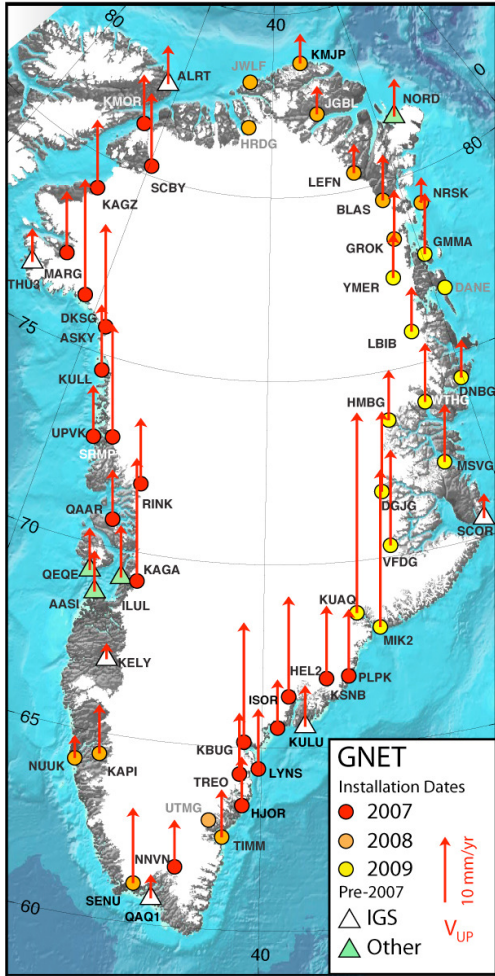


Greenland ice sheet mass balance from GPS, GRACE and ICESat,

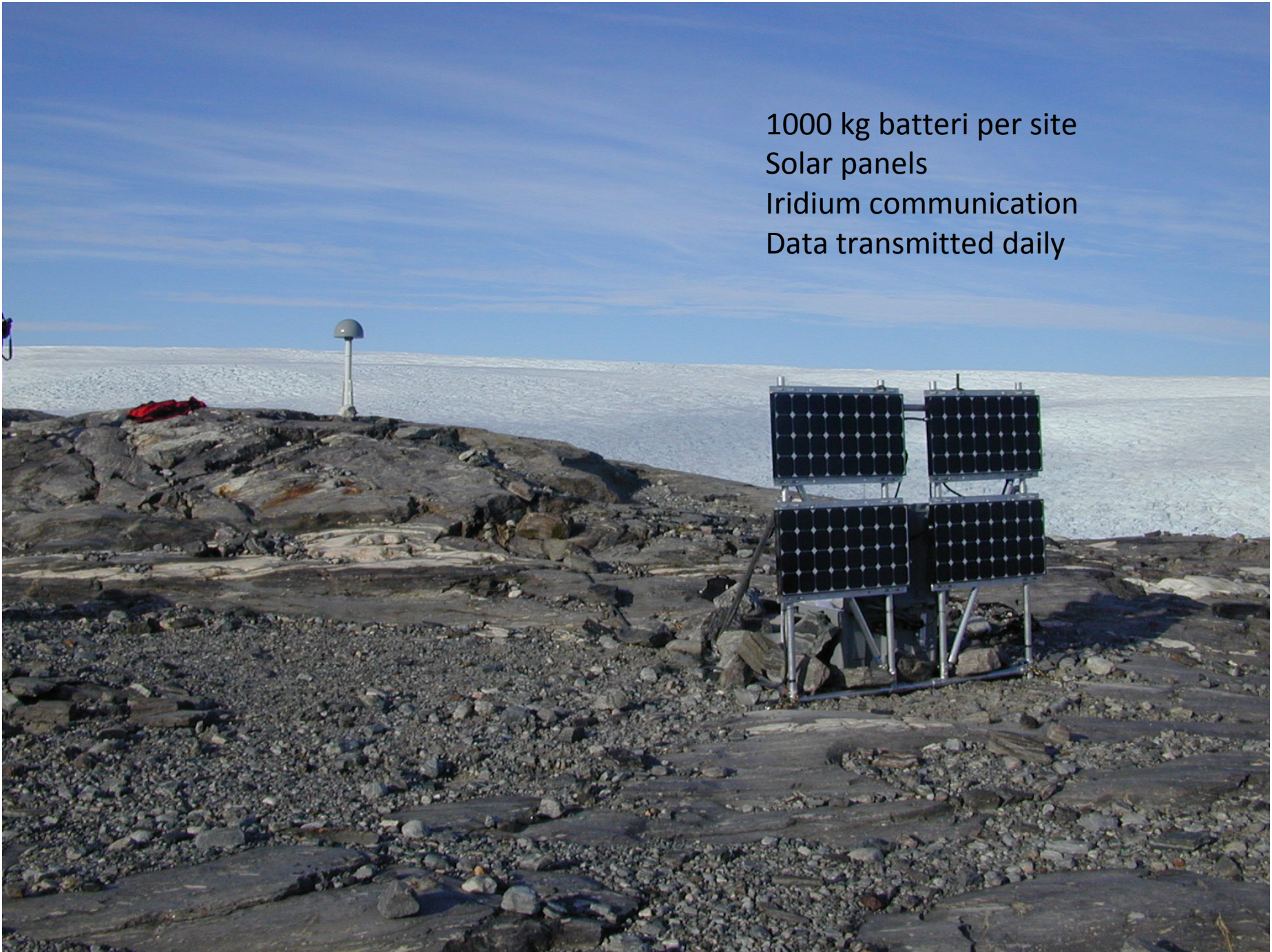
Shfaqat Abbas Khan

DTU Space - National Space Institute, Technical University of Denmark, Department of
Geodesy, Copenhagen, Denmark.

