

IslandsDEM

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Helgarson and the ArcticDEM team

EuroGeographics webinars
Oct 29th, 2020



**Veðurstofa
Íslands**





ArcticDEM

New elevation map details Alaska like never before

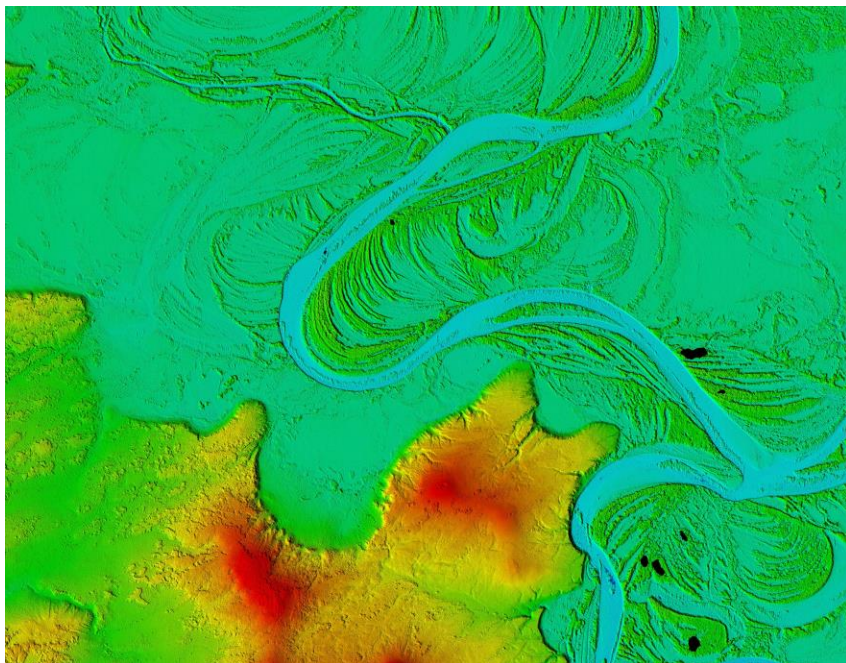


The Obama White House

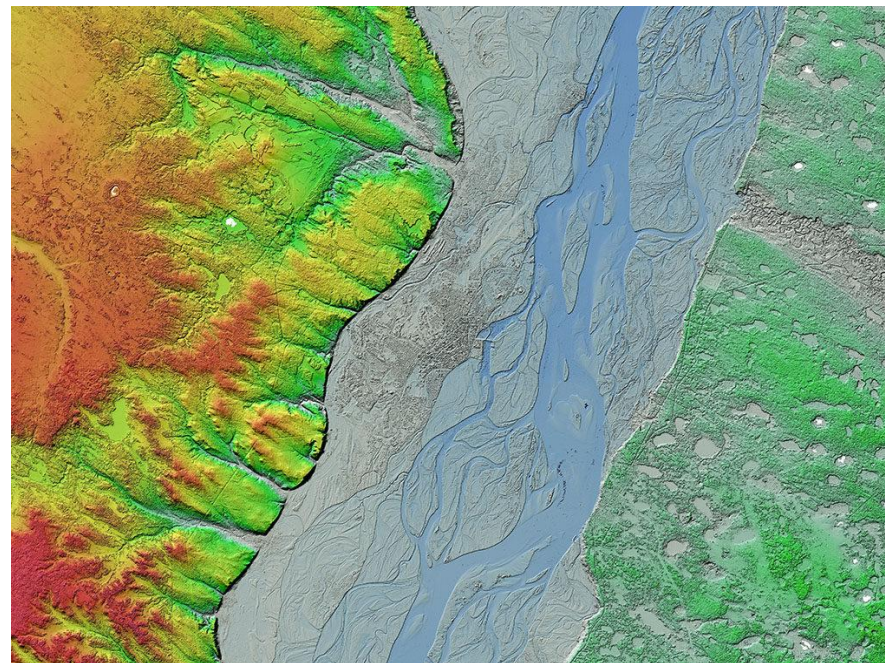
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"The National Geospatial Intelligence Agency and the National Science Foundation are leading a private-public collaboration to create the first ever publicly available, high-resolution, satellite-based elevation map of the entire Arctic" (Barack Obama, 2015)



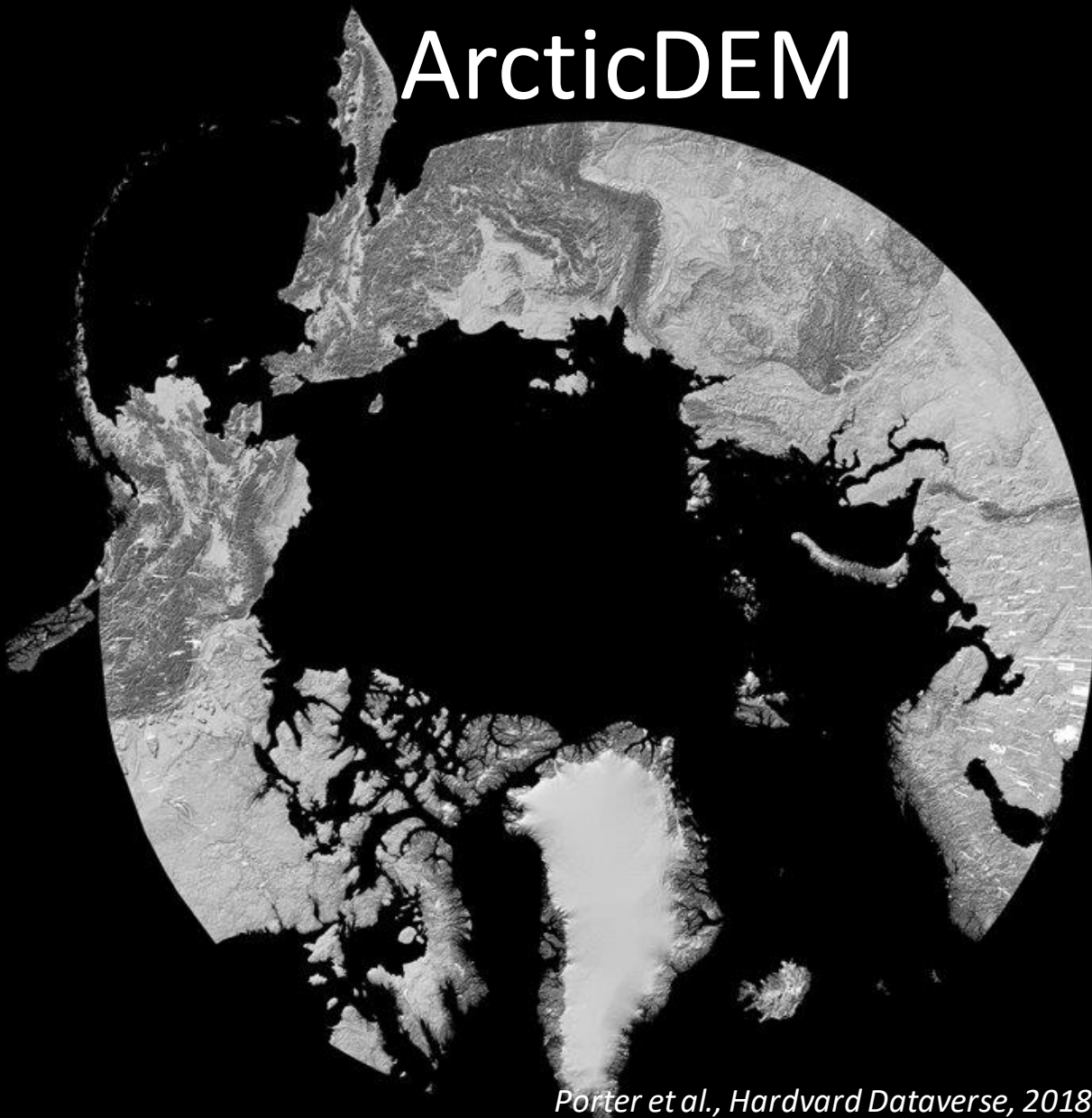
Koyukuk River in Western Alaska.
NGA press release (<https://www.nga.mil/>)



