

**Additional information to AWS measurements (Section 2.1.1):**

Table S1: Details of all sensors and measurement specifications at AWS<sub>M</sub> and AWS<sub>G</sub> (Section 2.1.1) with sensor height in parentheses and nominal accuracy according to the manufacturer.

Variable	AWS <sub>M</sub> (Moraine)	AWS <sub>G</sub> (Glacier)
temperature (°C)	Vaisala HMP45C** (2m) ± 0.2°C	Vaisala HMP45C (2m) ± 0.2°C
relative humidity (%)	Vaisala HMP45C** (2m) ± 2%	Vaisala HMP45C (2m) ± 2%
wind speed (m/s)	R.M. Young/05103 (2m) ± 0.3 m/s	R.M. Young/05103 (2m) ± 0.3 m/s
wind direction (°)	R.M. Young/05103 (2m) ± 3°	R.M. Young/05103 (2m) ± 3°
incoming short-wave rad. (W/m <sup>2</sup> )	Schenk Star 8101 (2m) ± 3%	Kipp&Zonen CG3 (2m) ± 5%***
reflected short-wave rad. (W/m <sup>2</sup> )		Kipp&Zonen CG3 (2m) ± 5%***
incoming long-wave rad. (W/m <sup>2</sup> )		Kipp&Zonen CMP3 (2m) ± 10%***
outgoing long-wave rad. (W/m <sup>2</sup> )		Kipp&Zonen CMP3 (2m) ± 10%***
relative surface height change* (m)		Campbell Ultrasonic SR50 ± 1cm
precipitation (mm)	Ott Pluvio Precipitation gauge ± 1%	

\*surface height change driven by climatic mass balance \*\*artificially ventilated until 2009 \*\*\*for daily totals

