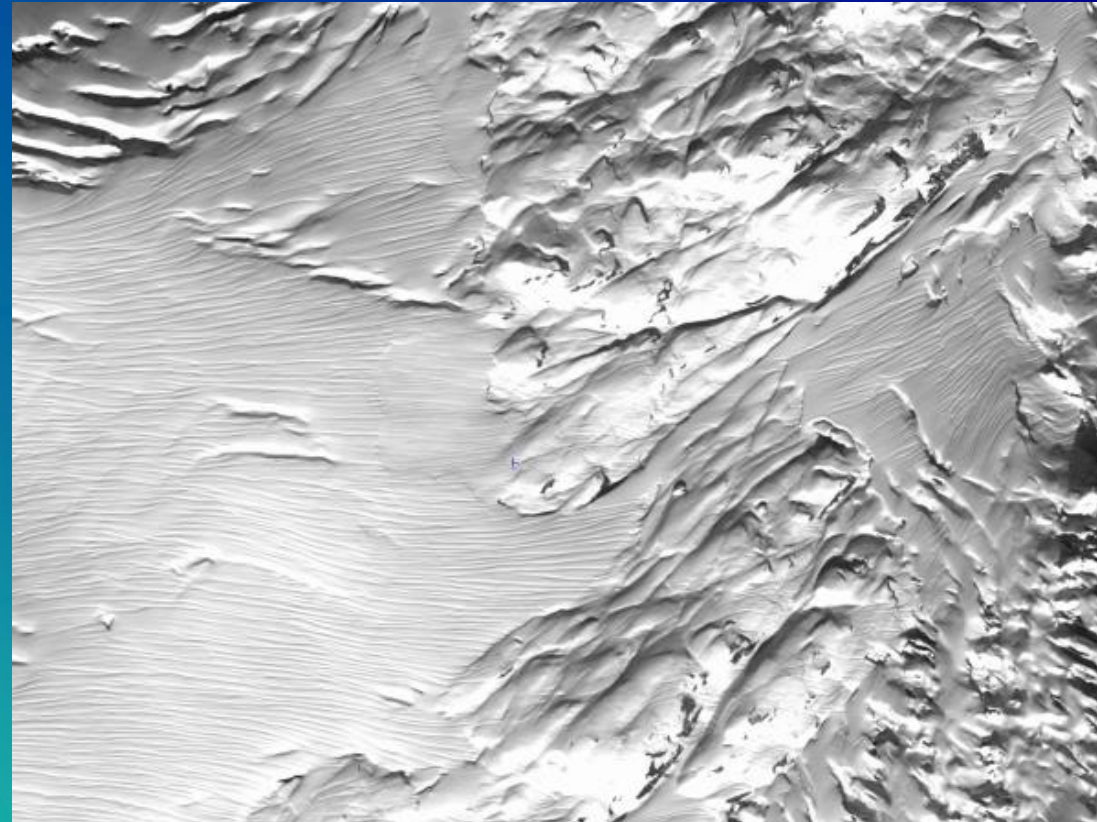


LEGOS/CNRS

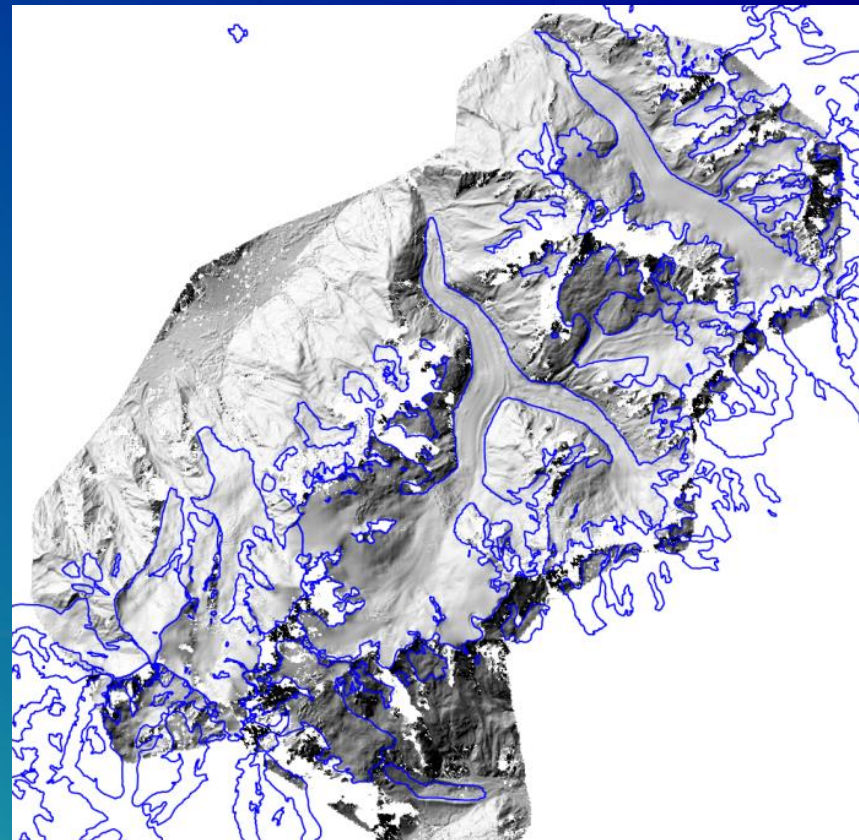
Etienne BERTHIER
CNRS Research Director

Glaciologist, using satellite imagery to study the impact of climate change on glaciers.



USE CASE

Measuring the impact of the 2022 heatwave on glaciers in the Mont Blanc area



Application: Monitoring of climate change

Location: Mont-Blanc, Chamonix, France

Products: Pléiades and Pléiades Néo stereo images



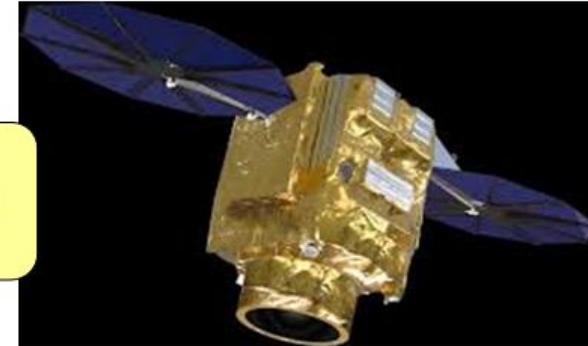
Data : PHR and Pléiades Neo stéréo imagery

