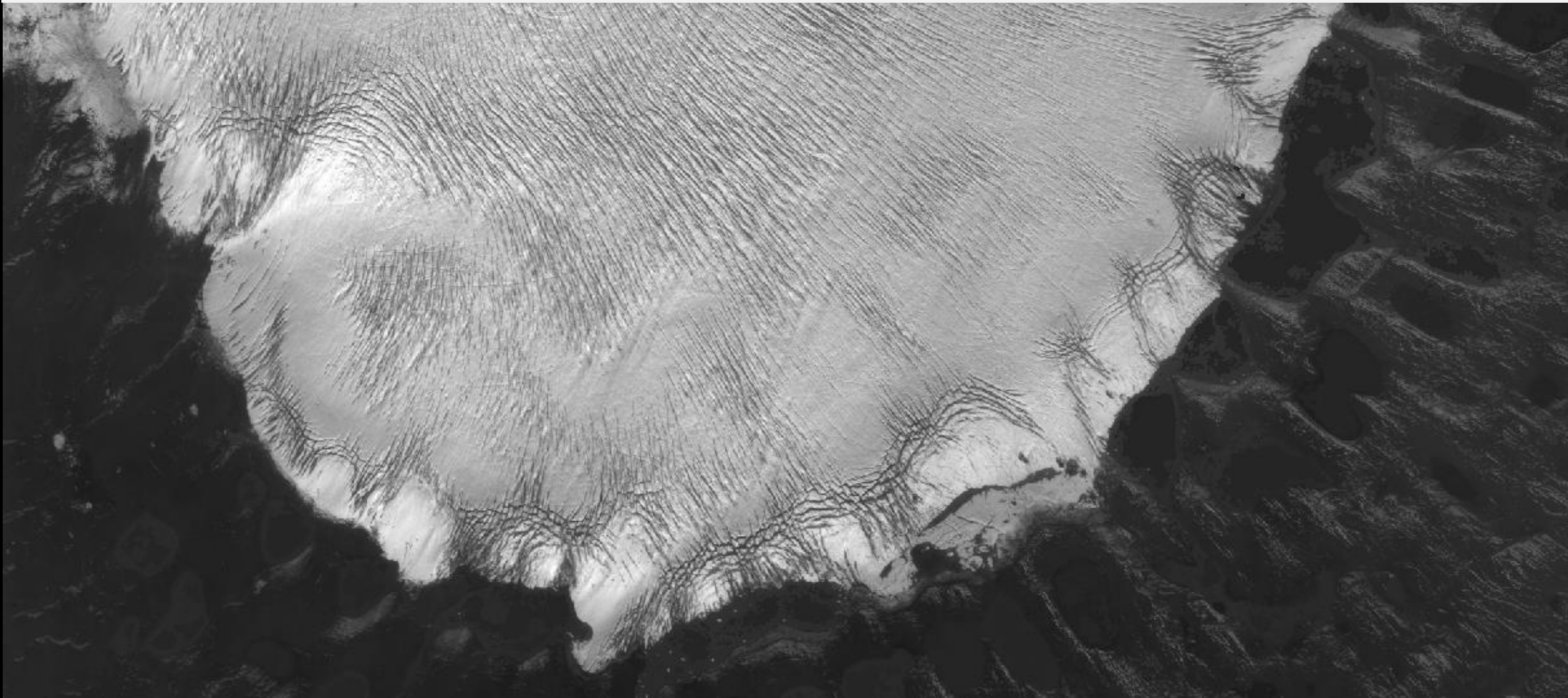


Seasonal-to-decadal geodetic mass balance of Hofsjökull, central Iceland, 1980–2020



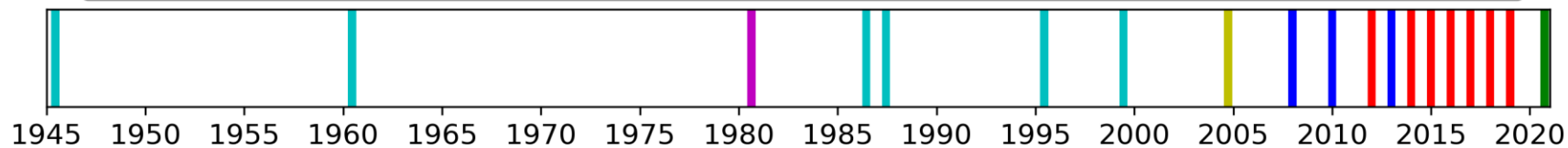
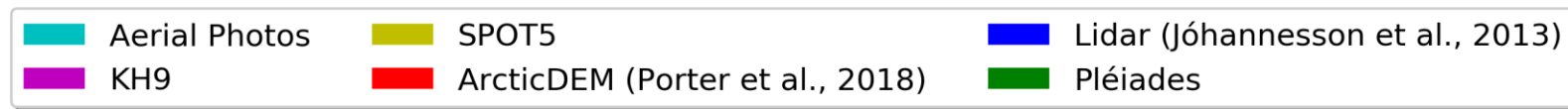
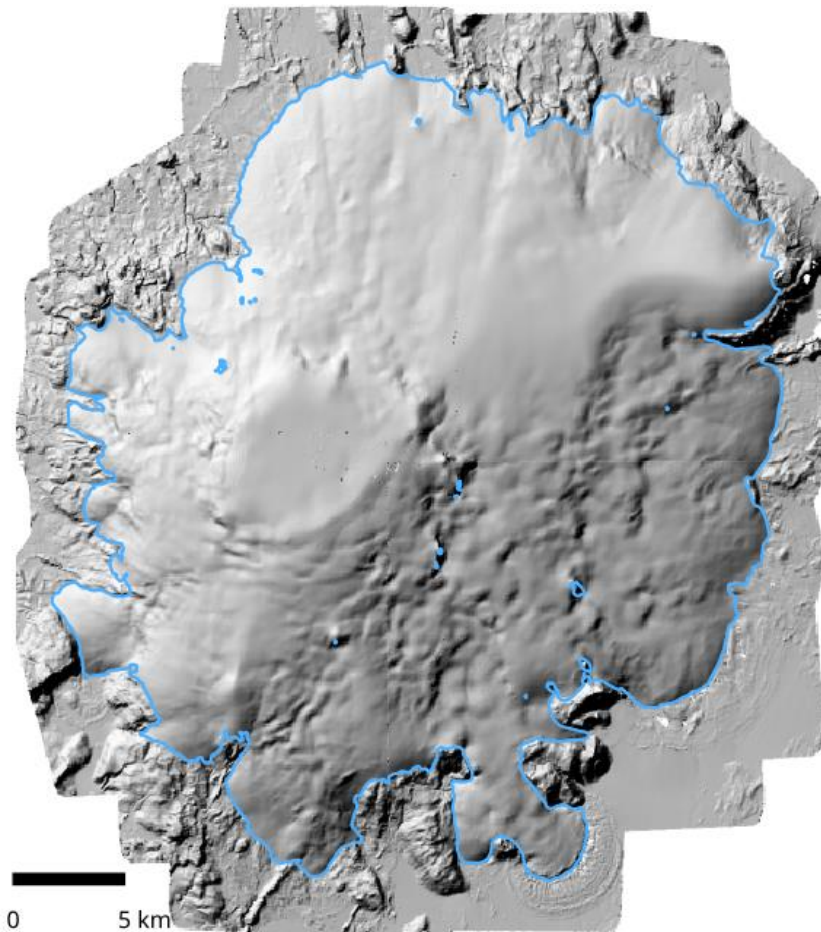
Joaquín M.C. Belart, Tómas Jóhannesson, Romain Hugonnet, Bob McNabb, Etienne Berthier, Þorsteinn Þorsteinsson, Johann Stötter

Múlajökull, 2 Oct 2020

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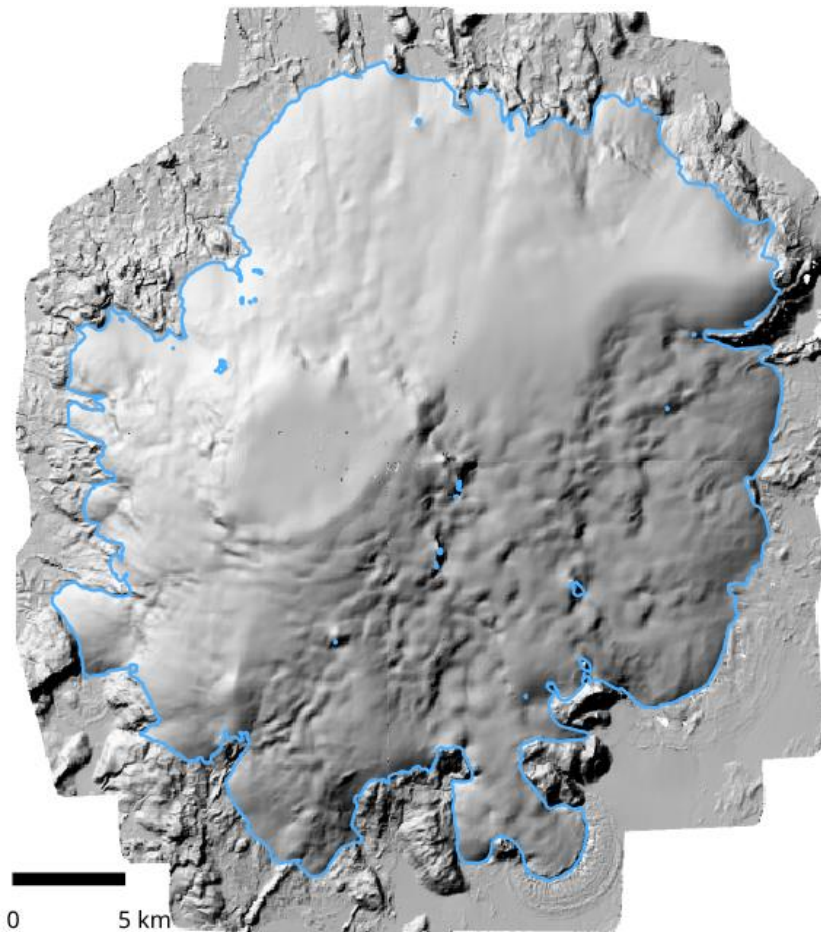
Hofsjökull, central Iceland: Data



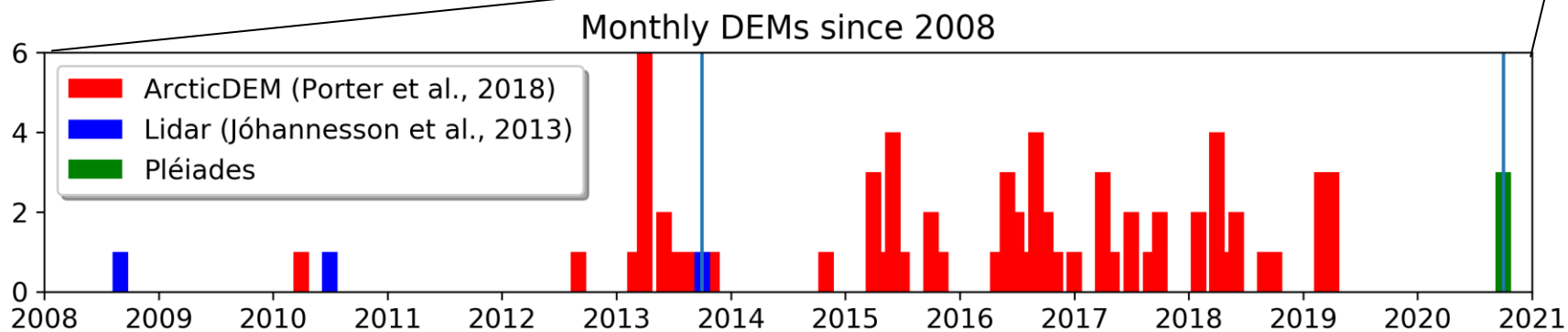
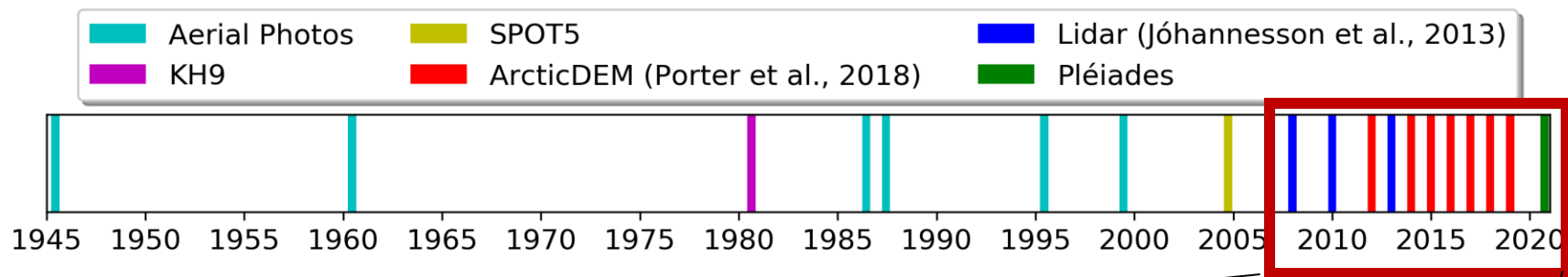
Pléiades DEM, Oct 2020



