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# Impact of sublimation losses in the mass balance of glaciers in semi-arid mountain regions

Alvaro Ayala (1), Francesca Pellicciotti (1,2), Paolo Burlando (1), Shelley MacDonell (3), James McPhee (4,5)

(1) ETH-Zurich, Institute of Environmental Engineering, Hydrology and Water Resources Management, Department of Civil, Environmental and Geomatic Engineering, Zurich, Switzerland (ayala@ifu.baug.ethz.ch), (2) Department of Geography, Faculty of Engineering and Environment, Northumbria University, Newcastle upon Tyne, UK., (3) Centro de Estudios Avanzados en Zonas Áridas (CEAZA), La Serena, Chile., (4) Department of Civil Engineering, Faculty of Physical and Mathematical Sciences, Universidad de Chile, Santiago, Chile., (5) Advanced Mining Technology Centre (AMTC), Faculty of Physical and Mathematical Sciences, Universidad de Chile, Santiago, Chile.

Glaciers in semiarid mountain regions may lose an important part of their winter snow accumulation through sublimation processes that are enhanced by the high-elevation, intense radiation and dry atmosphere of these environments. As glaciers in these regions secure freshwater resources to lower valleys during summer and drought periods, it is important to advance in a detailed quantification of their sublimation losses. However, logistical concerns and complex meteorological features make the measuring and modelling of glacier mass balances a difficult task.

In this study, we estimated the spring-summer mass balances of Tapado and Juncal Norte glaciers in the semiarid Andes of north-central Chile by running a distributed energy balance model that accounts for melt, refreezing and sublimation from the surface and blowing snow. Meteorological input data were available from on-glacier Automatic Weather Stations (AWS) that were installed during the ablation season of years 2005-06, 2008-09, 2013-14 and 2014-15. Snow pits, ablation stakes and a time-lapse camera that provided surface albedo were also available. Distributed air temperature and wind speed were dynamically downscaled from NASA MERRA reanalysis using the software WINDSIM and validated against the data from the AWSs. The rest of the meteorological variables were distributed using statistical relations with air temperature derived from the AWSs data. Initial snow conditions were estimated using satellite images and distributed manual snow depth measurements. Preliminary results show that total ablation diminishes with elevation and that, during the early ablation season (October-November), melt is the main ablation component below 4500 m with sublimation dominating the ablation above this elevation. Above 4500 m an important fraction of meltwater refreezes during night. As the ablation season advances (December-February), melt extends to higher elevations, refreezing plays a smaller role and sublimation is restricted to wind-exposed sites above 5000 m.

Our results help to understand and identify the mechanisms that control the glacier mass balance in this region and provide a base line for glaciological and hydrological future simulations.