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Supplement of

Thinning-induced glacier deceleration in the Zanskar Himalayas

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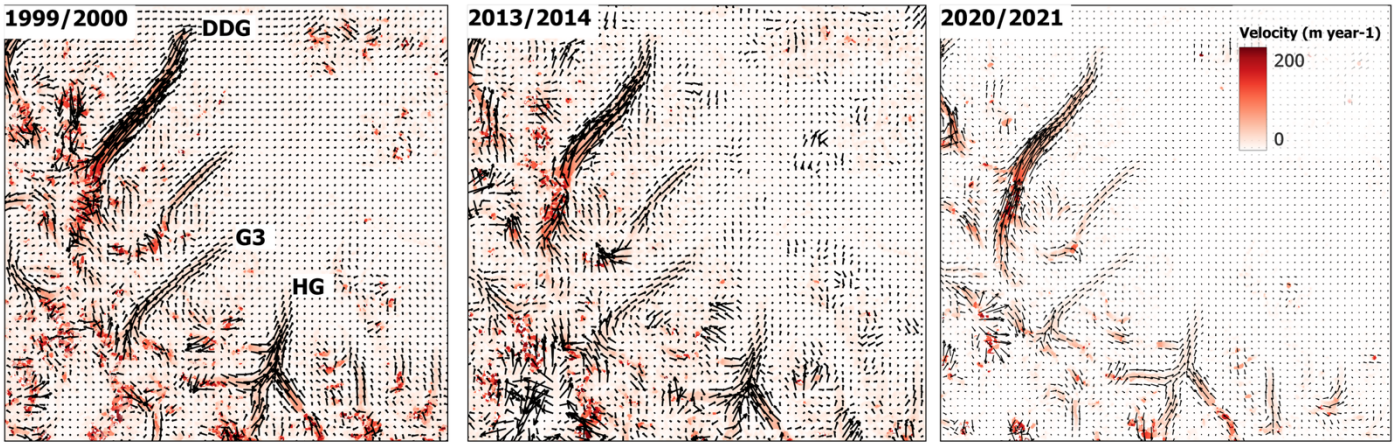
S1. Data Information

Supplement Table S1. Details of Satellite images and DEM used for annual velocity estimation and analysis, with sensor name and spatial resolution. All the data extracted is from Path: 148, and Row: 37