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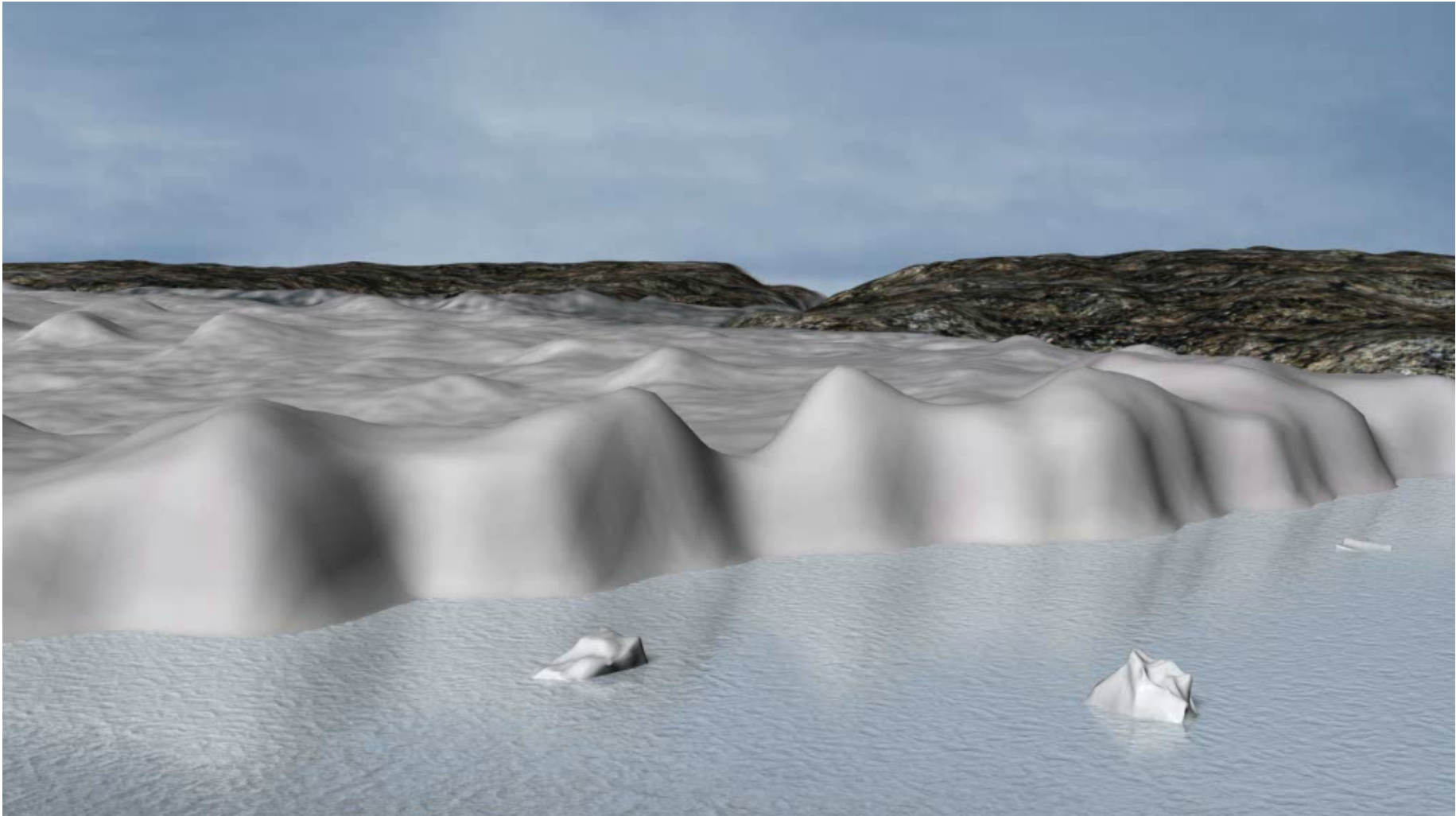
1000 kg batteri per site
Solar panels
Iridium communication
Data transmitted daily