Yakutsk on the Lena River, Siberia.
ArcticDEM release 6, PGC

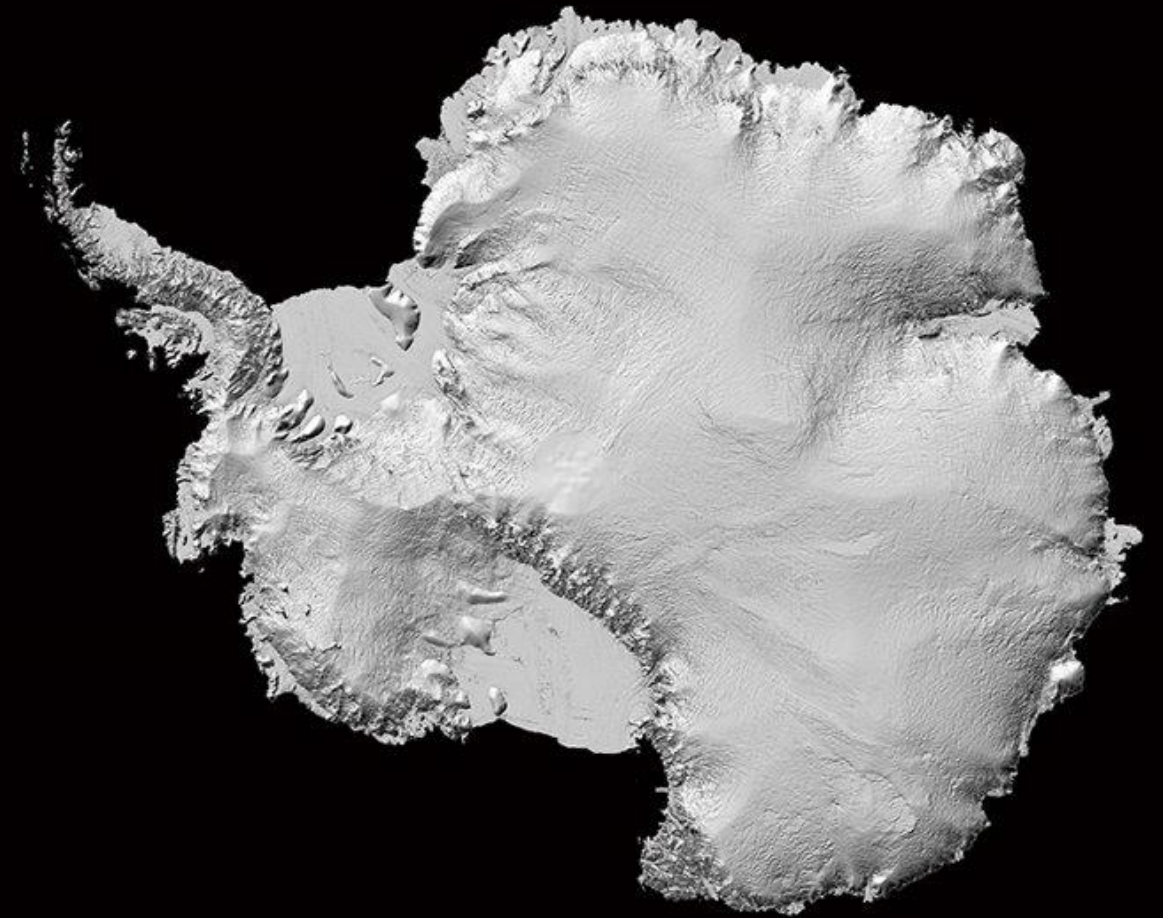


ArcticDEM



Porter et al., Harvard Dataverse, 2018

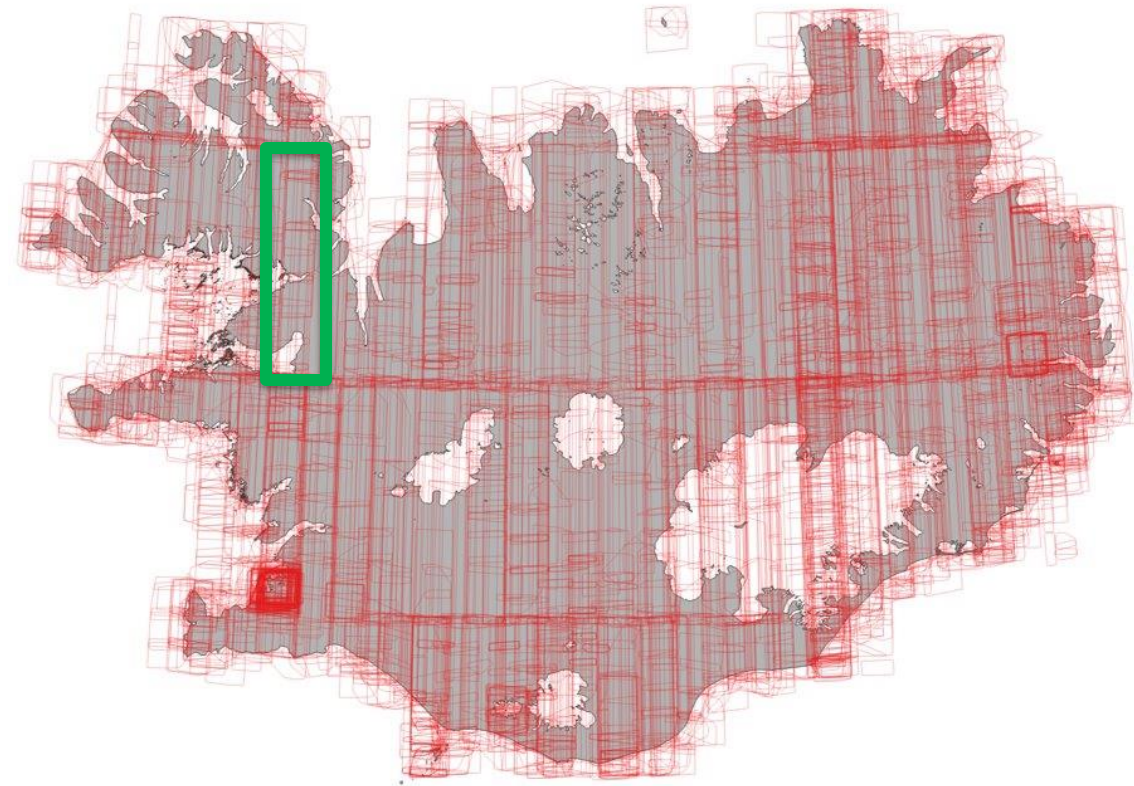
REMA



Howat et al., The Cryosphere, 2019

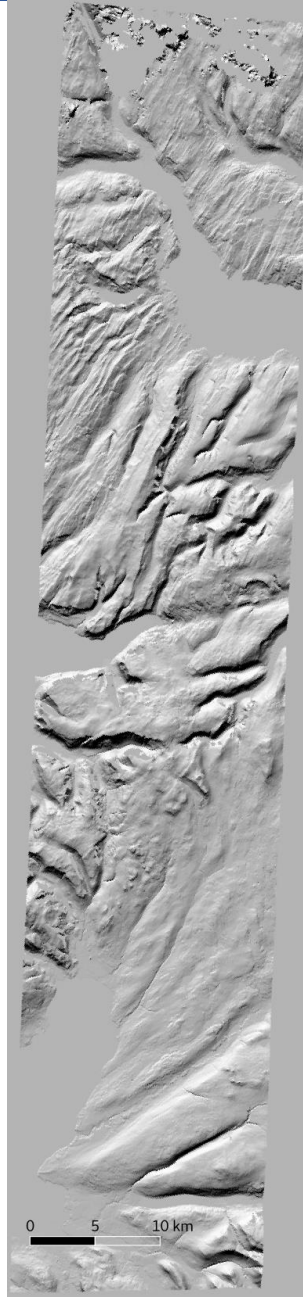


