Integrated microgravimetric and seismic monitoring approach in the Þeistareykir volcanic geothermal field (North Iceland)

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ÍSOR Iceland GeoSurvey
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Scientific objectives

Interpretation of gravity changes in terms of mass movements related to geothermal production and injection in a complex volcano-tectonic-setting

Instrumental calibration and correction of gravity data

→ Observatory gravity measurements at J9 in Strasbourg

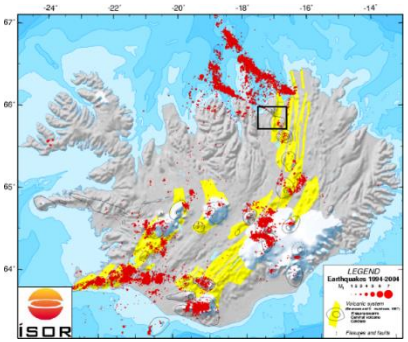
→ Absolute gravity measurements (calibration and drift correction)

→ Hydro-meteorological and GNSS measurements

Interpretation of gravity data

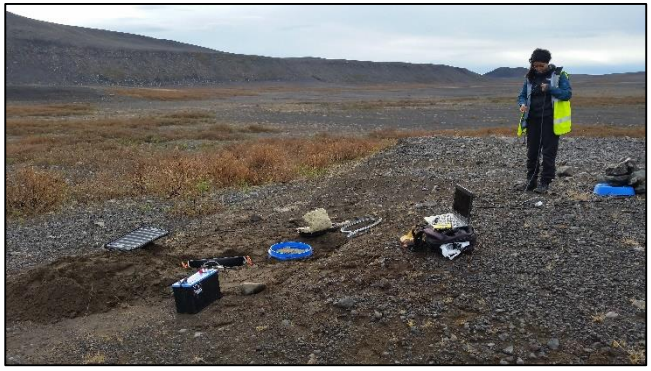
→ Discrimination between natural and manmade influences on gravity observations

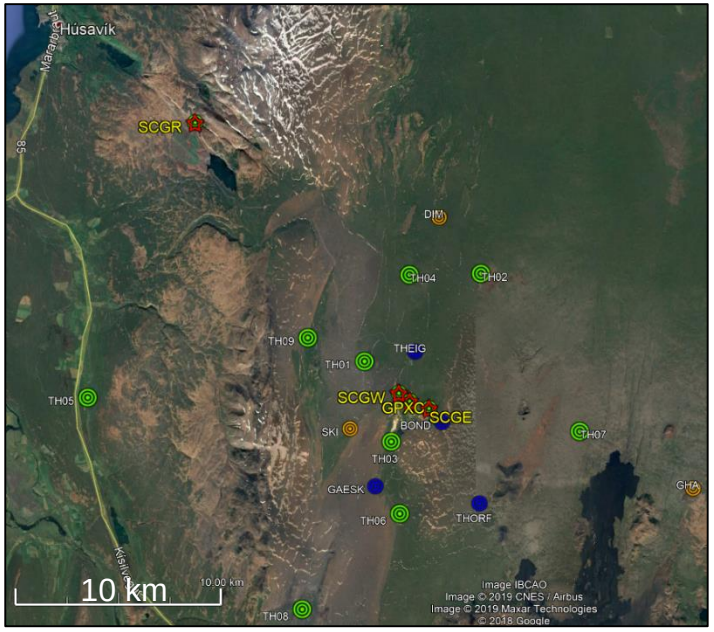
Passive seismic monitoring



- Continuous monitoring (since Sep 2017)
- Very dens local network (incl. Icelandic permanent stations)
- Analysis of local seismicity: natural! and exploitation related?

