Earthquakes and eruptions in the Reykjanes peninsula

NKG General Assembly 2022
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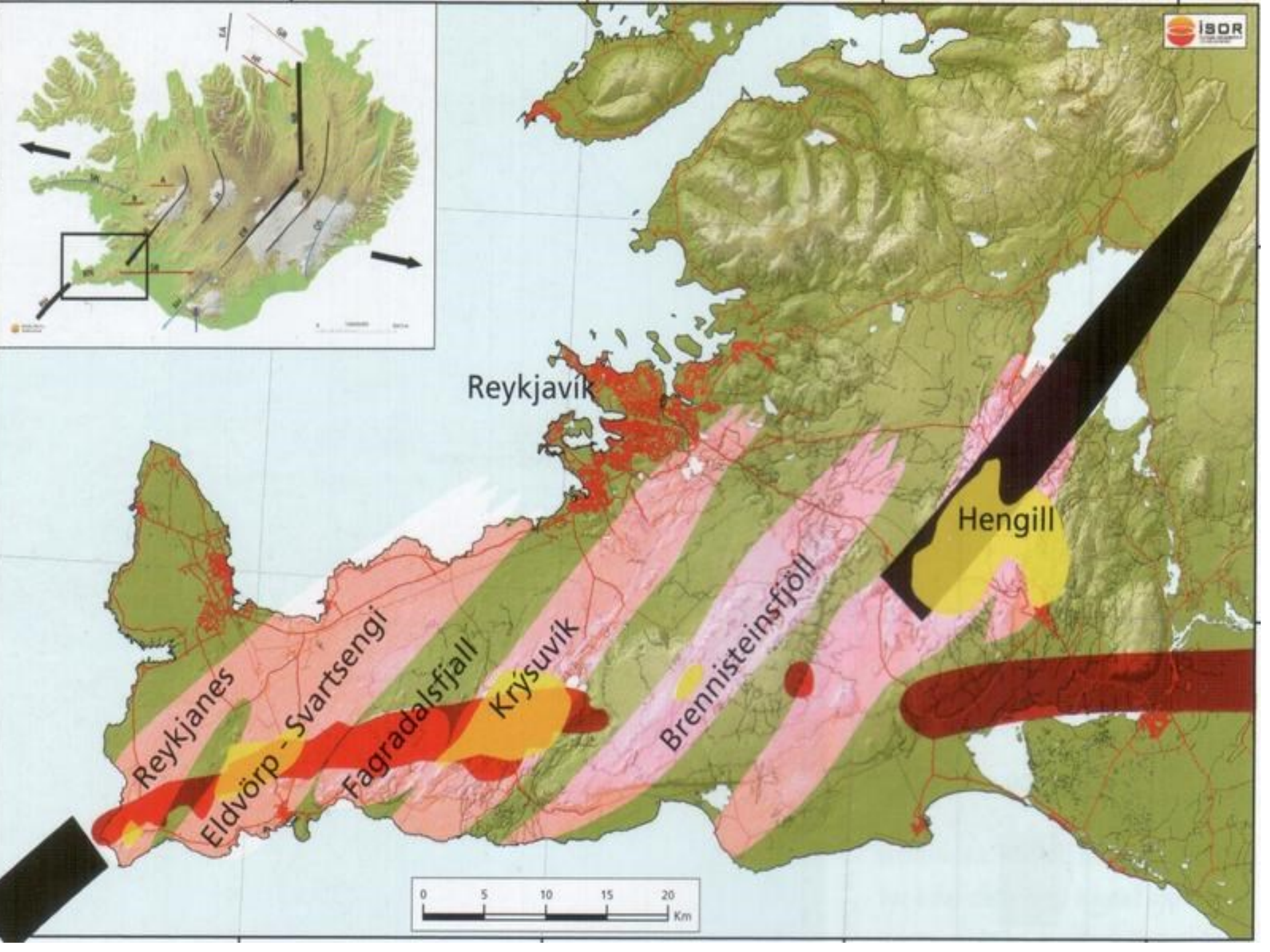
General structure and volcanism of the Reykjanes peninsula

