



Supplement of

Atmospheric drivers of melt-related ice speed-up events on the Russell Glacier in southwest Greenland

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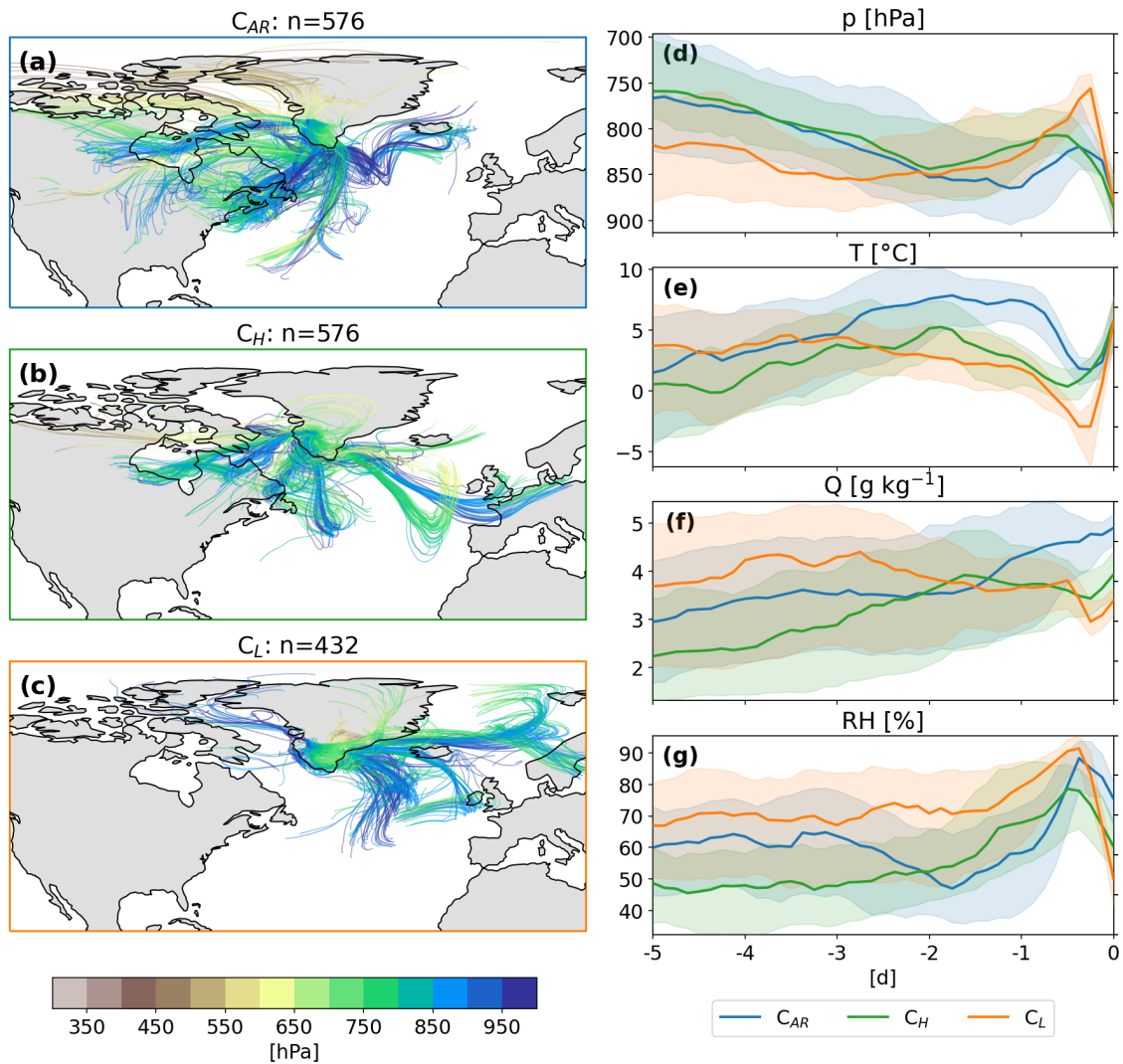


Figure S1. (a–c) 5-day backwards trajectories colored according to their vertical level for all MI-days in each cluster. Trajectories are started at 10&30 hPa above the ground level at eight locations in the Russell Glacier ablation area at 9, 12, and 15 UTC-3. (d–g) median temporal evolution of pressure (p), temperature (T), absolute moisture (Q), and relative humidity (RH) for all air masses within the same cluster, with the respective intertercile (33th–66th percentile) range shaded.

