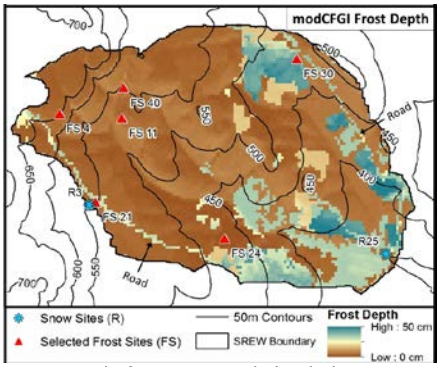
- Accurate snow and frozen ground simulations are required for reservoir operations and planning. 70% of annual runoff in western United States is from snowmelt.
- Prior to this work, HEC-HMS did not have a frozen ground method and only had temperature-index snow method that is simple to use but can lead to innacuracies.
- GSSHA had advanced snow and frozen ground methods, but often require too much forcing data to utilize.
- Changing in seasonal patterns and land use (urbanization, forest fires, etc.) can have a large impact on snow, frozen ground, and the resultant streamflow.

The main goal of R&D is to improve the spatial simulation of snow, frozen ground, and resultant streamflow using only readily-available data, making the methods applicable to most USACE watersheds.

Approach

The snow and frozen ground methods developed utilize elevation and land cover maps (existing model inputs) to improve the spatial simulation of snow and frozen ground. By doing so, both topography and land cover are better accounted for in the snowpack and frozen ground simulations, which improve the timing and volume of streamflow simulations.

Outcomes



Example frozen ground simulation at Sleepers River, Vermont

- Improved snow, frozen ground, and streamflow simulations at several test watersheds (Follum et al., 2015; 2018).
- The improved snow simulation method is currently within GSSHA and will be in HEC-HMS v4.4. In addition, and energy balance method will also be available in HEC-HMS 4.4.
- The improved frozen ground method is currently within the developmental version of GSSHA and will be in HEC-HMS v4.4.
- HEC-HMS and GSSHA training classes and material available in FY19.

More Information

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https://wiki.erdc.dren.mil/index.php?title=Advanced_Snow_Modeling_Capabilities_Within_Distributed_Hydrologic_Models

https://wiki.erdc.dren.mil/Flood_and_Coastal_Storm_Damage_Reduction_Research_Program