Supplements

S1. Modelled ice thickness and volume with *GlabTop*

The thickest ice (>100 m) is found at the principle valley glaciers which are the Mer de Glace, and its tributaries (Tacul and Leschaux glaciers), the Argentière and Miage glaciers, but also at the tongues of the Tré la Tête, Tour and Talèfre glaciers (Fig. S1).

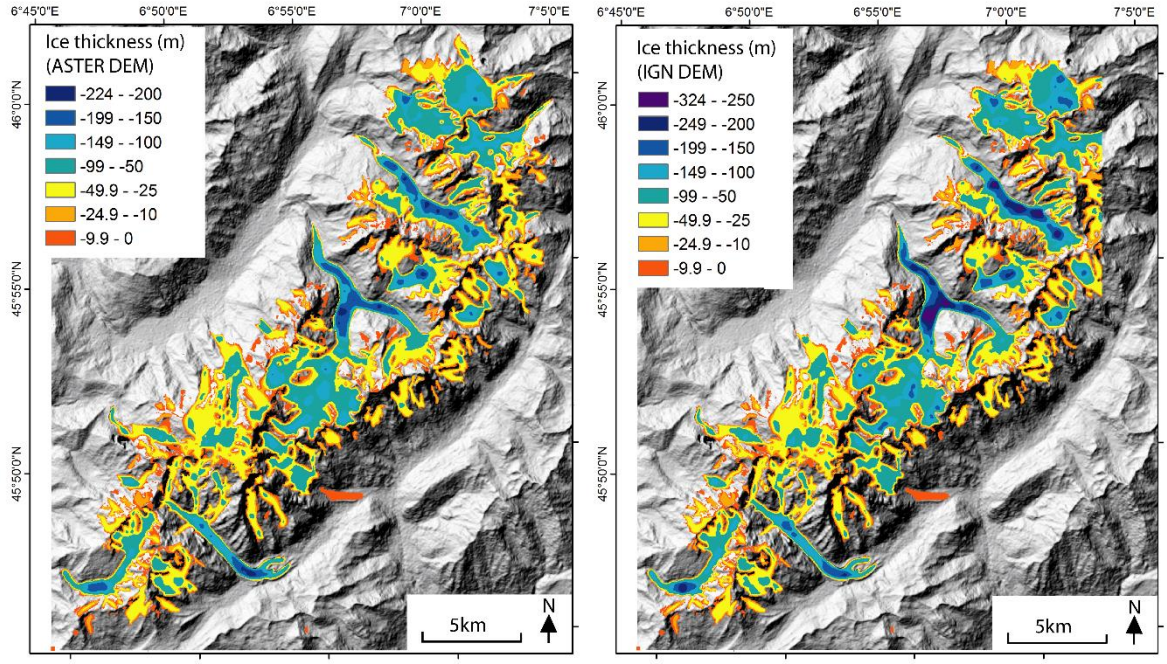

Figure S1. Predicted ice thickness with *GlabTop* and the ASTER DEM (left) and IGN DEM (right).

The accumulation zones of the Mer de Glace (Vallée Blanche and Géant glacier), the Plateau du Trient, Saleina, Triolet and Pré de Bar glaciers also have ice thickness > 100 m. Ice thickness > 250 m was modelled at some locations of the Tacul, Leschaux and Argentière glaciers based on the IGN DEM, surrounded by large areas of ice > 200 m, which is also found in the flat area of the Tré-la-Tête glacier. Simulations on the ASTER DEM resulted in thinner predicted ice, barely exceeding 200 m at locations

where predicted ice is > 250 m on the IGN DEM. The thickest ice was predicted with the RGD DEM (Fig. S2).