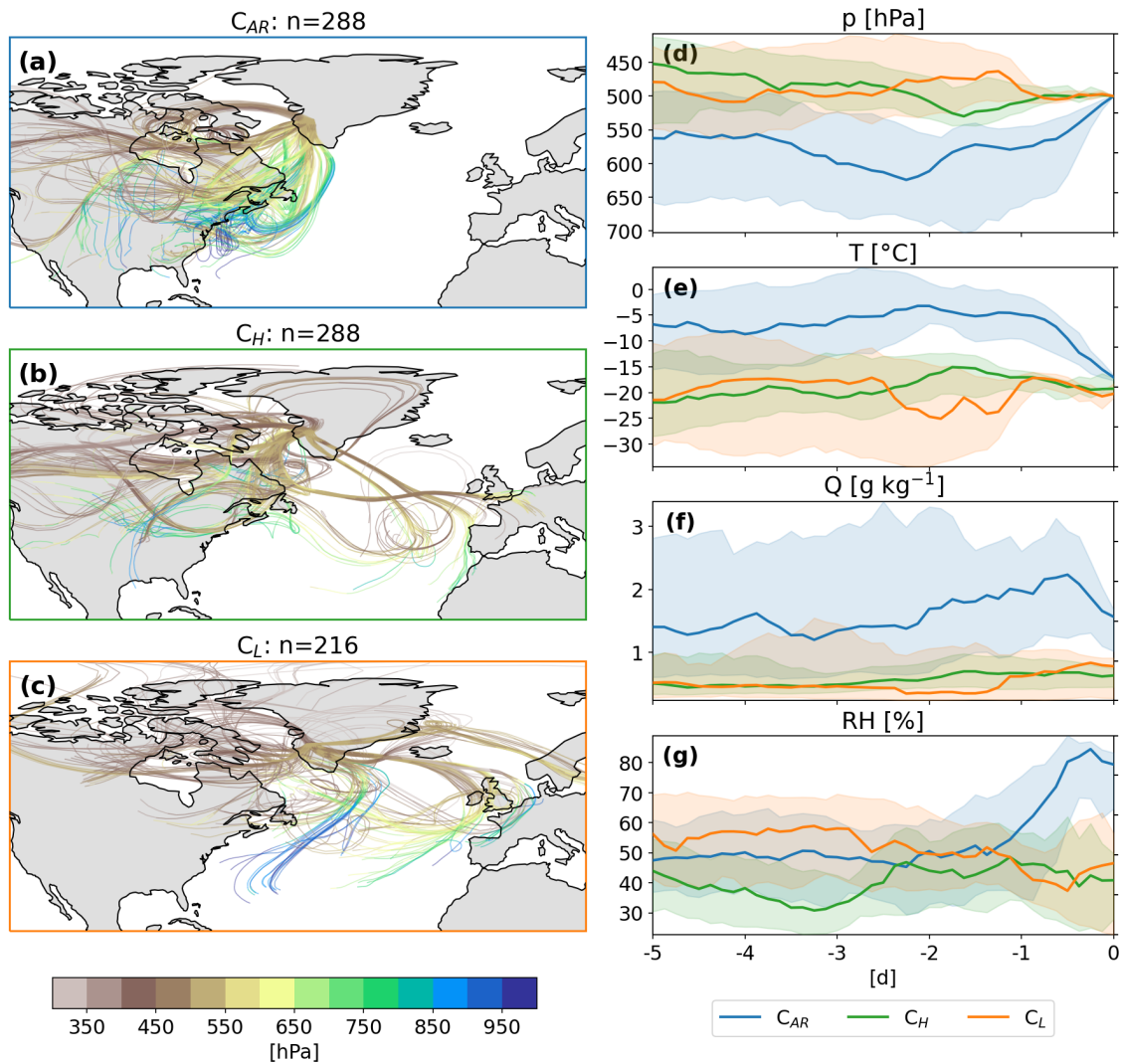


Figure S2. (a–c) 5-day backwards trajectories colored according to their vertical level for all MI-days in each cluster. Trajectories are started at 500 hPa at eight locations in the Russell Glacier ablation area at 9, 12, and 15 UTC-3. (d–g) median temporal evolution of pressure (p), temperature (T), absolute moisture (Q), and relative humidity (RH) for all air masses within the same cluster, with the respective intertercile (33th–66th percentile) range shaded.

Table S1. Data for each ice speed-up event. "Max. melt-increase" refers to the MI-day and "Total melt-increase" to all consecutive days where all datasets agree on increasing melt. "Accelerating stations" are defined by a $>50 \text{ m year}^{-1}$ increase in local ice velocities during the speed-up event.