Seismometer installation and seismic network at Þeistareykir



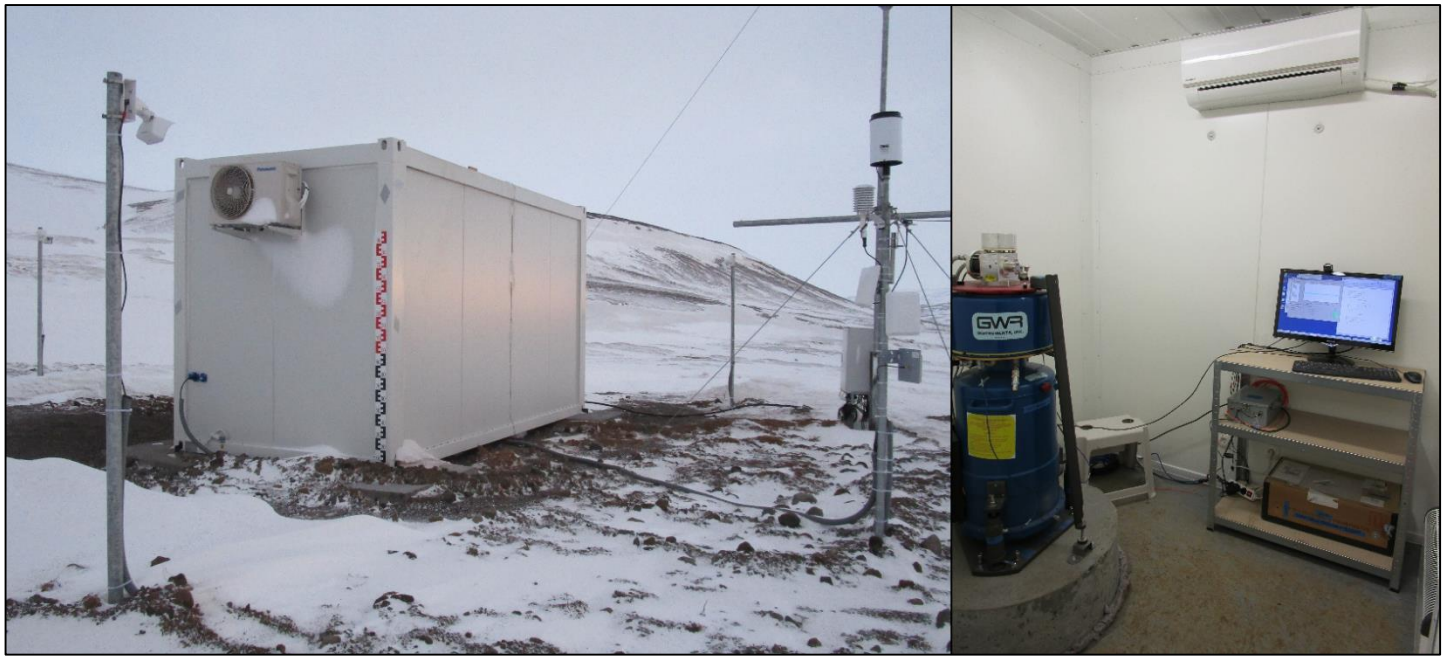


Gravity network and campaigns at the Þeistareykir geothermal field

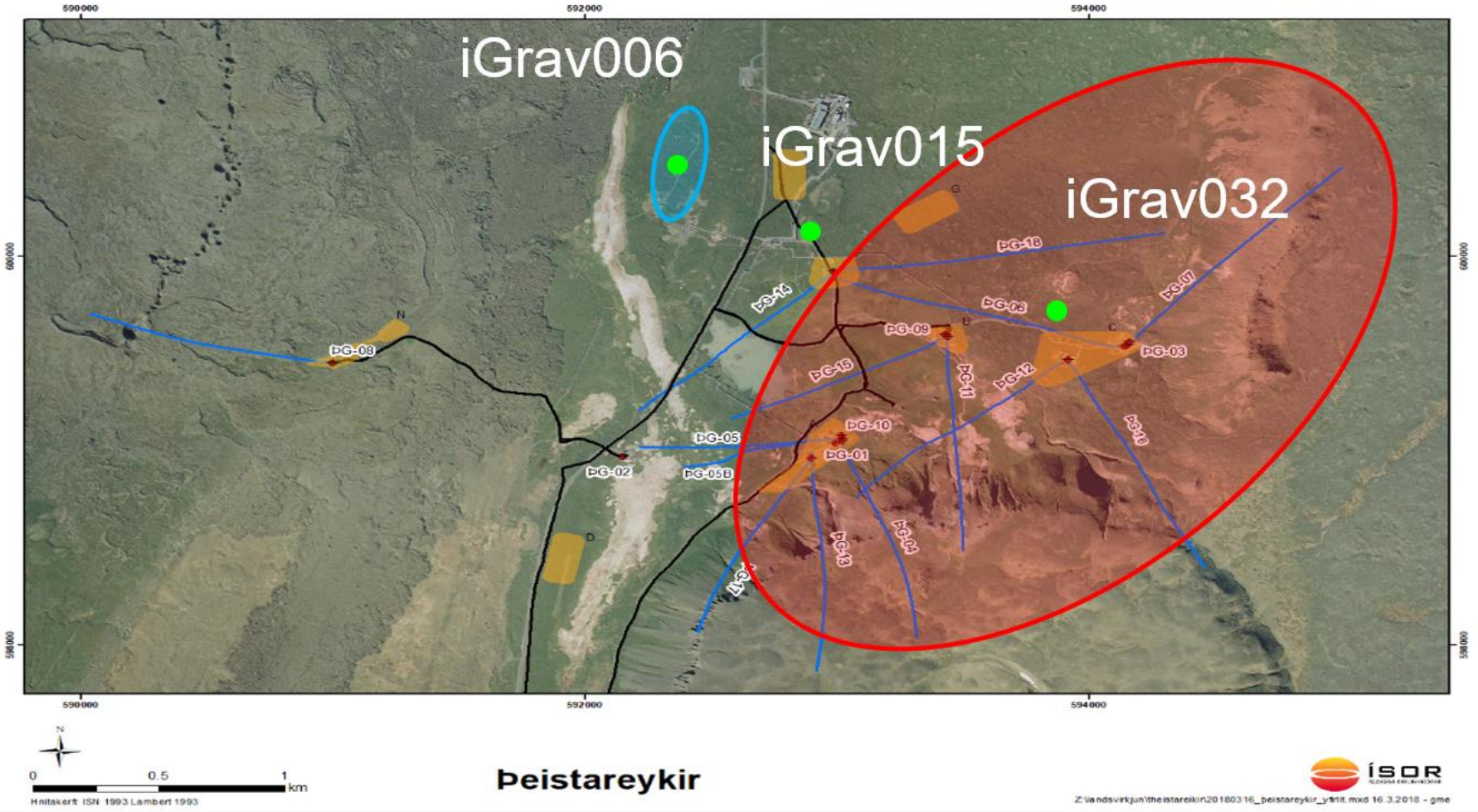
- 3 micro-gravity campaigns (summers 2017+2018+2019)
- 3 absolute gravity campaigns (winter 2018, summers 2018+2019)
- 4 continuous gravity monitoring stations (since December 2017)