Hofsjökull, central Iceland: Data

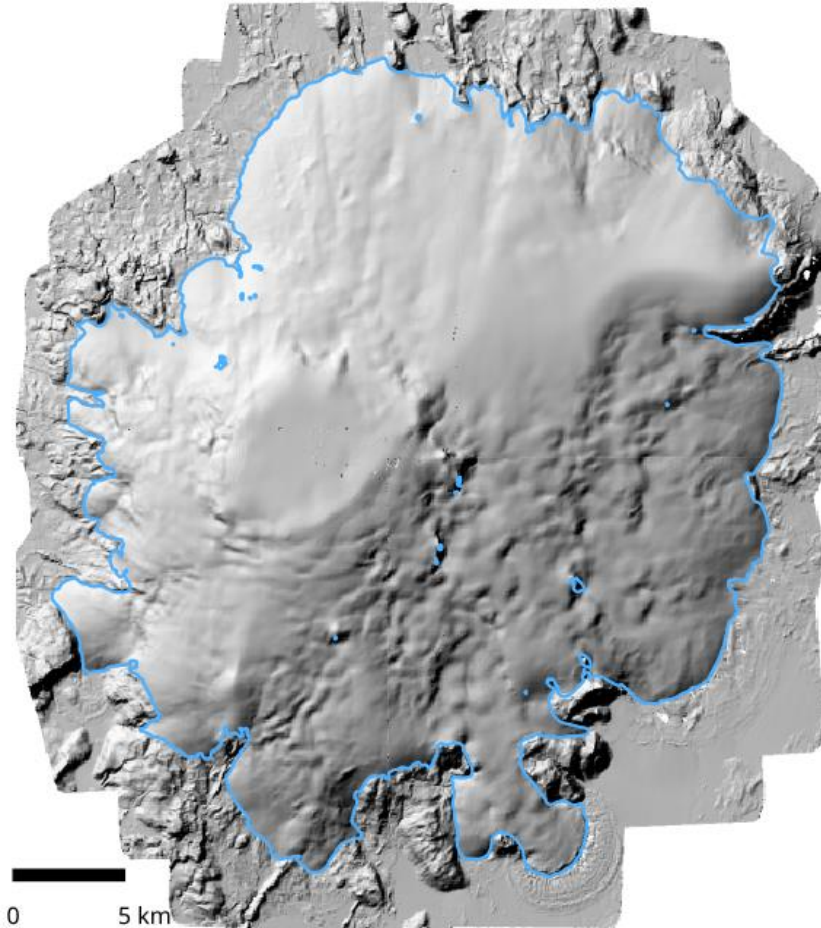


Pléiades DEM, Oct 2020

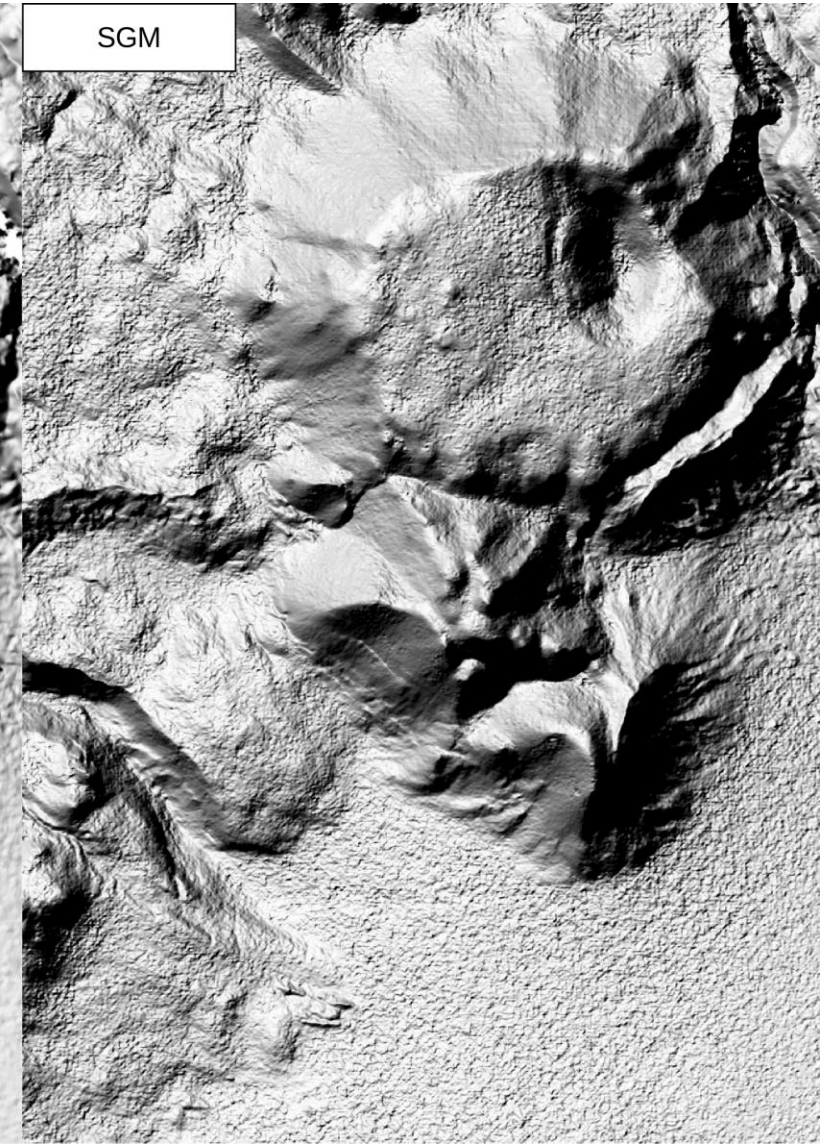
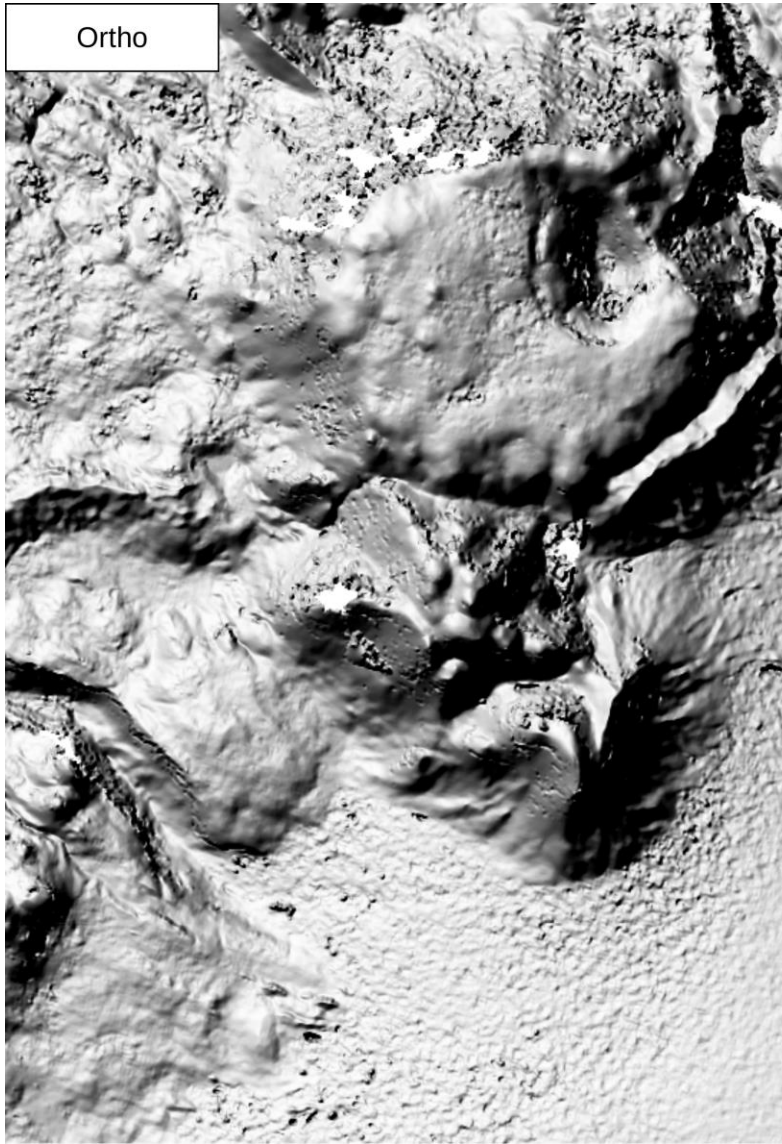


