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An open source package of enhanced degree-day (hourly) models.

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The hydrological importance of snowmelt is evident not only in the high elevation zones where snow remains in the winter period but also downstream where snowmelt has a variety of uses in many part of the world such us irrigated agriculture, public supply, hydropower, etc. For this reason modeling snowmelt (SM) and snow water equivalent (SWE) is a crucial step for simulating water budgets. Degree-day (hourly) and enhanced degree-day (hourly) approaches for modeling SM and SWE are commonly used in many hydrological applications. In this work we tested and compared three enhanced degree-day models in order to investigate the minimum degree of complexity required for simulating SM and SWE dynamics. The models are implemented as components in the NewAge-JGrass system, are open source and freely available.. They can be connected to others component of the system such as meteorological interpolation algorithms to create input data time-series, calibration algorithms to estimate optimal model parameters and a Geographic Information System to visualize model results. The models are applied for the Cache la Pudre river basin (Colorado, USA). Models parameters are calibrated in order to fit measured SWE daily time series at three SNOTEL stations. Optimal parameter sets were estimated for each year of the simulation period in each station in order to understand their temporal and spatial variability. Model performances were evaluated by using traditional goodness of fit indices such as Kling Gupta Efficiency, Root mean Square error and percentage bias. Enhanced degree-day (hourly) models perform better than traditional degree-day (hourly) model. Parameters of enhanced degree-day (hourly) models present a lower variability in time respect traditional degree-day (horuly) models parameters.