Glaciers_cci

Frank Paul and the Glaciers_cci consortium

Project Status (latest results and data)

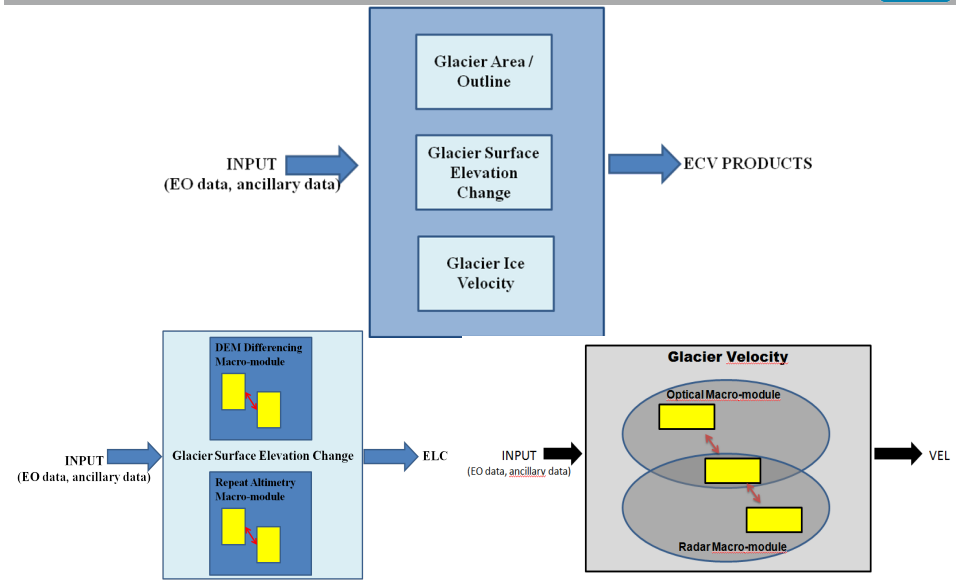
Document Deliverables: Status

Task	Code	Deliverable Title	Stage 1 Year 1 KO +3	Stage 1 Year 1 KO +6	Stage 1 Year 1 KO +9	Stage 1 Year 1 KO +12	Stage 2 Year 2 KO +15	Stage 2 Year 2 KO +18	Stage 2 Year 2 KO +21	Stage 2 Year 2 KO +24	Stage 3 Year 3 KO +27	Stage 3 Year 3 KO +30	Stage 3 Year 3 KO +33	Stage 3 Year 3 KO +36
Requirements Analysis & Prod. Specs	D1.1	User Requirements Document	*											
	D1.2	Product. Specification Document		*										
	D1.3	Data Access Requirements Doc.	*											
Algorithm Development, Intercomparison and Selection	D2.1	Product Validation Plan		*										
	D2.2	Database for Task 2		*										
	D2.3	ATBD v0		*										
	D2.4	Round-Robin Data Package			*									
	D2.5	Prod. Val. & Algo Selection Rep			*									
	D2.6	ATBD v1					*							
	D2.7	DPM v1					*							
	D2.8	IODD v1					*							
System Protoyping & ECV Production	D3.1	System Prototype Description						*						
	D3.2	System Verification Report						*						
	D3.3	Database for Task 3						*						
	D3.4	Product User Guide								*				
	D3.5	Climate Research Data Package								*				
	D3.6	ATBD v2							*					
	D3.7	DPM v2							*					
	D3.8	IODD v2							*					
Final Prod. Val & User Assess.	D4.1	Prod. Val. & Intercomp. Report											*	
	D4.2	Climate Assessment Report												*
System Specification	D5.1	System Requirements Document			*									
	D5.2	System Specification Doc V0				*								
	D5.3	System Specification Doc V1							*					