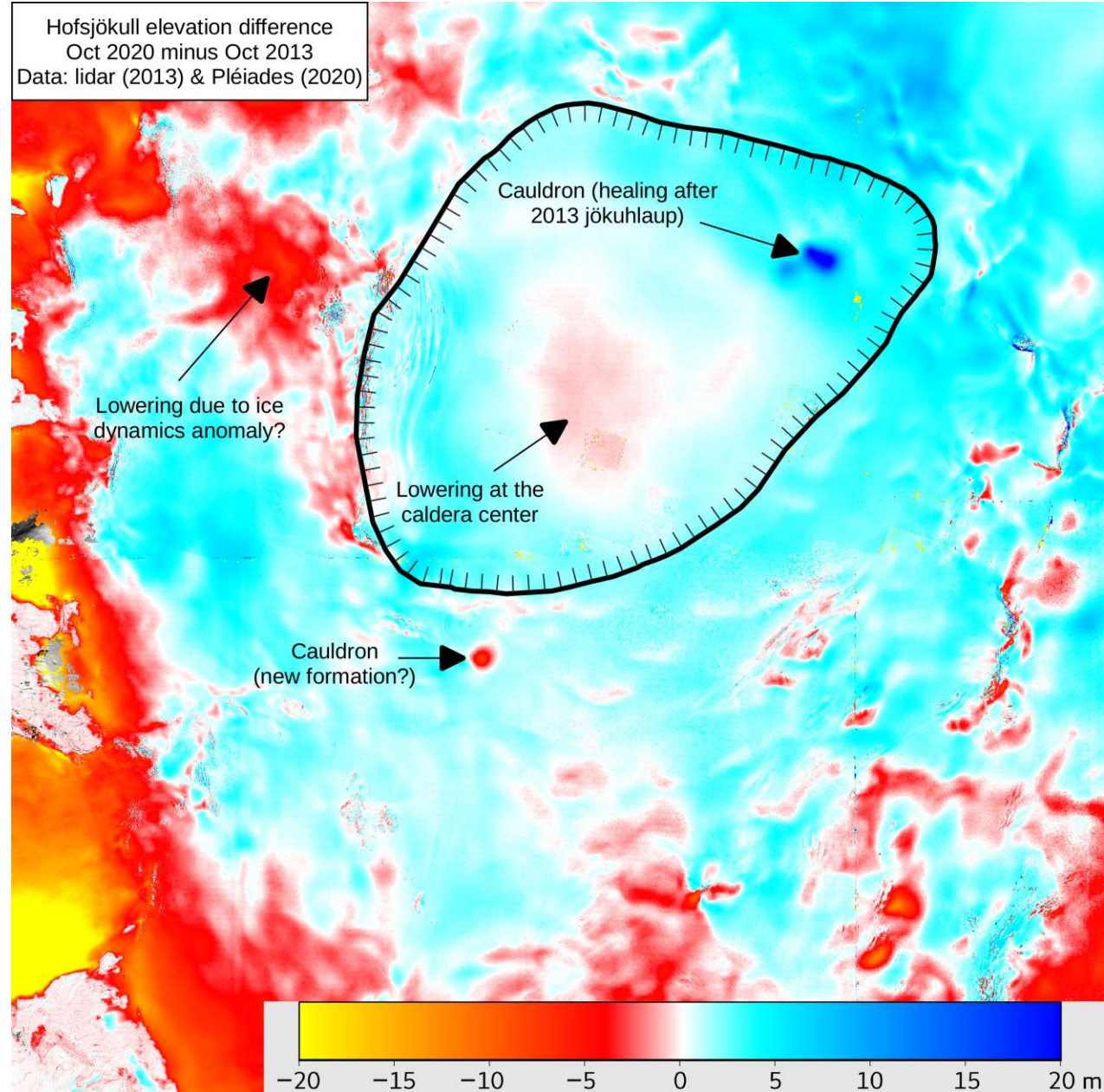
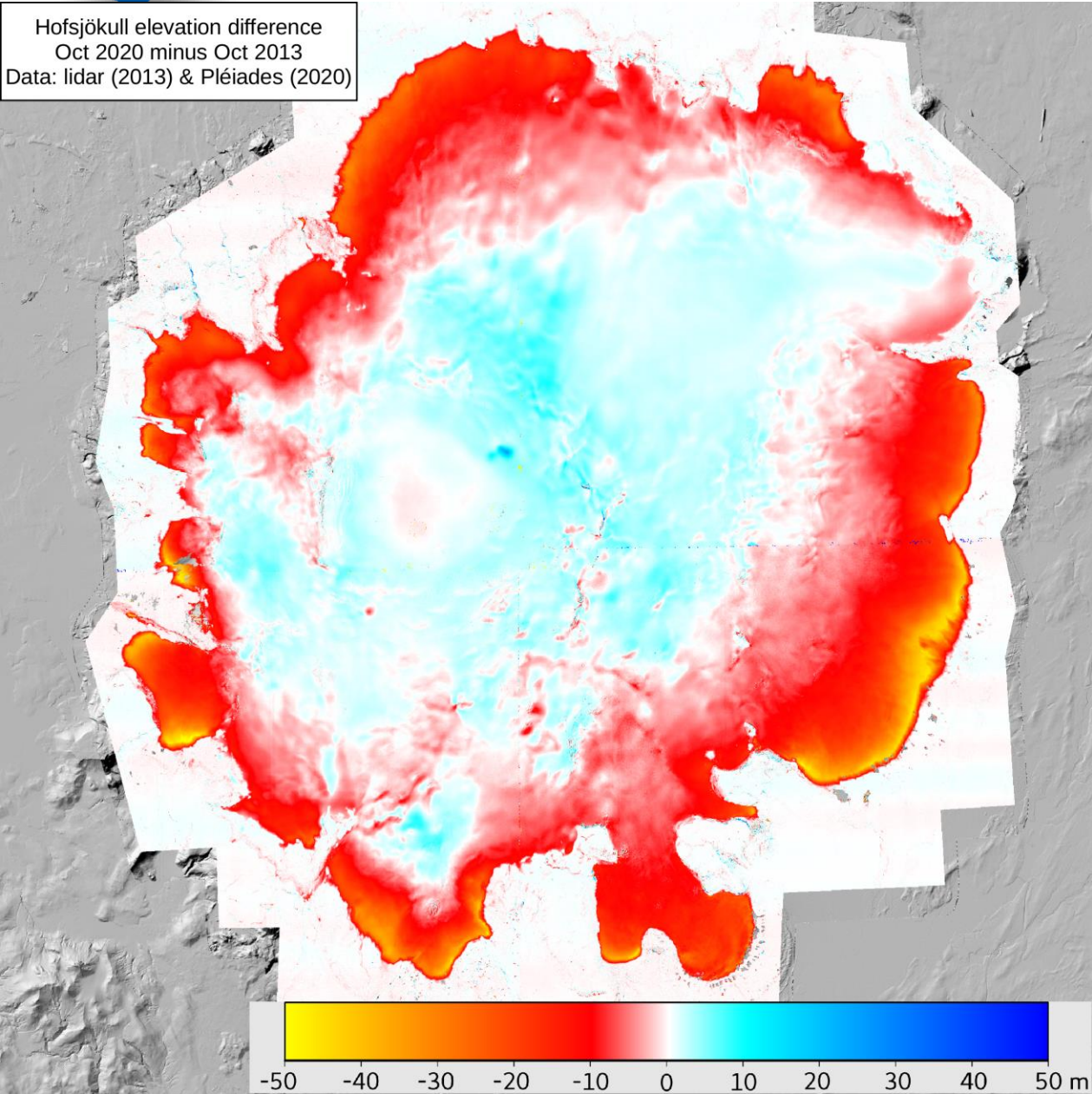


Overview of newest data: Pléiades (1, 2 and 5 Oct)



Pléiades DEM, Oct 2020

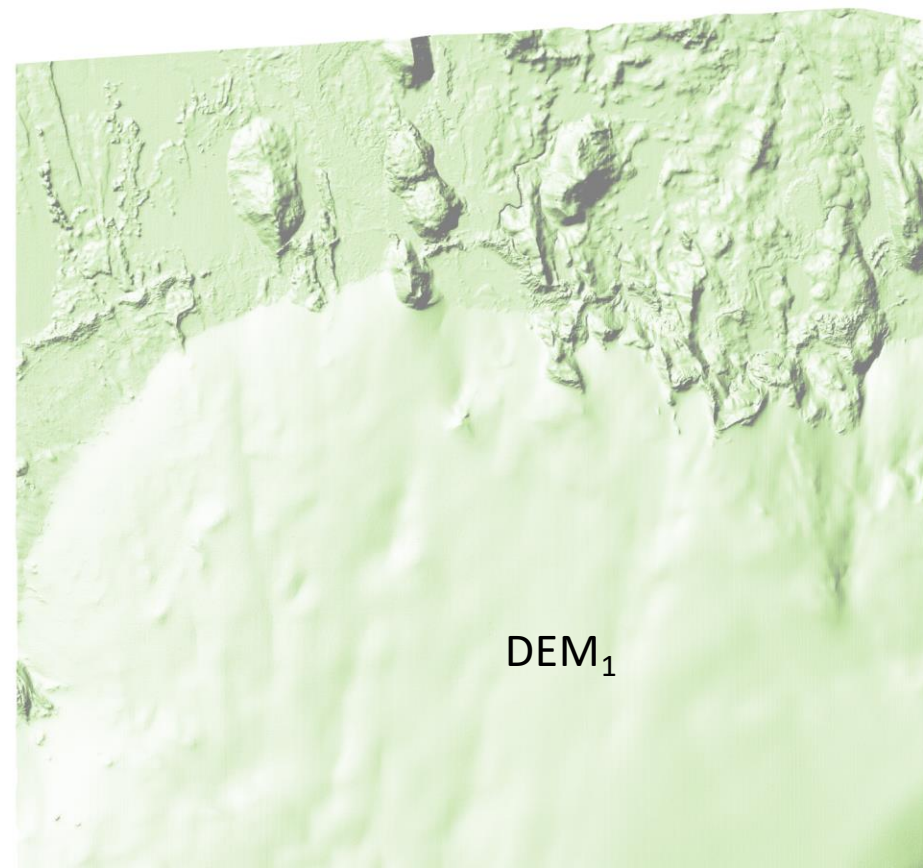






ArcticDEM co-registration

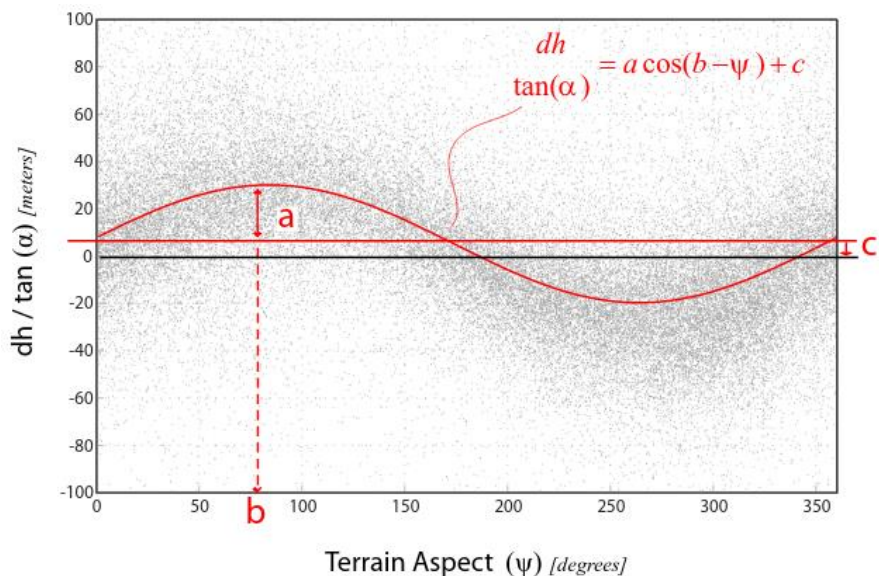
- Each DEM has a positional accuracy ± 10 m (XYZ)



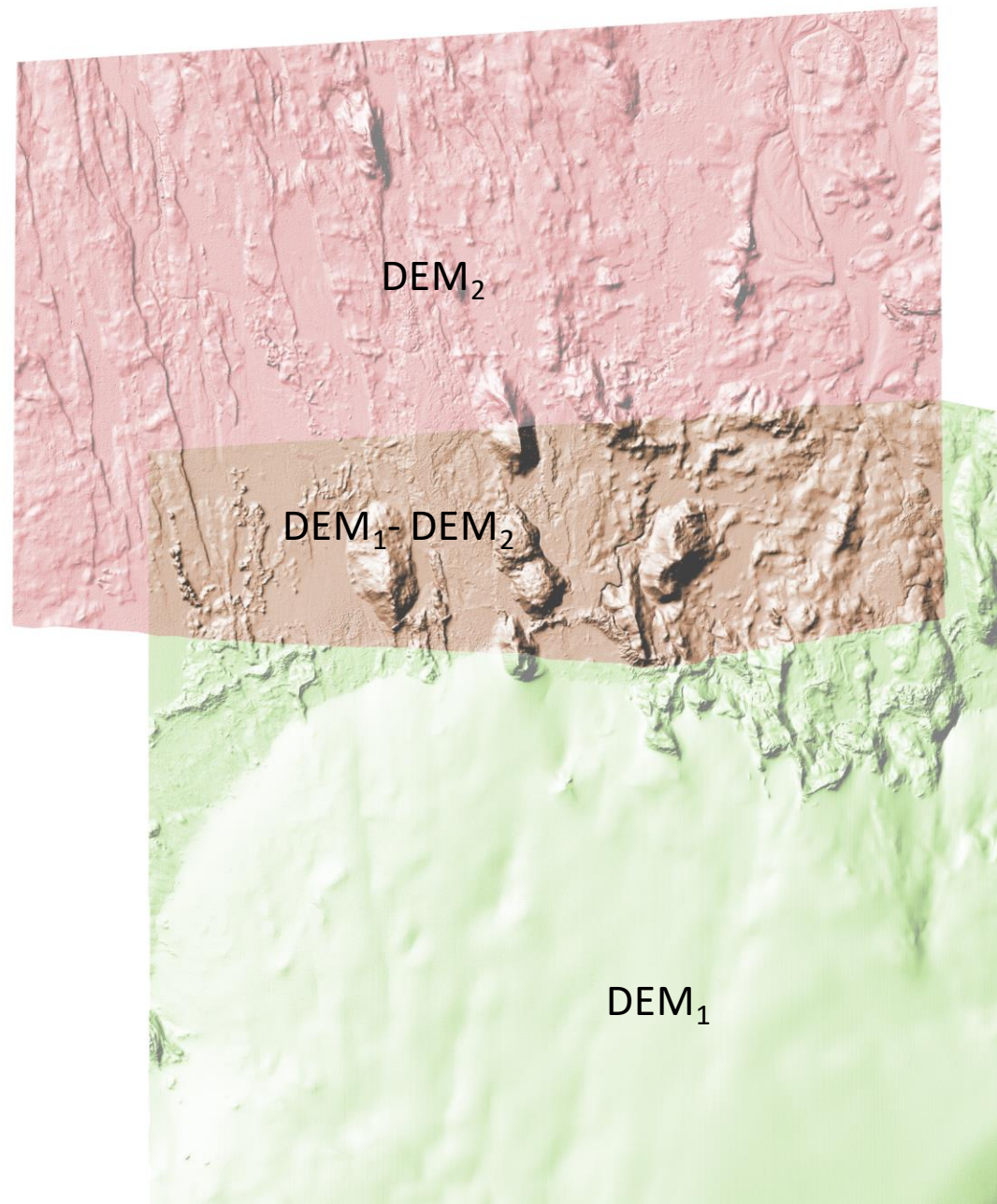


ArcticDEM co-registration

- Each DEM has a positional accuracy ± 10 m (XYZ)
- Co-registration to calculate the shift (ΔX , ΔY , ΔZ) of one DEM relative to another DEM