AIRBUS



Pléiades 1A & 1B, 0.7 m
PHR

VHR satellites

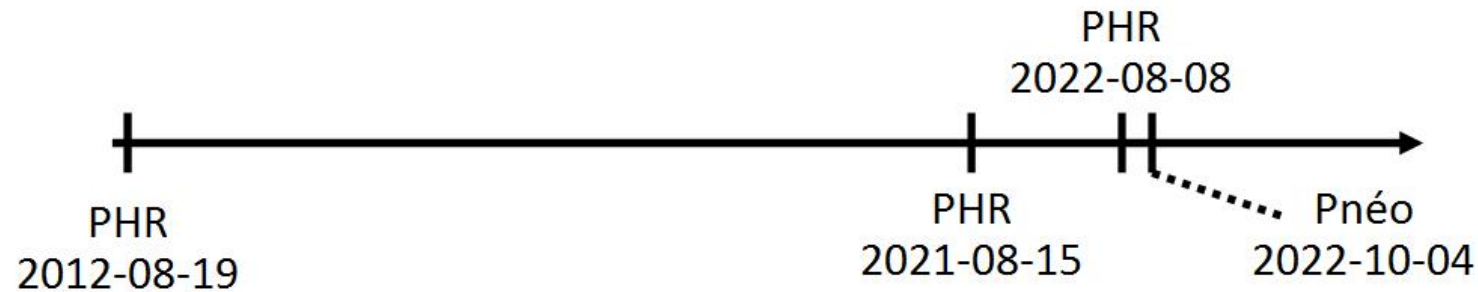


Pléiades Néo 03 & 04, 0.3 m
Pnéo

Along-track stereo
satellite agility

DEMs using Ames Stereo Pipeline

Beyer et al., ESS, 2016





Method: DEM differencing

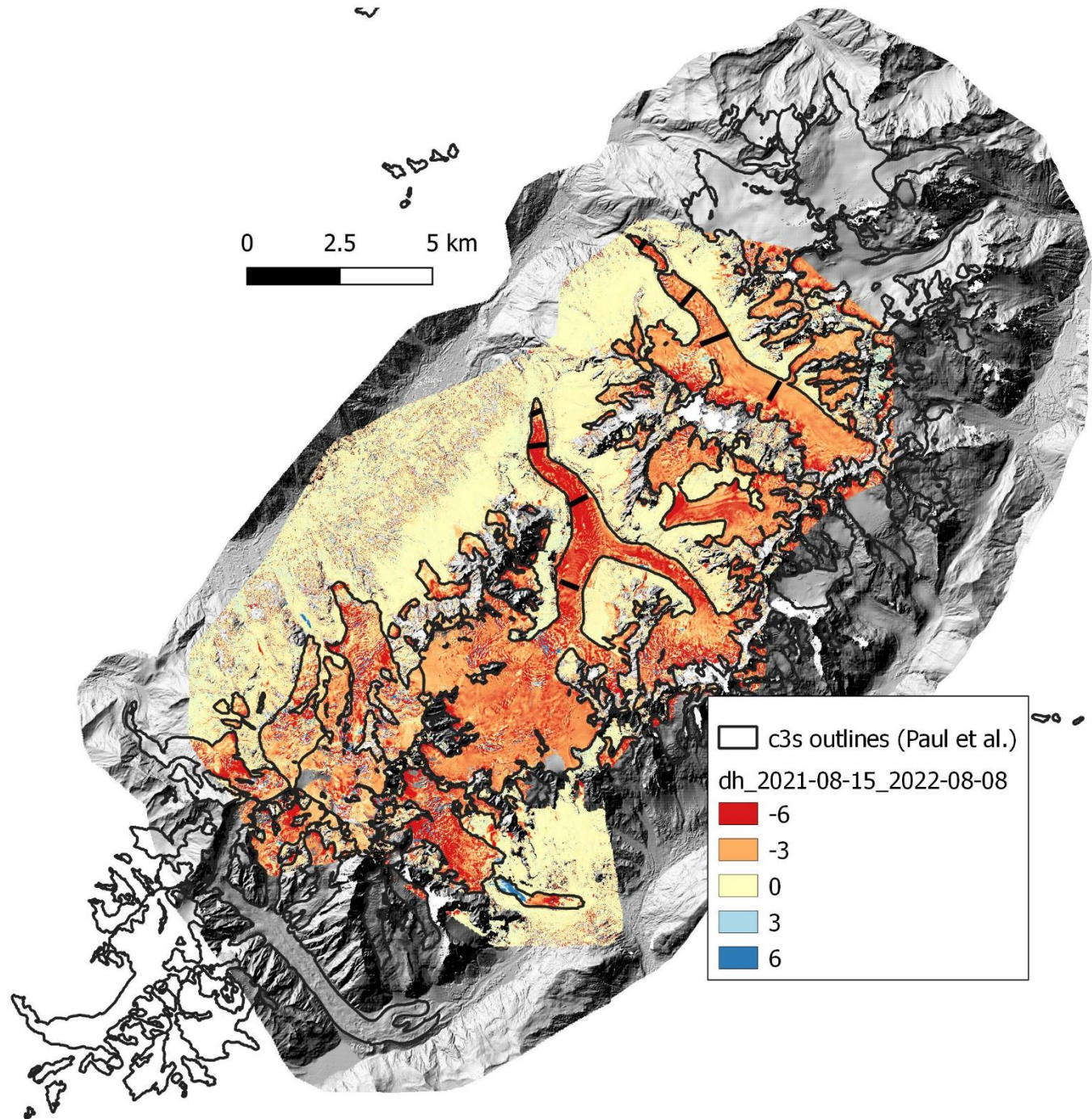
- DEMs are generated without control point at a ground sampling distance of 4 m
- DEMs are coregistered to a reference DEM on the stable ice free terrain to minimize elevation differences
- They are differentiated to obtain a map of the elevation changes on glaciers