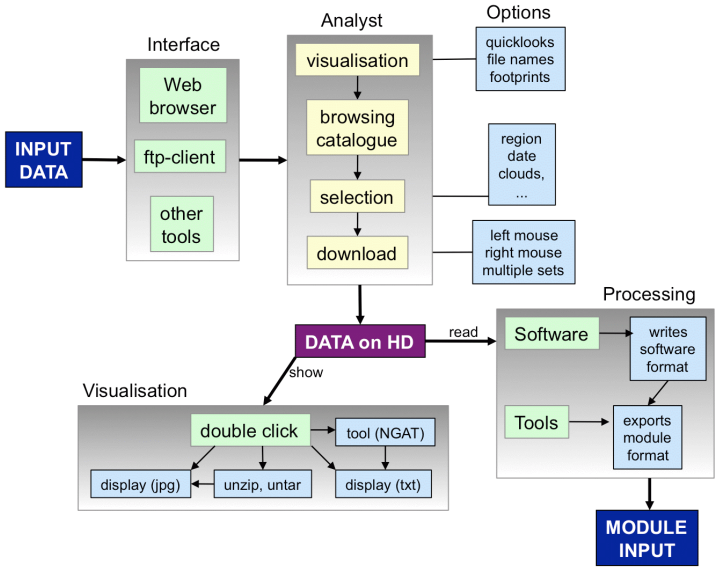
- accepted
- submitted
- in prep.
- open

The Distributed Data Processing System

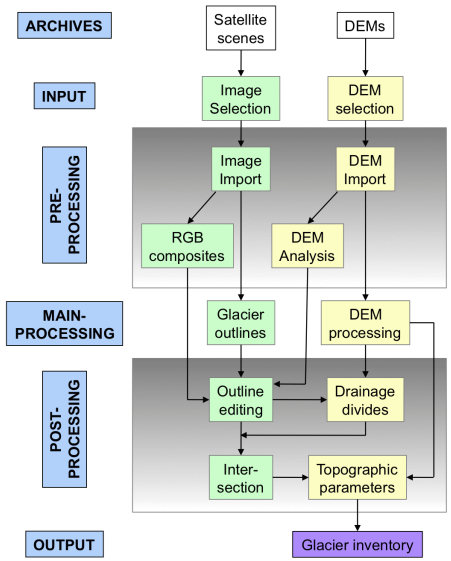
The Processing System: Macro-modules



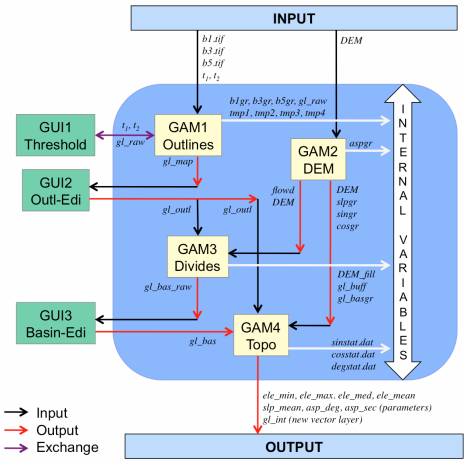
The Input Interface (all products)