ArcticDEM in Iceland



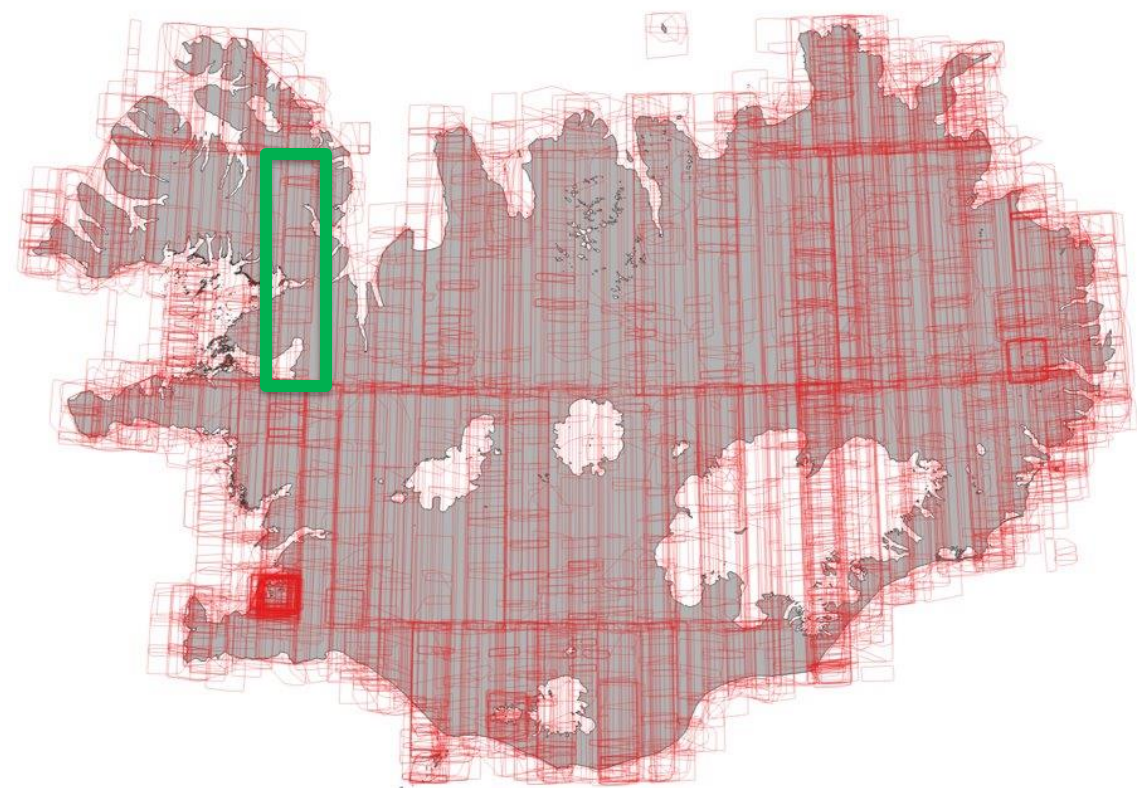
3227 DEMs in 2x2m, acquired in 2008-2017 (~1 Tb)

Strips up to 200 km (N-S), 18 km (E-W)



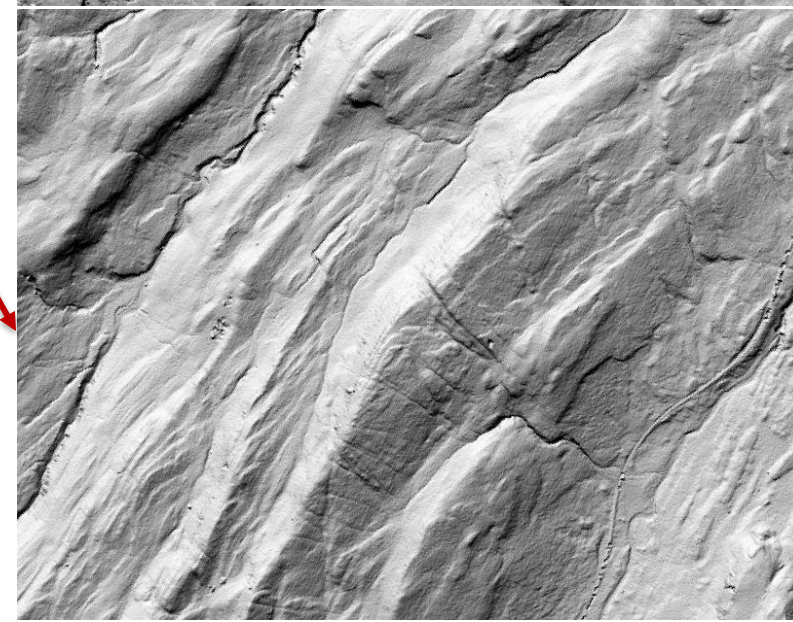
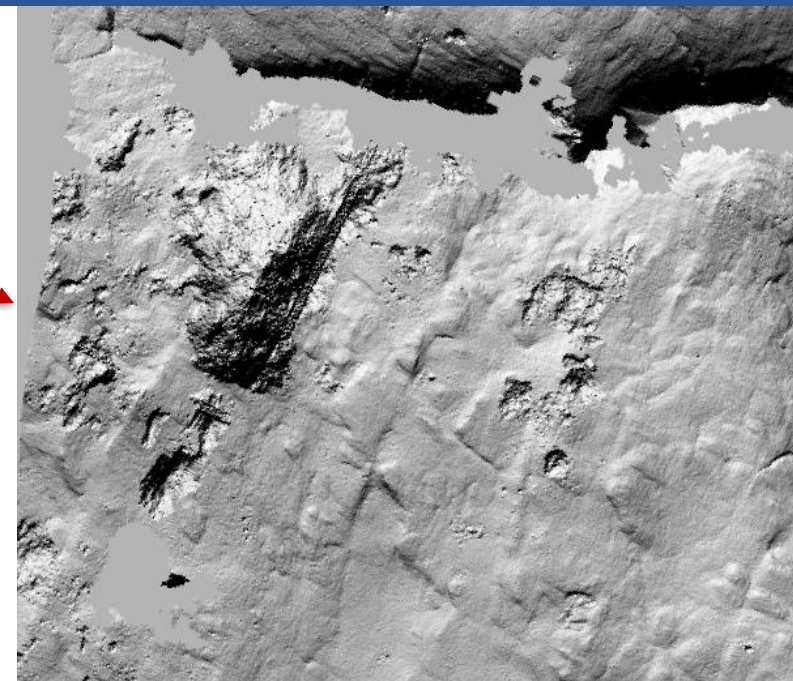
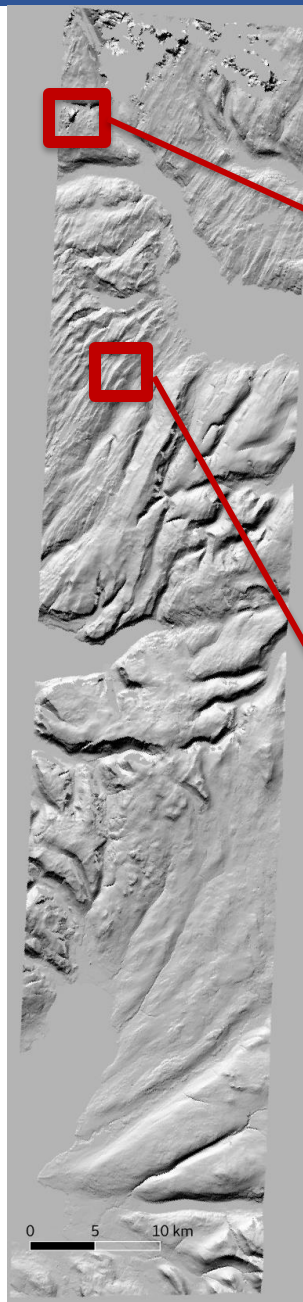