Nuth & Kaab TC

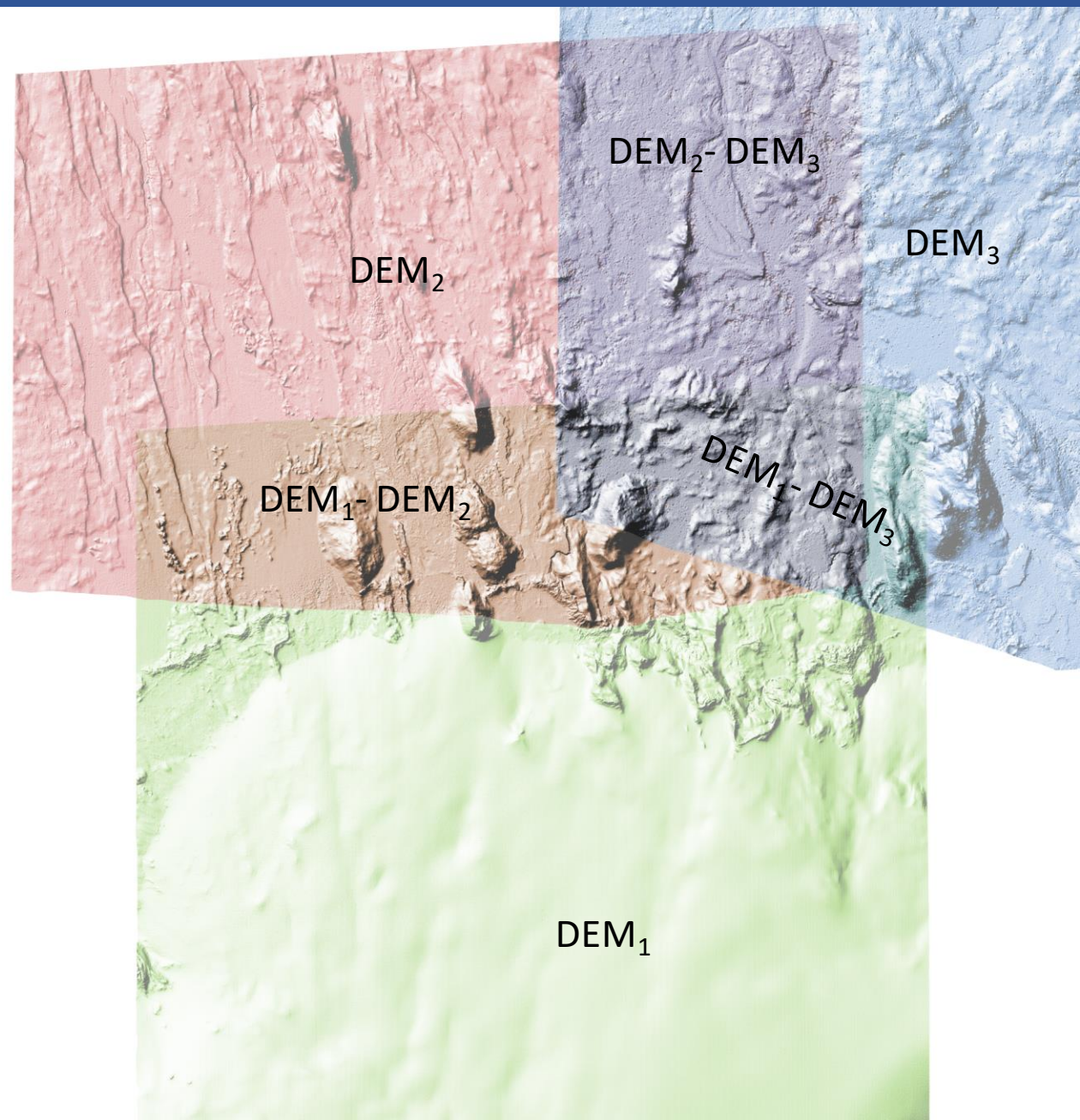




ArcticDEM co-registration

- Each DEM has a positional accuracy ± 10 m (XYZ)
- Co-registration to calculate the shift (ΔX , ΔY , ΔZ) of one DEM relative to another DEM

$DEM_1 - DEM_2 + \Delta X_{1-2} = 0$	$DEM_1 - DEM_2 + \Delta Y_{1-2} = 0$	$DEM_1 - DEM_2 + \Delta Z_{1-2} = 0$
$DEM_1 - DEM_3 + \Delta X_{1-3} = 0$	$DEM_1 - DEM_3 + \Delta Y_{1-3} = 0$	$DEM_1 - DEM_3 + \Delta Z_{1-3} = 0$
(...)	(...)	(...)



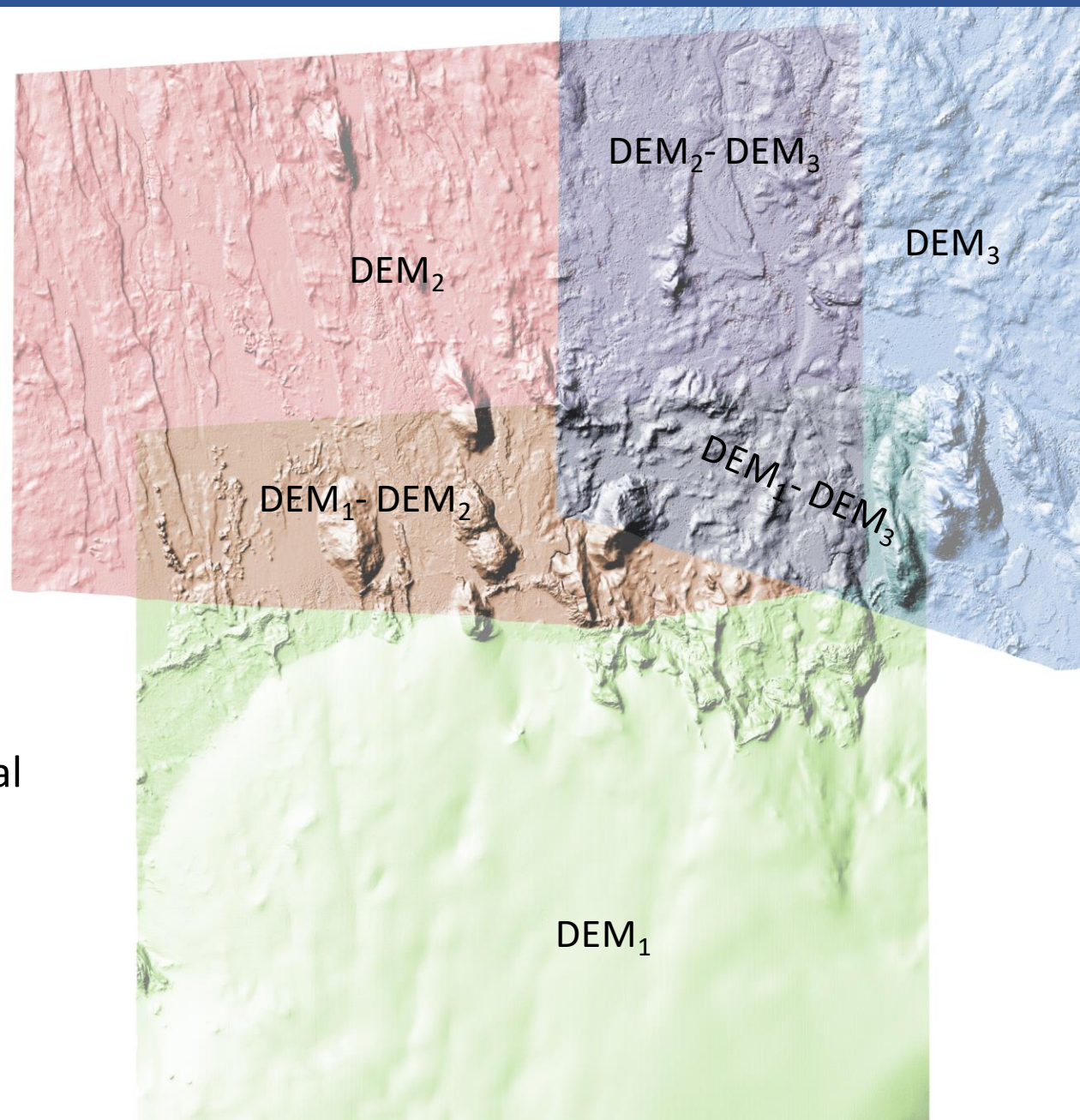


ArcticDEM co-registration

- Each DEM has a positional accuracy ± 10 m (XYZ)
- Co-registration to calculate the shift (ΔX , ΔY , ΔZ) of one DEM relative to another DEM

$$\begin{array}{lll} \text{DEM}_1 - \text{DEM}_2 + \Delta X_{1-2} = 0 & \text{DEM}_1 - \text{DEM}_2 + \Delta Y_{1-2} = 0 & \text{DEM}_1 - \text{DEM}_2 + \Delta Z_{1-2} = 0 \\ \text{DEM}_1 - \text{DEM}_3 + \Delta X_{1-3} = 0 & \text{DEM}_1 - \text{DEM}_3 + \Delta Y_{1-3} = 0 & \text{DEM}_1 - \text{DEM}_3 + \Delta Z_{1-3} = 0 \\ (\dots) & (\dots) & (\dots) \end{array}$$

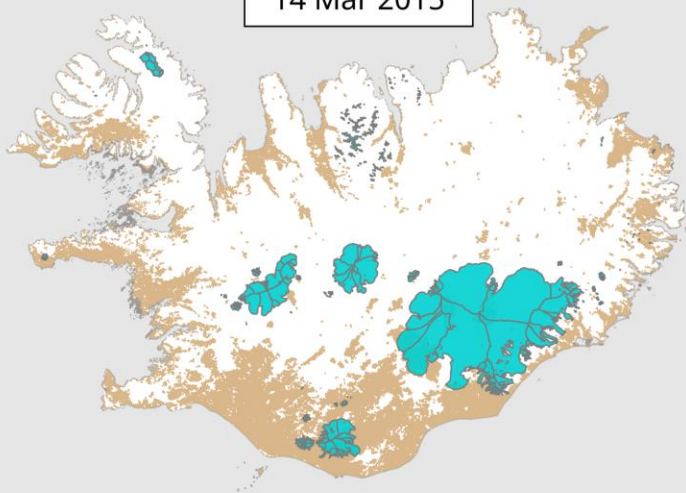
- 200 ArcticDEMs: 4000 pairwise shifts calculated. Optimal shift of each individual ArcticDEM strip
- **Horizontal accuracy >1 m (XY) and > 0.5 m (Z)**