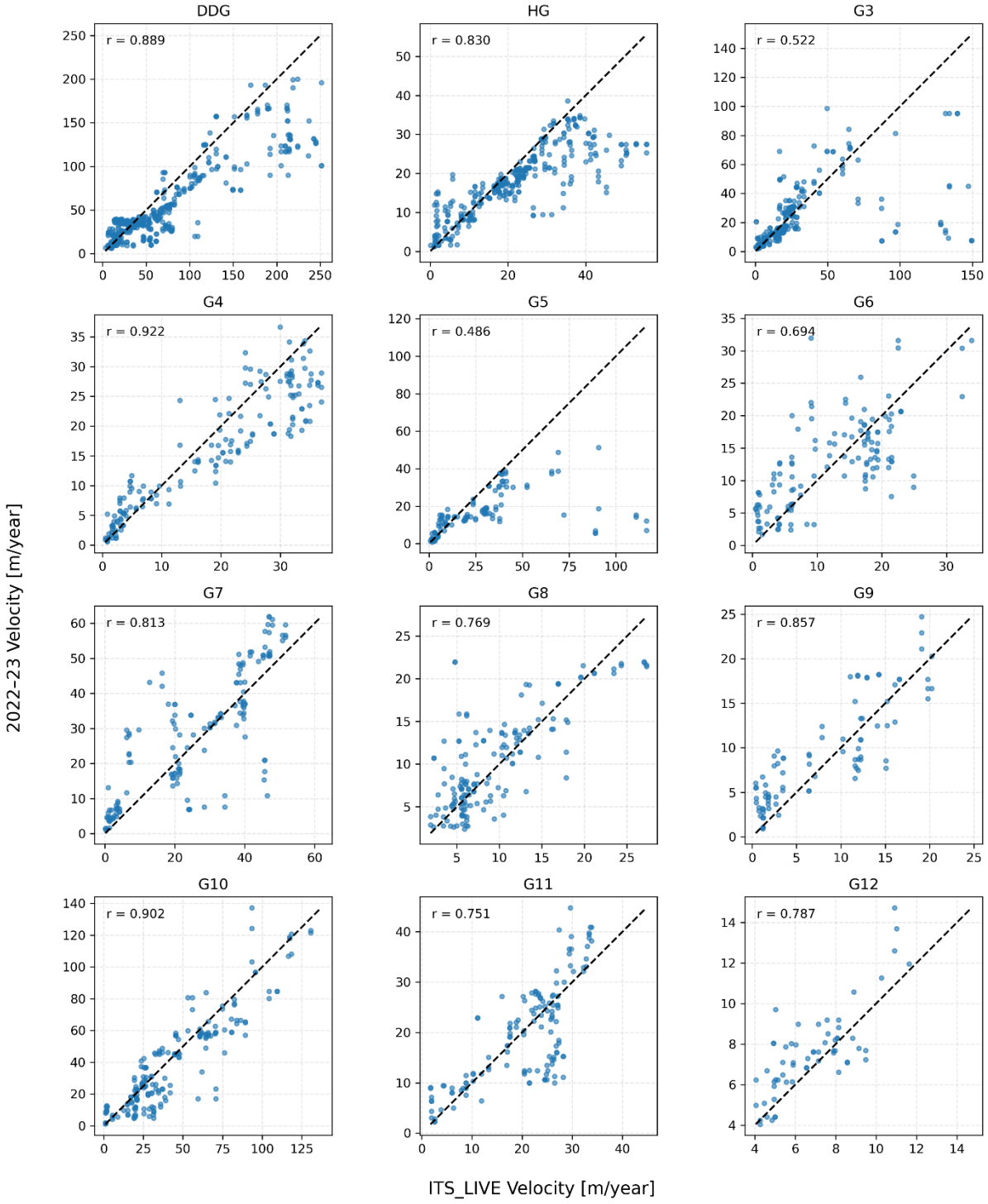
Scene ID	Satellite	Date	Spatial Resolution
LT05_L1TP_148037_19921024_20200914_02_T1_B2	Landsat 5	24-10-1992	30m
LT05_L1TP_148037_19930824_20200913_02_T1_B2	Landsat 5	24-08-1993	30m
LT05_L1TP_148037_19940726_20200913_02_T1_B2	Landsat 5	26-07-1994	30m
LT05_L1TP_148037_19960901_20200911_02_T1_B2	Landsat 5	01-09-1996	30m
LT05_L1TP_148037_19970920_20200909_02_T1_B2	Landsat 5	20-09-1997	30m
LT05_L1TP_148037_19981009_20200908_02_T1_B2	Landsat 5	09-10-1998	30m
LE07_L1TP_148037_19990817_20200918_02_T1_B8	Landsat 7	17-08-1999	15m
LE07_L1TP_148037_20000904_20200917_02_T1_B8	Landsat 7	04-09-2000	15m
LE07_L1TP_148037_20021028_20200916_02_T1_B8	Landsat 7	28-10-2002	15m
LT05_L1TP_148037_20081004_20200828_02_T1_B2	Landsat 5	04-10-2008	30m
LT05_L1TP_148037_20091007_20200825_02_T1_B2	Landsat 5	07-10-2009	30m
LT05_L1TP_148037_20101010_20200823_02_T1_B2	Landsat 5	10-10-2010	30m
LT05_L1TP_148037_20110927_20200820_02_T1_B2	Landsat 5	27-09-2011	30m
LC08_L1TP_148037_20130714_20200912_02_T1_B8	Landsat 8	14-07-2013	15m
LC08_L1TP_148037_20141005_20200910_02_T1_B8	Landsat 8	05-10-2014	15m
LC08_L1TP_148037_20151008_20200908_02_T1_B8	Landsat 8	08-10-2015	15m
LC08_L1TP_148037_20160908_20200906_02_T1_B8	Landsat 8	08-09-2016	15m
LC08_L1TP_148037_20171029_20200902_02_T1_B8	Landsat 8	29-10-2017	15m
LC08_L1TP_148037_20180829_20200831_02_T1_B8	Landsat 8	29-08-2018	15m
LC08_L1TP_148037_20190629_20200829_02_T1_B8	Landsat 8	29-09-2019	15m
LC08_L1TP_148037_20200919_20201006_02_T1_B8	Landsat 8	19-09-2020	15m
LC08_L1TP_148037_20210906_20210915_02_T1_B8	Landsat 8	06-09-2021	15m
LC09_L1TP_148037_20220901_20230331_02_T1_B8	Landsat 8	01-09-2022	15m
LC09_L1TP_148037_20230904_20230904_02_T1_B8	Landsat 8	04-09-2023	15m
DEM	**Data Version**		
ASTGTMV003_N33E076_dem_32643	ASTER GDEM V003	-	30m

Supplement Table S2. Details for satellite image pairs used for glacier surface velocity, with the estimated uncertainty