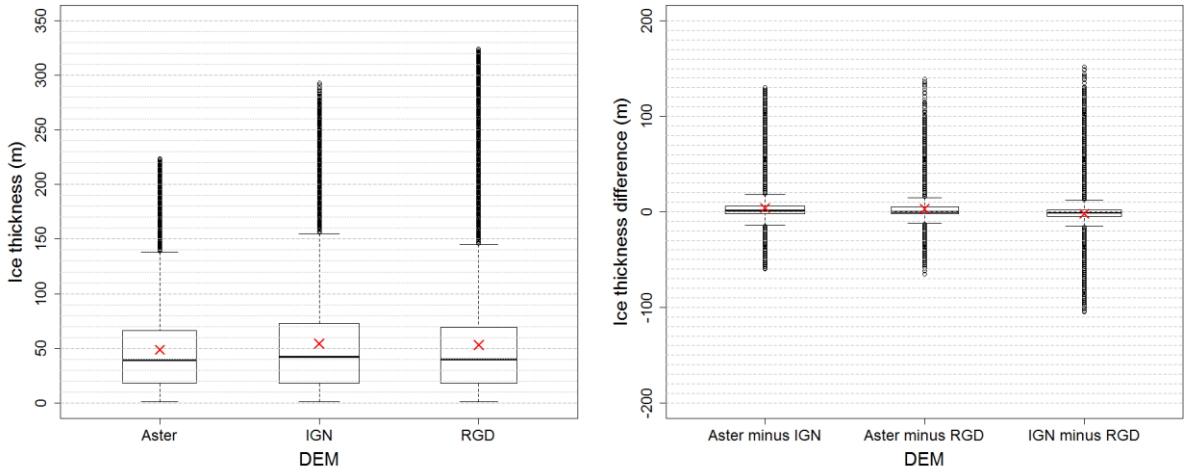

Figure S2. Summary statistic of the ice thickness modelled with the ASTER and IGN DEM, and of the differences in ice thickness results. The lowest and highest boundaries of the boxes respectively display the 1st and 3rd quartile (Q1 and Q3) of the observations. The lowest and highest whiskers respectively show Q1-((Q3-Q1)×1.5]) and (Q3+((Q3-Q1)×1.5)). The dots are the outliers. The red squares display the mean values.

More than half of the glacier surface area is underlain by ice thinner than 50 m, and 75% is < 80 m (Fig. 3 left; Tab. 1). This general pattern is consistent between DEMs, but locally, the ice thickness may vary by 10-20 m, depending on the DEM used to run GlabTop, while differences > 100 m are rare (Fig. 3 right). The surface area and volume represented by the thickest ice (> 150 m) also greatly differ between the DEMs, while these parameters are more consistent for thinner ice (Tab. S1). The Argentière glacier and the Mer de Glace as well as their tributaries, respectively account for 9 and 19.5% of the glacier surface area and 13 and 27% of the total ice volume.

Ice thick. (m	ASTER				IGN			
	Surf. area (km^2)	%	Volume (km^3)	%	Surf. area (km^2)	%	Volume (km^3)	%
0 - 25	53.7	32.8	0.7	8.2	46.6	32	0.5	6.2
25 – 50	49.6	30.3	1.8	22.4	41.5	28.5	1.6	18.8
50 – 100	39.8	24.3	2.8	34.5	35.7	25.5	2.8	32.1
100 – 150	14.4	8.8	1.7	21.7	12.9	8.8	1.7	19.1
> 150	6.3	3.7	1.1	13.2	8.9	6.1	2.1	23.9
Total	163.8	100	7.96	100	145.5	100	8.7	100

Table S1. Glacier surface area and volume calculated for 6 ice thickness classes and the 2 DEMs. Statistics are not provided for the RGD DEM because it does not cover the Swiss and Italian sides of the massif.

The mean ice thickness peaks at 1900 m a.s.l. with a value > 150 m with the IGN DEM (Fig. S3) and decreases to reach a minimum value of 20 m between 3500 and 3700 m a.s.l., but increases again up to 40 m at 4600 m a.s.l. The glacier surface area follows a totally different pattern, with a peak at 3000 m a.s.l. and sharp decrease above and below, to respectively 3700 and 2300 m a.s.l., followed by gradual decrease towards the highest and lowest elevations. The glacier volume mostly follows the distribution of the surface area, despite a slightly more irregular pattern below the elevation of the maximum value reached at 2900-3000 m.

Comparison of modelled glacier bed topography with measured glacier bed elevation at the Argentière glacier shows that predicted ice thickness is often underestimated, and may be up to twice thinner than the measured thickness.