- There are 6 active volcanic systems in the Reykjanes peninsula
- Earthquakes are frequent but generally small and occur in swarms
- Most connected to plate tectonics
- Rarely exceed magnitude 6
- Last active volcanic period was from around 800 to 1240 BC
- Volcanic activity has started again
- Most of the Icelandic population lives in the area or close by


ÍSOR
Reykjavík
Hengill
Reykjanes
Eldvörp - Svartsengi
Fagradalsfjall
Krýsuvík
Brennisteinsfjöll
0
5
10
15
20
Km

Earthquakes in Reykjanes peninsula

- The unrest started in January 2020 with uplift around the mountain Þorbjörn close to town of Grindavík
- First large earthquake on Marsh 12th 2020 of magnitude 5.2, followed by several smaller
- Another earthquake on October 20th magnitude 5.6, followed by several smaller

The first eruption

- On February 24th, 2021, we had an earthquake of magnitude M5.7
- Continuous unrest followed
- Around 60000 earthquakes in few coming week
- Clear signs of magma intrusion from INSAR and GNSS
- Eruption started on March 19th in Geldingadalir, just east of Fagradalsfjall and ended on September 18th

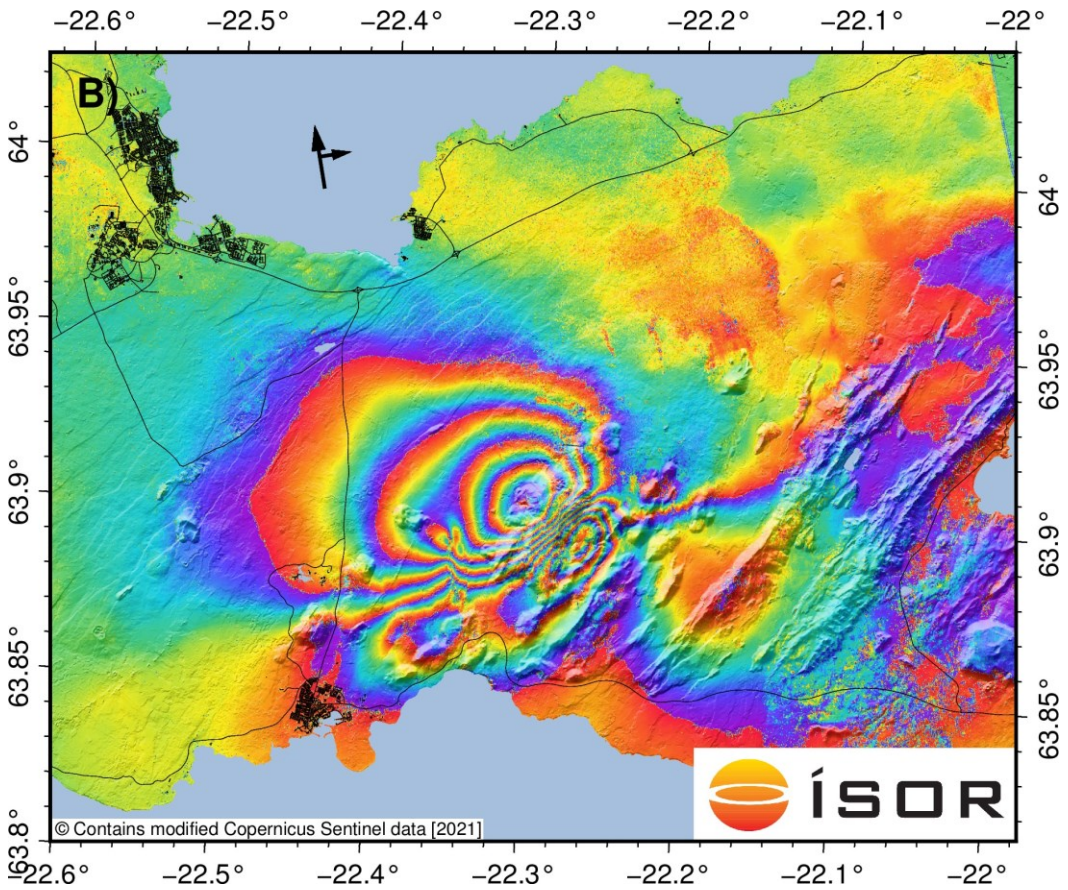
The unrest continues

- In December 2021 some unrest started again
  - Earthquakes up to M4.9
  - Signs of magma intrusion
  - Did not end in eruption
- Uplift of 5-5.5 cm in Þorbjörn between April 28th and May 28th 2022
- In late July similar unrest started again
  - Earthquakes up to M5.5
  - Signs of magma intrusion
  - Another eruption started on August 3rd
  - Ended on August 21st

Geodetic activities at the early stages

- INSAR and GNSS were playing vital role in monitoring the event at the early stages
- Lot of news coverage explaining how INSAR works
- New CGNSS stations were installed in the area
- A lot of interest in drone and aerial surveying of the area
- Questions about reference
- Obviously dynamic