Date (start)	duration [d]	Total ice velocity increase [m year^{-1}]	Max. melt-increase [mm d^{-2}]	Total melt-increase [mm d^{-1} event $^{-1}$]	Lag (MI-day vs. start date) [d]	Max. DMI rainfall increase [mm d^{-2}]	Max. MAR rainfall increase [mm d^{-2}]	Total lake drainage area [km^2]	Spring event (per station)	Accelerating stations	Stations with missing data	#days with consecutive melt increase	SOM nodes during melt increase	
18/05/2009	3	30.1	-	-	-	-	0.4	-	L1	L1	-	-	-	
01/06/2009	3	62.8	12.2	12.2	1	0.3	-	-	L3	L1,2,3	-	1	5	
06/06/2009	2	27.7	13.0	13.0	-1	2	-	0.1	-	L2-3	-	1	5	
15/06/2009	3	51.9	4.6	4.6	0	4.6	-	1.5	-	L1,2,3	-	1	20	
27/06/2009	4	27.7	5.4	9.6	0	4.6	2.0	1.5	-	L2	-	2	4, 4	
02/07/2009	2	69.4	-	-	0	1.01	0.8	-	-	L2,3	-	-	-	
07/07/2009	2	61.8	17.4	17.4	-1	-	-	0.4	-	L2,3	-	1	15	
10/07/2009	3	29.3	6.6	6.6	0	1.7	0.1	0.4	-	L3,5	-	1	20	
20/07/2009	2	24.8	-	-	-	-	-	4.7	-	L5	-	-	-	
26/07/2009	5	42.4	-	-	-	0.81	-	4.8	-	L4,5,6	-	-	-	
10/09/2009	2	23.3	4.0	4.0	0	3.99	4.0	-	-	L2	L5	1	1	
07/05/2010	4	68.0	19.8	20.2	0	0.02	-	-	L2,3	L1,2,3	L4	2	5, 5	
16/05/2010	7	124.1	15.3	23.3	5	0.01	0.5	0.1	-	L1,2,3	L4	2	3, 3	
29/05/2010	2	18.8	-	-	0	0.01	-	-	-	-	L4	2	-	
05/06/2010	1	54.8	15.1	21.3	0	-	-	-	-	L2,3	L4	2	14, 20	
16/06/2010	3	65.3	11.5	33.2	1	14	0.8	-	-	L2,3	L4	3	2, 1, 1	
24/06/2010	3	55.0	15.3	15.3	0	-	0.4	2.8	-	L2,3,5	L4	1	20	
17/07/2010	3	33.6	9.3	9.3	0	-	-	0.9	-	L5	L4	1	20	
27/07/2010	4	34.6	7.5	14.5	0	0.01	3.6	-	-	L2,3	L4	2	15, 16	
12/08/2010	2	18.1	-	-	0	-	0.2	-	-	L3	L5	1	-	
27/08/2010	1	17.5	4.5	4.5	0	17.2	6.4	-	-	L2	L1,4,5	1	8	
02/06/2011	8	112.7	12.4	12.4	3	1.2	0.7	-	L1,2,3	L1,2,3	-	1	7	
14/06/2011	2	42.7	14.0	14.0	0	-	-	1.1	-	L2,3,4	-	1	14	
21/06/2011	2	60.8	6.5	6.5	1	0.01	0.2	0.1	-	L2,3,4	-	1	5	
06/07/2011	2	52.5	16.2	16.2	0	1.99	6.8	3.4	-	L3,4,5	-	1	3	
11/07/2011	2	39.1	16.9	21.1	1	-	1.8	-	-	L2,3	-	2	15, 19	
19/07/2011	2	57.1	18.1	18.1	-1	-	5.3	-	-	L4,5,6	-	1	11	
09/07/2011	2	21.9	17.8	17.8	1	-	7.6	-	-	L3,4	L1,2	1	9	
03/08/2011	1	17.6	-	-	-	-	1.8	-	-	L4	L1,2	1	9	
06/08/2011	2	21.9	6.5	6.5	0	-	0.1	-	-	-	L1,2	1	9	
25/08/2011	1	32.8	2.8	2.8	-1	3.2	1.6	-	-	L3	L1,2	1	3	
27/08/2011	1	53.5	7.6	12.5	0	10	3.9	-	-	L4,5,6	L1,2	2	8, 2	
09/09/2011	2	22.6	-	-	0	0.01	0.2	-	-	L2	L5	2	-	
05/05/2012	4	20.0	5.1	9.9	1	1.1	0.9	-	L1	L1	L5	3	5, 5, 5	
27/05/2012	2	92.8	21.9	32.5	0	6.99	2.9	-	L3	L1,2,3	L5	3	8, 2, 5	
14/06/2012	2	48.4	11.9	11.9	0	2.4	4.4	-	-	L2,3	L5	1	4	
18/06/2012	3	30.1	17.6	17.6	1	-	-	3.4	-	L4	L5	1	9	
23/06/2012	3	55.4	23.8	23.8	0	10.3	4.6	4.8	-	L3,4,6	L5	1	5	
05/07/2012	2	27.1	5.6	5.6	0	5.19	7.9	-	-	L3	L5	1	3	
08/07/2012	3	98.6	17.2	29.7	1	3	3.6	0.1	-	L2,3,4,6	L5	2	3, 3	
23/07/2012	1	15.5	-	-	-	0.01	1.8	-	-	-	L5	-	-	-
25/07/2012	4	160.4	18.0	39.6	2	2.99	3.0	-	-	L2,3,4,6	L5	3	3, 3, 3	
14/08/2012	3	22.8	17.8	17.8	1	3.99	5.7	-	-	L4	L1,2,3,5	1	4	
09/09/2012	4	23.8	9.5	9.5	1	2	0.4	-	-	L3	L2	1	7	
19/09/2012	3	22.7	10.2	16.1	1	2.3	4.0	-	-	L4	L2,3,5,6	3	15, 8, 7	
Average	-	46.5	9.8	12.2	-	2.3	2.0	0.7	-	-	-	-	-	