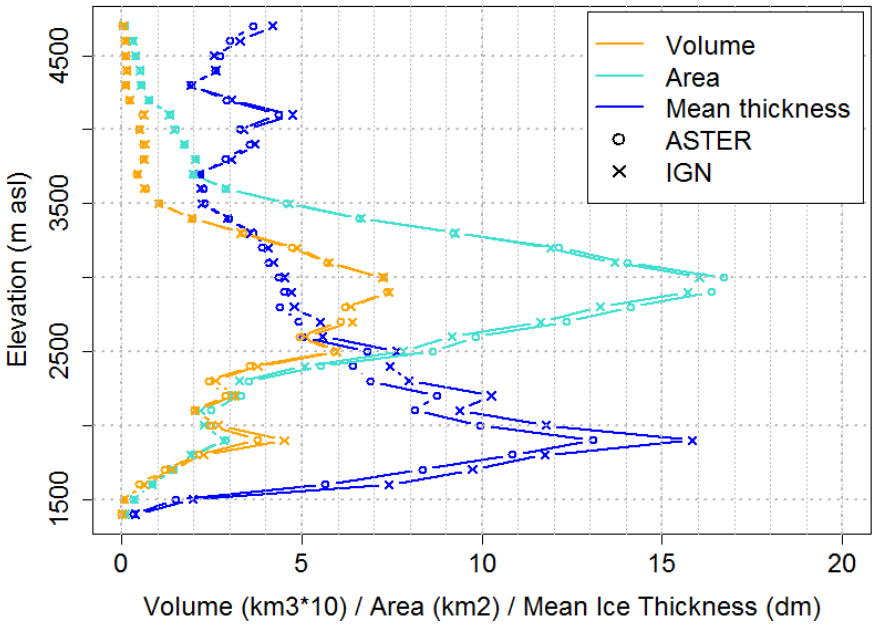

Figure S3. Distribution of the ice volume, surface area and mean thickness for elevation interval of 100 m, calculated with Glabtop with the ASTER and IGN DEMs. Statistics are not provided for the RGD DEM as it does not cover the Swiss and Italian side of the massif.

S2. Characteristics and analysis of predicted GBOs with *GlabTop*

Glacier	ID (IGN/ASTER)	Criterion (i)	Criterion (ii)	Criterion (iii)	Criterion (iv)	Total value	Maximum value	Percentage of filled value	Length change (m)	Retreating rate per year	Number of years before potential lake formation
Mer de Glace, Tacul, Leschaux	27/86-93	5	3	3	2	13	20	65	2198	9.1	242
	146 (RGD)	3	5	4	4	16	20	80	> 2198	9.1	> 242
	63	4	4	3	4	15	20	75	> 2198	9.1	> 242
	64	5	4	3	3	15	20	75	> 2198	9.1	> 242
	61	5	2	0	2	9	20	45	> 2198	9.1	> 242
	67	5	2	1	4	12	20	60	> 2198	9.1	> 242
	142	4	2	2	2	10	20	50	> 2198	9.1	> 242
	42-37/132	4 to 5	2 to 3	2	4	16	20	80	> 2198	9.1	> 242
	38/113	4 to 5	1 to 2	2	1	13	20	65	> 2198	9.1	> 242
	40/127	4 to 5	1 to 2	4	0	10	20	50	> 2198	9.1	> 242
	156	5	1	3	1	10	20	50	> 2198	9.1	> 242
	132 (RGD)	4	4	1	5	14	20	70	> 2198	9.1	> 242
	54-58/159	4	5	4	4	17	20	85	> 2198	9.1	> 242
Talèfre	33/103	4	5	5	NA	14	15	93	0	8.34	Imminent
	30/89	5	3	3	0	11	20	55	1594	8.34	191
Argentière	na/38	4	2	3	2	11	20	55	542	5.7	95.8
	12 and 44	4	5	3	5	17	20	85	268	5.7	47.4
	13/47-50	5	4	3	4	16	20	80	1676	5.7	296
	16-20/59-61	5	2	2	3	12	20	60	> 1676	5.7	> 296
	21/63	5	2	1	1	9	23	39	> 1676	5.7	> 296
	24/65-66	5	3	1	3	12	20	60	> 1676	5.7	> 296
Tour	6-7 and 18	4	5	4	3	16	20	80	689	11	62.3

	9/na	4	4	2	4	14	20	70	1951	11	177
Plateaux du Trient	3 and 5	5	4	4	5	18	20	90	1923	14	134
	na/16	4	1	0	1	6	20	30	3122	14	> 134
Saleina	na/35	3	4	3	5	15	20	75	2000	8.4	238
	na/18	4	0	0	3	7	20	35	> 2000	8.4	> 238
	11/na	5	4	4	5	18	20	90	> 2000	8.4	> 238
Pré de Bar	29/91	5	4	3	4	16	20	80	2249	5.1	442
Triolet	32/96	4	5	4	5	18	20	90	1007	15	68.7
	43/134	5	5	4	4	18	20	90	550	15	37.5
Miage (I)	91/231	2	NA	0	0	2	15	13	0	4.1	imminent
	92/235	3		0	0	3	15	20	0	4.1	imminent
	89/229	4	0	0	0	4	20	20	1226	4.1	297
	81/218	4	2	1	0	7	20	35	> 1226	4.1	> 297
Tré la Tête	103/253	4	5	5	4	18	20	90	1408	4.3	326
	217 (RGD)	5	3	3	2	13	20	65	>1408		> 326
Plan Glacier	76/211	5	4	3	3	15	20	75	412	3.4	122
Bionnassay	194 (RGD)	5	5	1	4	15	20	75	1713	5.13	334
Lée Blanche	na/249	4	5	4	5	18	20	90	835	20.1	41.6
Bossons	195 (RGD)	3	4	NA	0	7	15	46	5975	12.2	489
Brenva	203	4	3	4	5	16	20	80	2582	?*	?