**Overview of meteorological conditions measured at AWS<sub>M</sub> during our investigation period:**

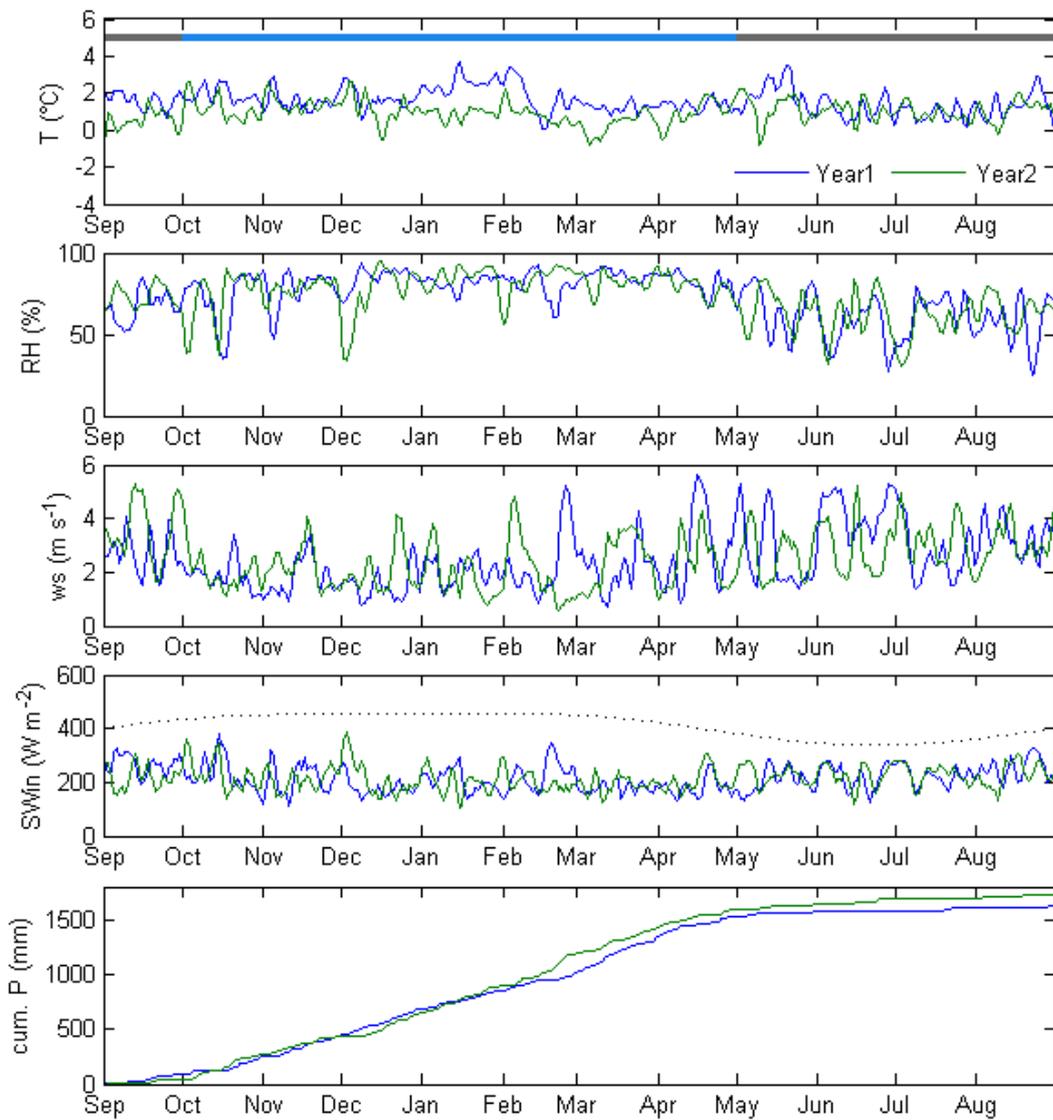


Fig. S1. 3 day running means of temperature, air humidity, wind speed, solar radiation and precipitation as cumulated daily sum measured at AWS<sub>M</sub>. Blue lines show year 1 (Sept. 2006 – Aug. 2007) and green lines year 2 (Sept. 2007 – Aug. 2008). The dotted black line in the SWIn plot is the calculated top of atmosphere solar radiation.

**Additional information on the temperature transfer from AWS<sub>M</sub> to the glacier (Section 2.1.1):**

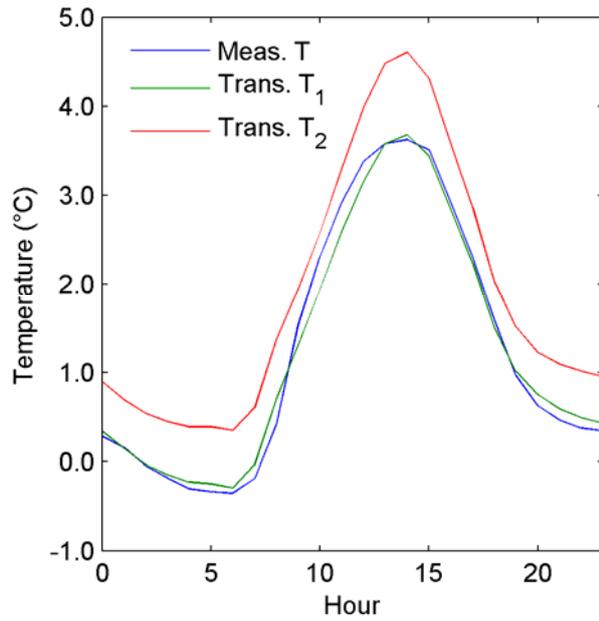


Fig. S2. Mean diurnal cycle of air temperature measured at AWS<sub>G</sub> (meas. T), transferred from AWS<sub>M</sub> to AWS<sub>G</sub> with the transfer function (Trans. T<sub>1</sub>) described in Section 2.1.1 and with a constant gradient of  $-0.55^{\circ}\text{C } 100\text{m}^{-1}$  (Trans. T<sub>2</sub>) for the period July 2011 to February 2012.

**Additional information on model deviations from measurements calculated with a cross-validation approach (Section 2.2.3 and Section 3.1.1):**

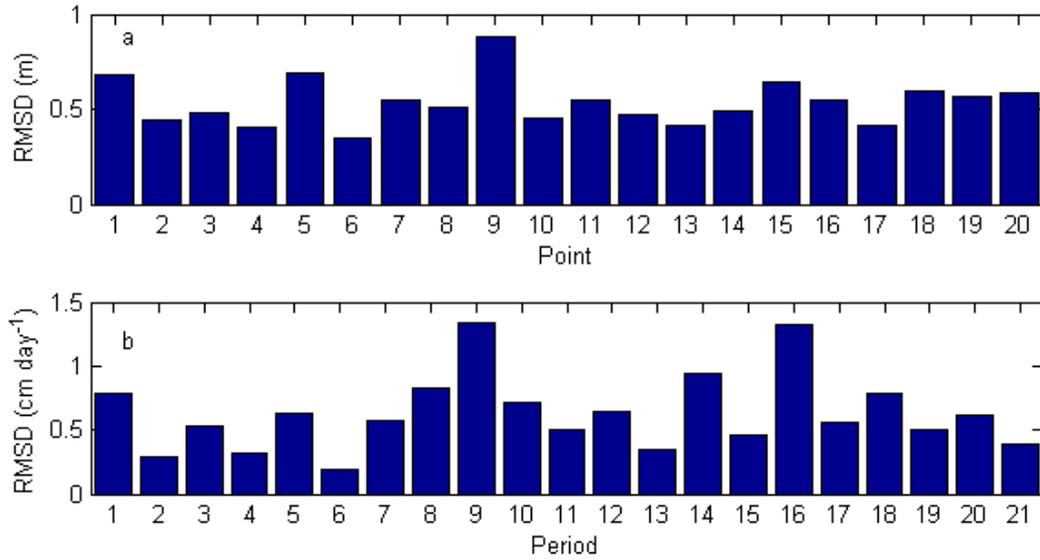


Fig. S3. RMSD of each point compared to the stake measurement for model parameter combinations optimized at all other points in (a). RMSD between model results and stake measurements for each time period with model parameter combinations optimized for all other time periods in (b).