

Table 1. Parameters in TOPKAPI-ETH’s snow and ice modules for the 1955–2016 time period. The tested ranges of some parameters are given in parentheses.

Module	Parameter	Symbol	Calibrated value			Units	References for the selected values and ranges
			Simulation				
			Individual glaciers	Maipo basin	River		
Snow accumulation and gravitational transport	Snow and rain threshold	P_T	0 (0–3)	2 (0–3)		°C	Typical ranges for this variable
	Snow holding capacity parameter 1	SRF_C	250	250		m	Ragetli and Pellicciotti (2012)
	Snow holding capacity parameter 2	SRF_d	0.172	0.172		–	
ETI model	Shortwave radiation factor	SRF	0.002–0.014	0.009 (0.002–0.014)		mm m ² h ⁻¹ W ⁻²	Pellicciotti et al. (2008), Ragetli and Pellicciotti (2017), Ayala et al. (2016, 2017b)
	Air temperature factor	TF	0–0.4 (0.01–0.05)	0.01 (0.01–0.05)		mm h ⁻¹ °C	
	Air temperature threshold for the onset of melt	T_T	0 (0–3)	1 (0–3)		°C	
Sub-debris ice melt	Shortwave radiation factor	SRF_d	0.25 × SRF (TS8)	–		mm m ² h ⁻¹ W ⁻²	Ayala et al. (2016), Burger et al. (2019)
	Air temperature factor	TF_d	0.25 × TF (TS9)	–		mm h ⁻¹ °C	
	Albedo debris	α_{debris}	0.16	–			
Surface albedo	Albedo of fresh snow	α_1	0.83 (0.80–0.95)	0.90 (0.80–0.95)			Cuffey and Paterson (2010)
	Decay of snow albedo	α_2	0.11	0.11			Brock et al. (2000), Ragetli and Pellicciotti (2012)
	Ice albedo	α_{ice}	0.3	–			Cuffey and Paterson (2010)

tainty of the geodetic mass balances are 3.2 and 1.2 m w.e. for the periods 1955–2000 and 2000–2003, respectively. In contrast to the model setup for the entire Maipo River basin, in this setup we do not perform any corrections to account for sublimation or other mass removal apart from melt. However, as these models are calibrated on volume loss (thus including both losses by sublimation and melting), it can be assumed that glacier response is well captured, but the portioning of hydrological fluxes (sublimation versus runoff) is un-

constrained. A summary of literature-derived and calibrated parameters for the individual models is shown in Table 1. Within each model, melt factors for debris-covered areas are fixed to 25 % of the values for debris-free areas. The 25 % factor is estimated from the comparison between melt rates on debris-free and debris-covered sites on Piramide, Bello and Yeso glaciers in the Estero del Yeso catchment (Ayala et al., 2016; Burger et al., 2019), a sub-catchment of the Maipo River basin.