

Atmospheric circulation influences on glaciers in High Asia: A Tibetan case study

T. Mölg¹, F. Maussion¹ and D. Scherer¹

¹ Chair of Climatology, Technische Universität Berlin, Germany
thomas.moelg@campus.tu-berlin.de

An increasing number of studies have demonstrated the spatial variability of recent glacier changes in High Asia (Himalaya-Karakoram-Pamir system and Tibetan Plateau). The influence of atmospheric circulation, however, has only been discussed in conceptual ways without providing detailed quantifications. Here we attempt to provide the physical basis of circulation influences on Zhadang Glacier, situated on the south-central Tibetan Plateau. The methodology uses high-resolution atmospheric modeling, the output of which is linked to a glacier mass balance model without statistical downscaling, and includes Monte Carlo and ensemble techniques to quantify uncertainty in modeled glacier mass balance. The modeling system is run over a full decade (2001-2011) and evaluated by in-situ measurements. We investigate the influence of (1) the Indian Summer Monsoon and (2) the mid-latitude westerlies on Zhadang Glacier's mass and energy budgets. We show that annual mass balance is strongly determined by the intensity of monsoon onset in May/June, but equally important influences are exerted by the mid-latitude climate through the high-level westerly jet and associated air-mass advection. Hence, conceptual models of climate drivers of mass-balance in monsoonal High Asia should be reconsidered.

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