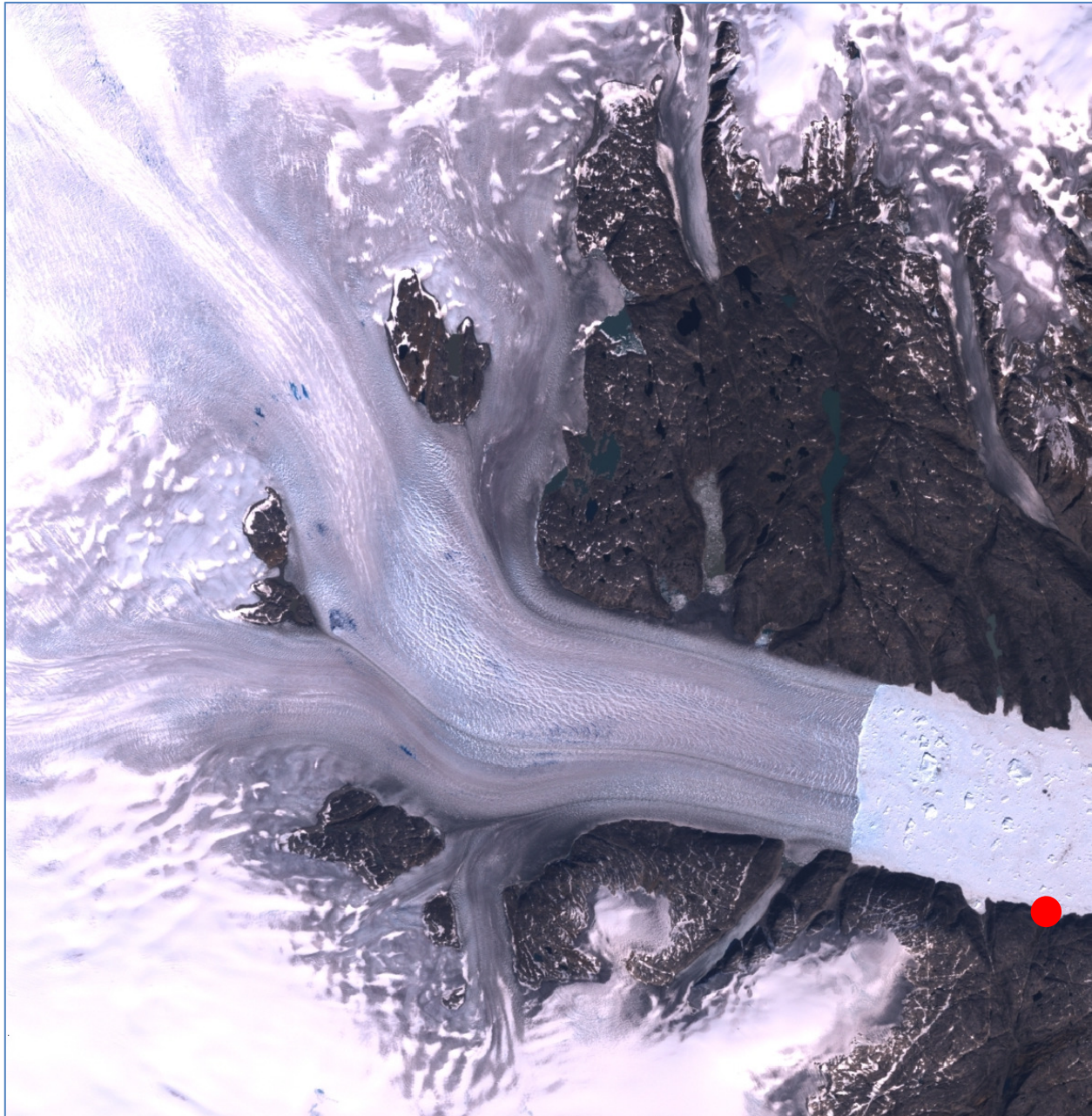


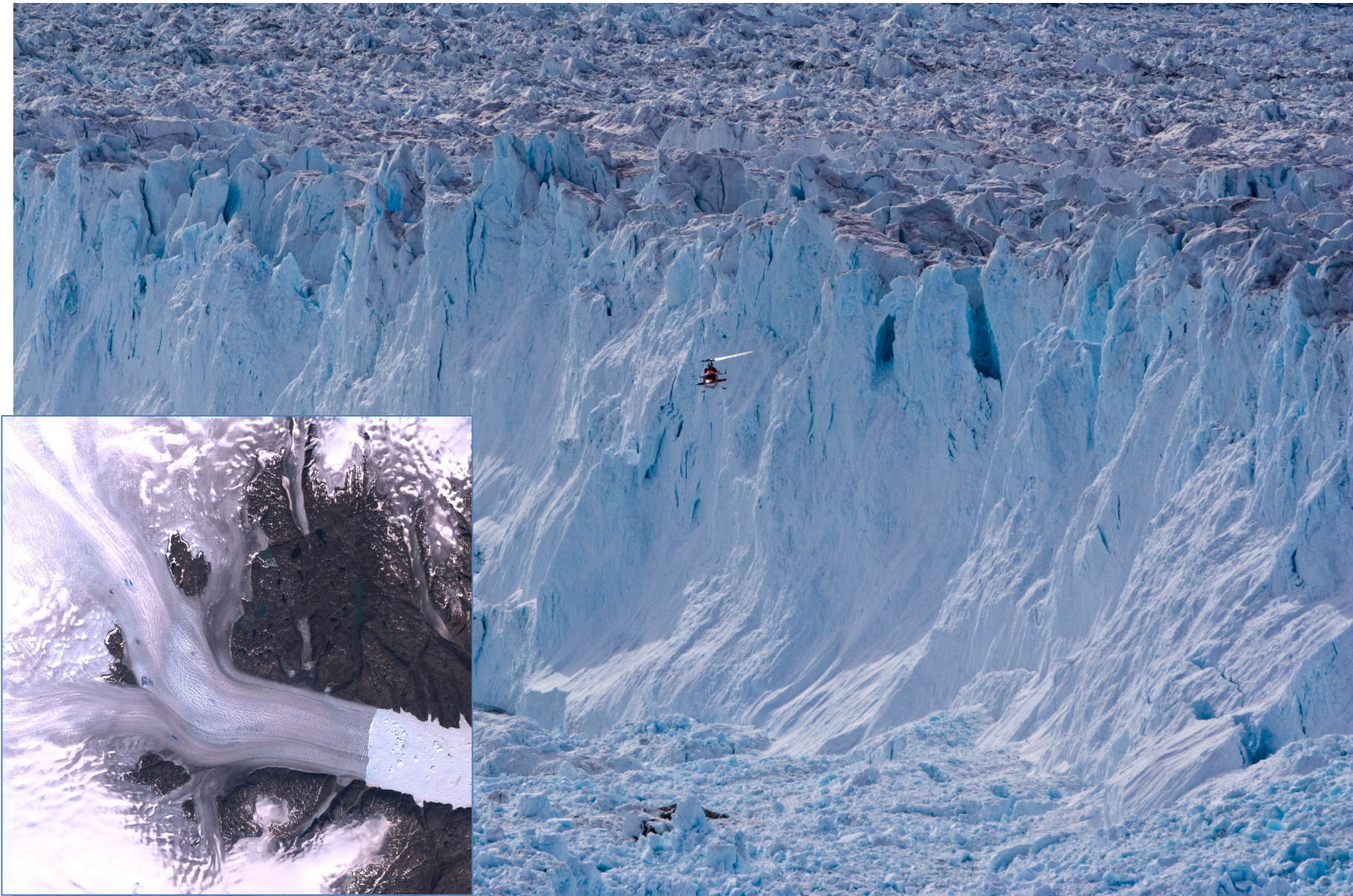
1000 kg batteri per site
Solar panels
Iridium communication
Data transmitted daily