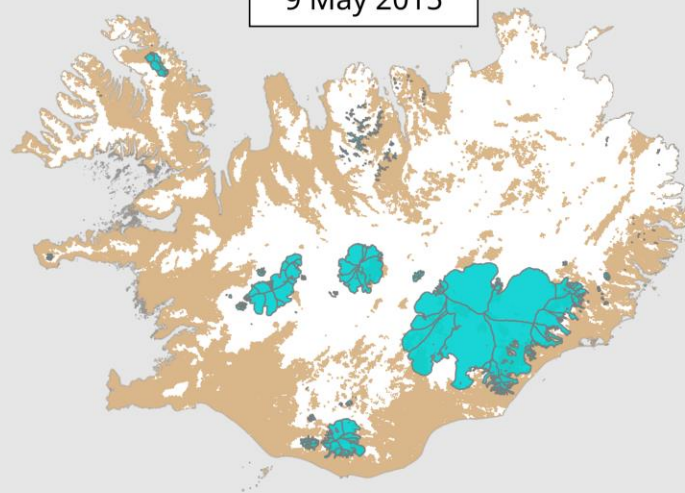


ArcticDEM co-registration: Masking

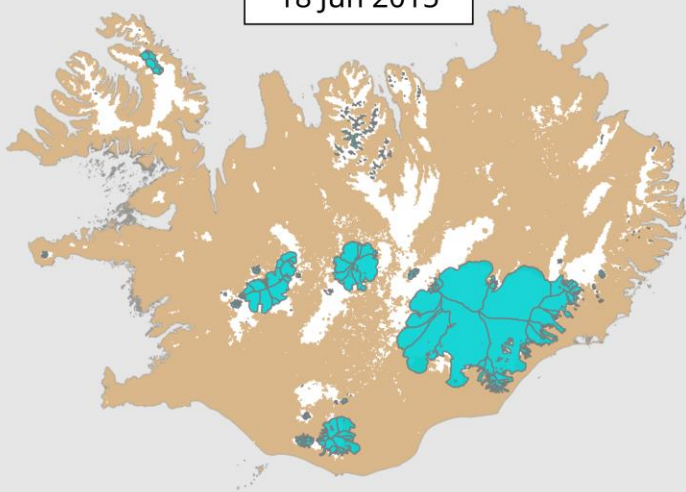
14 Mar 2015



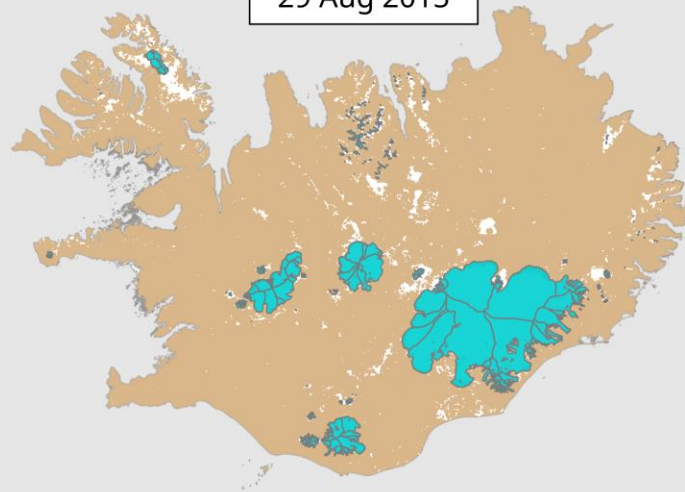
9 May 2015



18 Jun 2015



29 Aug 2015

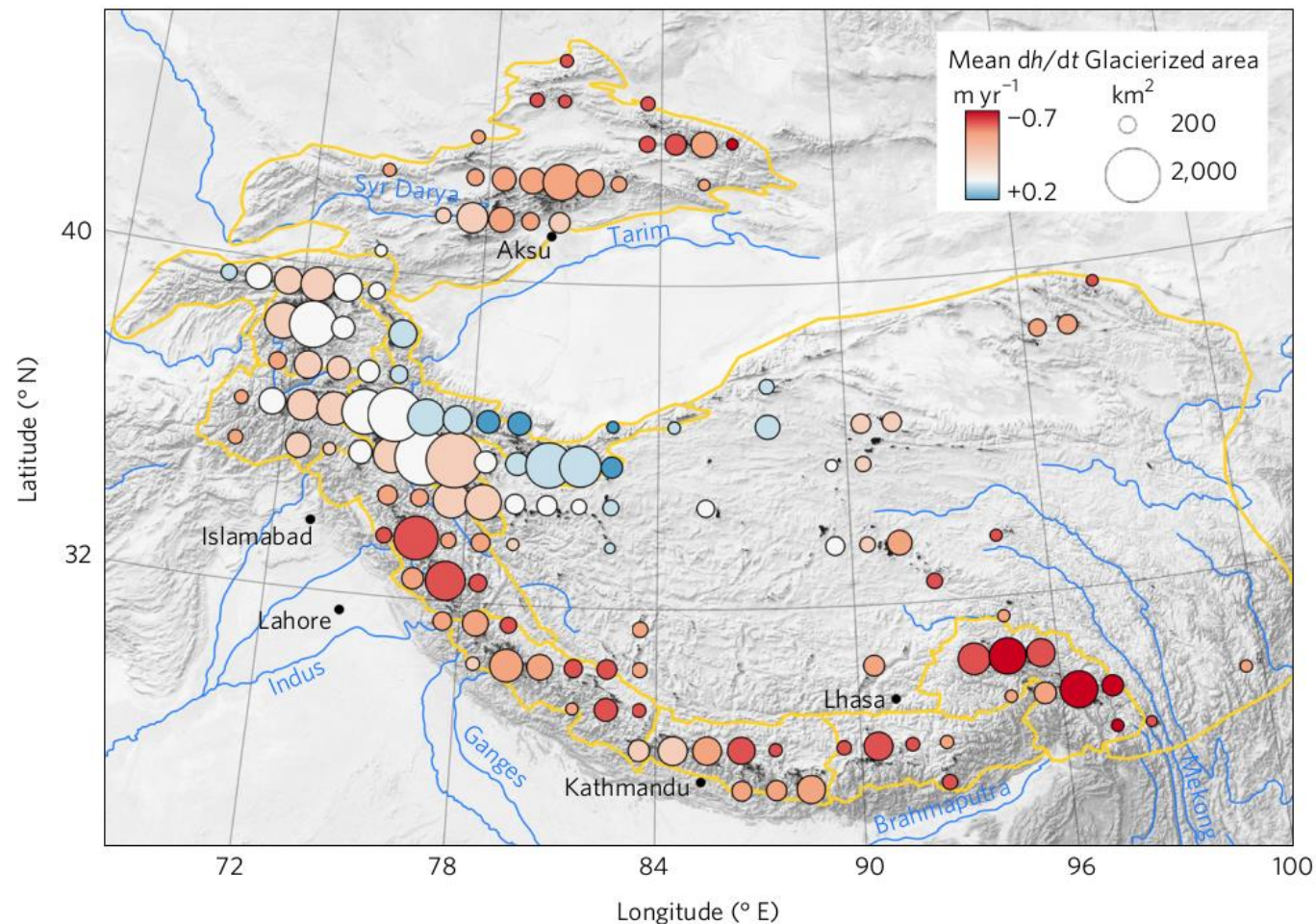
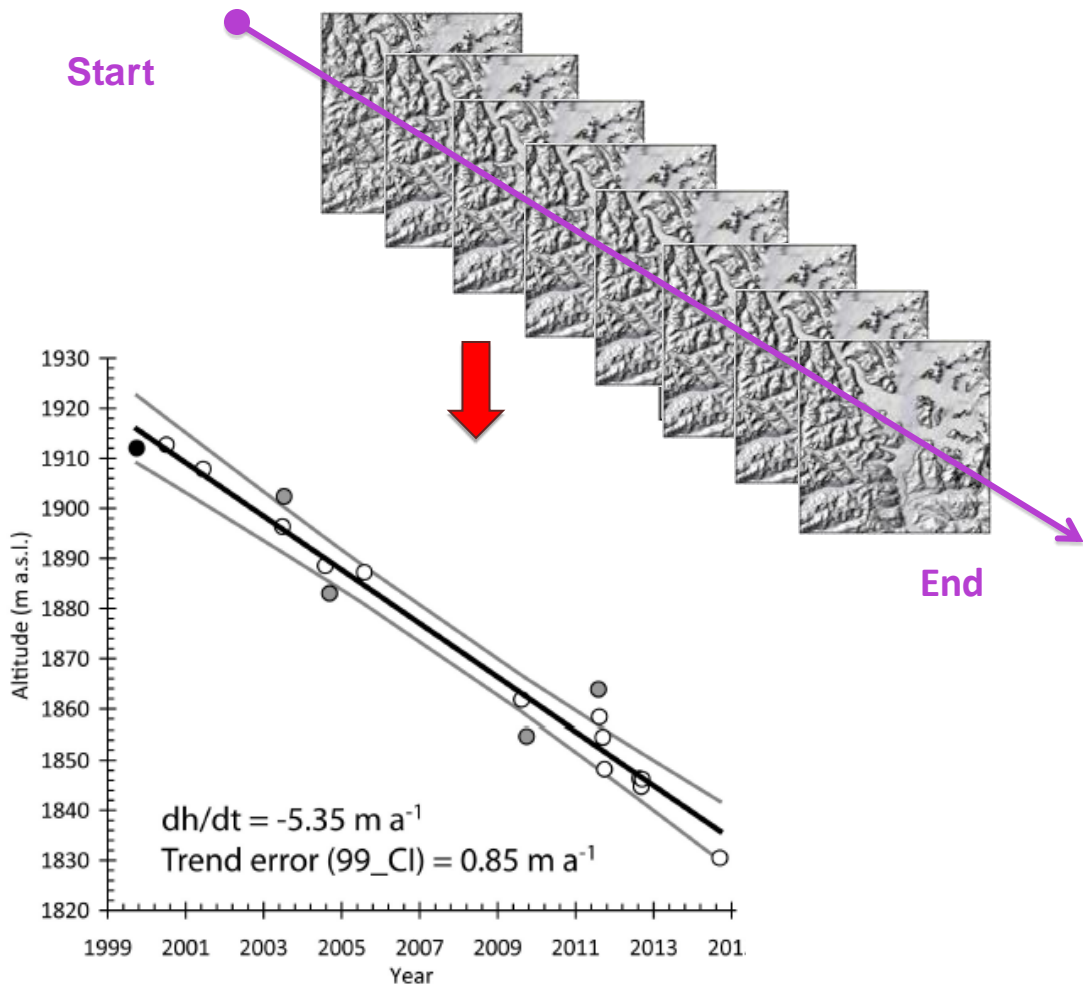


MOD10A2: 8-day snow masks since 2000
(Ref)

GLIMS Glacier outline inventory (Raup,
Hannesdóttir)



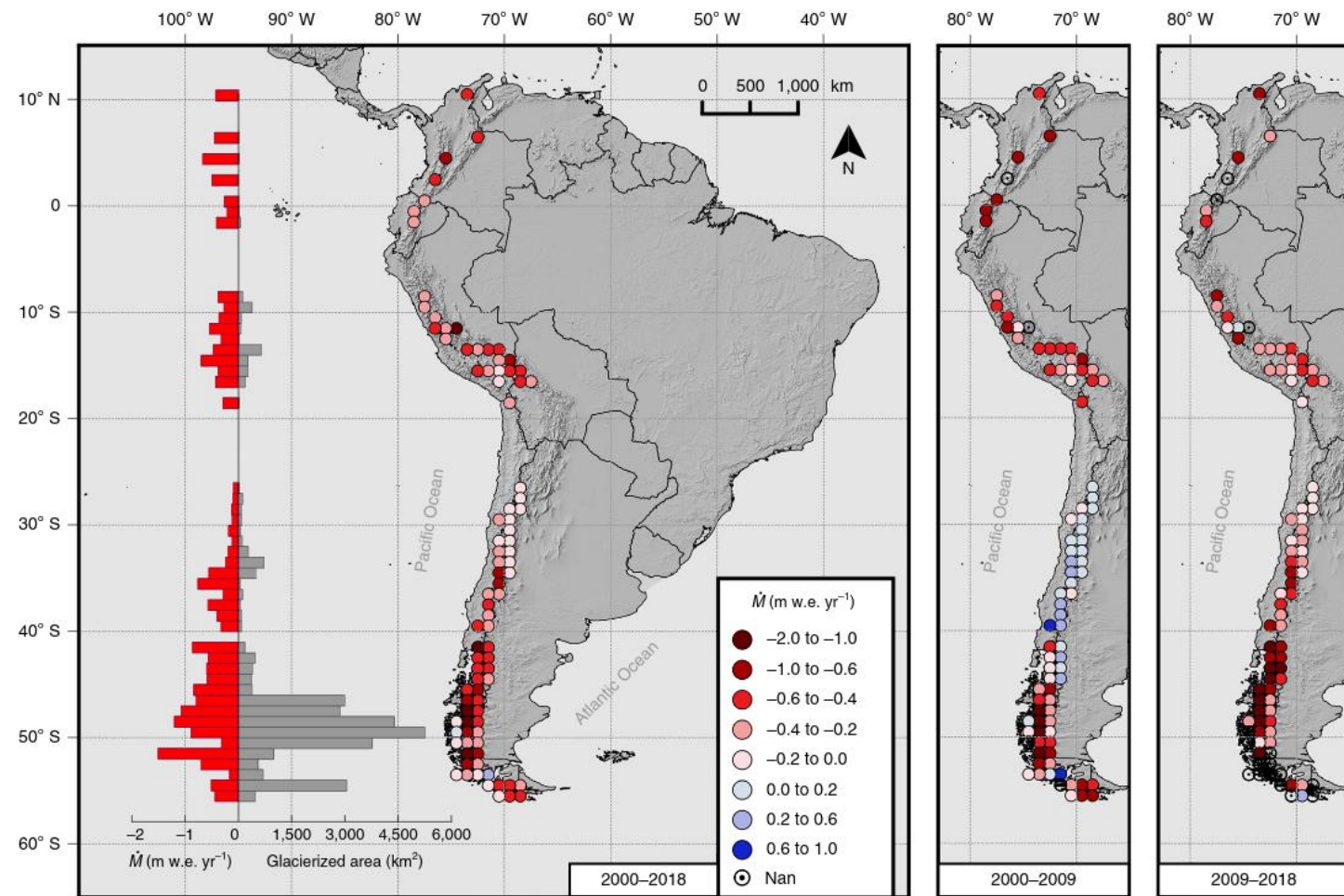
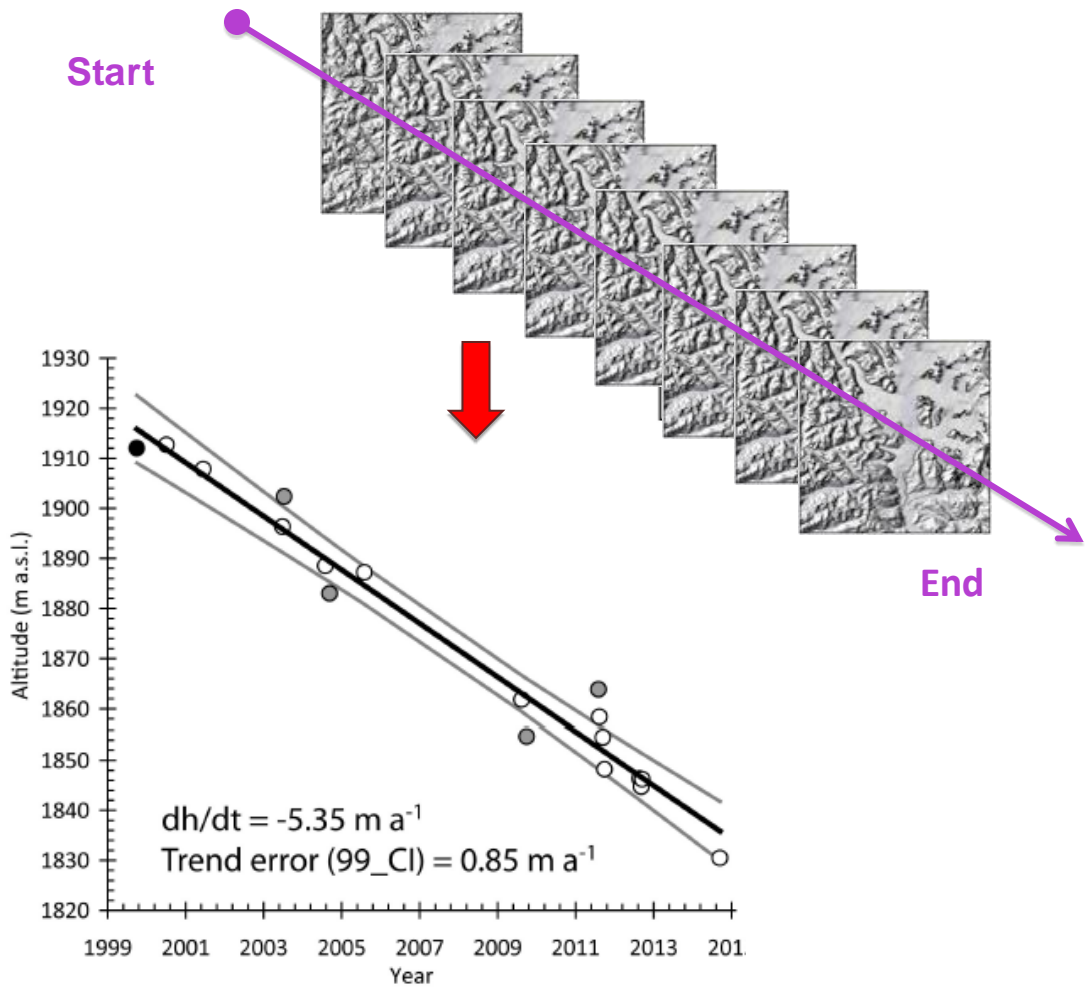
Stacks of ASTER DEMs