Results

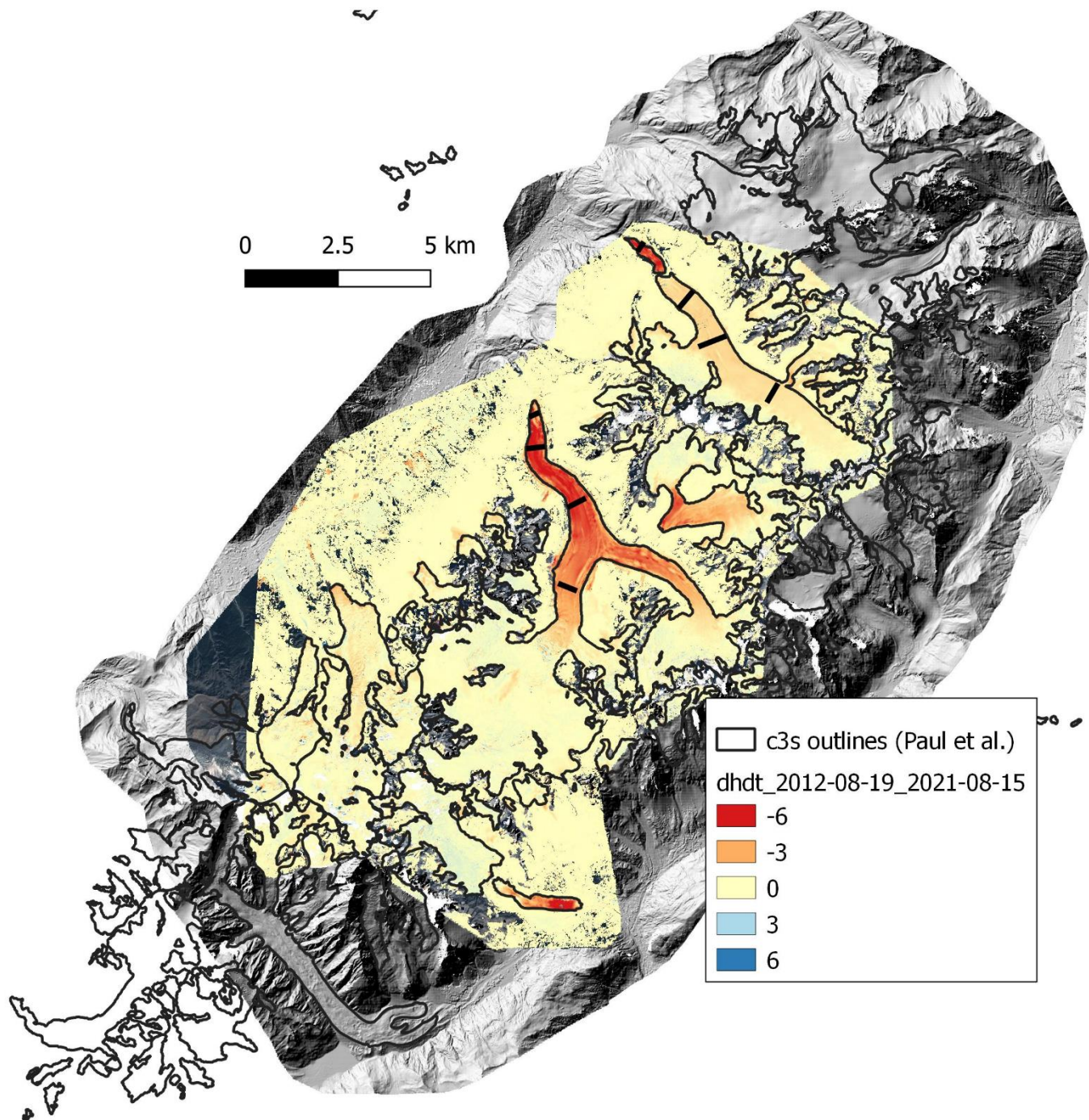
- Map of elevation changes from August 2021 to August 2022
- Red on glaciers : they are thinning rapidly and at all elevations
- Validation using GPS highly accurate measurements at 8 transverse profiles: precision better than 50 cm