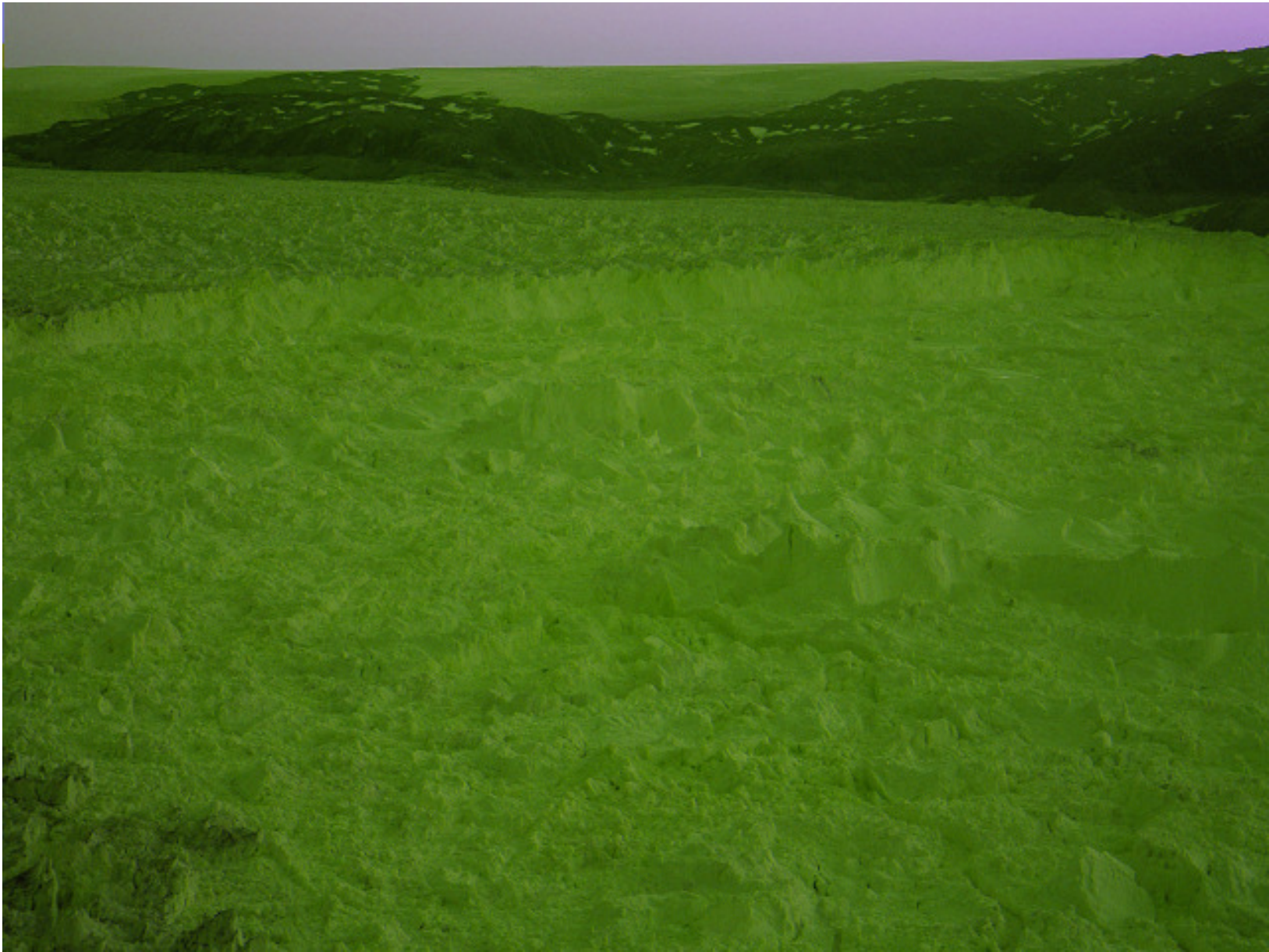


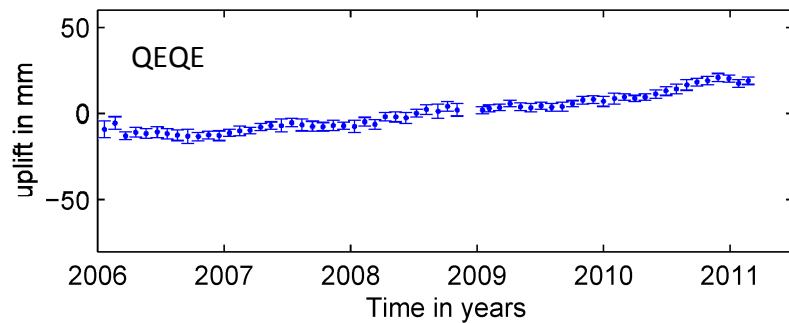
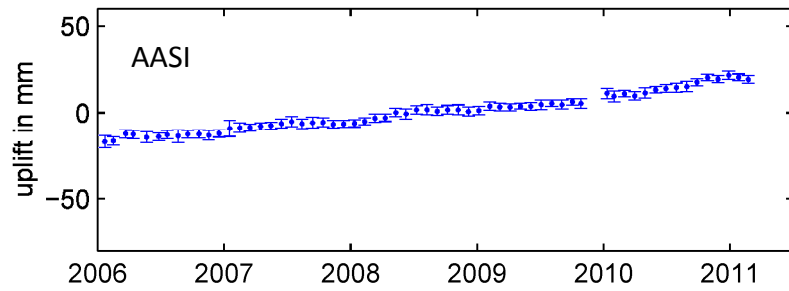
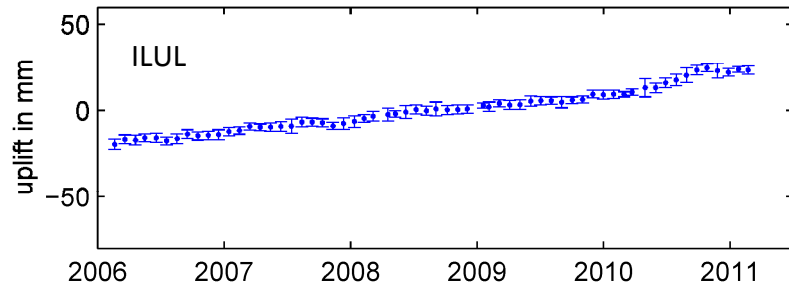
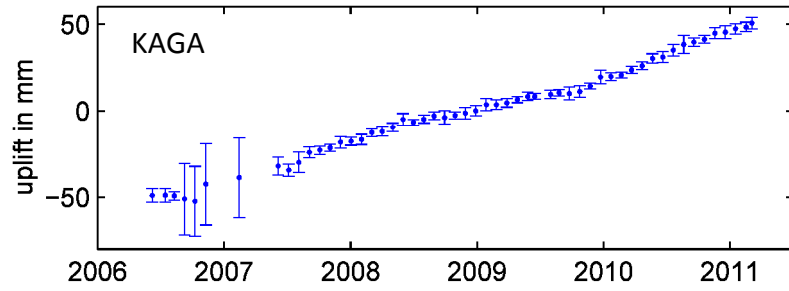
Takes up to 8 months to fix a site



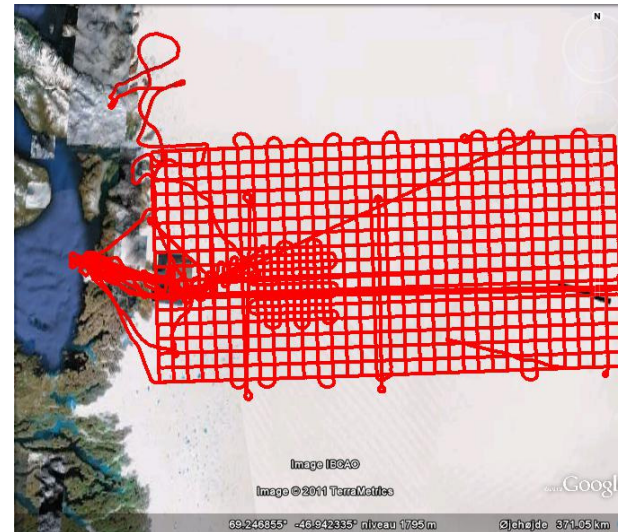
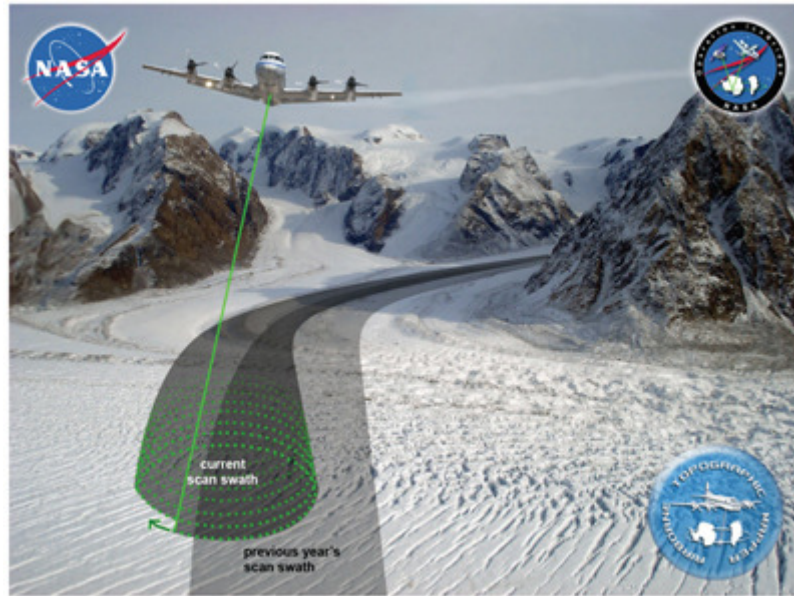