Brun et al., 2017. Nat. Geoscience



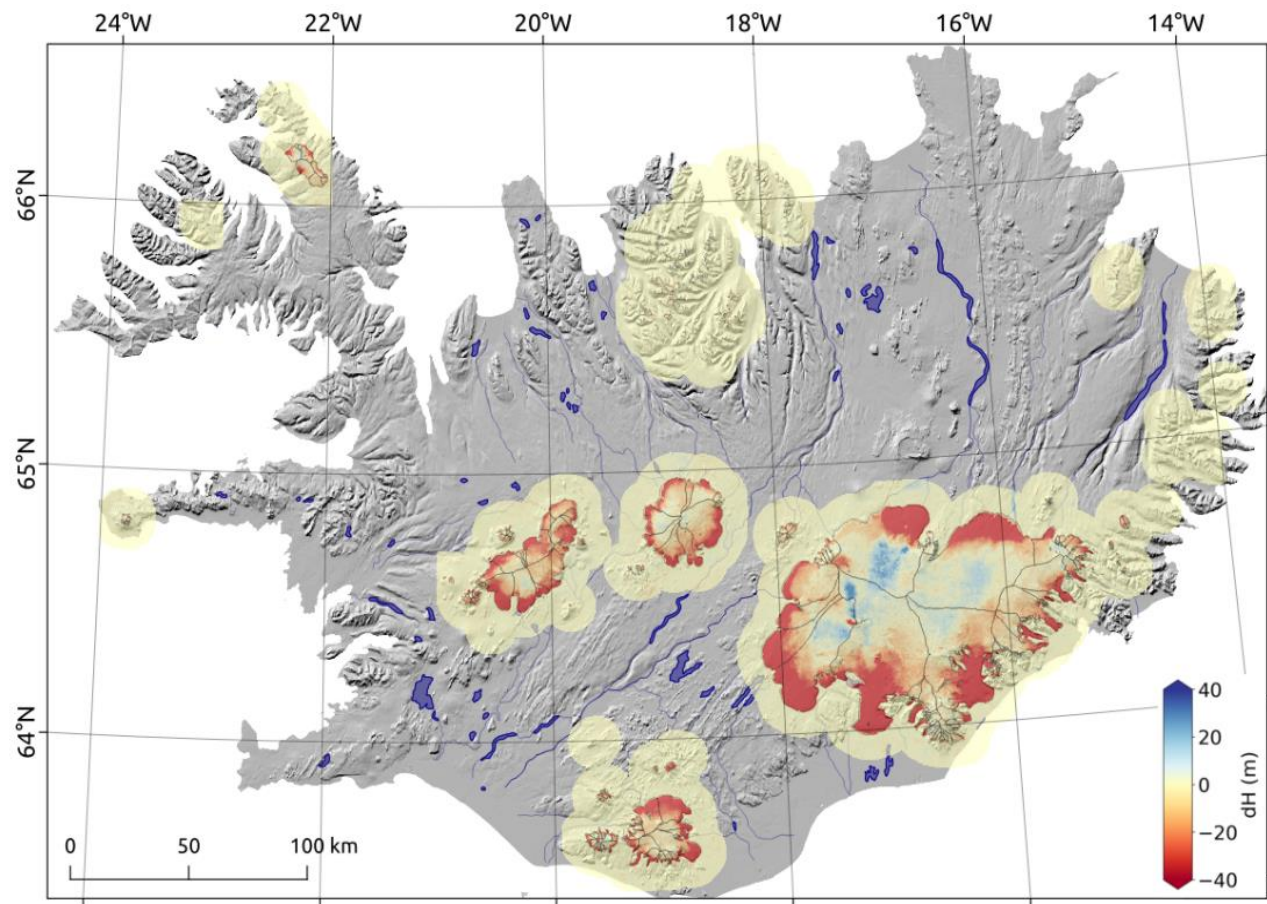
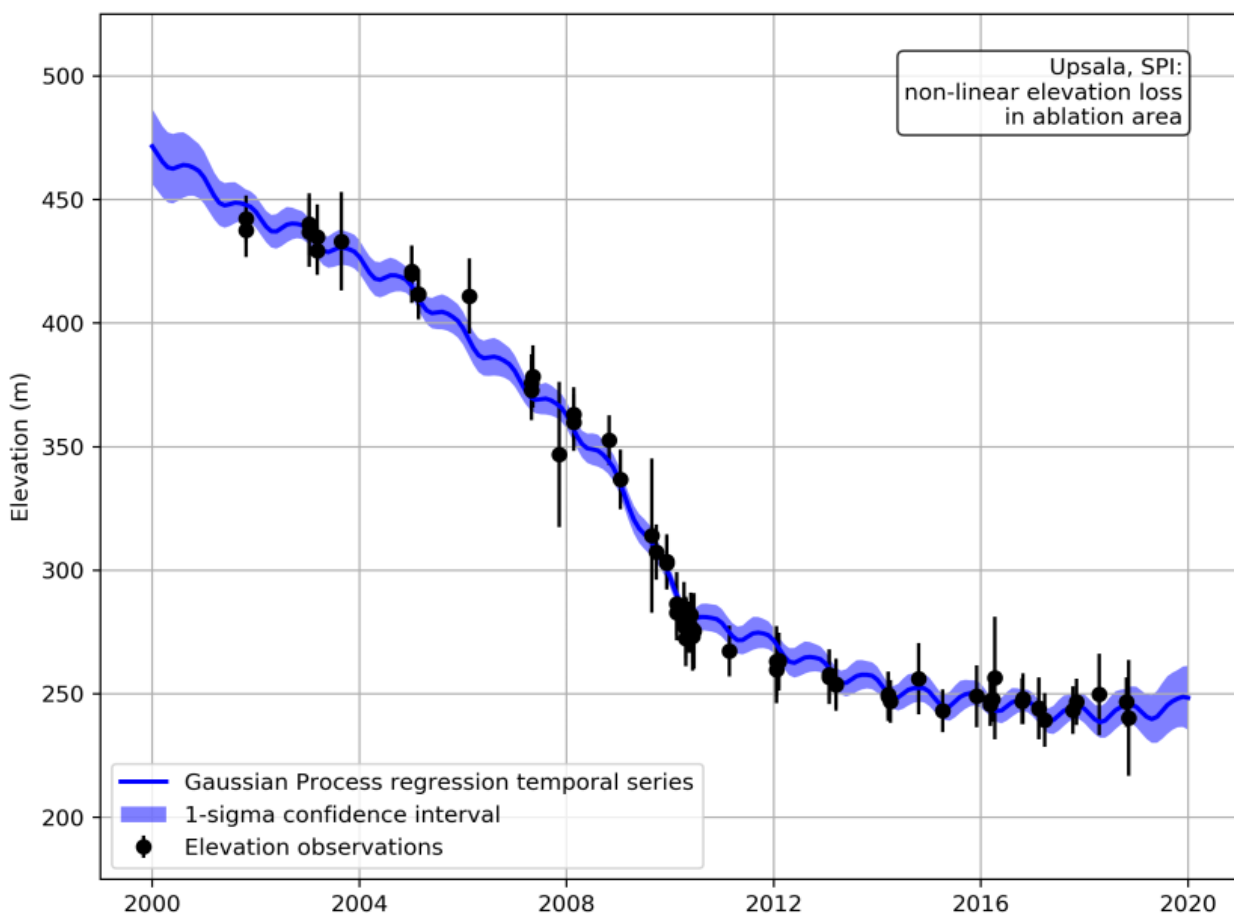
Stacks of ASTER DEMs