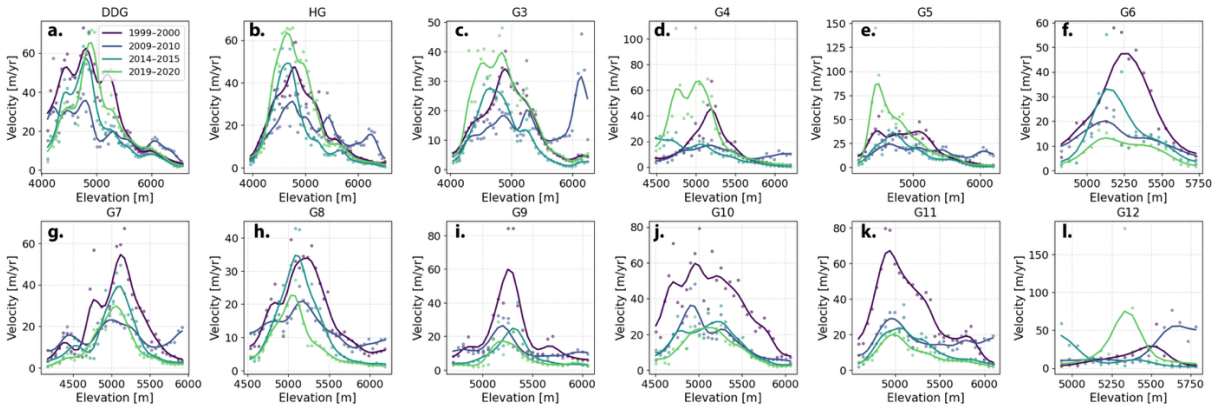
Inter-Annual Velocity	
Velocity Image Pair	**Estimated Uncertainty (m year^{-1})**
24-10-1992 - 24-08-1993	4.57
24-08-1993 - 26-07-1994	4.33
26-07-1994 - 01-09-1996	4.63
01-09-1996 - 20-09-1997	4.92
20-09-1997 - 09-10-1998	3.71
17-08-1999 - 04-09-2000	5.58
04-09-2000 - 28-10-2002	5.09
04-10-2008 - 07-10-2009	4.38
07-10-2009 - 10-10-2010	5.49
10-10-2010 - 27-09-2011	4.73
14-07-2013 - 05-10-2014	3.44
05-10-2014 - 08-10-2015	1.32
08-10-2015 - 08-09-2016	1.36
08-09-2016 - 29-10-2017	0.85
29-10-2017 - 29-08-2018	2.09
29-08-2018 - 29-09-2019	2.26
29-09-2019 - 19-09-2020	1.08
19-09-2020 - 06-09-2021	1.81
06-09-2021 - 01-09-2022	1.62
01-09-2022 - 04-09-2023	1.00



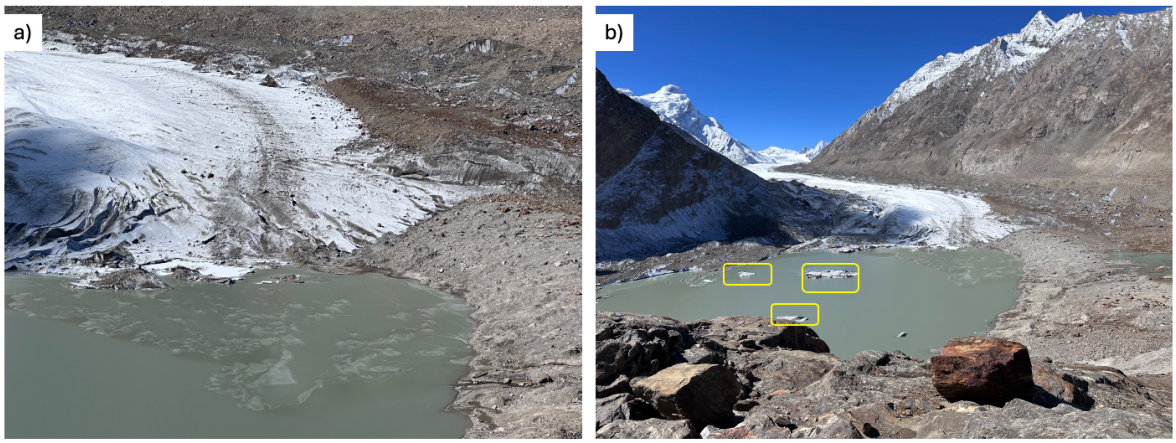
Supplement Figure S1: Velocity maps from different time periods (1999/2000, 2013/2014, and 2020/2021) overlayed with velocity vectors over some of the glaciers analysed in this study.



Supplement Figure S2: Comparison of ITS_LIVE velocity data (x-axis) (Gardner et al., 2025) with the data generated in this study (y-axis) for the year 2022-2023 for all the glaciers and the reported correlation coefficient r. The black dotted line represents the 1:1 correlation line.



Supplement Figure S3: (a-l) Velocity distribution of different glaciers in different elevation zones (bin size=50m) for different velocity time periods. Circles represent median values from each elevation bin, and the Gaussian-smoothed (sigma=1.5) lines show the trend. Each time period (1999-2000, 2009-2010, 2014-2015 and 2019-2020) is represented.



Supplement Figure S4: field photographs show a) the terminus of DDG in contact with the glacial lake; b) the presence of icebergs (marked in yellow box) floating in the glacial lake, indicating that DDG undergoes mechanical calving events. Photographs are from October 2023. (Photos taken by Andrew Mackintosh)

References:

Gardner, A. S., Greene, C. A., Kennedy, J. H., Fahnestock, M. A., Liukis, M., López, L. A., Lei, Y., Scambos, T. A., and Dehecq, A.: ITS_LIVE global glacier velocity data in near-real time, The Cryosphere, 19, 3517–3533, https://doi.org/10.5194/tc-19-3517-2025, 2025.