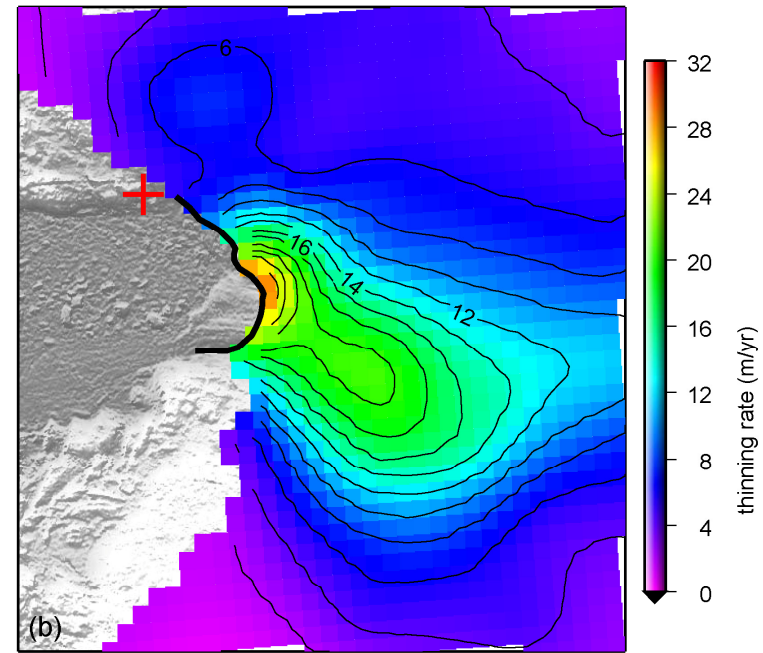
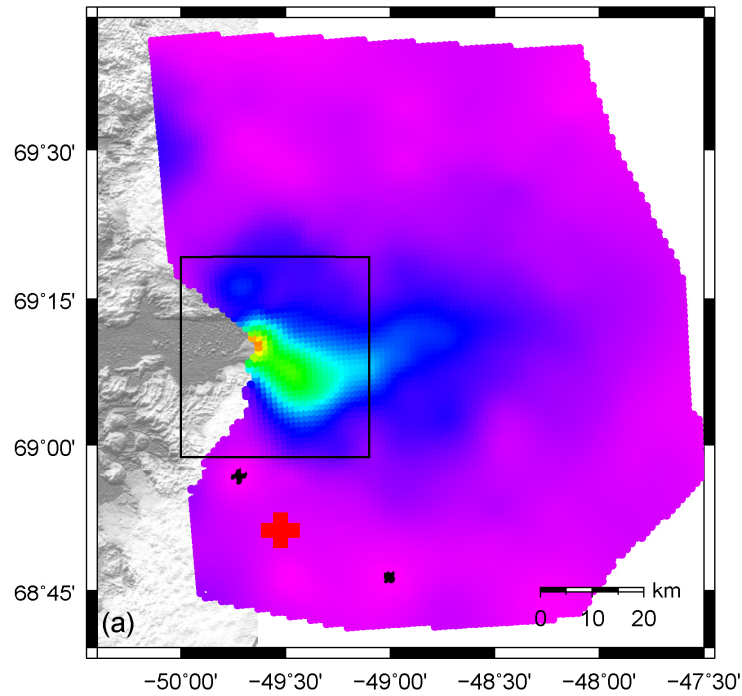