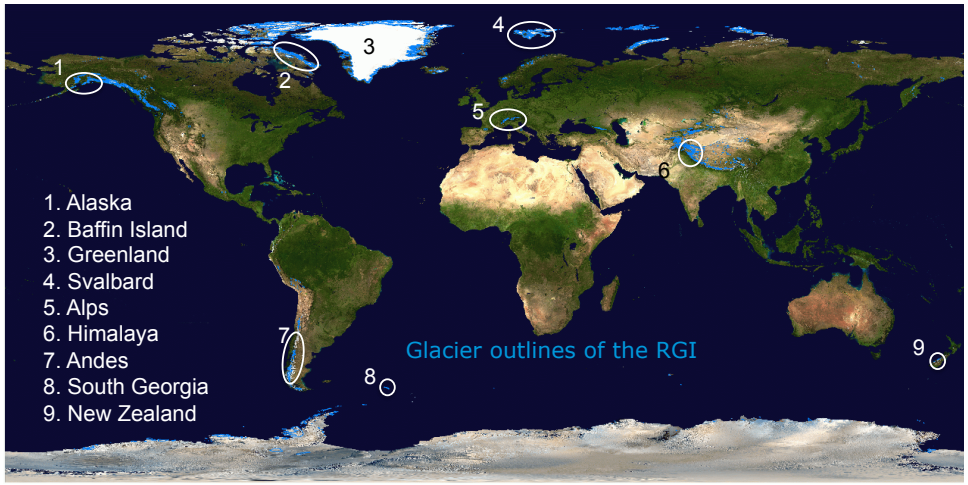
Workflow and modules: Area



Module-based data processing for glacier area



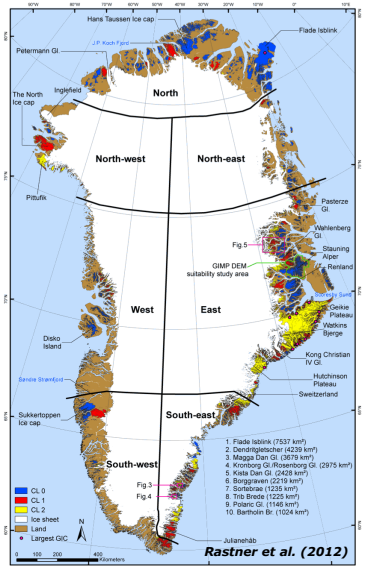
Data Products: The RGI contribution

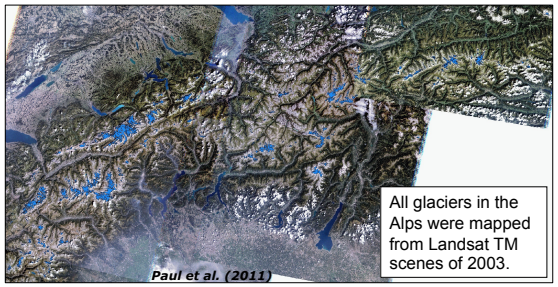


Background: MODIS Blue Marble

About 150 satellite scenes (ASTER, Landsat TM & ETM+) were processed by Glaciers_cci

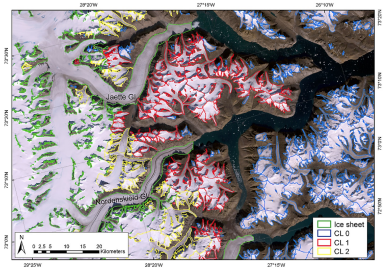
Data Products: Glacier Area





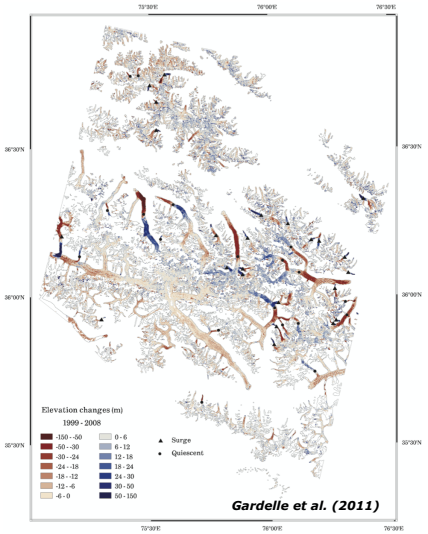
All glaciers in the Alps were mapped from Landsat TM scenes of 2003.

More than 20,000 local glaciers and ice caps on Greenland were mapped from Landsat ETM+ scenes. 3 different connectivity levels were assigned to serve the needs from the user groups.

