Submitted Abstract

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Abstract

We present a multi-site evaluation of meteorological variables in the Everest region (Nepal) using ERA5-Land and HARv2 reanalyses compared to in-situ observations, based on classical statistical metrics. Observation data have been collected since 2010 by seven meteorological stations located on or off glaciers between 4260 m a.s.l. and 6352 m a.s.l. in the upper Dudh Koshi basin. 2-m air temperature, relative humidity, wind speed, incoming shortwave, and longwave radiations, as well as precipitation, are considered successively. Overall, ERA5-Land reanalysis performs slightly better than HARv2 except for wind speed. Due to the complex topography, even the highest resolution reanalysis products fail to reproduce the observations, especially for variables that have a large spatial variability such as precipitation or wind speed. Air temperature is the variable that is best captured by reanalyses, as long as an appropriate lapse rate, spatiotemporally variable and preferentially assessed by local observations, is used to extrapolate it vertically. A cold bias is still observed but attenuated over clean-ice glaciers. On average, we observe a moderate humid bias, slightly more important for HARv2 than for ERA5-Land, resulting in a spectacular over-estimation of precipitation during the monsoon and in relative humidity a little too high the rest of the year. The agreement between reanalysed and observed shortwave and longwave incoming radiations depends on the elevation difference between the station site and the reanalysis grid cell. The seasonality of wind speed is only captured by HARv2. Before being used for glacier mass and energy balance studies, reanalysis data must be bias-corrected using in-situ meteorological records.