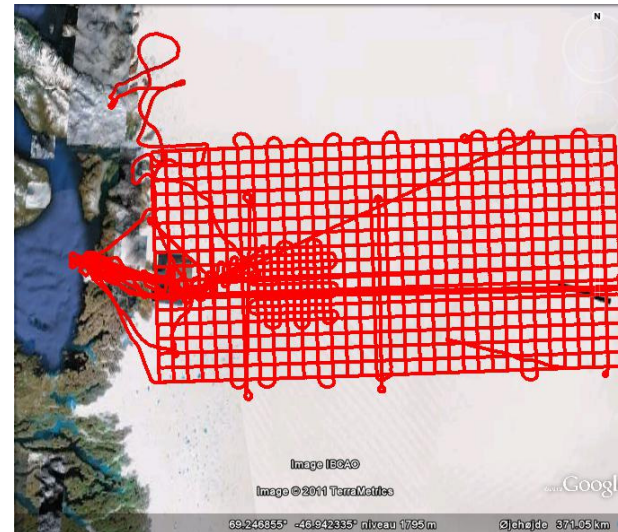
Elevation changes

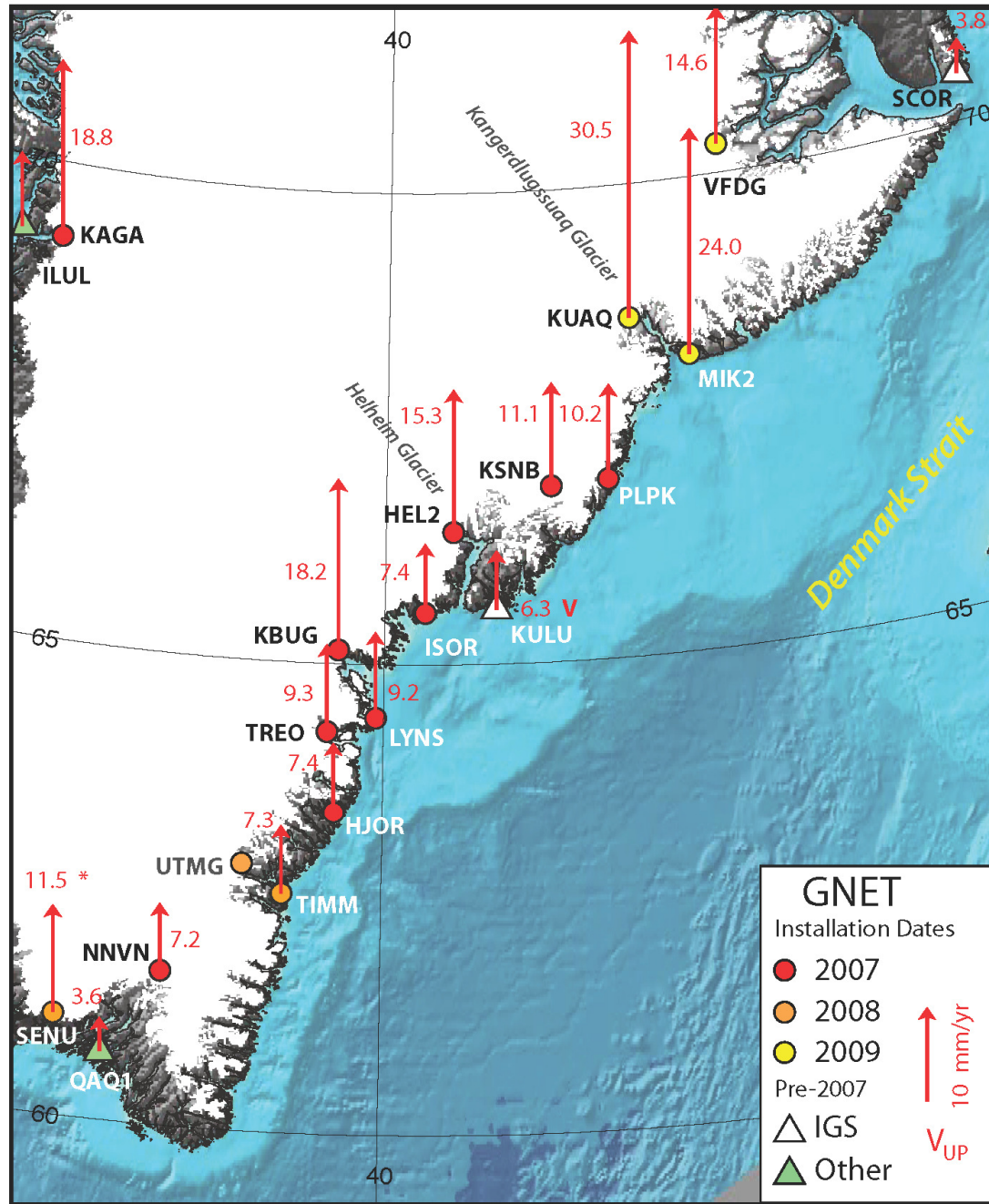


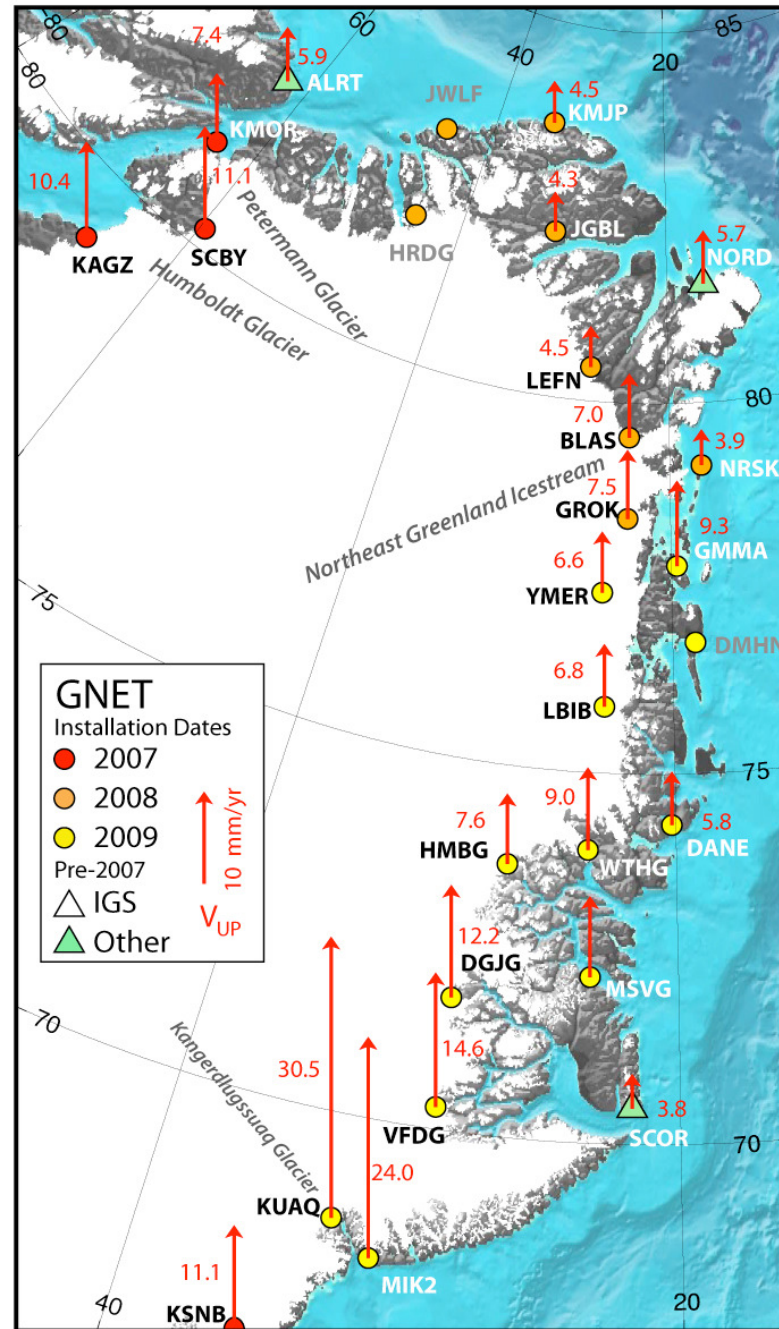
Elevation change mode from ATM 2006-2011