ArcticDEM in Iceland



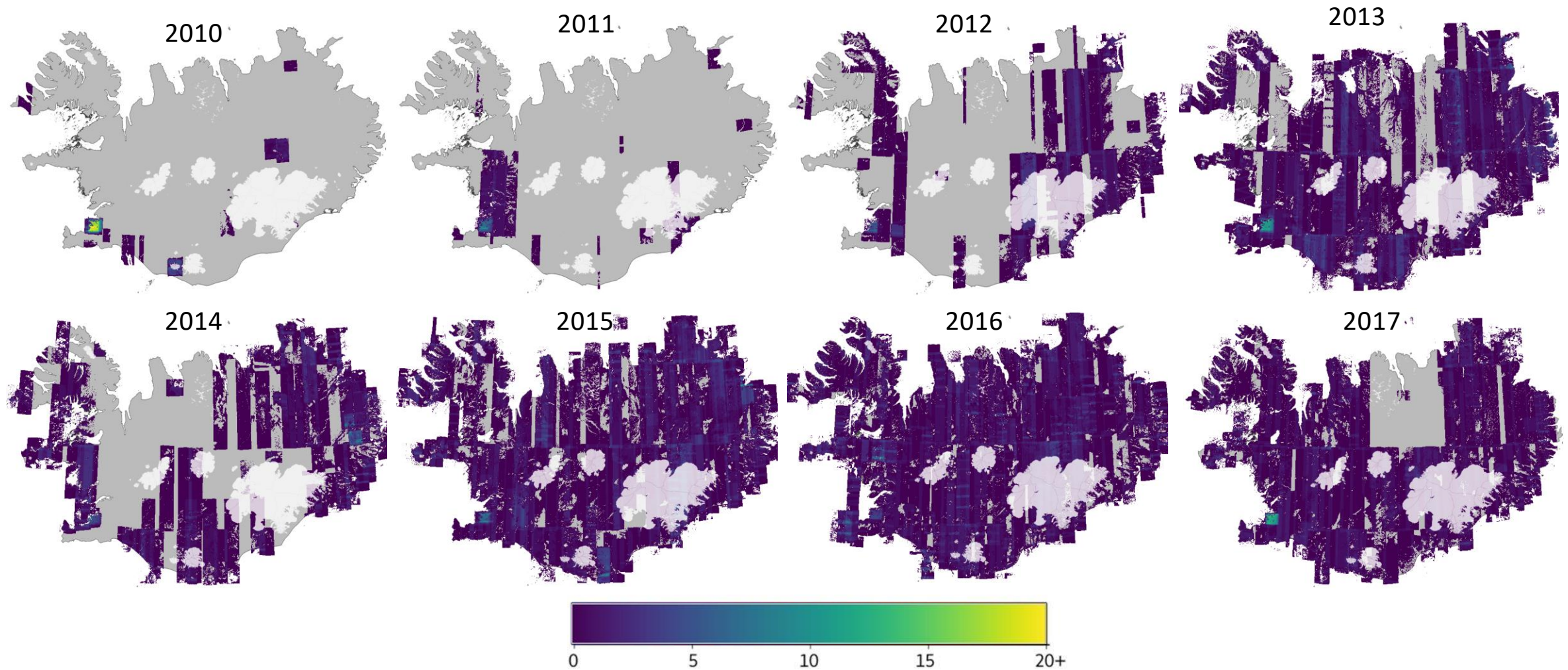
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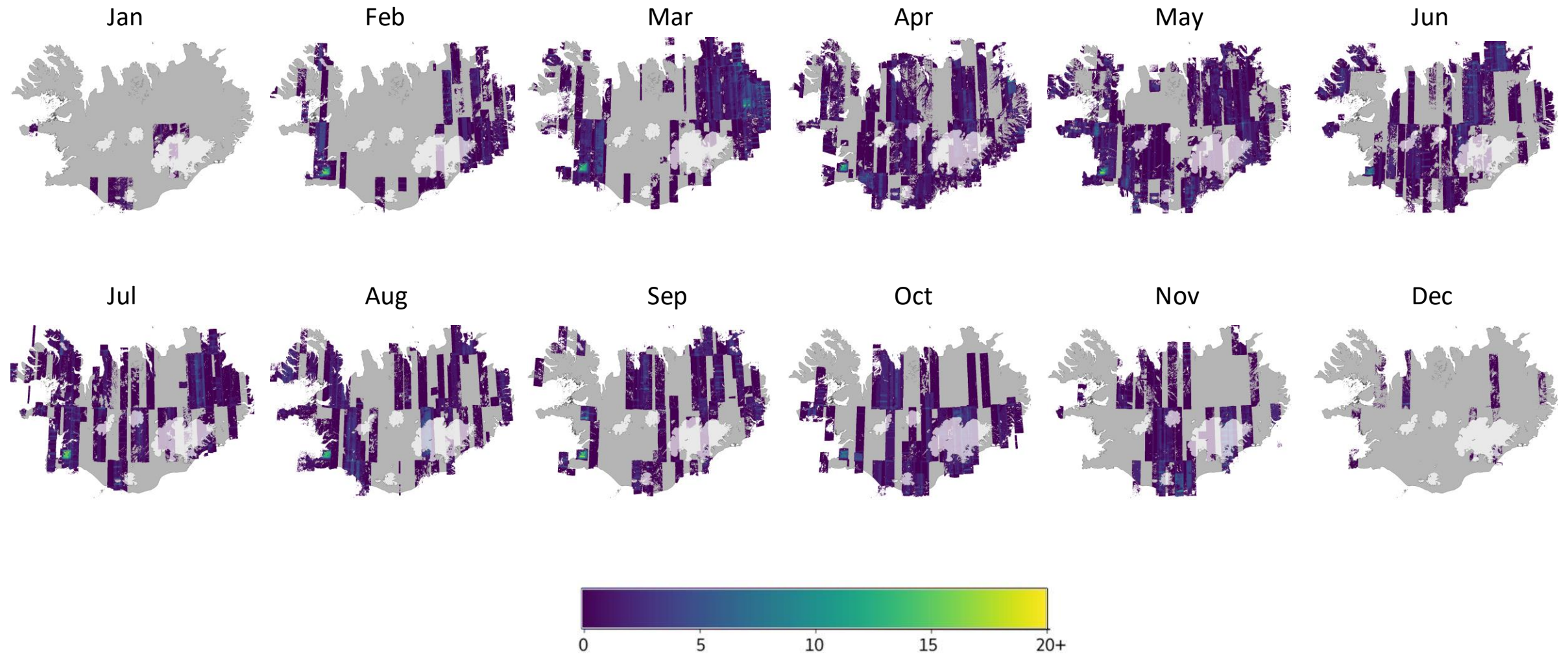