Table S2. Analysis of the predicted GBOs with GlabTop. * « ? » indicate that it is not possible to calculate a glaicer retreat rate due to glacier change in morphology.

S3. Characteristics and analysis of GBOs visually detected

Glacier	ID	Criterion (i)	Criterion (ii)	Criterion (iii)	Criterion (iv)	Total value	Maximum value	Percentage of filled value	Length change (m)	Retreating rate per year	Number of years before potential lake formation
Jetoula	1	4	5	1	2	12	20	60	164	1.8	90.2
Thoule	2	5	4	2	3	14	20	70	600	3.1	194.1176
	3	5	5	2	3	15	20	75	323	3.1	104.5
Planpincieux	4	4	5	2	4	15	20	75	595	2.8	211.129
Glacier de Frebrouze	5	4	5	3	5	17	20	85	377	6.1	61.89552
Gruetta	6	3	5	3	3	14	20	70	197	1.5	130.02
Brouillard	7	3	5	0	0	8	20	40	227		
Lée Blanche	8	3	5	0	0	8	20	40	304	20. 1	15.13122
		3	3	1	0	7	20	35	2244	20. 1	111.6923
	10	4	5	0	1	10	20	50	1755	20. 1	87.35294
	11	4	5	0	1	10	20	50	1455	20. 1	72.42081
Estelette	12	3	5	1	2	11	20	55	365	12.7	28.61045
Brouillard amont	13	3	5	1	3	12	20	60	1170	3.5	333
Mont Blanc	14	4	5	2	1	12	20	60	?	?	?
	15	3	3	1	0	7	20	35	?	?	?
Dome	16	4	5	0	0	9	20	45	?	?	?
	17	3	5	1	1	10	20	50	?	?	?

Bionnassay (Italy)	18	3	5	0	2	10	20	50	?	?	?
Tré la Tete	19	4	2	2	1	9	20	45	5870	4.3	1360.122
	20	4	3	0	0	7	20	35	3025	4.3	700.9146
	21	4	4	0	0	8	20	40	3809	4.3	882.5732
	22	3	4	0	0	7	20	35	5429	4.3	1257.939
	23	4	5	1	2	12	20	60	5519	4.3	1278.793
Bossons	24	4	5	1	2	12	20	60	5041	12.2	411.9527
	25	4	3	1	3	11	20	55	3336	12.2	272.6194
	26	4	5	1	1	11	20	55	1847	12.2	150.9376
Bionnassay	27	5	5	3	5	18	20	90	1239	3.8	324.7034
	28	3	5	0	0	8	20	40	2941	3.8	770.7448
	29	4	3	2	0	9	20	45	3530	3.8	925.1034
Bossons	30	4	5	0	0	9	20	45	6219	12.2	508.2194
	31	5	5	0	1	11	20	55	4397	12.2	359.3247
	32	3	5	2	4	14	20	70	384	12.2	31.38065
	33	4	5	1	4	14	20	70	2500	12.2	204.3011
Pré de Bar	34	4	5	1	2	12	20	60	959	5.1	188.375
A neuve	35	5	3	2		10	15	66.67	508	5.3	96.30332
Treutse Bô	36	4	5	4	3	16	20	80	147	1.5	98
Tour	37	4	3	3	2	12	20	60	2524	11.0	228.3619
Tête Rousse	38	5	5	0	1	11	20	55	NA	NA	NA
	39	4	5	3	NA	12	15	80	NA	NA	NA

60

Table S3. Analysis of the GBOs visually detected. * « ? » indicate that it is not possible to calculate a glacier retreat rate cecause teh concerned glacier is the tributary of a trunk glacier and extrapolating its retreating rate to the tributary might be irrelevant.