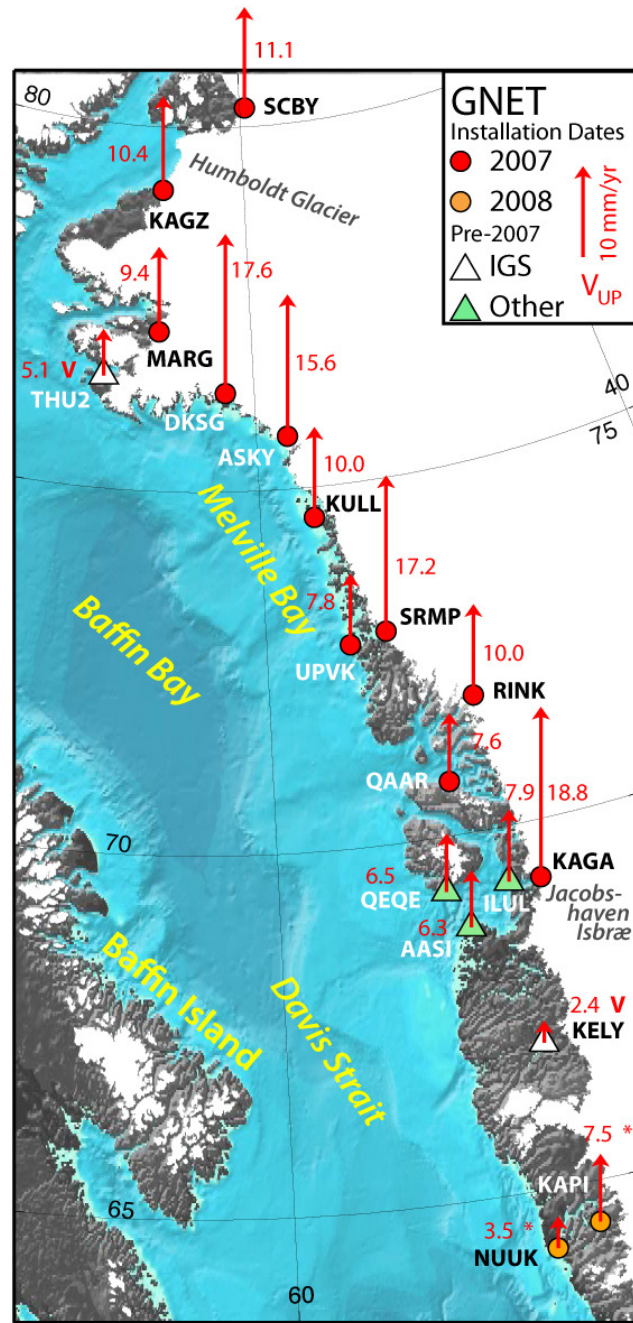


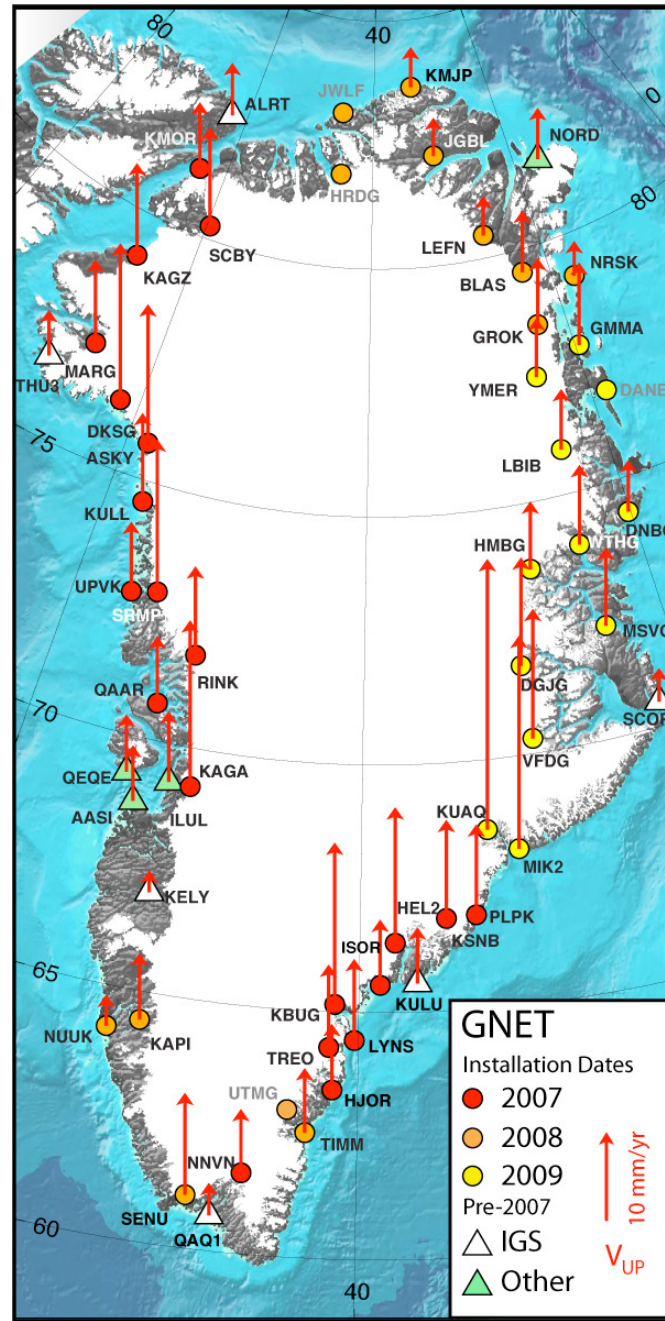
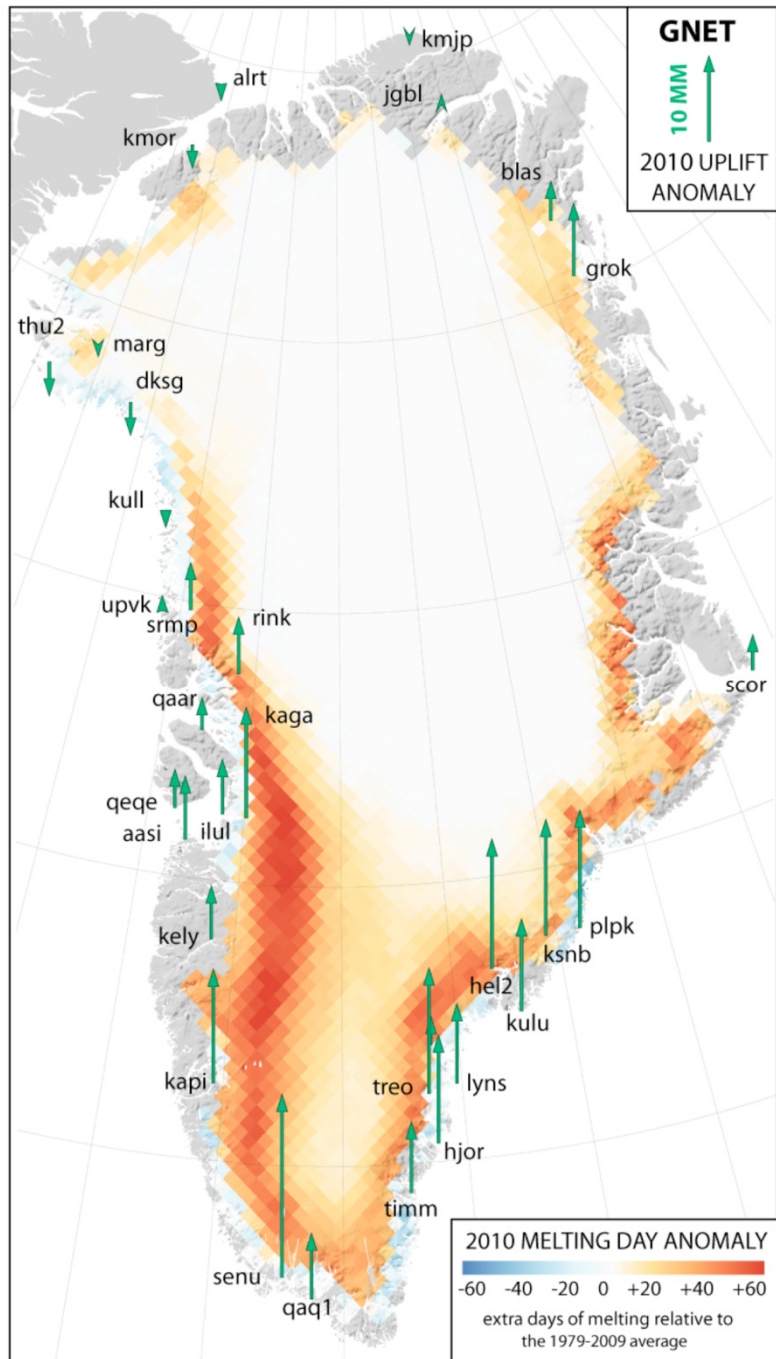
GPS and ATM data suggest $20 \text{ km}^3/\text{yr}$