Ascending track T16: 3 Mar. – 9 Mar. 2021



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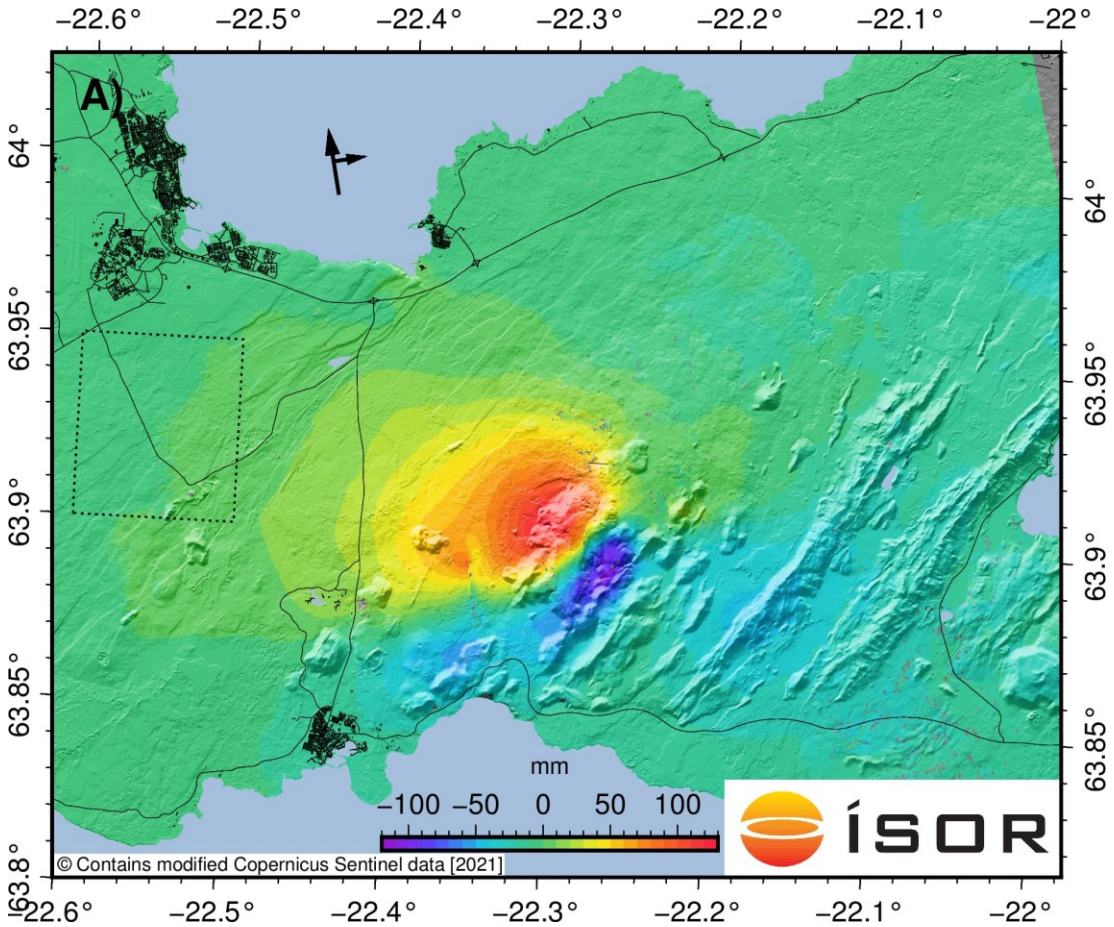
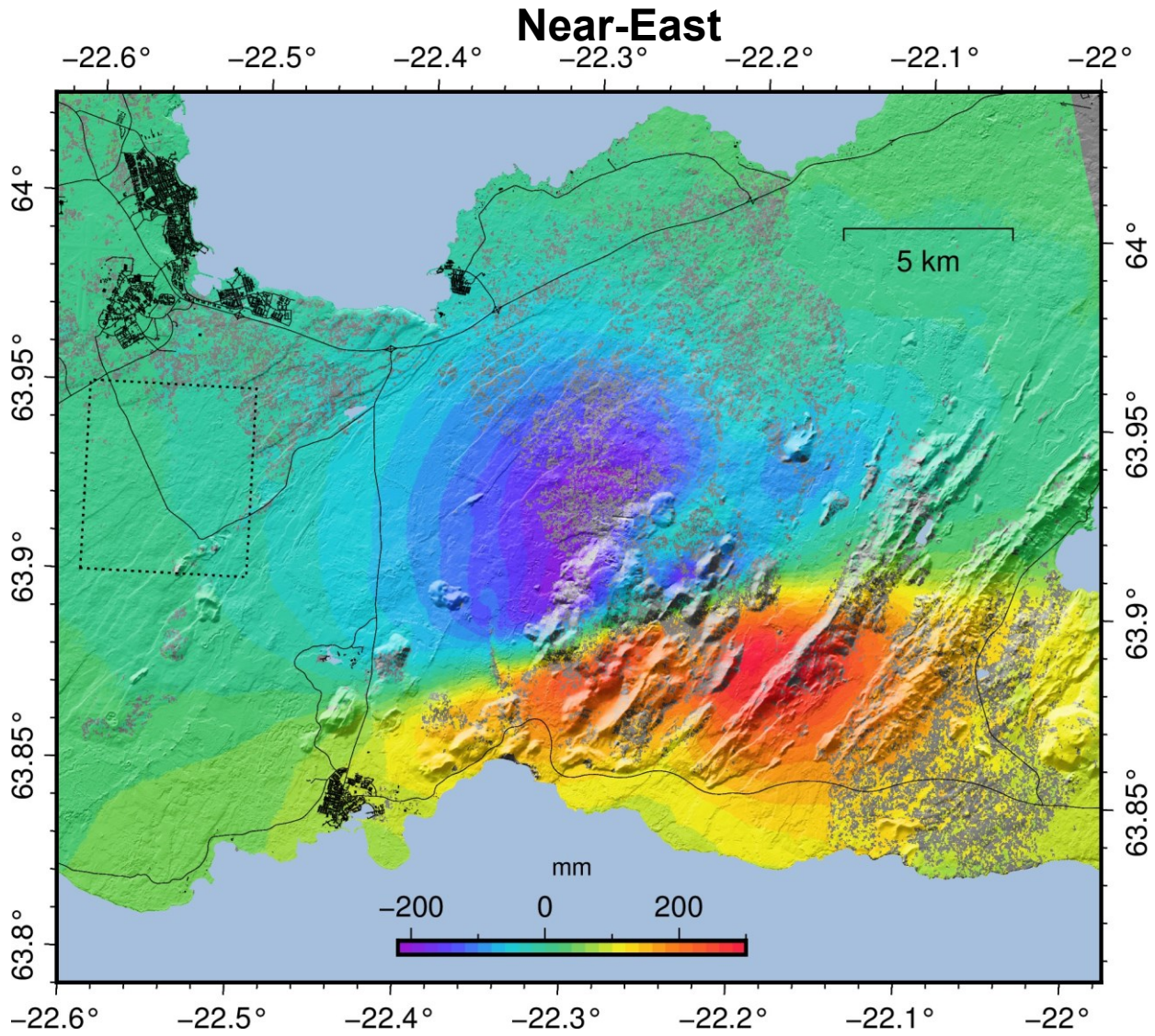