Results

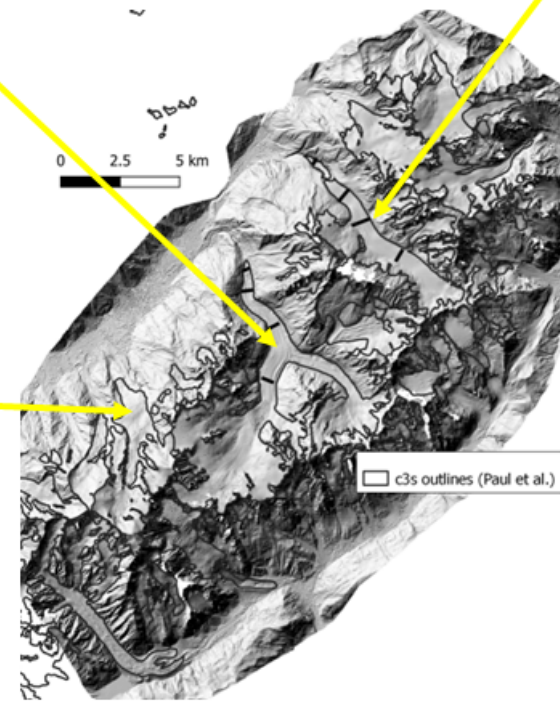
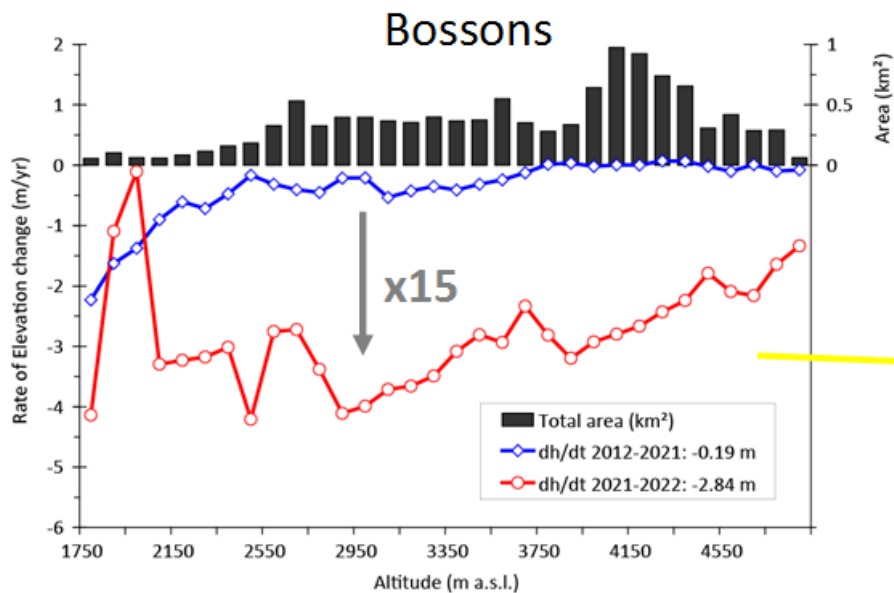
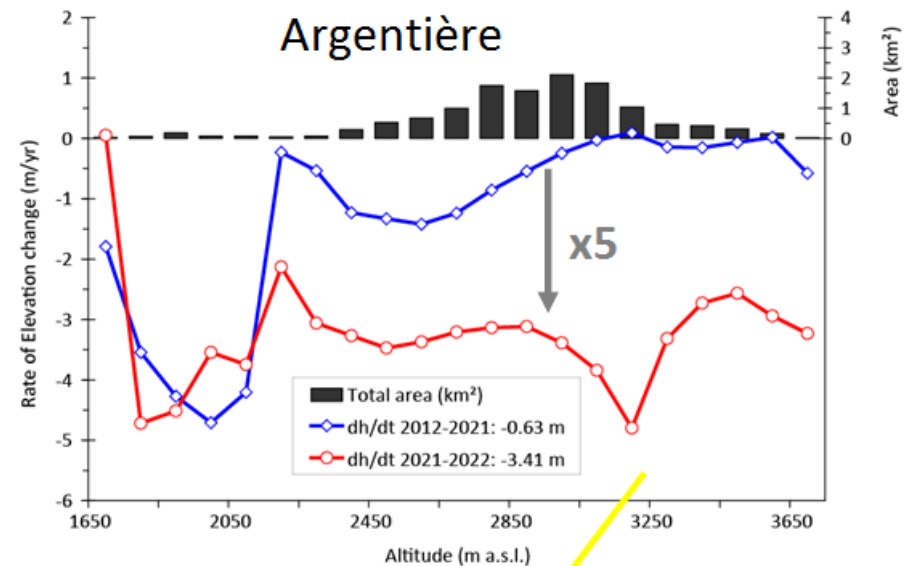
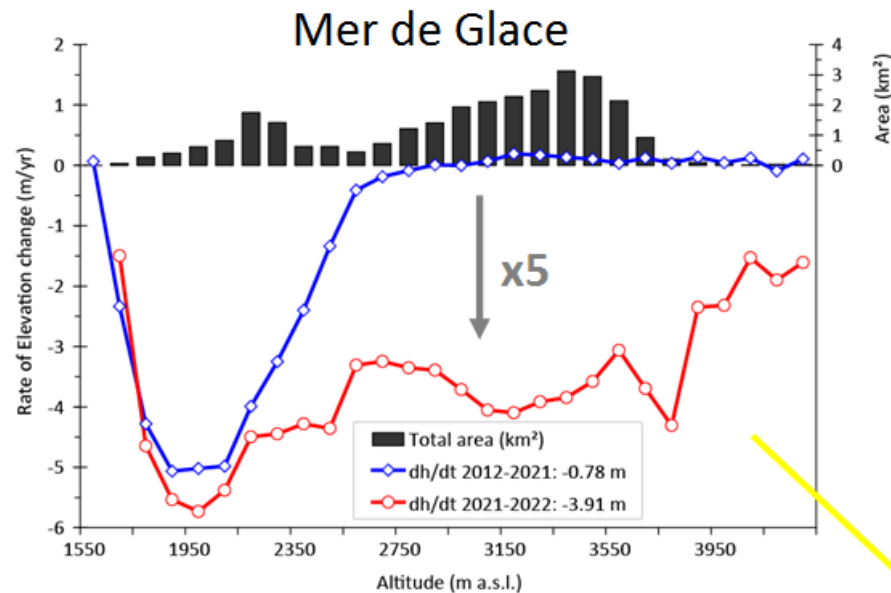
- Map of elevation changes from August 2012 to August 2021
- Not the very good coregistration of the DEMs off glaciers
- Red on glacier tongues : they were thinning mostly in their lower elevations and the upper parts were resisting quite well