ArcticDEM in Iceland



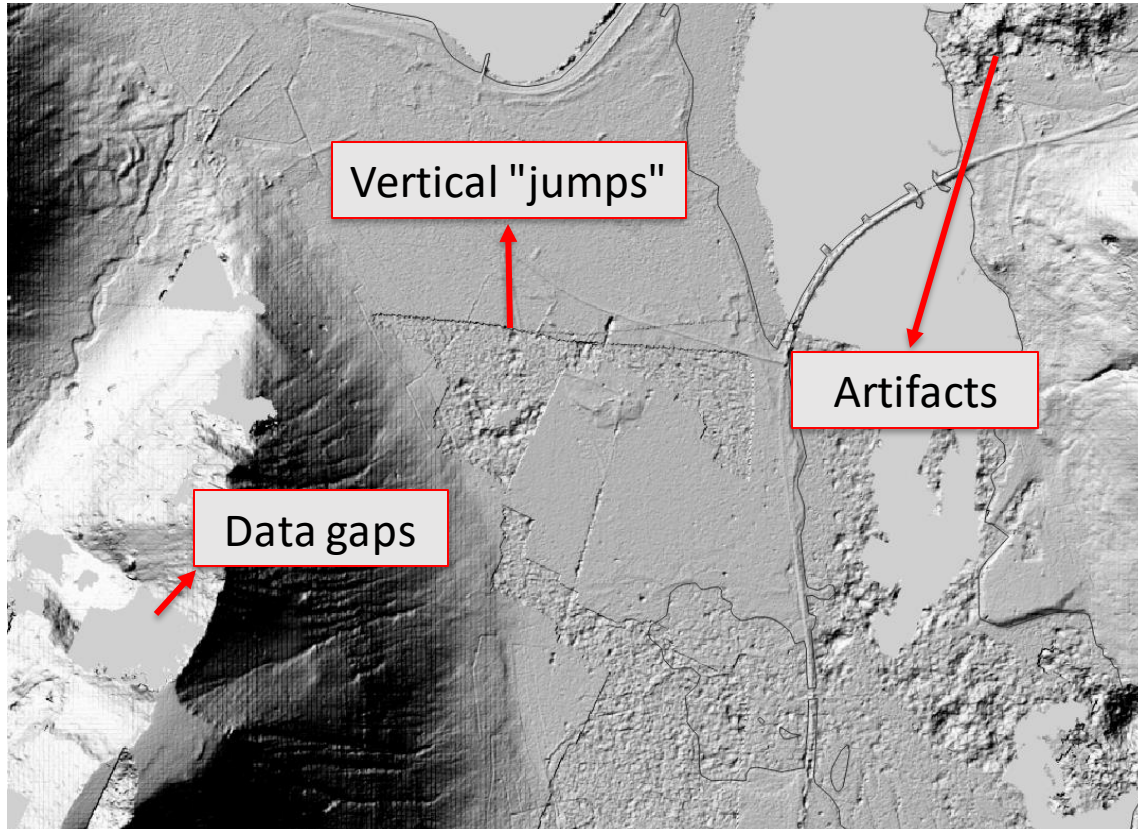


ArcticDEMs in Iceland





Challenges in the ArcticDEM

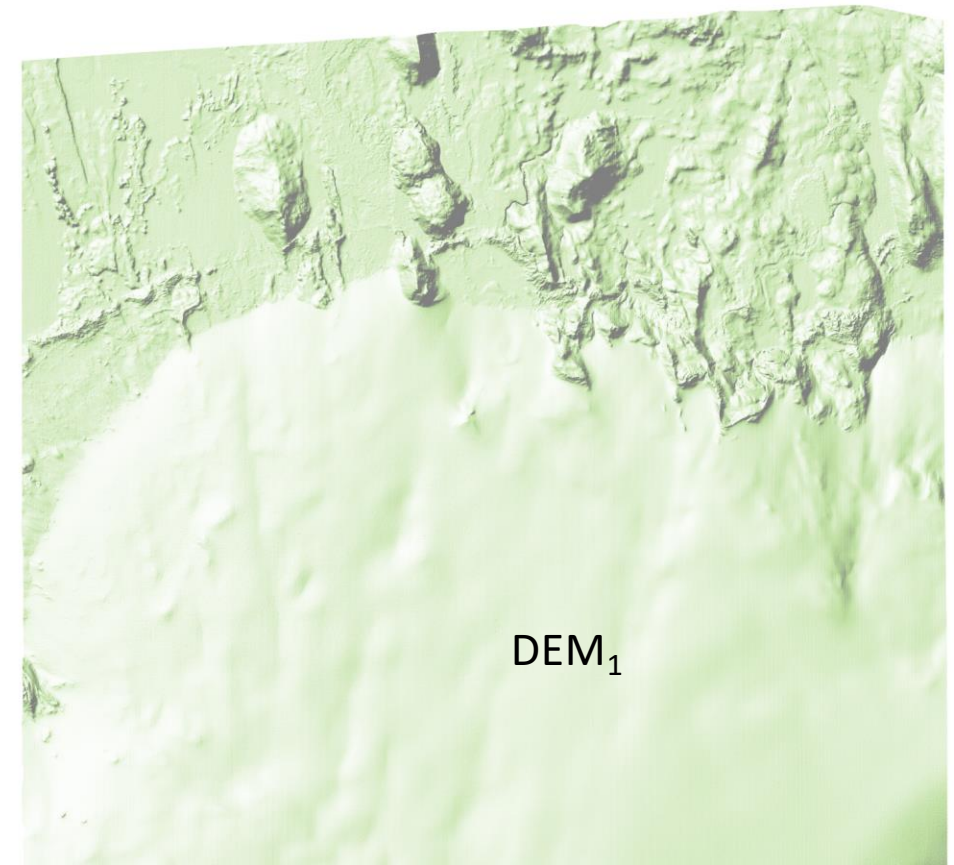


- Poor absolute location (± 10 m XYZ)
- Heterogeneous DEM quality (roughness, artifacts)
- Challenges for end-user operations



ArcticDEM co-registration

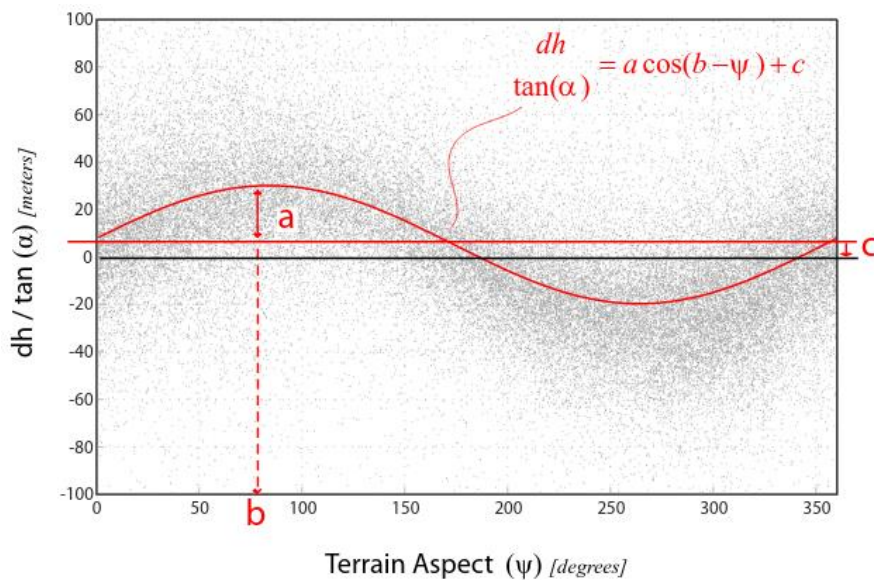
- Each DEM has a positional accuracy ± 10 m (XYZ)



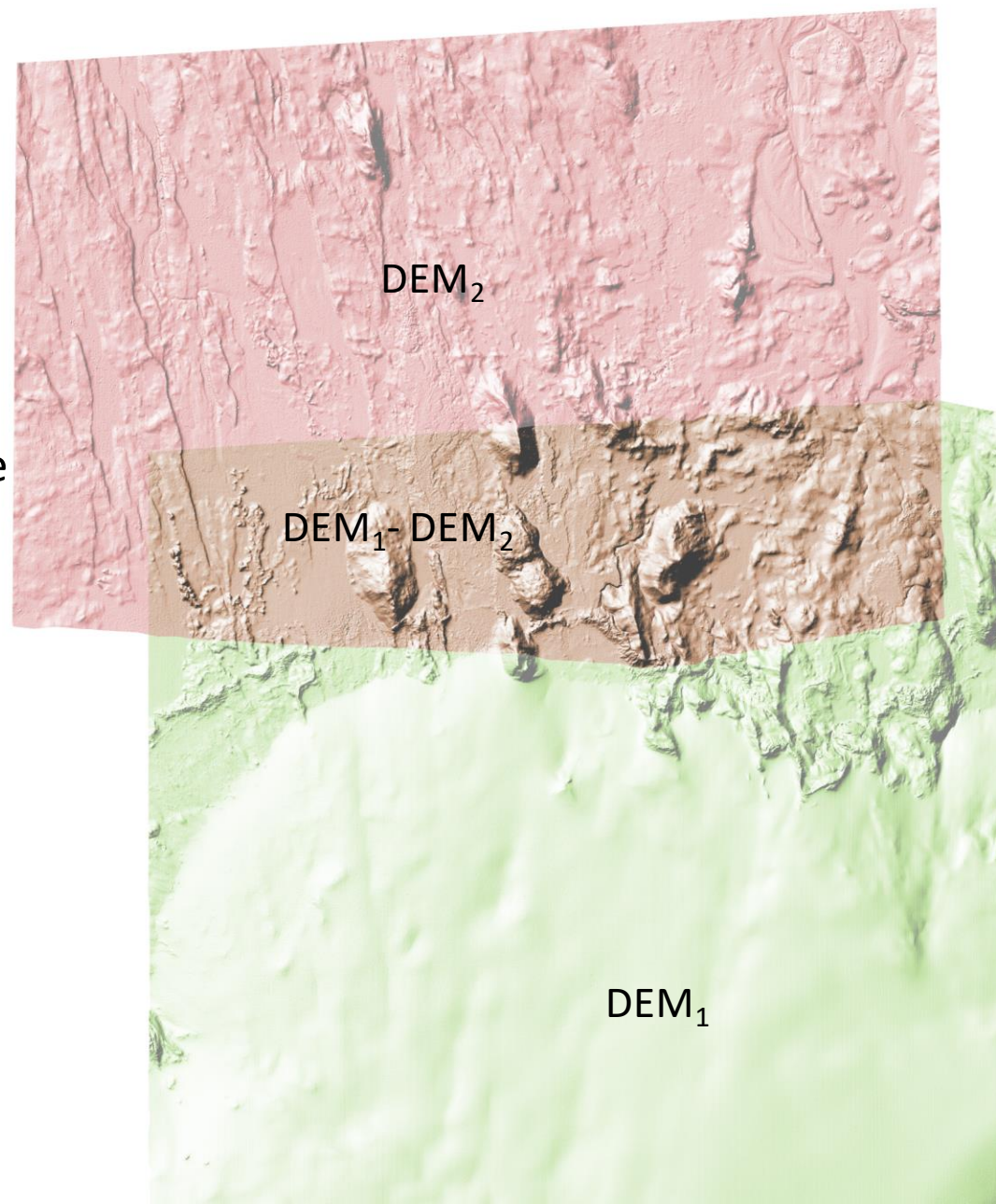


ArcticDEM co-registration

- Each DEM has a positional accuracy ± 10 m (XYZ)
- Co-registration to calculate the shift of one DEM relative to another DEM ($\Delta\xi_{ij}$)



