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Temporal disaggregation of daily meteorological grid data

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For operational flood forecasting, the Norwegian Water Resources and Energy Administration (NVE) applies the conceptual HBV rainfall-runoff model for 117 catchments. The hydrological models are calibrated and run using an extensive meteorological grid data set providing daily temperature and precipitation data back to 1957 for entire Norway at 1x1 km grid resolution (seNorge grids). The daily temporal resolution is dictated by the resolution of historical meteorological data. However, since meteorological forecasts and runoff observations are also available at a much finer than a daily time-resolution (e.g. 6 hourly), and many hydrological extreme events happens at a temporal scale of less than daily, it is important to try to establish a historical dataset of meteorological input at a finer corresponding temporal resolution.
We present a simple approach for the temporal disaggregation of the daily meteorological seNorge grids into 6-hour values by consulting a HIRLAM hindcast grid data series with an hourly time resolution and a 10x10 km grid resolution. The temporal patterns of the hindcast series are used to disaggregate the daily interpolated observations from the seNorge grids. In this way, we produce a historical grid dataset from 1958-2010 with 6-hourly temperature and precipitation for entire Norway on a 1x1 km grid resolution. For validation and to see if additional information is gained, the disaggregated data is compared with observed values from selected meteorological stations. In addition, the disaggregated data is evaluated against daily data, simply split into four fractions. The validation results indicate that additional information is indeed gained and point out the benefit of disaggregated data compared to daily data split into four. With regard to temperature, the disaggregated values show very low deviations (MAE, RMSE), and are highly correlated with observed values. Regarding precipitation, the disaggregated data shows cumulative distribution functions (CDF) which are very consistent to those of measured values. Especially for extreme precipitation events with occurrence probabilities lower than 15 %, the disaggregated data is much more appropriate to measurements than the simply fractioned daily data. For the recalibration of the hydrological models – and especially with regard to flood forecasting purposes – these results are very promising.