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Probabilistic correction of precipitation measurement errors using a Bayesian Model Average Approach applied for the estimation of glacier accumulation

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Precipitation is a major component of the water cycle that returns atmospheric water to the ground. Without precipitation there would be no water cycle, all the water would run down the rivers and into the seas, then the rivers would dry up with no fresh water from precipitation. Although precipitation measurement seems an easy and simple procedure, it is affected by several systematic errors which lead to underestimation of the actual precipitation. Hence, precipitation measurements should be corrected before their use.
Different correction approaches were already suggested in order to correct precipitation measurements. Nevertheless, focusing on the outcome of a single model is prone to statistical bias and underestimation of uncertainty. In this presentation we propose a Bayesian model average (BMA) approach for correcting rain gauge measurement errors.
In the present study we used meteorological data recorded every 10 minutes at the Condoriri station in the Bolivian Andes. Comparing rain gauge measurements with totalisators rain measurements it was possible to estimate the rain underestimation. First, different deterministic models were optimized for the correction of precipitation considering wind effect and precipitation intensities. Then, probabilistic BMA correction was performed.
The corrected precipitation was then separated into rainfall and snowfall considering typical Andean temperature thresholds of -1°C and 3°C. Hence, precipitation was separated into rainfall, snowfall and mixed precipitation. Then, relating the total snowfall with the glacier ice density, it was possible to estimate the glacier accumulation. Results show a yearly glacier accumulation of 1200 mm/year. Besides, results confirm that in tropical glaciers winter is not accumulation period, but a low ablation one. Results show that neglecting such correction may induce an underestimation higher than 35 % of total precipitation. Besides, the uncertainty range may induce differences up to 200 mm/year.
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