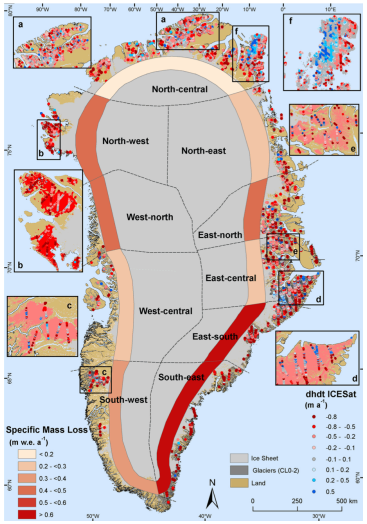


Data Products: Elevation Change

DEM differencing in the Karakoram

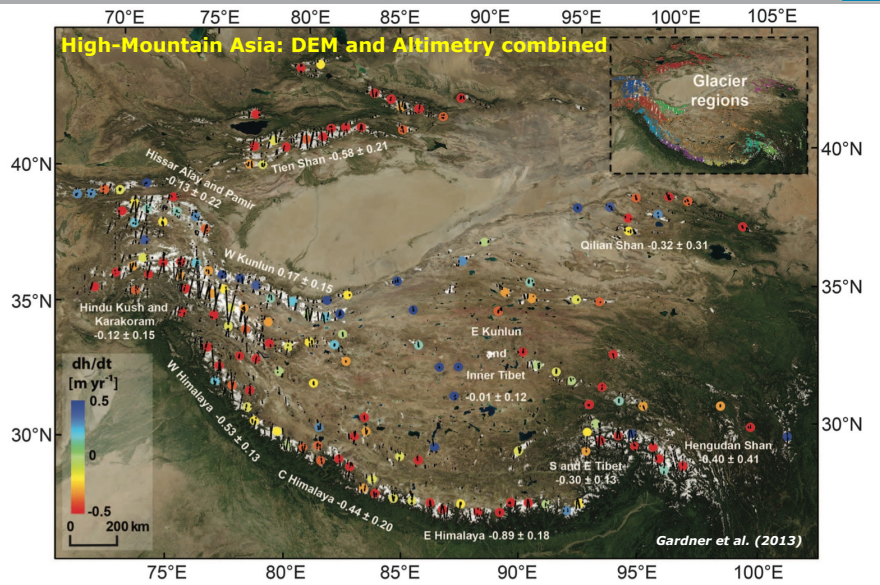


Altimetry in Greenland

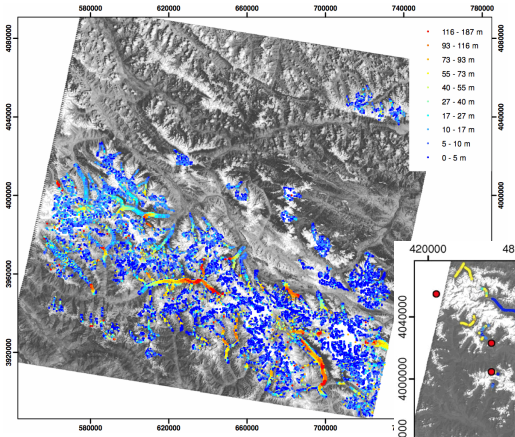


Bolch et al. (2013)

Data Products: Elevation Change

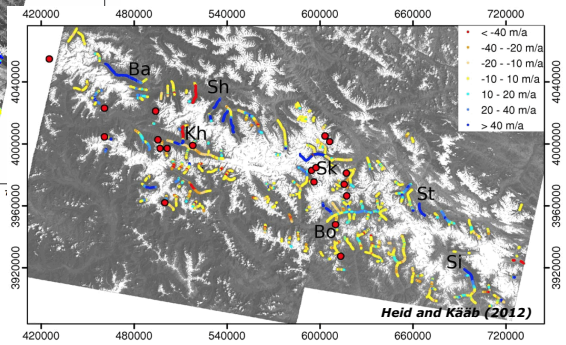


Data Products: Velocity (optical)