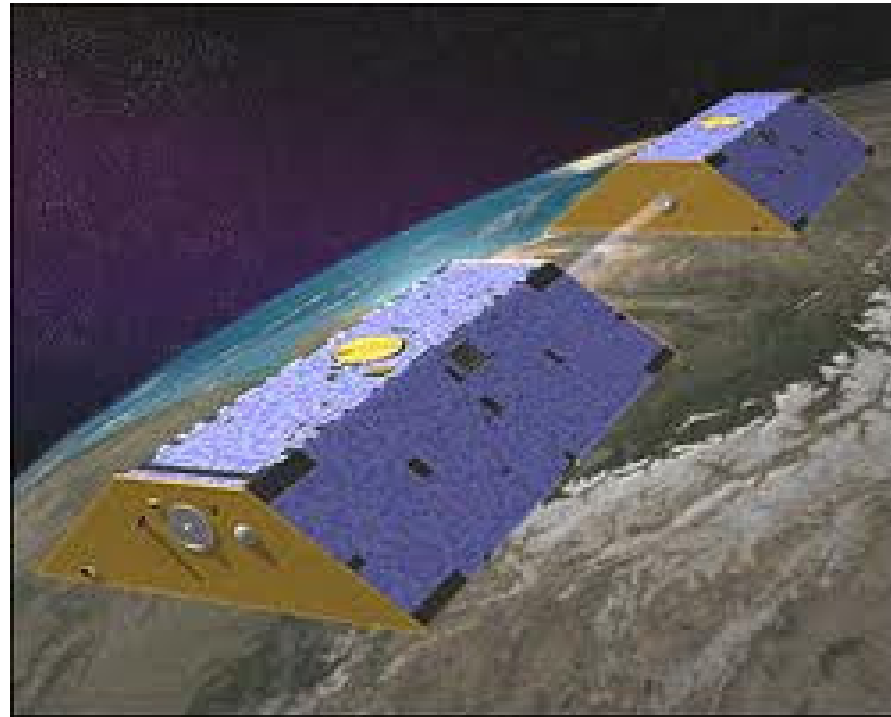


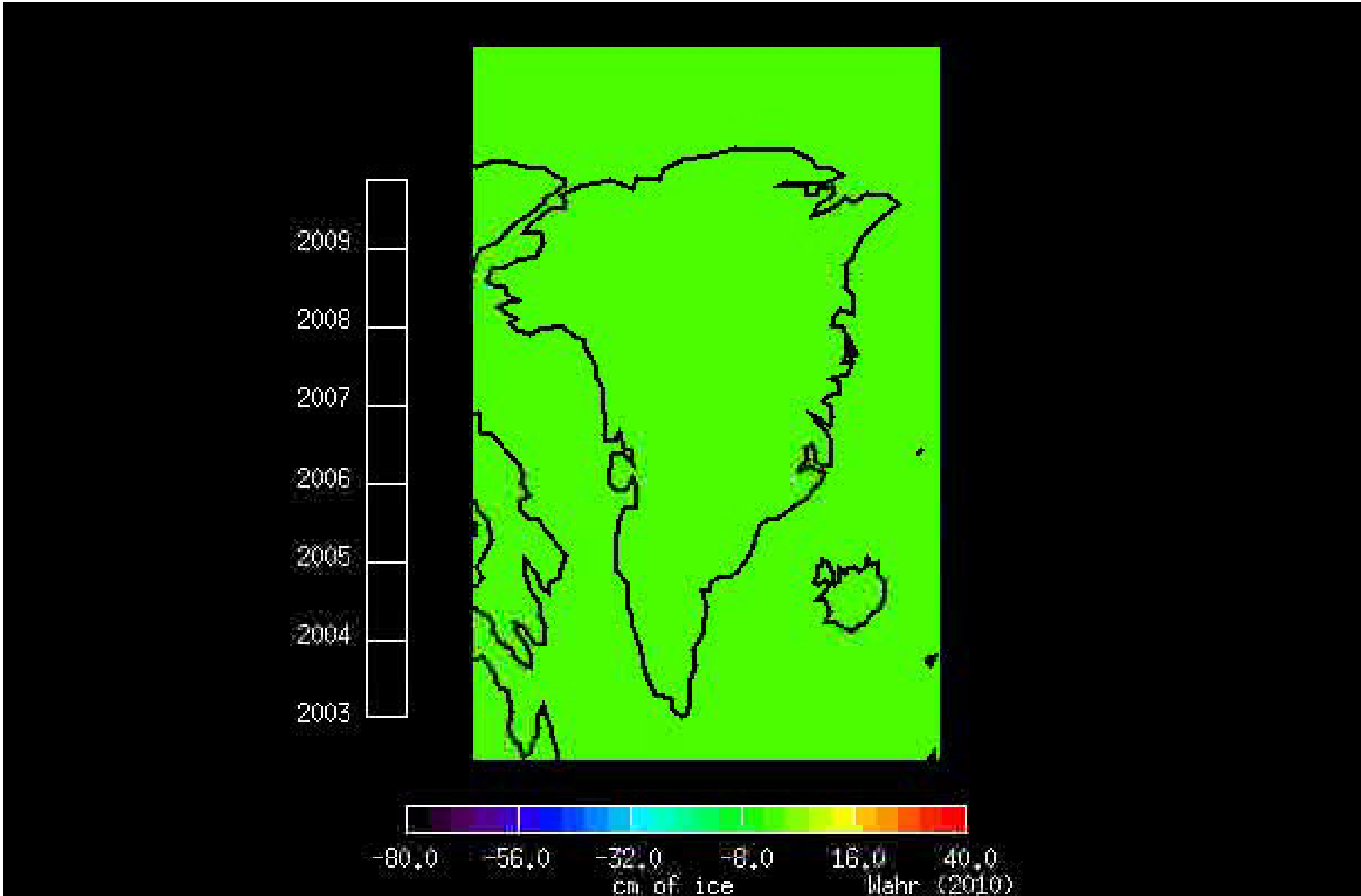






GRACE measures changes in gravity -> mass changes





Conclusions

GRACE, GPS show consistent results.

**Acceleration in ice loss in northwest in 2005,
southeast 2004.**

**Elastic uplift of up to 3 cm/yr due to present
day ice loss.**

**South Greenland experienced “extra” 1 cm of
uplift in 2010 due to huge melting of ice.**