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Performance evaluation of gridded climate data in snow-melt models calibrated by spatial snow-cover observations from MODIS

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Considering the snow effect on land and atmospheric processes, accurate representation of seasonal snow evolution including the distribution and melt volume, is highly imperative to strengthen water resources development trajectories in mountainous regions. However, along with the high sensitivity to climate change, the limitation of reliable snow-melt estimation in these regions is further exacerbated with data scarcity. This study thus attempts to develop relatively simpler degree-day snow-models driven by freely available gridded datasets for data scarce snow-fed regions. The methodology uses readily available MODIS imageries to calibrate the snow-melt models on snow-distribution instead of snow-amount. In addition, freely available cloud masks from geostationary satellites are also used to complement the snow-melt models. The major advantage of this approach is the possibility of regional calibration using freely available reasonably accurate climate data, without the need of direct snow depth measurements. These models offer relative simplicity and plausible alternatives to data intensive physically based model as well as in-situ measurements and have a wide scale applicability allowing immediate verification with point measurements.

Bavaria region in Germany is selected for this study. E-OBS (European Observations) gridded precipitation and temperature datasets (0.25 degrees) are considered here instead of the ground measured data to replicate “a data scarce scenario” as in most of the mountainous regions around the globe. The coarser meteorological inputs are downscaled applying the delta method using WorldClim monthly climate surfaces to 0.0833 degrees (~1km) grids. MODIS images are also resampled and upscaled to 1km resolution for uniformity. The qualitative pixel-to-pixel comparison suggest a very good agreement with MODIS data and the calibrated parameter sets depict plausible temporal stability.

The snow-melt volume will be further used in HBV hydrological model as standalone input to simulate the streamflow in one of the snow-fed catchments in Bavaria and to evaluate the performance of this approach in streamflow. The abstract will the updated as soon as the results are available.