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

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An increasing number of studies have demonstrated the spatial variability of recent glacier changes in High Asia (Himalaya-Karakoram 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, (2) the East Asian Summer Monsoon, and (3) the mid-latitude westerlies on Zhadang Glacier's mass and energy budgets, and how the importance of these atmospheric flows varies through different seasons. The present study will therefore reveal whether the current assumption of dominant westerlies (monsoon) in winter (summer) holds, or if atmospheric circulation impacts on glaciers of the Tibetan Plateau are more complex than thought.