Mass balance of 14 Icelandic glaciers, 1945–2017: spatial variations and links with climate

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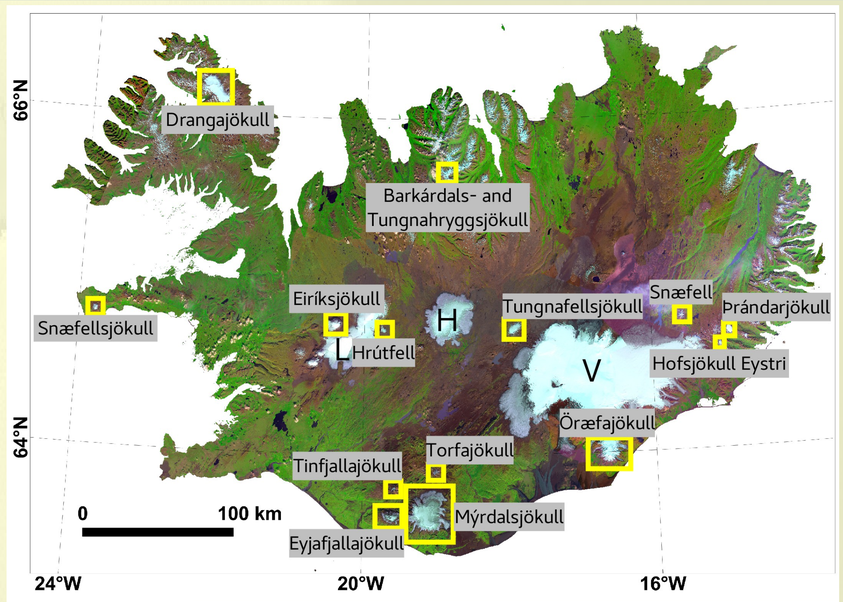
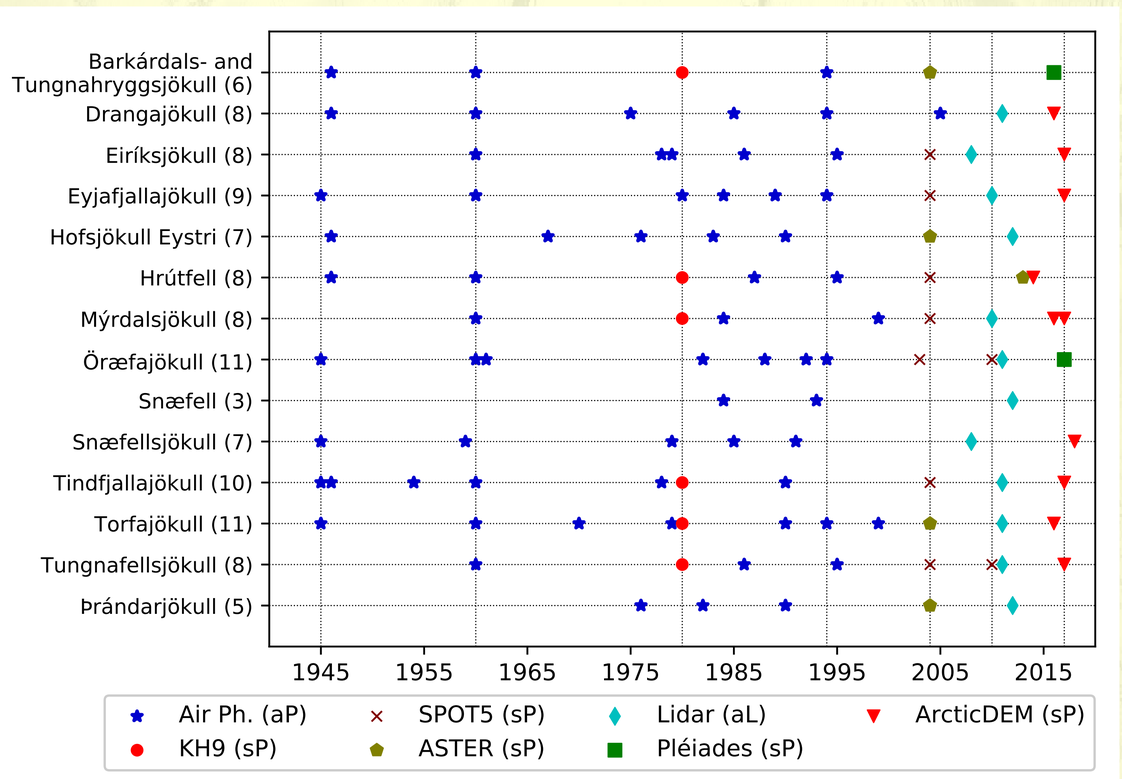
In a nutshell*:*

- Processing of stereoimages and creation of multi-temporal DEMs from 1945 to 2017, for 14 glaciers scattered over Iceland
- Calculation of geodetic mass balance, floating-date and fixed-date (seasonally-corrected)
- Regression model relating geodetic mass balance with summer temperature and winter precipitation
- Temporally-homogenized mass balances calculated for 1945–1960, 1960–1980, 1980–1994, 1994–2004, 2004–2010 and 2010–2017