Dussailant et al., 2019. Nat. Geoscience



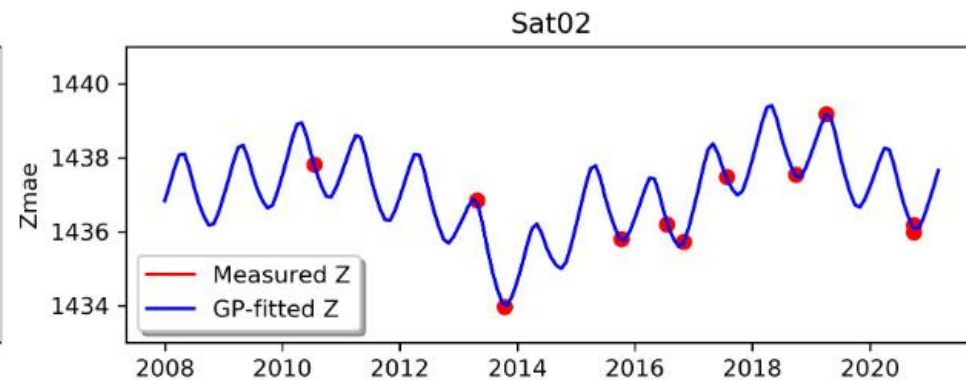
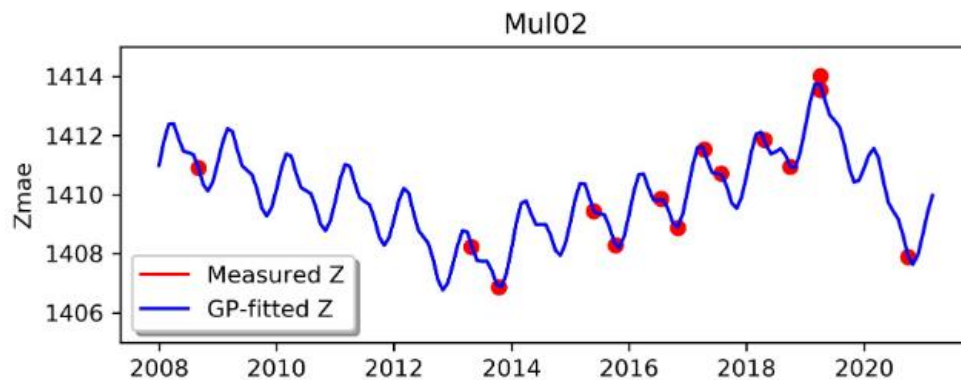
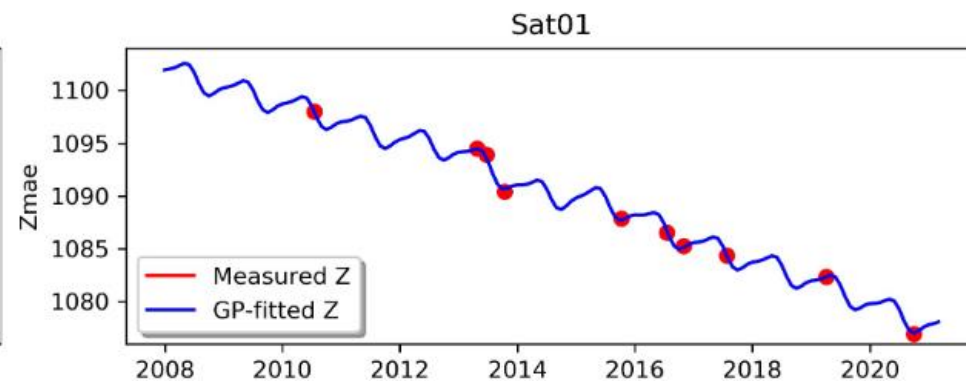
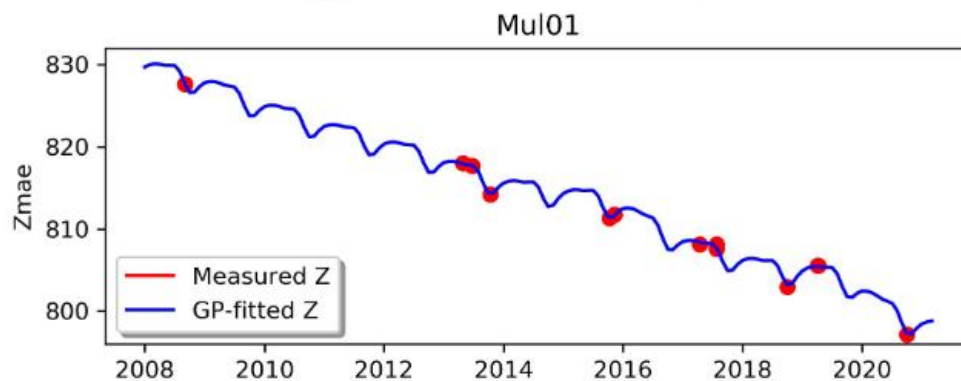
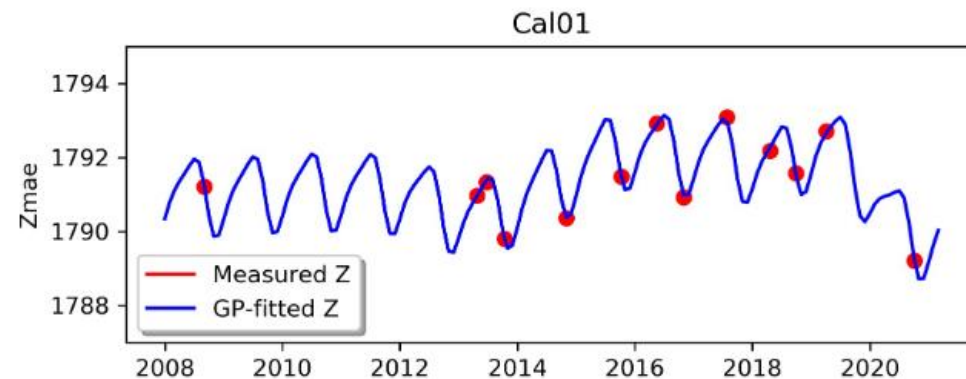
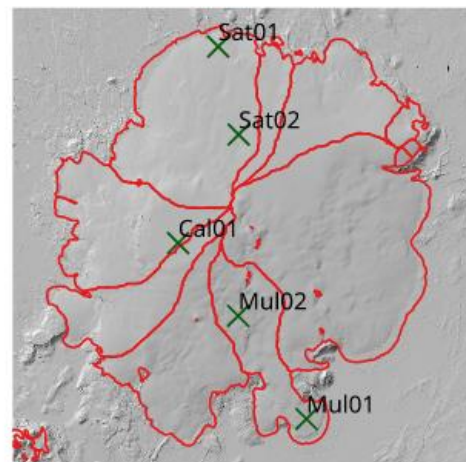
Global study: ASTER dh 2000-2019



Hugonnet et al., Nature (in revision). Figures from Hugonnet et al., EGU 2020



Hofsjökull: Gaussian Processes 2008-2020

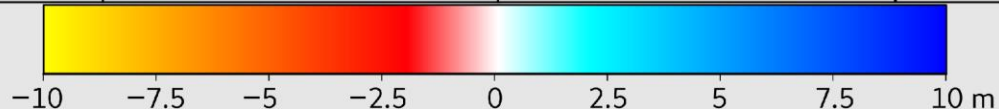
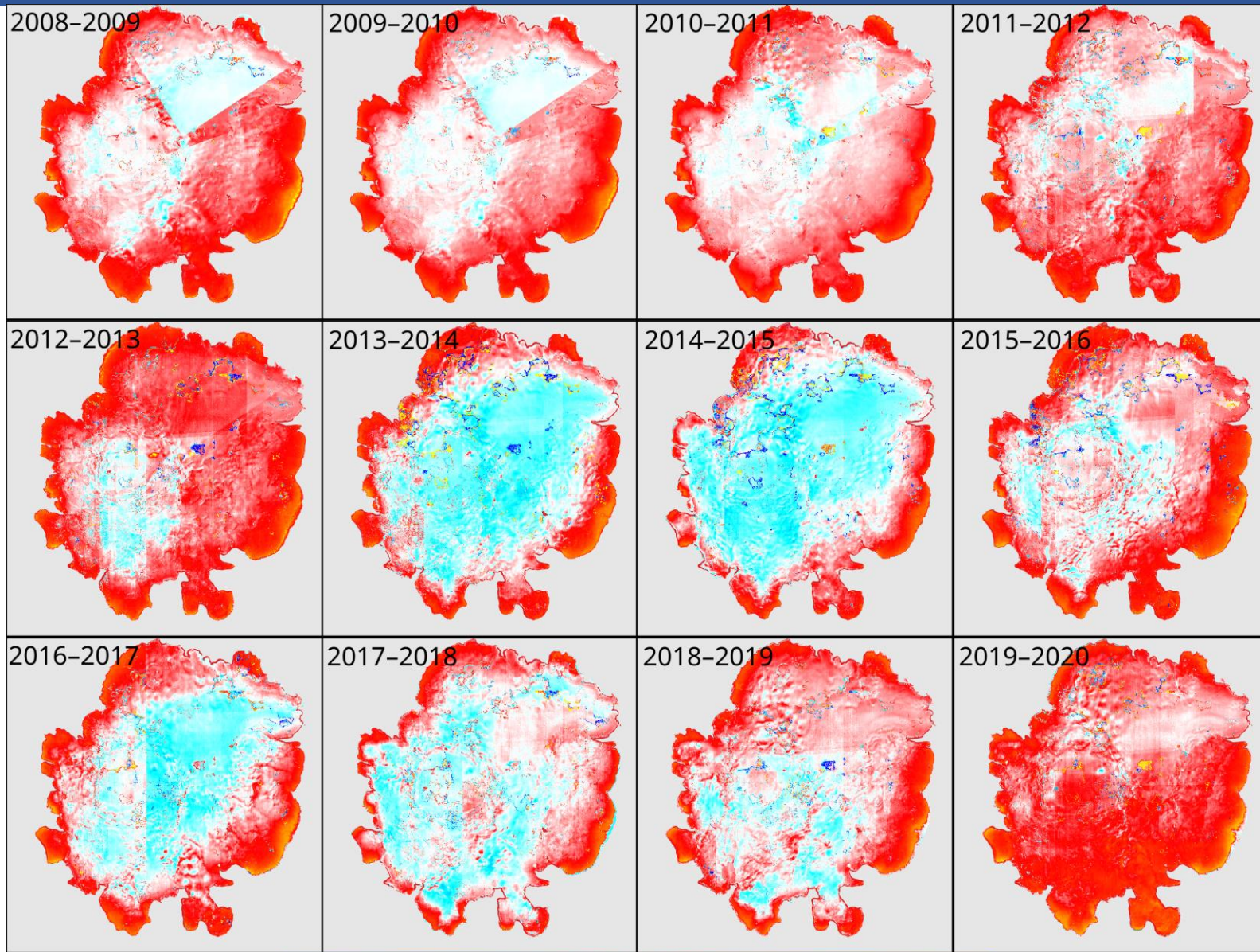
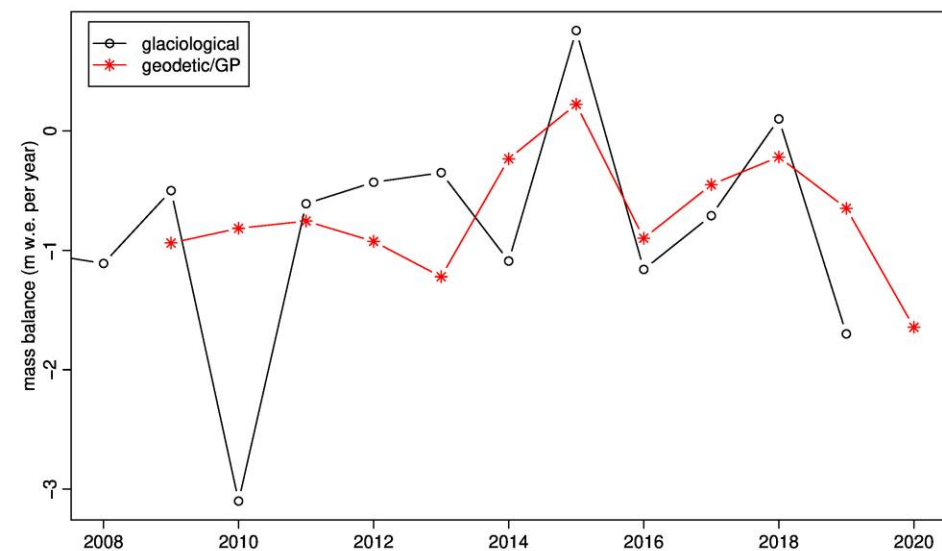


Monthly elev
changes
2008-2020
(gif)



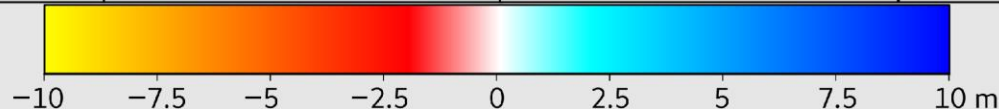
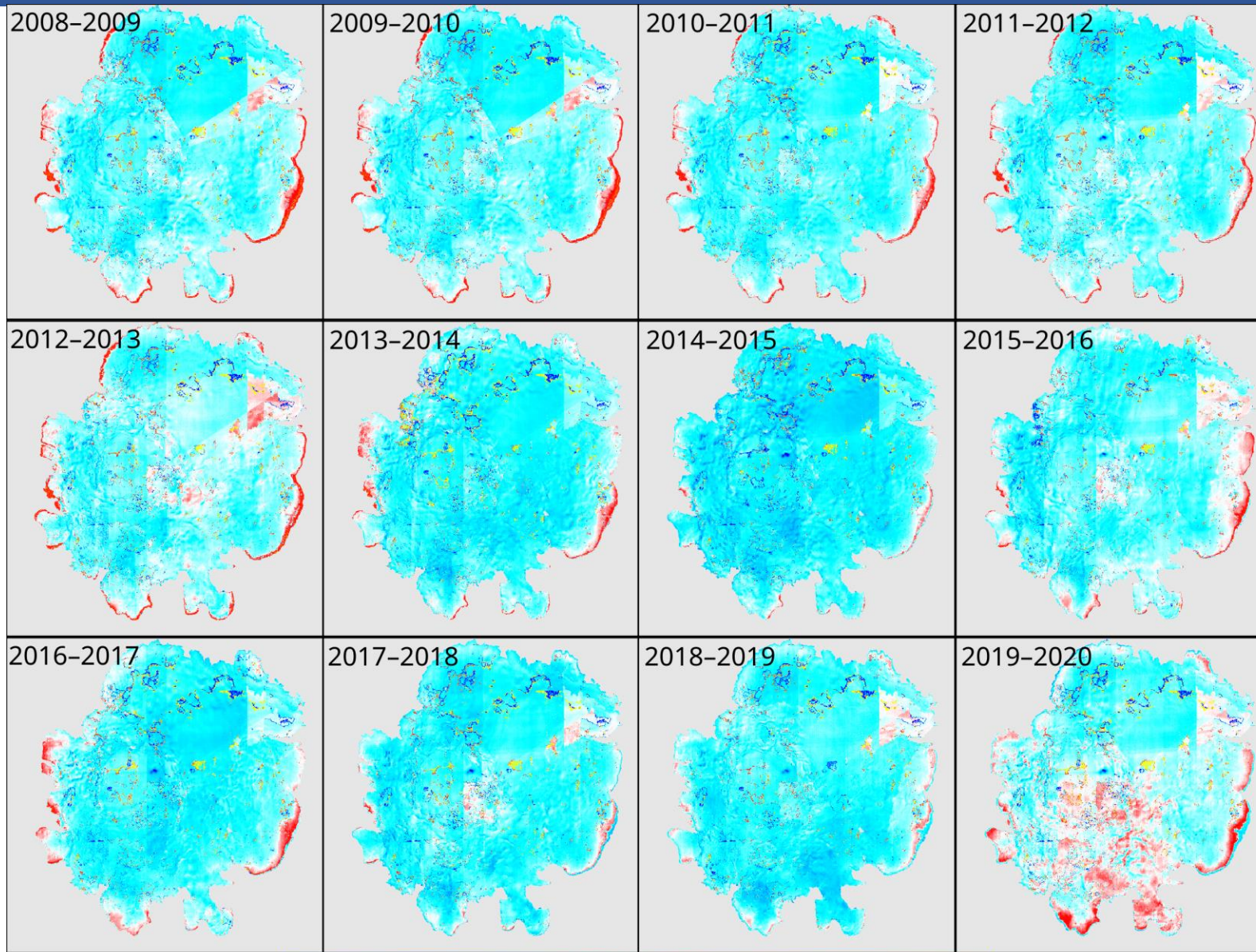
Elev. Diff: 1 Oct to 1 Oct