Total deformation since beginning of unrest-9. mar.2021 (approximation)



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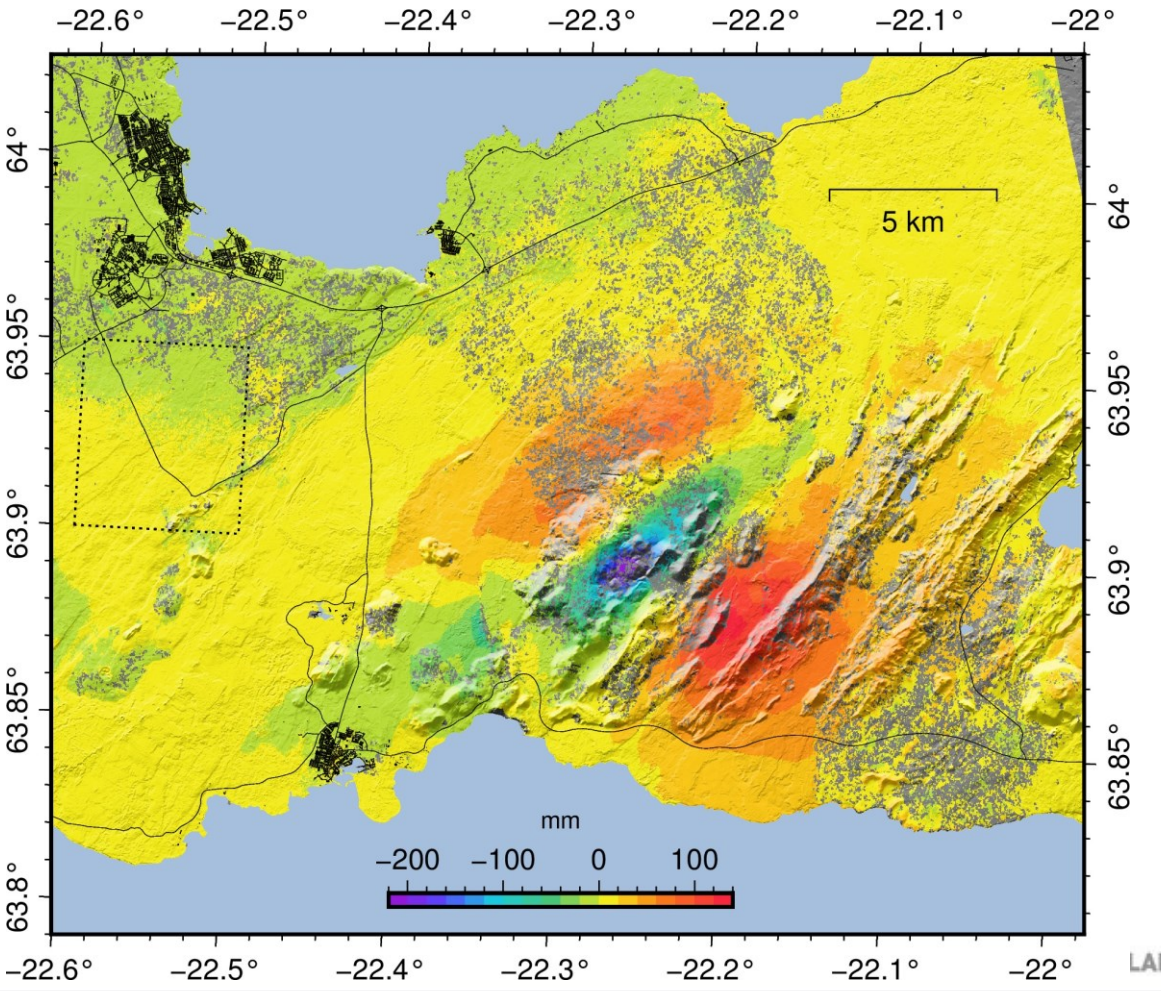
