Study project/master's thesis @HFM:
Comparing remotely-sensed and simulated snowcover

Problem description

The knowledge of the amount of snowcover in a catchment is important for river flow forecasting as the melting of snow changes the flow without any precipitation as the rate of melting depending on the amount can bring high flows when they are not expected.
Traditionally, rainfall-runoff models are calibrated on river flows only. Flows resulting due to melting snow are particularly difficult to model as actual rate of melt depends on factors other than air temperature. To investigate if the model is correctly simulating the snow formation and melt dynamics, MODIS snowcover can be used as a reference. The miss match of MODIS and model snowcover can then be compared to determine if the difference is due to the description of the snow-melt process of the model or due to the incorrect estimation of the falling snow or both. Based on the evaluations, the weak spots in the entire modeling chain can be rectified. This has major implications for river flow forecasts in terms of floods and river flow volumes for water supplies, power generation and transport.

Steps

The general setup would be as follows: Prepare gridded precipitation input using the observation network in the state of Bavaria for catchments where snowfall takes place. Similarly, temperature grids are also calculated. MODIS snowcover is resampled to match the model grid. The model is calibrated on river flows. After calibration the snow depth times series is extracted. A threshold is applied on the snow depth, above which a cell is considered to have snow. This threshold can be adjusted to maximize the correlation of model snow to that of MODIS. Next, the areas where snowcover do not match are investigated in space-time. Reasons are found depending on the situation. Corrections are applied whether to the snow model or the falling precipitation accordingly. The model is recalibrated to see if the resulting snowcover and snowmelt are better than before.

Requirements

The student is expected to have some background in rainfall-runoff modeling, statistics, geostatistics and programming in python as everything mentioned above is coded in it. The required background could be acquired before and/or during the study.

Contact

Interested students may write to me **(faizan.anwar@tum.de)** for further discussion. The work load can be adjusted depending on the student if they want to pursue a study project or a master's thesis.