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On the impact of using downscaled reanalysis data instead of direct measurements for modeling the mass balance of a tropical glacier (Cordillera Blanca, Peru)

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Due to their setting, tropical glaciers are sensitive indicators of mid-tropospheric meteorological variability and climate change. Furthermore these glaciers are of particular interest because they respond faster to climatic changes than glaciers located in mid- or high-latitudes. As long-term direct meteorological measurements in such remote environments are scarce, reanalysis data (e.g. ERA-Interim) provide a highly valuable source of information. Reanalysis datasets (i) enable a temporal extension of data records gained by direct measurements and (ii) provide information from regions where direct measurements are not available. In order to properly derive the physical exchange processes between glaciers and atmosphere from reanalysis data, downscaling procedures are required.

In the present study we investigate if downscaled atmospheric variables (air temperature and relative humidity) from a reanalysis dataset can be used as input for a physically based, high resolution energy and mass balance model. We apply a well validated empirical-statistical downscaling model, fed with ERA-Interim data, to an automated weather station (AWS) on the surface of Glaciar Artesonraju (8.96° S | 77.63° W). The downscaled data is then used to replace measured air temperature and relative humidity in the input for the energy and mass balance model, which was calibrated using ablation data from stakes and a sonic ranger. In order to test the sensitivity of the modeled mass balance to the downscaled data, the results are compared to a reference model run driven solely with AWS data as model input. We finally discuss the results and present future perspectives for further developing this method.