EGU2020-7264, updated on 23 Oct 2020
https://doi.org/10.5194/egusphere-egu2020-7264
EGU General Assembly 2020

Impact of spatial resolution and interpolation schemes of precipitation data on hydrological modeling

Clara Hohmann[1,2], Sungmin Oh[2,3,4], Gottfried Kirchengast[1,2,3], Ulrich Foelsche[1,2,3], and Wolfgang Rieger[5]

[1]Wegener Center for Climate and Global Change, University of Graz, Austria (clara.hohmann@uni-graz.at)
[2]FWF-DK Climate Change, University of Graz, Austria
[3]Institute for Geophysics, Astrophysics, and Meteorology/Institute of Physics, University of Graz, Austria
[4]now at: Biogeochemical Integration, Max Planck Institute for Biogeochemistry, Jena, Germany
[5]Bavarian Environment Agency, Augsburg, Germany

Hydrological modelling depends strongly on precipitation input. Especially, to simulate very localized heavy precipitation events, models require precipitation information with a high spatial and temporal resolution. In order to study the influence of precipitation station densities and interpolation schemes on hydrological model performance, we use gauge data from the highly dense station network WegnerNet (www.wegenernet.org). The WegenerNet is located in the southeastern Alpine forelands of Austria. It measures precipitation and other meteorological variables at a 5-min time sampling with about 150 climate stations in an area of about 22 km x 16 km (i.e ~ one station per 2 km²). We complement these data by the operational networks of the Austrian weather and hydrographic services (ZAMG and AHYD), leading to a total of 158 stations.

This highly dense station network permits us to analyze the precipitation data uncertainty for specific short and long duration events over the lower Styrian Raab catchment (about 500 km²) and its sub-catchments (about 10 to 50 km²). For modeling, we employ the process-based model WaSiM (www.wasim.ch) with a 100 m x 100 m spatial and a 30 minutes temporal resolution. We calibrated the model with all 158 precipitation stations and inverse distance weighting (IDW) interpolation scheme; this simulation is used as our reference run (Ref-158). We performed further simulations with only stations from ZAMG, the 5-Stations case, also include the stations from AHYD (adding another 3 stations), the 8-Stations case, and step by step including stations from the WegenerNet, the 16-Stations, 32-Stations and 64-Stations cases. For each simulation, we compared three interpolation schemes: two IDW setups and Thiessen polygons. Our study focuses on short duration, local extremes (convective events in 2009, 2010, 2011), but for comparison also includes long duration frontal extreme events.

Our results suggest that for the runoff simulation with dense precipitation stations (Ref-158) the effect of the interpolation scheme is negligible. By contrast, modeling with low-resolution precipitation data obtained from less than 10 stations, the interpolation scheme leads to deviations of over 20% in terms of peak flow. These deviations are especially pronounced for the

short duration events. For the total Styrian Raab catchment, the 32-Stations case is as good as the Ref-158 case, independent of the interpolation scheme (mostly smaller than 10% deviation). For the long duration events and the IDW interpolation scheme even, the 5-Stations case is sufficient. For the smaller catchments, the peak flow is much more event-dependent. More stations do not necessarily lead to less deviation to the reference and no clear under- or over-estimation is visible.