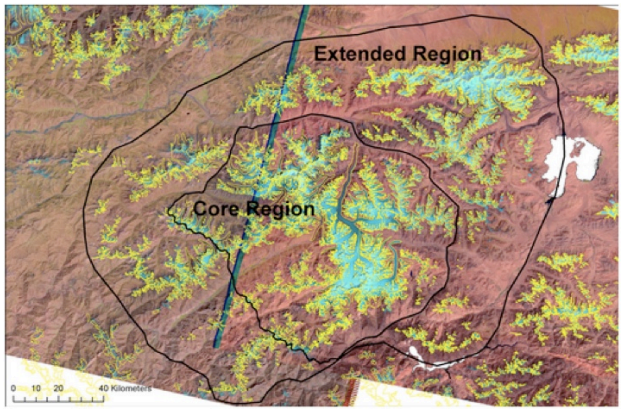


Glacier Velocity in the Karakoram

Left: One year period after filtering
Below: 10 year trends (blue: surging)



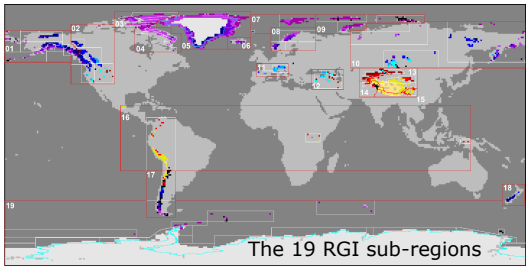
Data Products: Pamir CRDP



For a test site in the Pamir region (Fedschenkoglacier) we will create all products:
- corrected glacier outlines (to be validated with PALSAR coherence & Google Earth)
- DEMs from ASTER and SRTM, elevation changes from DEM differencing and altimetry
- velocity from optical and microwave data for different points in time

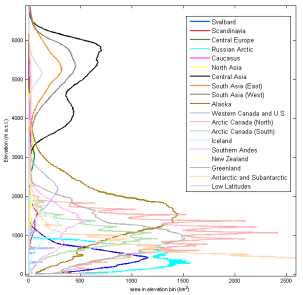
=> This package will be provided to the CRG for accuracy assessment and comments

Use of Gaciers_cci data products



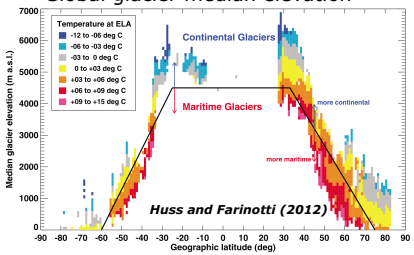
Pfeffer et al. (in prep.)

Global glacier hypso-metry



Radic et al. (2013)

Global glacier median elevation



Huss and Farinotti (2012)

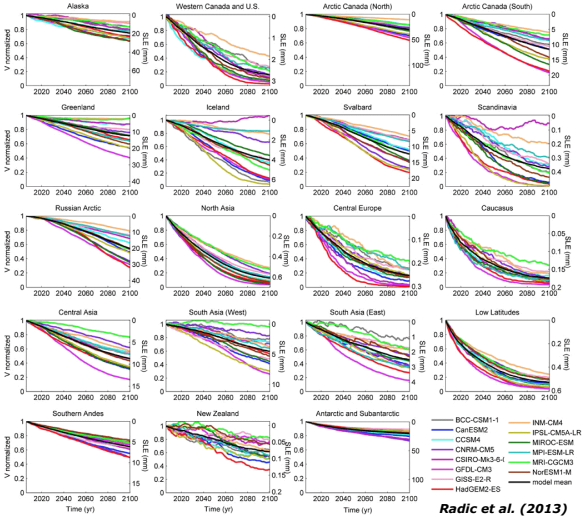
Number, area, volume, thickness of all glaciers