Nuth & Kääb, TC, 2011





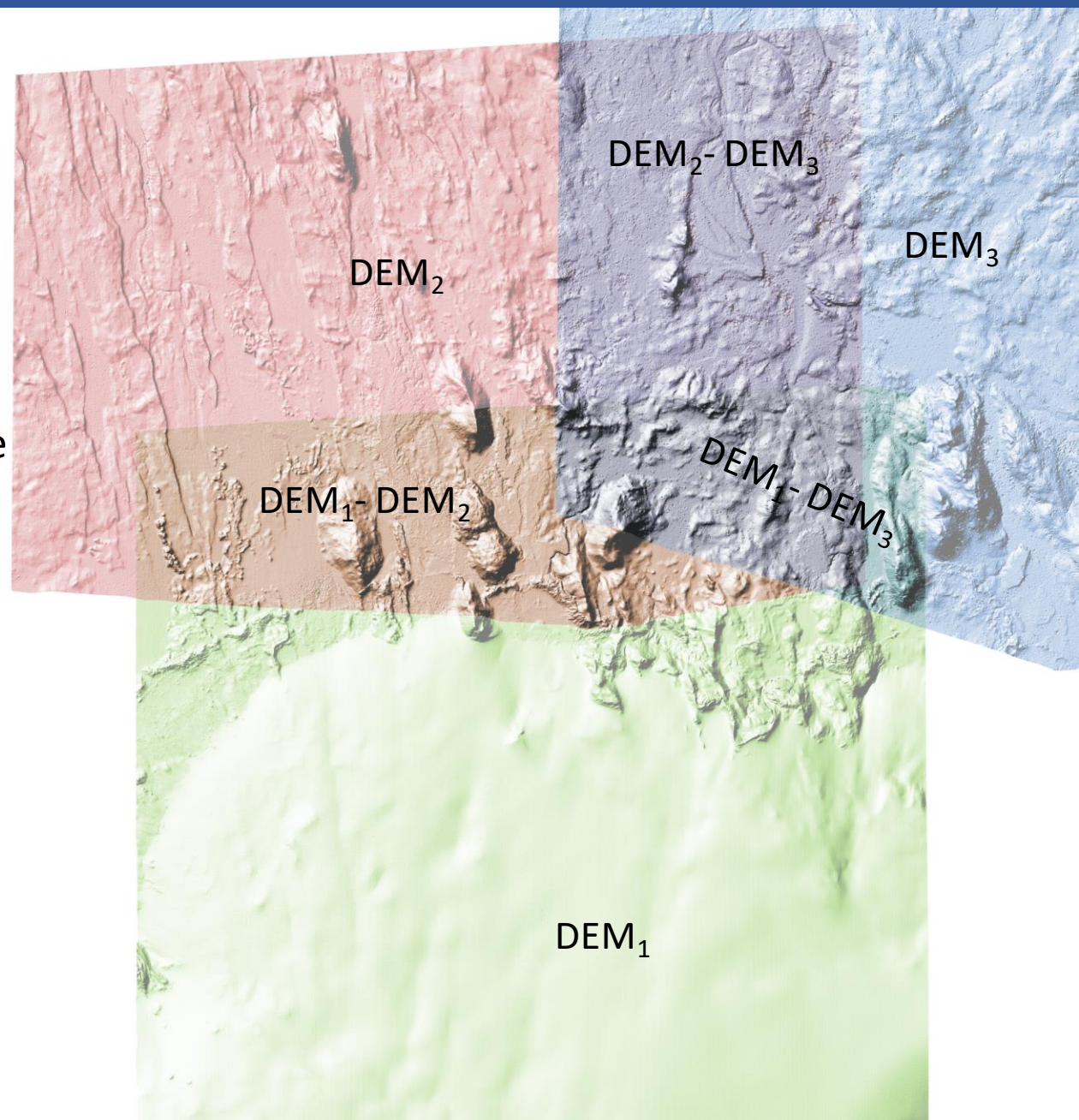
Rscript 'Isqstripoffsets'

- Each DEM has a positional accuracy ± 10 m (XYZ)
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$$\begin{aligned}\Delta\xi_{x_2} - \Delta\xi_{x_1} &= \Delta\xi_{x_{12}} \\ \Delta\xi_{x_3} - \Delta\xi_{x_1} &= \Delta\xi_{x_{13}} \\ &(\dots)\end{aligned}$$

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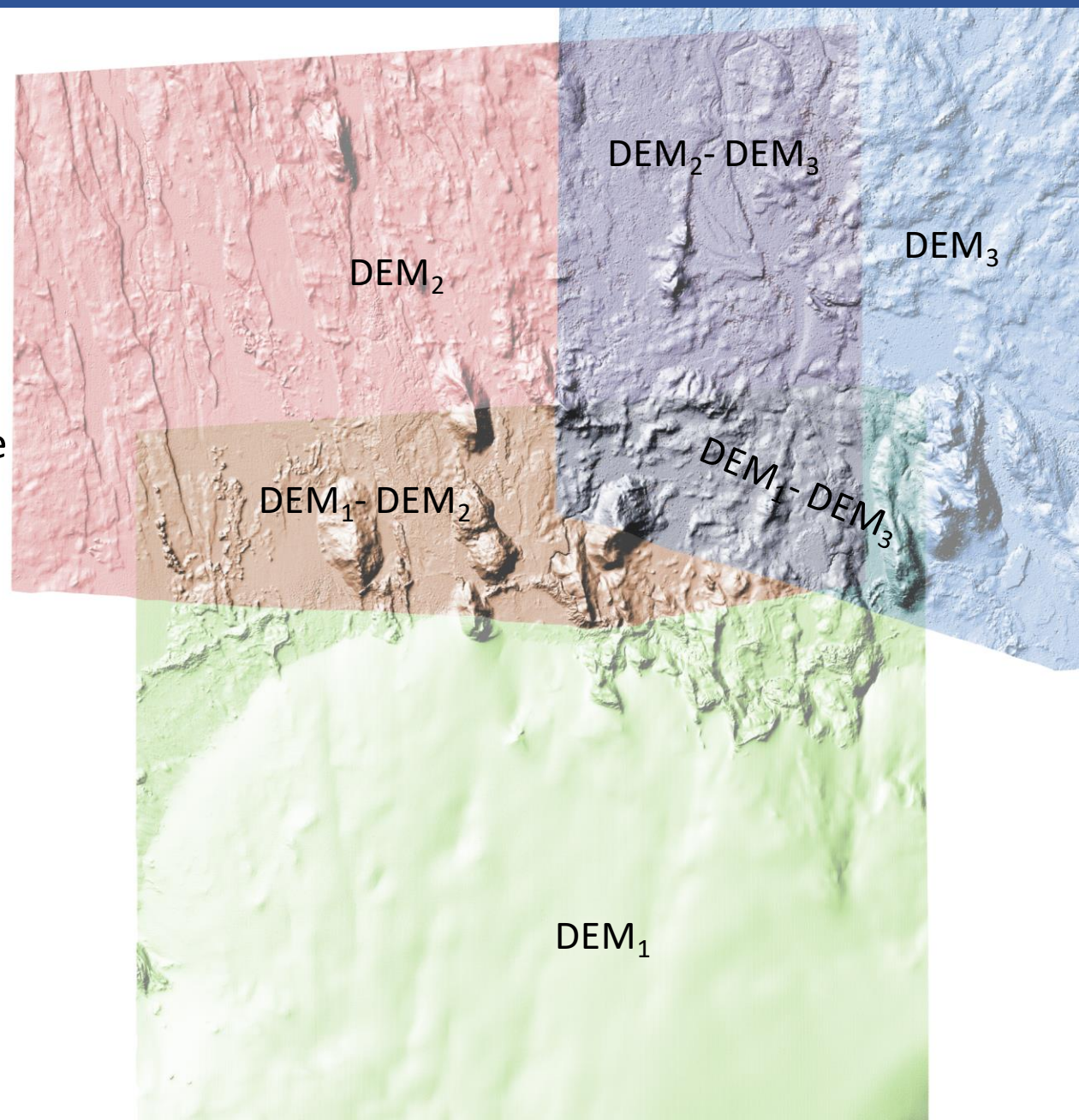
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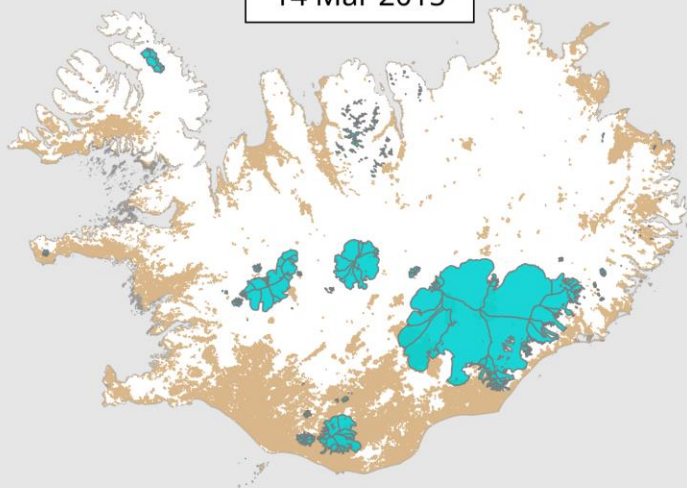
- 3227 ArcticDEMs: ~50000 pairwise shifts calculated. Optimal shift ($\Delta\xi_i$) calculated for each ArcticDEM
- Accuracy better than 1 m (XY) and 0.5 m (Z)