Data*:*

- Stereoimages, lidar (Jóhannesson et al., 2013), ArcticDEM (Porter et al., 2018)
- Gridded climatic data: temperature 1949–2018 (Crochet et al., 2007), precipitation 1957–2006 (Crochet et al., 2011), precipitation 1980–2018 (Nawri et al., 2017)



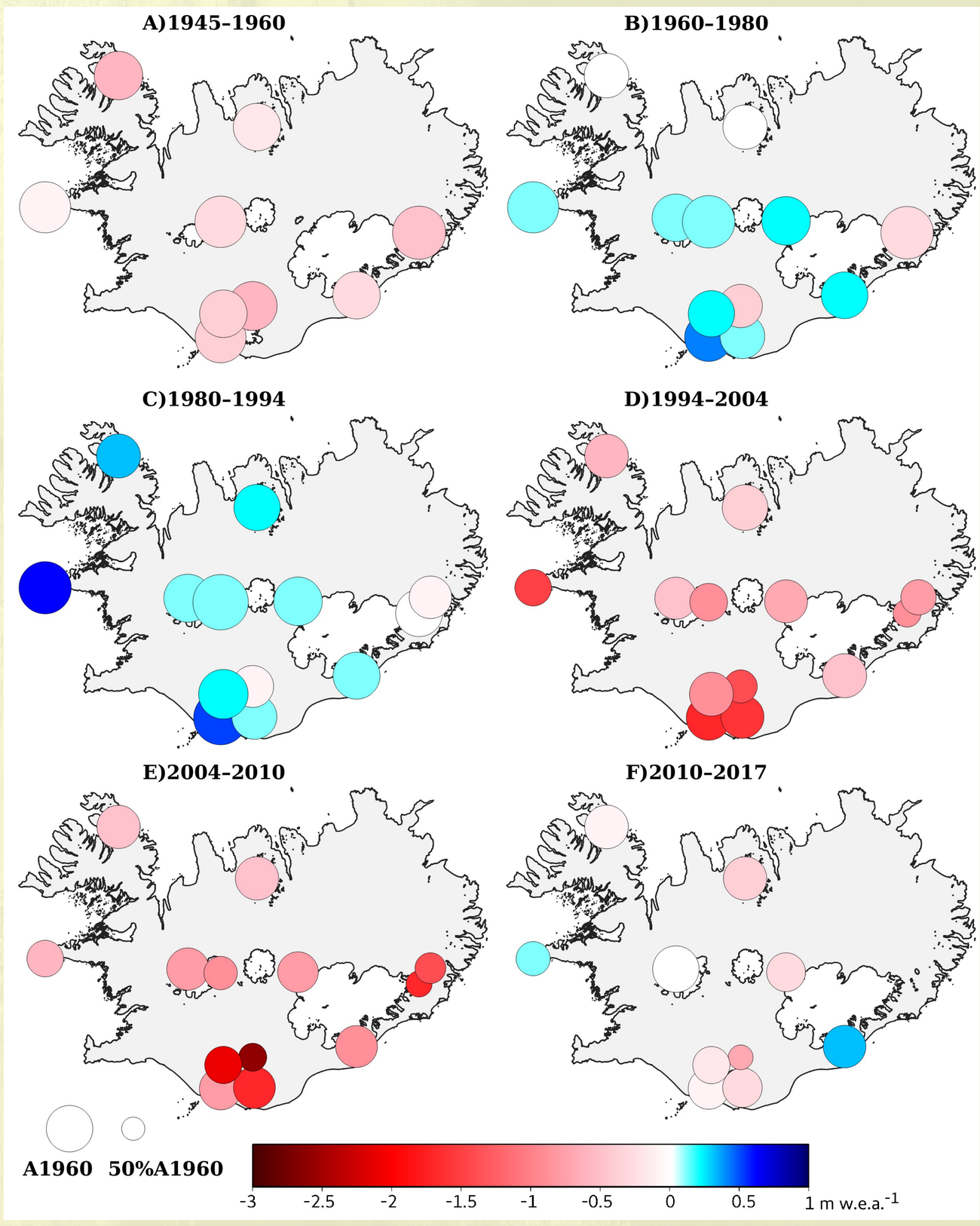
Methods*:*

- Photogrammetry, seasonal corrections, uncertainties, mass-balance-climate relationship from Belart et al. (2019).
- Temporal homogenization using modelled annual mass balance, obtained from a regression model between geodetic mass balance, summer temperature and winter precipitation

In more detail...

- Static sensitivities: –2.1±0.3 m w.e.a^{-1} K^{-1}, 0.2±0.1 m w.e.a^{-1} (10%)$^{-1}$ for the southern and western glaciers, and –0.7±0.1 m w.e.a^{-1} K^{-1}, 0.1±0.1 m w.e.a^{-1} (10%)$^{-1}$ for the central, eastern and northern glaciers.
- Long time periods: 0.1±0.1 m w.e.a^{-1} in 1960–1994, followed by –1.2±0.1 m w.e.a^{-1} in 1994–2010.
- The regression model shows good agreement (R^2>0.7) between observed and statistically derived mass balance

“The big picture”



Take away messages:

- First “Region-wide” study in Iceland (although only 10% of Icelandic glaciers were studied)
- Highest melt occurred in 1994–2010: –1.2±0.1 m w.e.a^{-1}, or 21.4±1.6 Gt
- Southern and western glaciers are more sensitive to summer temperature and winter precipitation and show the largest decadal mass-balance variabilitites

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