Setup for each gravity station

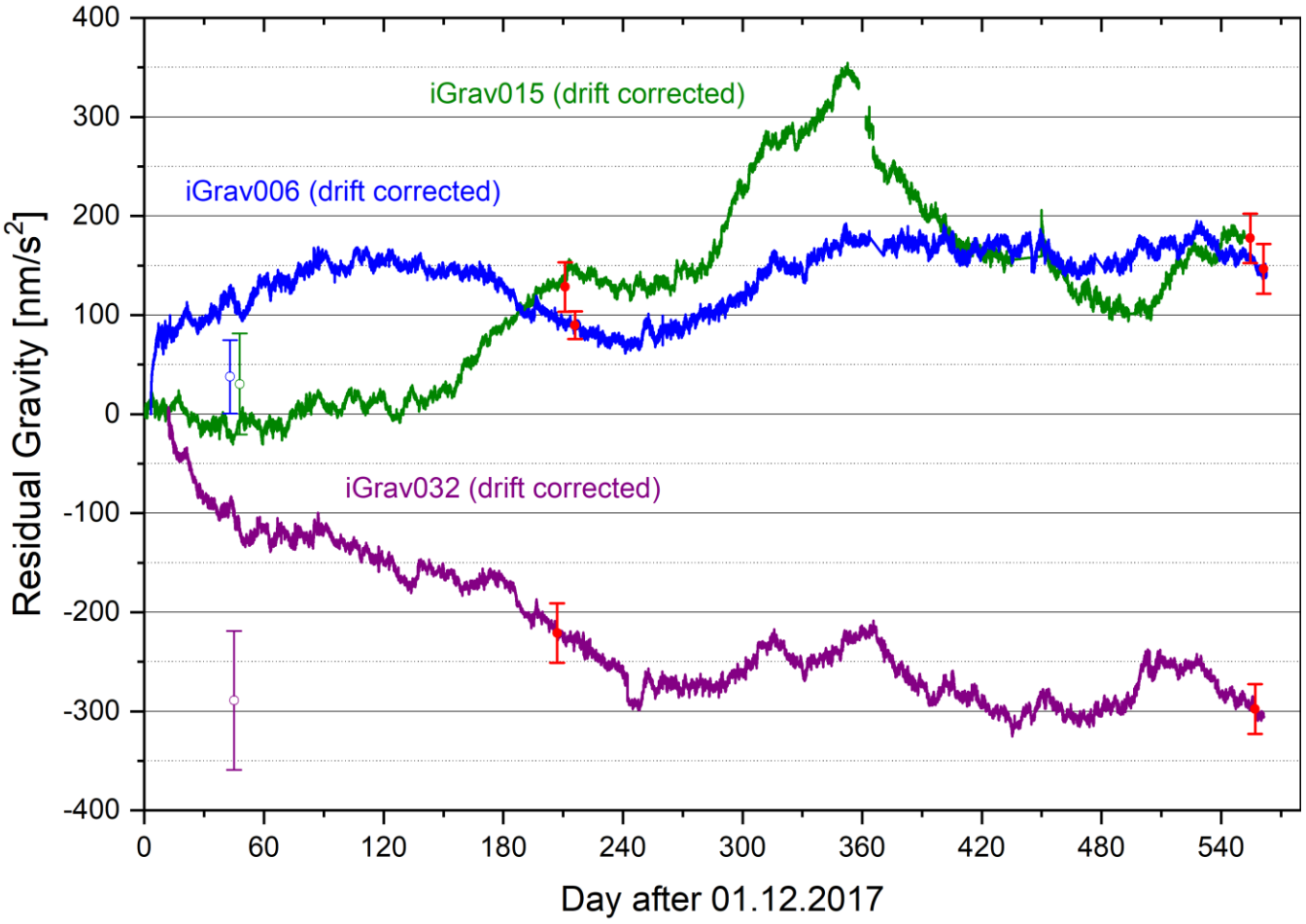
- Left: hydro-meteorological measurements and GNSS
- Right: gravity meter (iGrav) installed on concrete pillar