Mass balance of Hofsjökull, comparison of geodetic and glaciological results



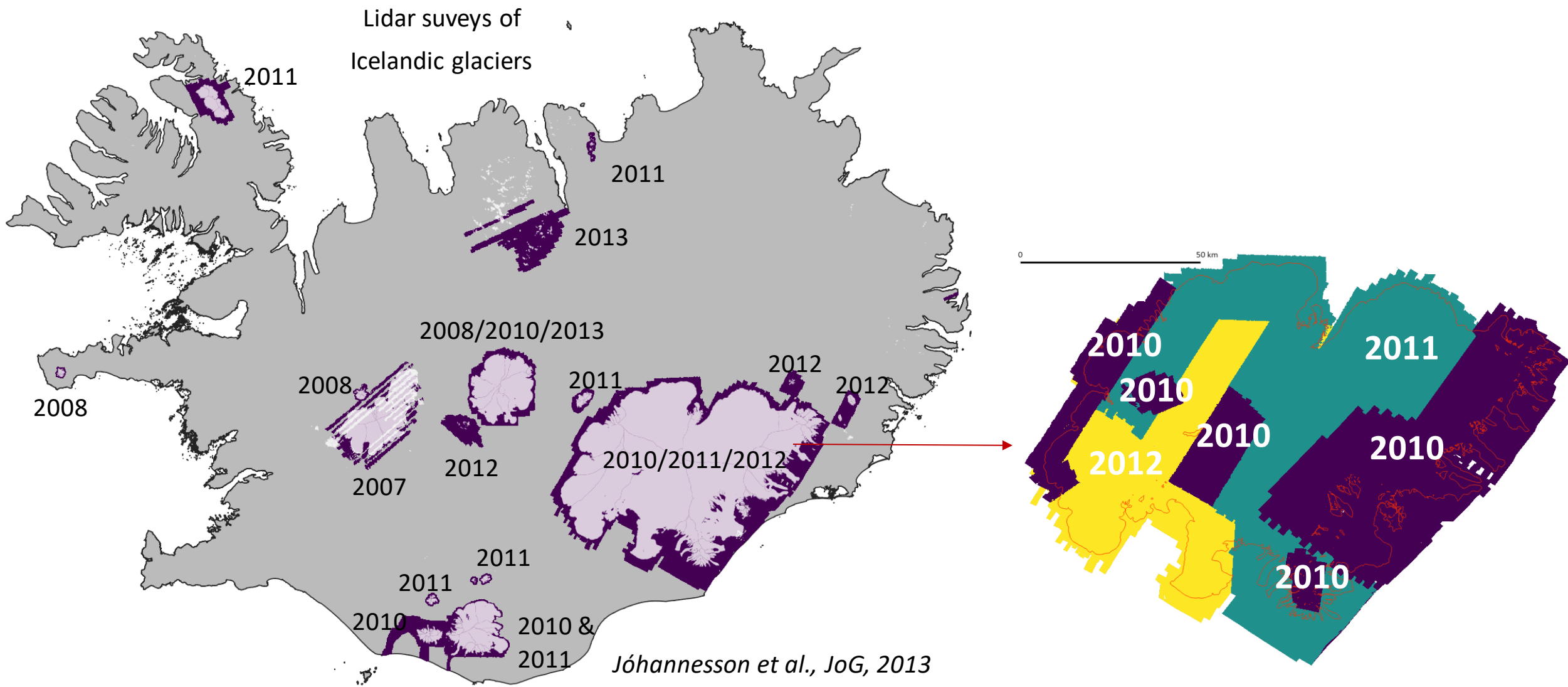


Elev. Diff: 1 Oct to 1 Jun



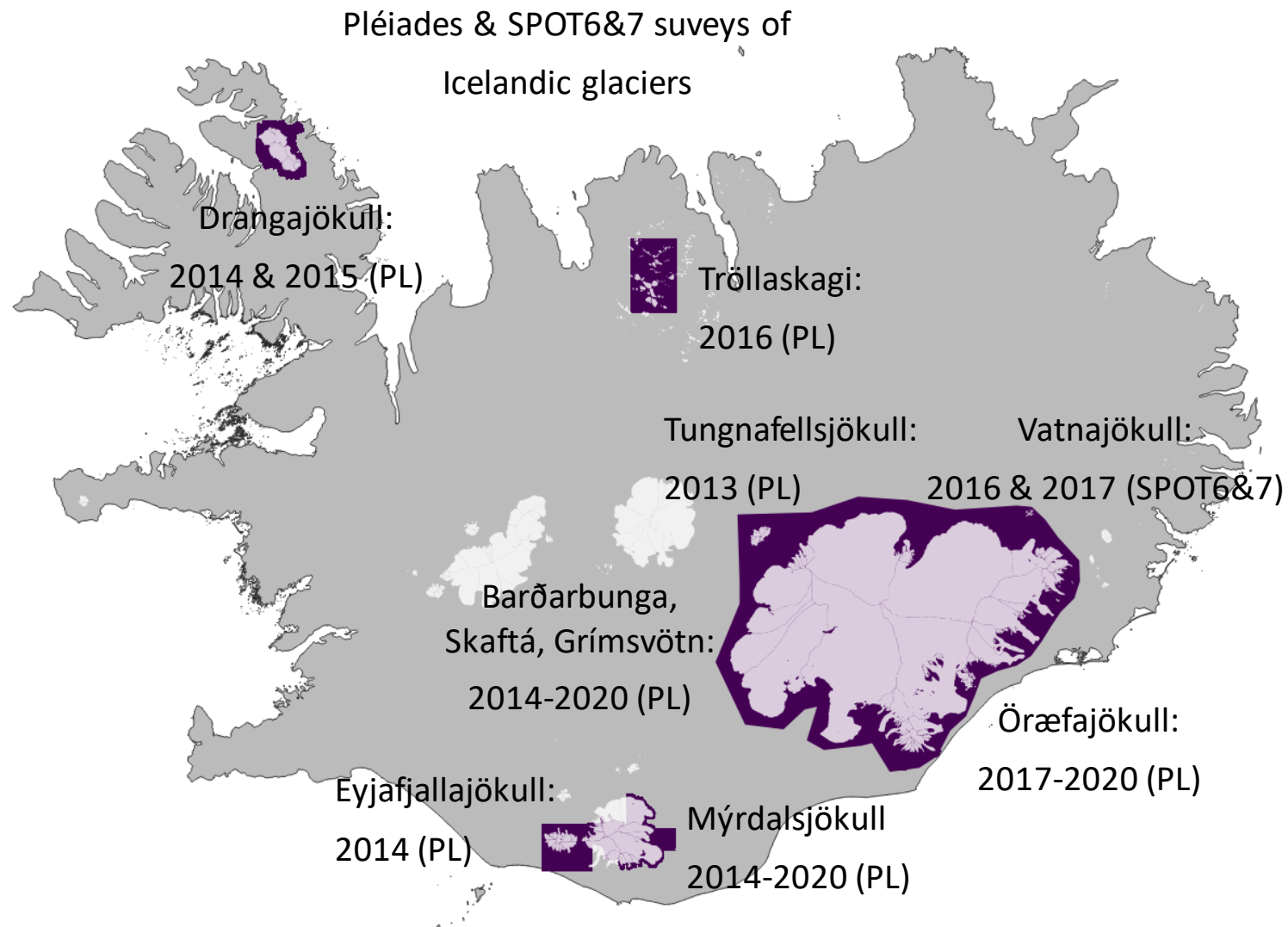


Next steps: Vatnajökull, Langjökull, Mýrdalsjökull...





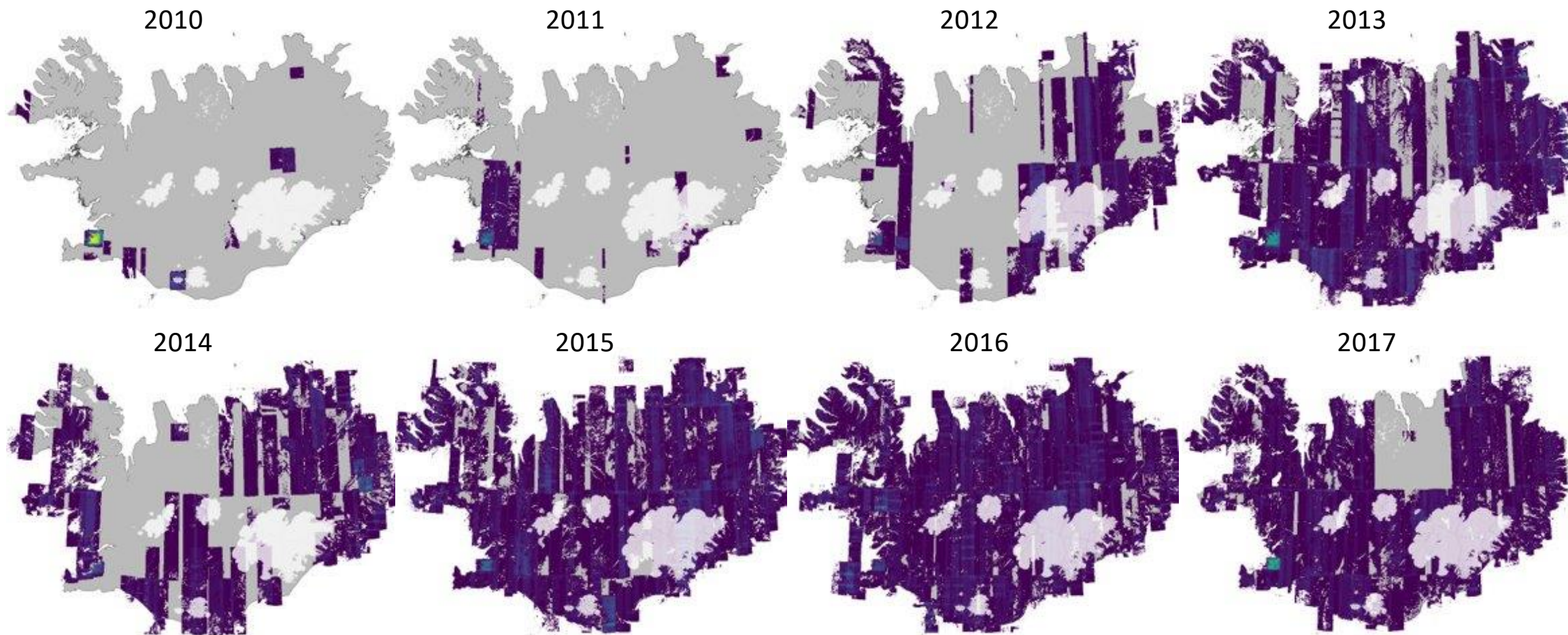
Next steps: Vatnajökull, Langjökull, Mýrdalsjökull...





Next steps: Vatnajökull, Langjökull, Mýrdalsjökull...

ArcticDEM coverage 2010-2017



Takk!



LANDMÆLINGAR
ÍSLANDS



Veðurstofa
Íslands



*And thanks to the ArcticDEM, the lidar mapping of Icelandic glaciers, the ISIS & TOSCA CNES projects and many others!

Múlajökull, 2 Oct 2020

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