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Operational hydrology in highly steep areas: evaluation of tin-based toolchain

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Triangular Irregular Network (TIN) is known to be an efficient way to represent surface topography (Marsh et al. 2018). However, little attention has been given to assess direct benefits of the TIN-based terrain representation in operational hydrology. We connect Shyft-hydrology, a part of Shyft open-source project dedicated to distributed hydrologic modelling in operational environments, with Rasputin software intended for conversion of digital elevation models into simplified triangular meshes. Shyft is known for its high flexibility: the framework lets researcher test different functioning hypothesis with very little programming effort. We implemented new routine in Shyft-hydrology, which allows translation of solar radiation onto inclined surfaces based on (Allen et al. 2006). Thus, Shyft and Rasputin is a unique toolchain to study impact of hillslope variations in solar radiation onto snowmelt, evapotranspiration and discharge simulation.

We conducted several experiments on subcatchments of Narayani river located in Central Nepal. This area is known to be very steep, with meteorological stations, located mainly in the low-land. The re-analysis data for the area is coarse and prone to different kind of issues (Bhattarai et al 2020). The outcomes are promising: tin-based solution outperfoms regular grid, when running with Shyft-hydrology model most used in the operations. The new model with translated radiation also works well, giving us no decrease in performance of discharge simulations, but some more insights in snow modelling. We clearly see, what we expect from observations: sunny slopes melt earlier while shady ones keep snow for longer periods.

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