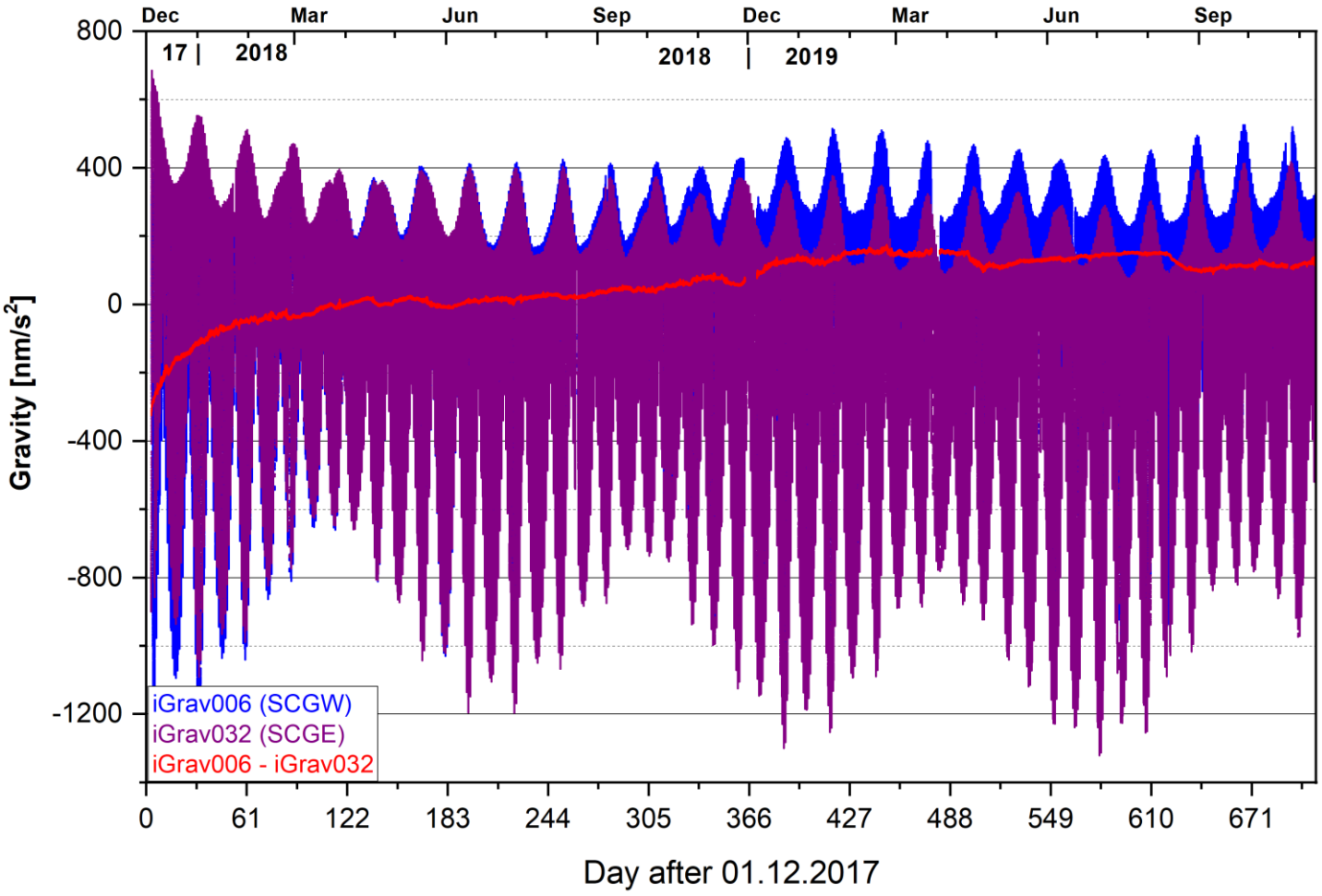
Gravity meter network at Þeistareykir → Injection and Production zones



1½ years gravity residuals at Þeistareykir → Drift correction (FG5 absolute gravity)



Drift corrected **raw gravity differences**: iGrav006 (injection) - iGrav032 (production)



Summary and Outlook

- First continuous monitoring of a geothermal reservoir with several superconducting gravity meters for more than one year
- Remotely operating with only short interruptions (~hours due to power failures)
- Instrumental drift of iGravs larger than expected

- Improvement of gravity residuals
  → Integration of hydro-meteorological and GNSS measurements
- Improvement drift corrections
  → Additional absolute gravity campaign (summer 2020, planned)
- Increasing spatial resolution of gravity changes
  → Comparison with micro-gravity measurements (CG5)
- Geothermal interpretation
  → Comparison with production and injection data from Landsvirkjun


Takk fyrir!