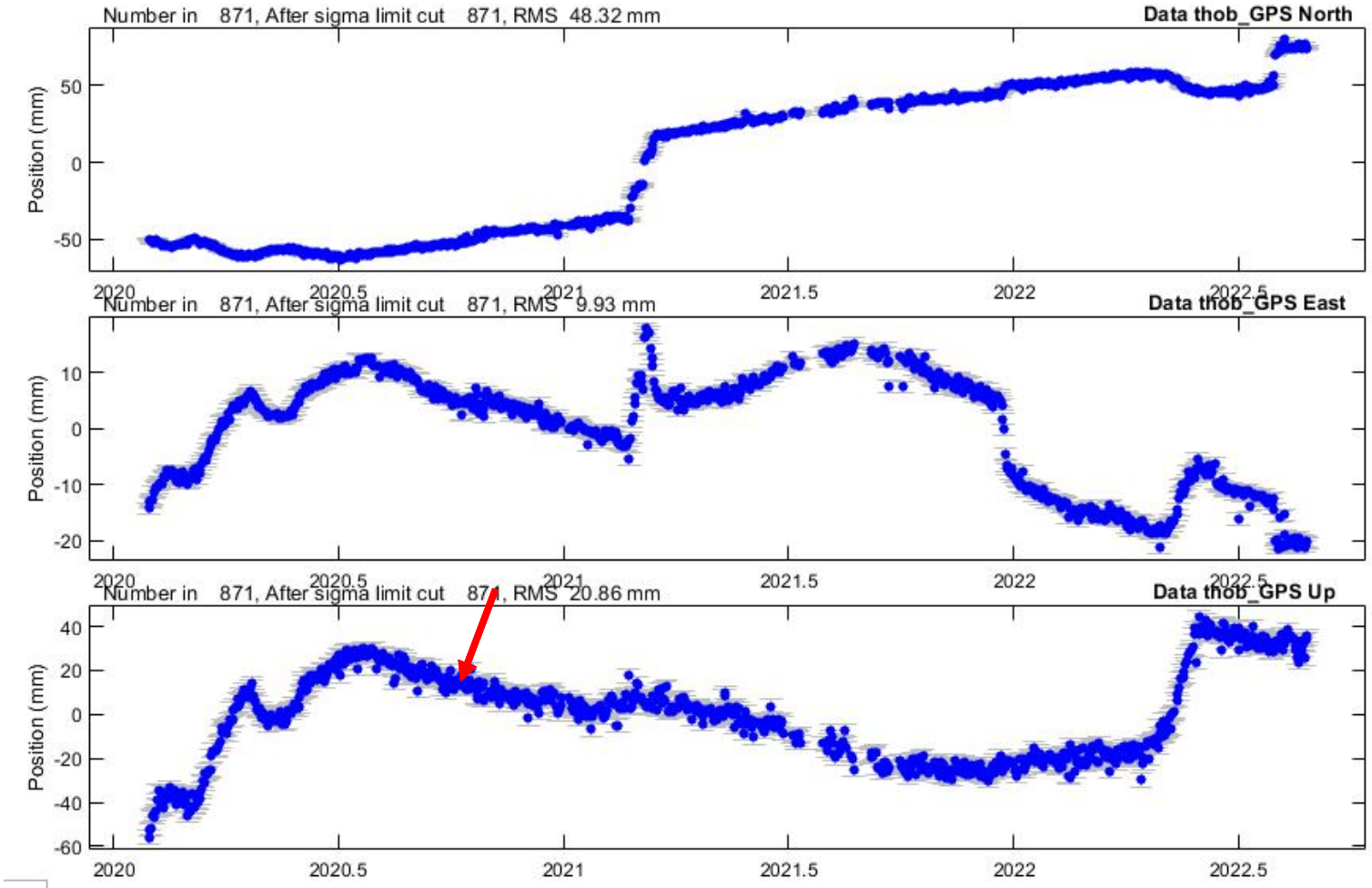
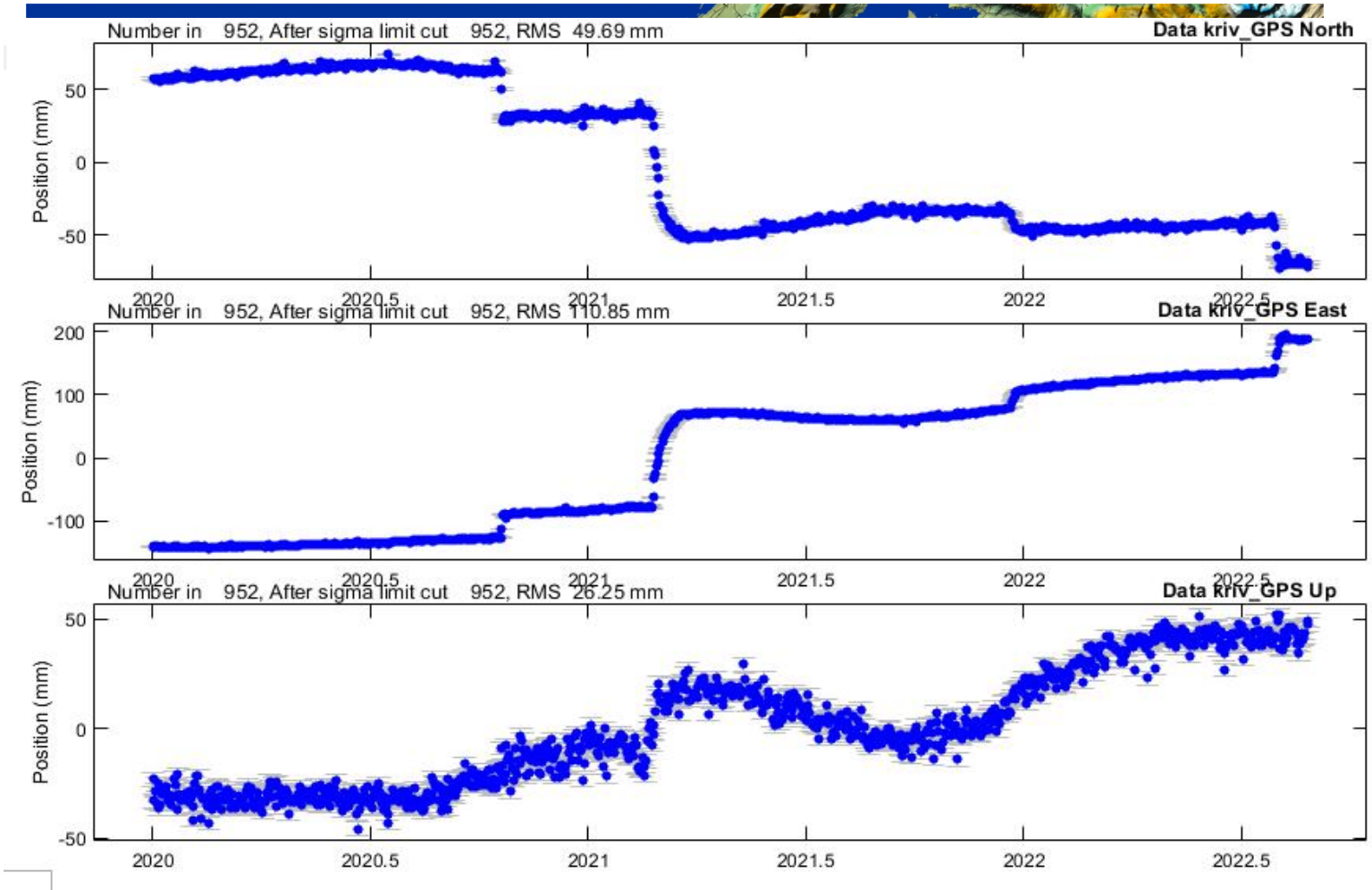