Results

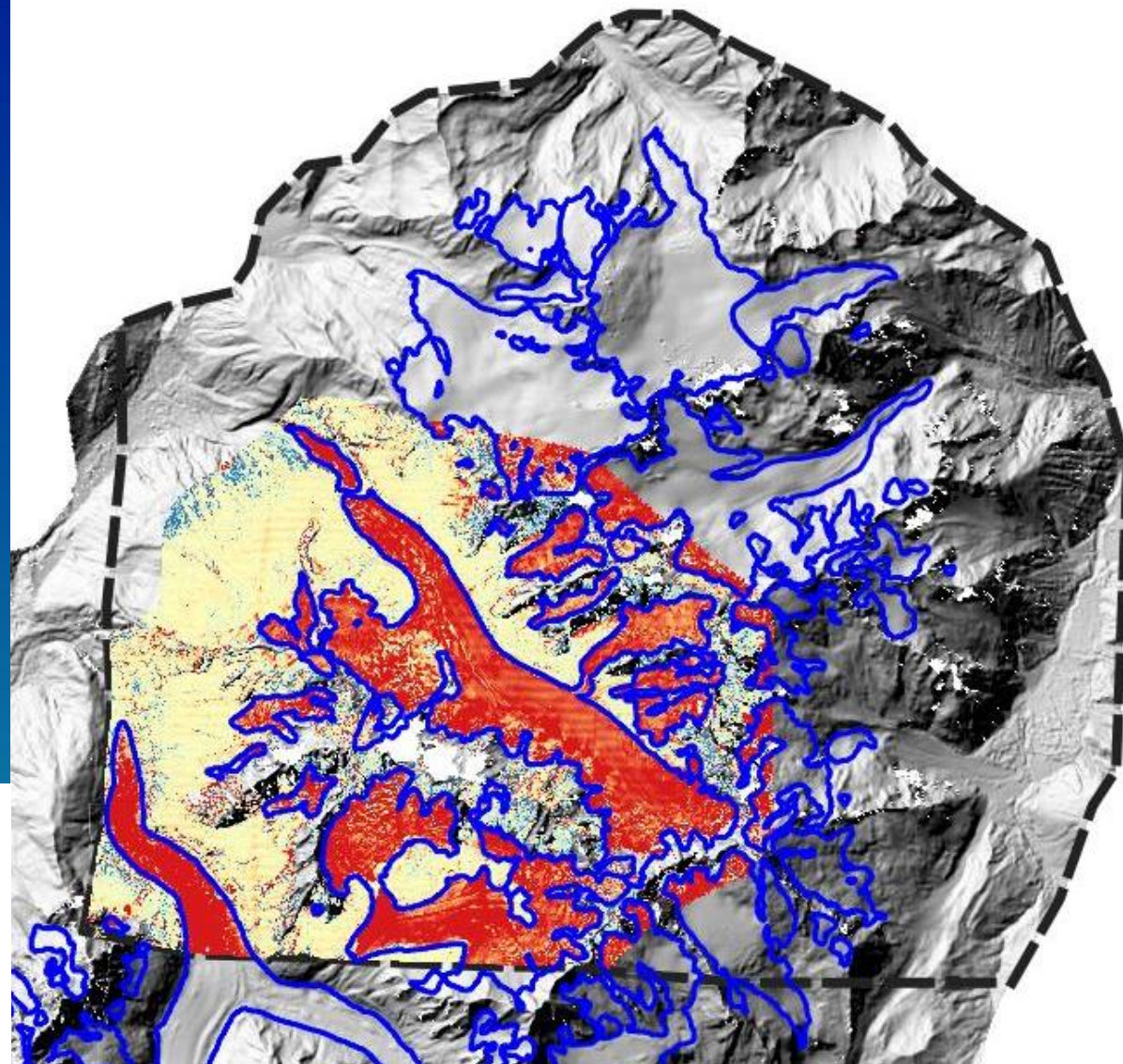
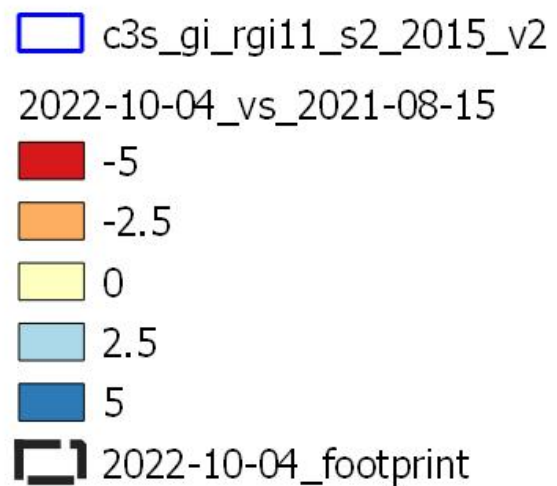
- Rate of change with altitude for the two periods
- Drastic acceleration of the mass loss in the last year