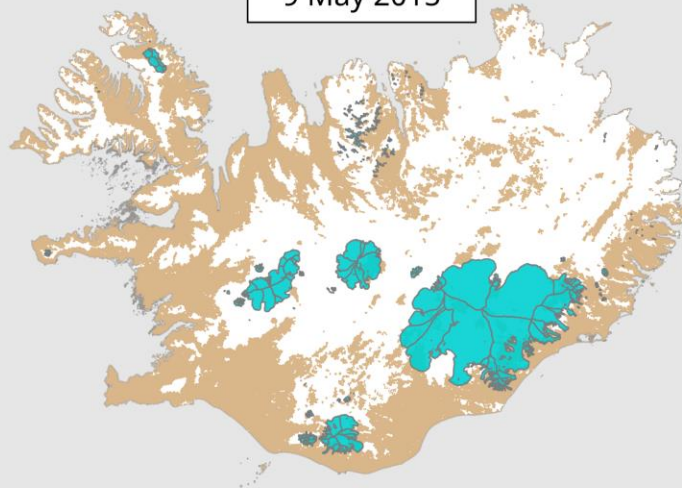


ArcticDEM co-registration: Masking

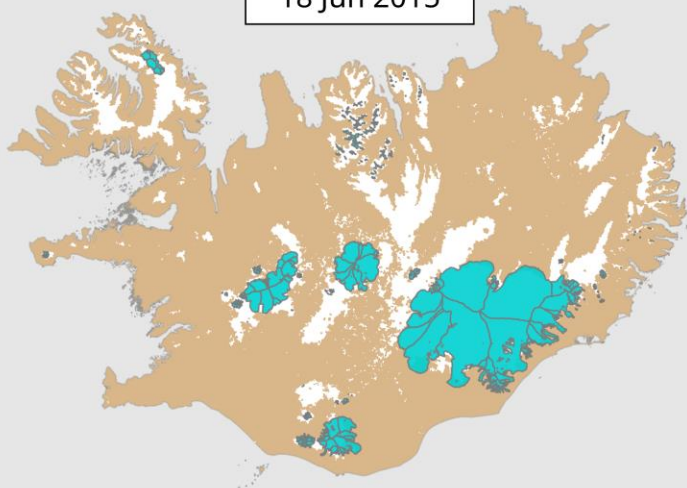
14 Mar 2015



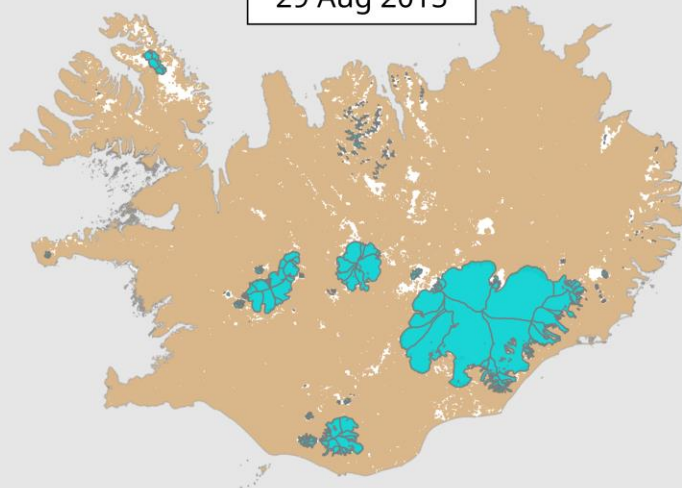
9 May 2015



18 Jun 2015



29 Aug 2015



MOD10A2: 8-day snow masks since 2000
(Hall et al., NSIDS, 2016)

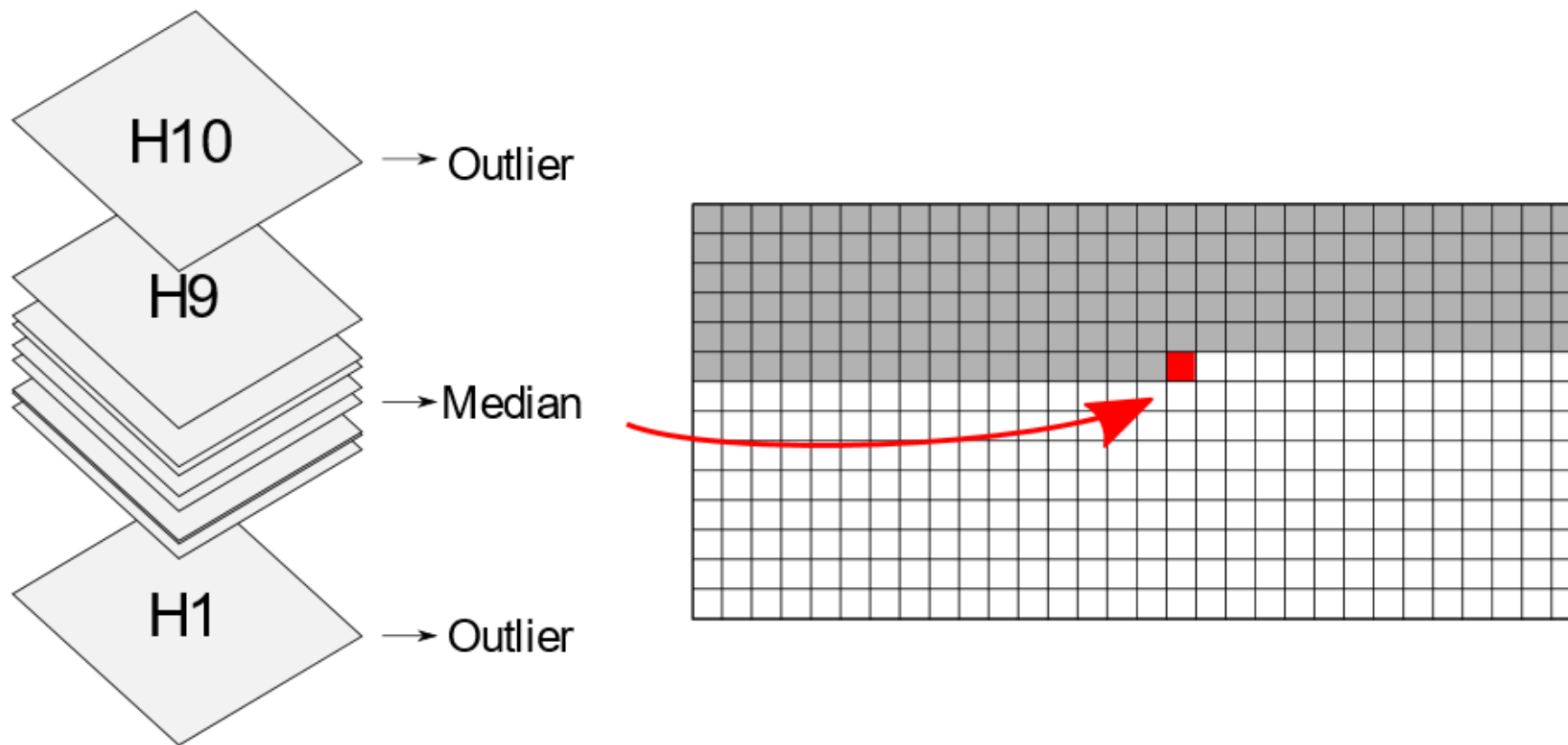
8-day snow products available since 2000
<https://nsidc.org/data/MOD10A2>

