Evolution of Purogangri Ice Cap, central Tibetan Plateau, 2000-2012
-
a comparison of two glaciological methods

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Due to their remoteness, their high altitude and the harsh climatic conditions, little is known about the state of the ice caps on the Tibetan Plateau (TP).This study focuses on mass balance measurements and modelling of Purogangri Ice Cap, located on the central TP. Covering an area of 397±9.7 km^2, Purogangri is the largest ice cap on the TP. Its behaviour is determined by dry and cold continental climate suggesting a polar-type glacier regime.

We present a first comparison of interferometrical derived surface elevation changes [1] with a physically based model calculating surface energy and mass balance during the last decade. Additionally, the migration of the snow line was derived from Moderate-resolution Imaging Spectro-radiometer (MODIS) measurements and compared with both approaches. The results are in good agreement with [2] and validated in detail with high resolution Landsat Satellite images. The snow line at the end of the ablation season is used as a proxy for the equilibrium line altitude (ELA). Its shift can be used as an indication of glacier mass balance variations.

The physically based melt model couples an energy balance to a multilayer snow model and therefore accounts for subsurface processes like refreezing, subsurface melt and densification of the snowpack. The performance of the model has been thoroughly evaluated against field data at Zhadang Glacier (south-central part of the Tibetan Plateau). For Purogangri Ice Cap the model is solely forced by meteorological data from the High Asia Reanalysis (HAR) which ensures continuous data coverage in regions where in-situ observations are non-existent.

First results of the energy balance model support the results obtained from the interferometrical approach. A predominant surface lowering of the glacier tongues is clearly evident, whereas glacier thickening is observed in the interior of the ice cap.

The results suggest a nearly balanced glacier regime for Purogangri Ice Cap between 2000 and 2012. These findings are in agreement with [2] and [3] who estimated balanced mass changes in the north-western part of the TP for a similar period, contrary to the remaining parts of the TP. Also, [4] found that Purogangri Ice Cap retreats at a much slower rate than other glaciers on the TP.

We propose possible mechanisms for the specific behaviour at Purogangri compared to other parts of the TP. For this purpose we evaluate meteorological variables from the HAR at Purogangri Ice Cap and Zhadang Glacier in order to analyse the dominant atmospheric drivers for mass balance variability in these two regions.

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