Results

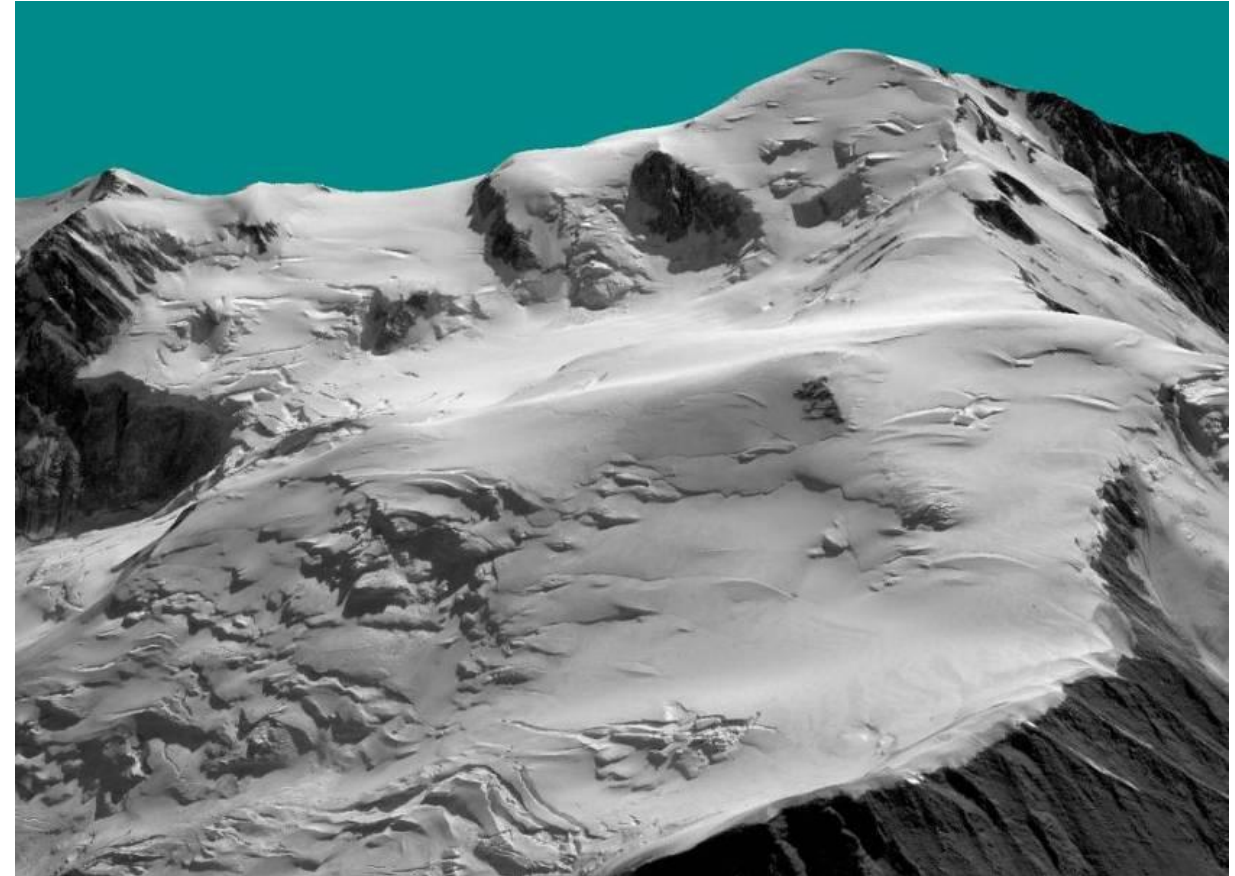
- Short term changes Pnéo vs PHR
- Elevation changes from 15 August 2022 to 4 October 2022





Benefits

- Very high resolution stereo images are an efficient way to measure the constantly evolving glacier topography
- It allows monitoring the impacts of climate change on glaciers and their consequences in term of sea level rise and water resources
- Data accessibility remains the main bottleneck to apply these methods at global scale and ensure the continuity of the glacier high resolution monitoring from space



*Images Recette Thématique Utilisateur Pléiades, © CNES
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