Supplementary material for "Surface mass balance modelling of the Juneau Icefield highlights the potential for rapid ice loss by the mid-21st century"

Ryan N. Ing¹, Jeremy C. Ely^{2*}, Julie M. Jones² and Bethan J. Davies³

*Corresponding author

1. School of Geosciences, University of Edinburgh, Edinburgh, UK, EH8 9XP

2. Department of Geography, The University of Sheffield, Sheffield, UK, S10 2TN

3. School of Geography, Politics and Sociology, Newcastle University, Newcastle upon Tyne, UK, NE1



Figure S1. The 100 optimisation runs for Taku Glacier, 2004 to 2008. The blue line represents glacier wide SMB from JIRP. The red line shows the simulated SMB from COSIPY. Each tile represents a model run, with the red to green colour map displaying the normalised RMSE between the simulated COSIPY SMB and the JIRP SMB.



Figure S2. Climate average for Juneau Icefield from downscaled GFDL data. A) Mean daily air temperature at 2 m, b) mean total annual precipitation, c) mean annual snowfall, d) mean incoming shortwave radiation.



Figure S3 As in Fig. S2 but for CCSM.

Glacier name	Survey start date	Period (years)	Annual SMB	
			Larsen et al.	COSIPY (this
			(2015)	study)
Taku	09/03/1993	19	0.13	0.08
Lemon Creek	09/03/1993	19	-0.91	-0.51
Meade	09/03/2007	5	-1.03	-0.31
Field	09/03/2007	5	-0.94	-0.06
Gilkey	09/03/2007	5	-0.75	-0.70
Llewellyn	09/03/2007	5	-0.61	-0.08
Mendenhall	09/05/1999	13	-0.57	-0.32
Willison	09/03/2007	5	-0.51	0.01

Table S1. Comparison of the annual SMB derived laser altimetry surveys and the CFSR-COSIPY simulations. The date of the first survey, and the period covered is also noted.



Figure S4. The ELA of glaciers across Juneau icefield. A) for CFSR-COSIPY past simulation (1989-2019). B) observed ELAs derived from satellite imagery in Ziemen et al. (2016) for the period 1996-2014). C) The difference between observed (B) and modelled (A) ELAs.

Table S2. Climate trend	s.
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	T2			RRR			
	Mean (^{o}C)	Trend (decade ^{-1})	p-value	Mean (mm annual)	Trend (decade ^{-1})	p-value	
Past (1980 to 2010)							
CFSR	-3.4	0.16	0.24	3100	-140	0.071	
GFDL	-4.4	0.44	0.035	3600	-350	0.0014	
CCSM	-2.9	0.19	0.54	3500	-180	0.062	
Future (2030 to 2060; RCP8.5)							
GFDL	-0.91	0.85	0.0012	3300	-190	0.053	
CCSM	-1.9	0.32	0.066	3200	-140	0.11	

	SNOWFALL			SWIN		
	Mean (m w.e. a^{-1})	Trend (decade ^{-1})	p-value	Mean (W m ^{-2})	Trend (decade ^{-1})	p-value
Past (1980 to 2010)						
CFSR	1.8	-0.092	0.058	110	-0.0040	1.0
GFDL	2.1	-0.21	0.0031	110	2.1	0.13
CCSM	2.0	-0.16	0.021	100	-0.35	0.87
Future (2030 to 2060; RCP8.5)						
GFDL	1.4	-0.17	0.016	100	0.64	0.63
CCSM	1.7	-0.17	0.56	100	-0.87	0.56



Figure S5: Spatial distributions of mean annual SMB for the reanalysis (CFSR; 1981 to 2019) and evaluation (GFDL and CCSM; 1981 to 2010) simulations. (a) CFSR, (b) GFDL, (c) CCSM, (d) mean of GFDL and CCSM and (e) difference between the CFSR mean and the mean of GFDL and CCSM.