Region	n	S (km^2)	V (km^3)	$\bar{h}$ (m)	SLE (mm)
Alaska	22,916	89,901	20,402 ± 1,501	226	50.7 ± 3.7
Antarctic and Subantarctic	3,318	133,173	37,517 ± 8,402	281	93.1 ± 20.9
Arctic Canada North	3,205	105,139	34,399 ± 4,699	327	85.4 ± 11.7
Arctic Canada South	6,679	40,893	9,814 ± 1,115	240	24.4 ± 2.8
Caucasus and Middle East	1,335	1,121	61 ± 6	55	0.2 ± 0.0
Central Asia	30,131	64,448	5,026 ± 503	77	12.5 ± 1.2
Central Europe	3,888	2,060	117 ± 10	56	0.3 ± 0.0
Greenland Periphery	13,860	87,765	19,042 ± 2,655	216	47.3 ± 6.6
Iceland	289	11,055	4,441 ± 370	401	11.0 ± 0.9
Low Latitudes	4,979	4,074	144 ± 16	35	0.4 ± 0.0
New Zealand	3,002	1,160	70 ± 5	60	0.2 ± 0.0
North Asia	3,455	2,816	140 ± 15	49	0.3 ± 0.0
Russian Arctic	353	51,665	16,839 ± 2,205	325	41.8 ± 5.5
Scandinavia	1,795	2,846	256 ± 19	90	0.6 ± 0.0
South Asia East	13,615	21,699	1,312 ± 119	60	3.3 ± 0.3
South Asia West	22,563	33,961	3,241 ± 287	95	8.0 ± 0.7
Southern Andes	19,089	32,521	6,674 ± 507	205	16.6 ± 1.3
Svalbard	2,058	33,932	9,685 ± 922	285	24.0 ± 2.3
Western Canada and USA	14,516	14,615	1,025 ± 84	70	2.5 ± 0.2
Total	171,046	734,856	170,214 ± 20,688	231	422.6 ± 57.1

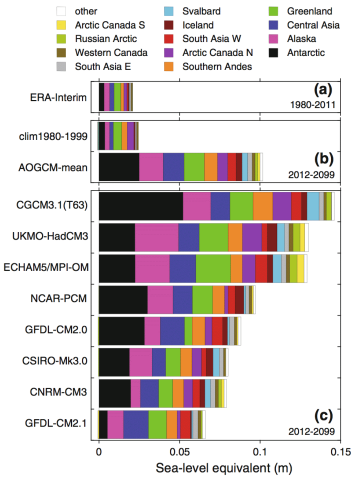
Huss and Farinotti (2012)

Use of Gaciers_cci data products

Coupling climate models with glacier models to determine future sea-level rise



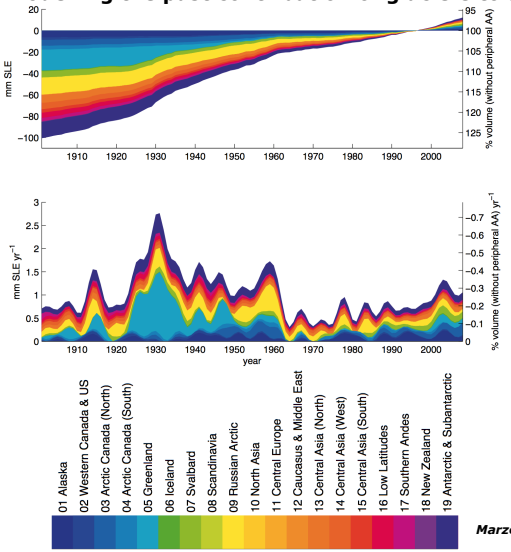
Radic et al. (2013)



Giesen and Oerlemans (2013)

Use of Gaciers_cci data products

Modelling the past contribution of glaciers to sea-level rise



Marzeion et al. (2012)

IPCC Publications using RGI data

Giesen, R.H. and Oerlemans, J., 2013: Climate-model induced differences in the 21st century global and regional glacier contributions to sea-level rise. *Climate Dynamics*.

Grinsted, A., 2013: An estimate of global glacier volume. *The Cryosphere*, **7**, 141-151.