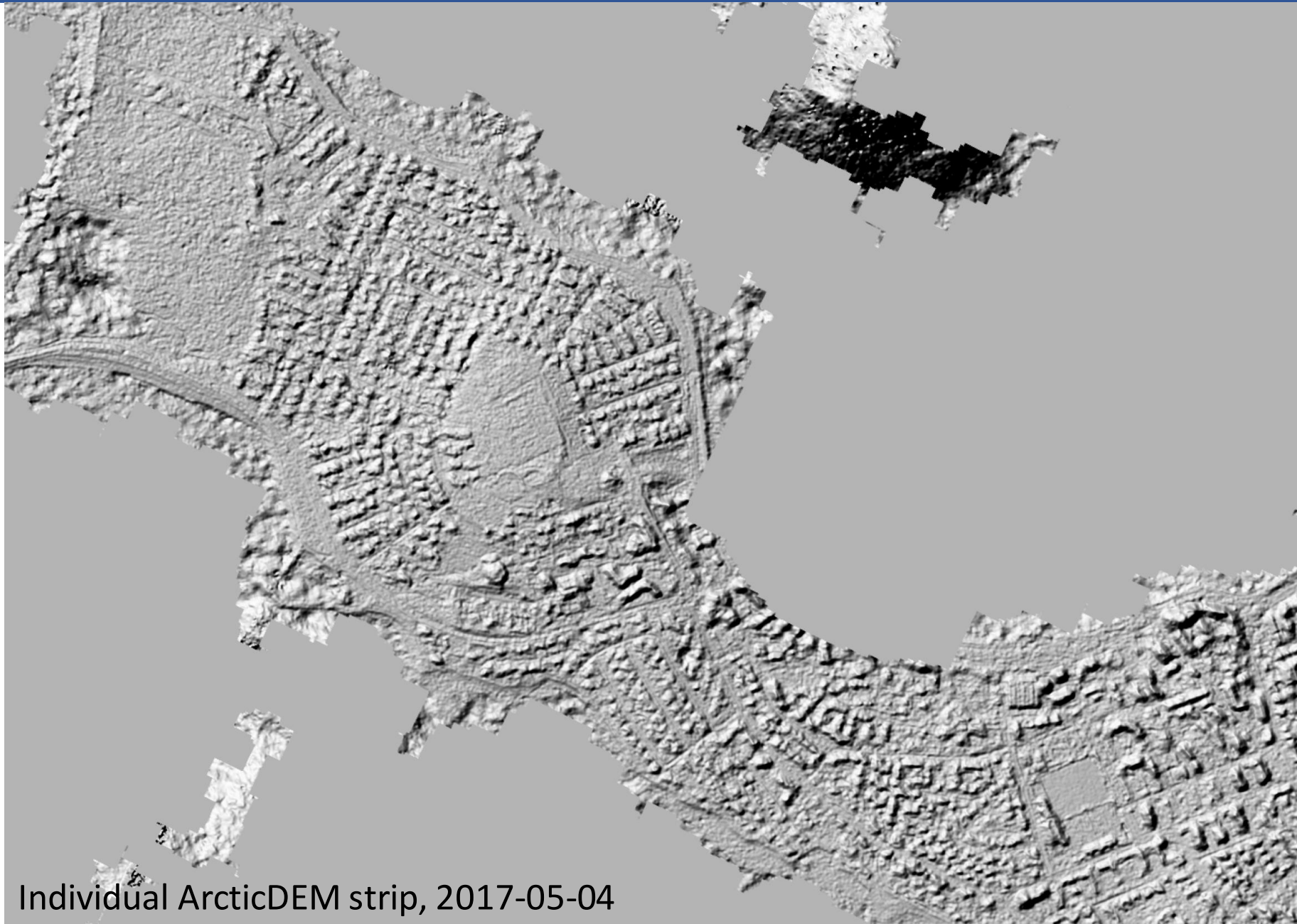
GLIMS: Glacier outline inventory
(Raup et al., *Global & Planetary change*, 2007.
Hannesdóttir et al., *Jökull*, 2020)

<http://www.glims.org/maps/glims>



DEM mosaic





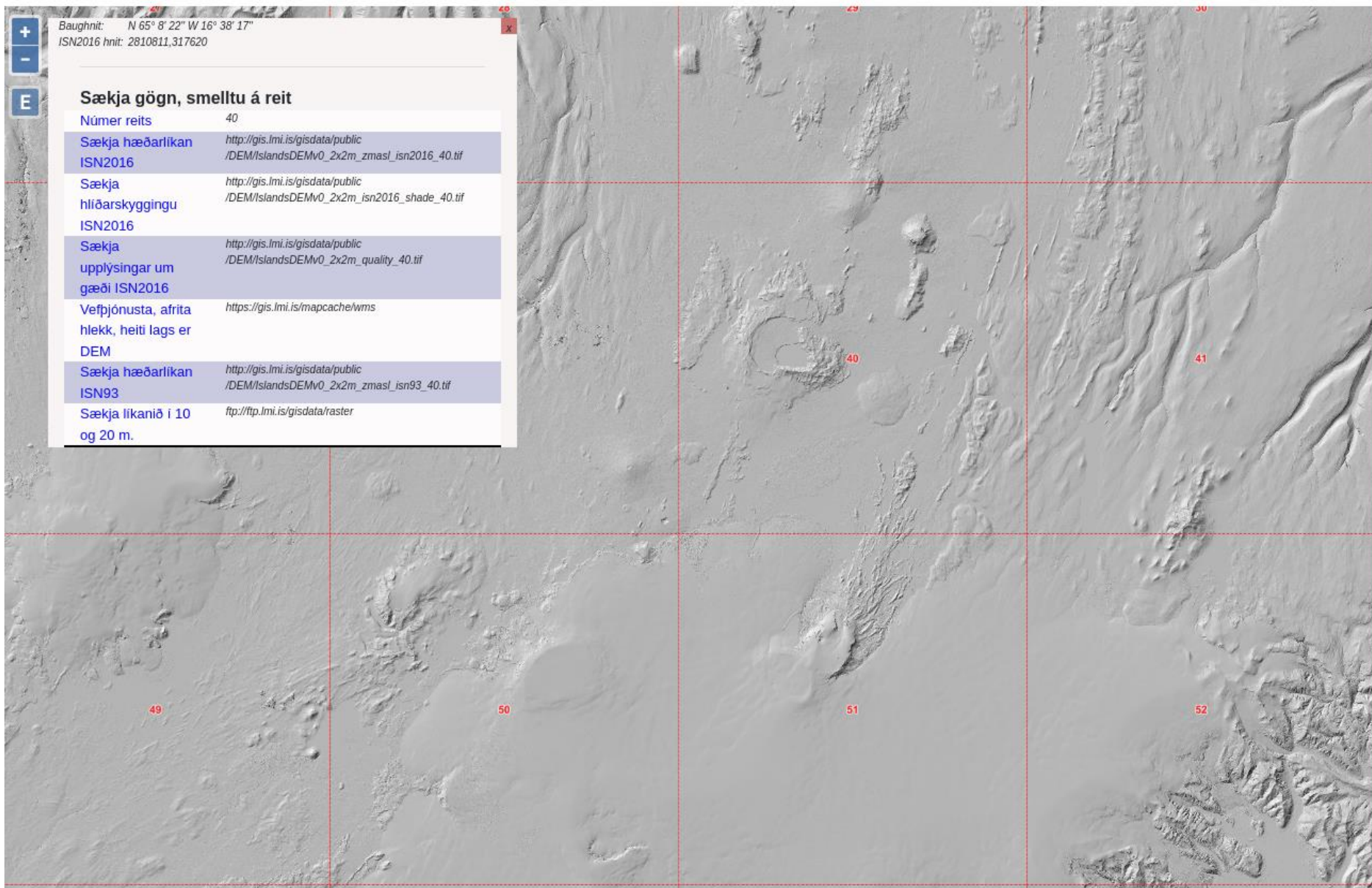
Individual ArcticDEM strip, 2017-05-04



Individual ArcticDEM strip, 2017-09-06



Median-based mosaic



Thank you

