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The impact of the resolution of meteorological datasets on catchment-scale drought studies

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Gridded meteorological datasets provide the basis to study drought at a range of scales, including catchment scale drought studies in hydrology. They are readily available to study past weather conditions and often serve real time monitoring as well. As these datasets differ in spatial/temporal coverage and spatial/temporal resolution, for most studies there is a tradeoff between these features. Our investigation examines whether biases occur when studying drought on catchment scale with low resolution input data. For that, a comparison among the datasets HYRAS (covering Central Europe, 1x1 km grid, daily data, 1951 – 2005), E-OBS (Europe, 0.25° grid, daily data, 1950-2015) and GPCC (whole world, 0.5° grid, monthly data, 1901 – 2013) is carried out. Generally, biases in precipitation increase with decreasing resolution. Most important variations are found during summer. In low mountain range of Central Europe the datasets of sparse resolution (E-OBS, GPCC) overestimate dry days and underestimate total precipitation since they are not able to describe high spatial variability. However, relative measures like the correlation coefficient reveal good consistencies of dry and wet periods, both for absolute precipitation values and standardized indices like the Standardized Precipitation Index (SPI) or Standardized Precipitation Evaporation Index (SPEI). Particularly the most severe droughts derived from the different datasets match very well. These results indicate that absolute values of sparse resolution datasets applied to catchment scale might be critical to use for an assessment of the hydrological drought at catchment scale, whereas relative measures for determining periods of drought are more trustworthy. Therefore, studies on drought, that downscale meteorological data, should carefully consider their data needs and focus on relative measures for dry periods if sufficient for the task.