Huss, M., and D. Farinotti, 2012: Distributed ice thickness and volume of 180,000 glaciers around the globe. *Journal of Geophysical Research*, **117**, F04010.

Marzeion, B., A. H. Jarosch, and M. Hofer, 2012: Past and future sea-level change from the surface mass balance of glaciers. *The Cryosphere*, **6**, 1295-1322.

Radić, V., A. Bliss, A. C. Beedlow, R. Hock, E. Miles, and J. G. Cogley, 2013: Regional and global projections of the 21st century glacier mass changes in response to climate scenarios from GCMs. *Climate Dynamics*.

Key Publications

Ahrendt, A. et al. (2012): Randolph Glacier Inventory [v2.0]: A Dataset of Global Glacier Outlines, Boulder, Colorado, Digital Media.

Bolch, T., Kulkarni, A., Kääb, A., Huggel, H., Paul, F., Cogley, J.G., Frey, H., Kargel, J.S., Fujita, K., Scheel, M., Bajracharya, S. and Stoffel, M. (2012): The state and fate of Himalayan glaciers. Science, 336, 310-314.

*Bolch, T., Sørensen, L., Mölg, N., Machguth, H., and Paul, F. (2013): Mass loss of Greenland's glaciers and ice caps 2003-2008 revealed from ICESat data. *Geophysical Research Letters*, 40, 875-881.

***Gardner, A.S., G. Moholdt, J.G. Cogley, B. Wouters, A.A. Arendt, J. Wahr, E. Berthier, R. Hock, W.T. Pfeffer, G. Kaser, S.R.M. Ligtenberg, T. Bolch, M.J. Sharp, J.O. Hagen, M.R. van den Broecke and F. Paul (2013)**: A consensus estimate of glacier contributions to sea level rise: 2003 to 2009. *Science*, 340 (6134), 852-857.

Heid, T. and Kääb, A. (2012a): Evaluation of existing image matching methods for deriving glacier surface displacements globally from optical satellite imagery. *Remote Sensing of Environment*, 118, 339-355.

Heid, T. and Kääb, A. (2012b): Repeat optical satellite images reveal widespread and long term decrease in land-terminating glacier speeds. *The Cryosphere*, 6, 467-478.

Kääb A., Berthier, E., Nuth, C., Gardelle, J. and Arnaud, Y. (2012): Contrasting patterns of early 21st century glacier mass change in the Hindu Kush - Karakoram - Himalaya. *Nature*, 488, 495-498.

Nuth, C. and Kääb, A. (2011): Co-registration and bias corrections of satellite elevation data sets for quantifying glacier thickness change. *The Cryosphere*, 5, 271-290.

Nuth C., Schuler T.V., Kohler J., Altena B. and Hagen J.O. (2012): Estimating the long term calving flux of Kronebreen, Svalbard, from geodetic elevation changes and mass balance modelling. *J. Glaciol.*, 58 (207), 119-133.

Paul, F. (2011): Melting glaciers and ice caps. *Nature Geoscience*, 4 (2), 71-72.

Paul, F., N. Barrand, S. Baumann, E. Berthier, T. Bolch, K. Casey, H. Frey, S.P. Joshi, V. Konovalov, R. Le Bris, N. Mölg, G. Nosenko, C. Nuth, A. Pope, A. Racoviteanu, P. Rastner, B. Raup, K. Scharrer, S. Steffen and S. Winsvold (in press): On the accuracy of glacier outlines derived from remote sensing data. *Ann. Glaciol.*, 54 (63), 171-182.

*Paul, F. and 24 others (subm.): The Glaciers Climate Change Initiative: Algorithms for creating glacier area, elevation change and velocity products. *Remote Sensing of Environment*.

Rastner, P., T. Bolch, N. Mölg, H. Machguth, R. Le Bris and F. Paul (2013): The first complete inventory of the local glaciers and ice caps on Greenland. *The Cryosphere*, 6, 1483-1495.

(**Bold**: cited in IPCC AR5, * latest publications)