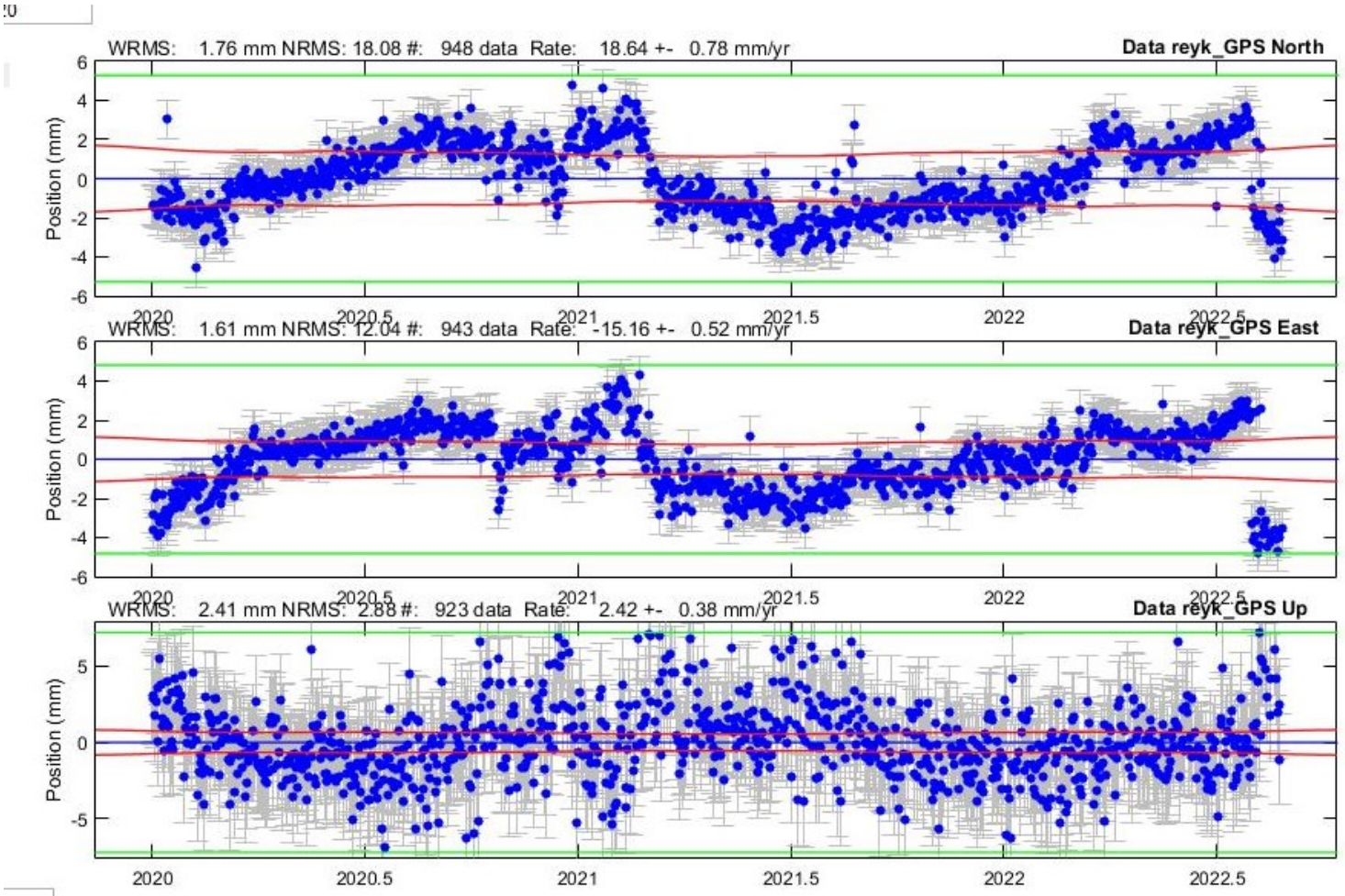
GNSS time series: THOB



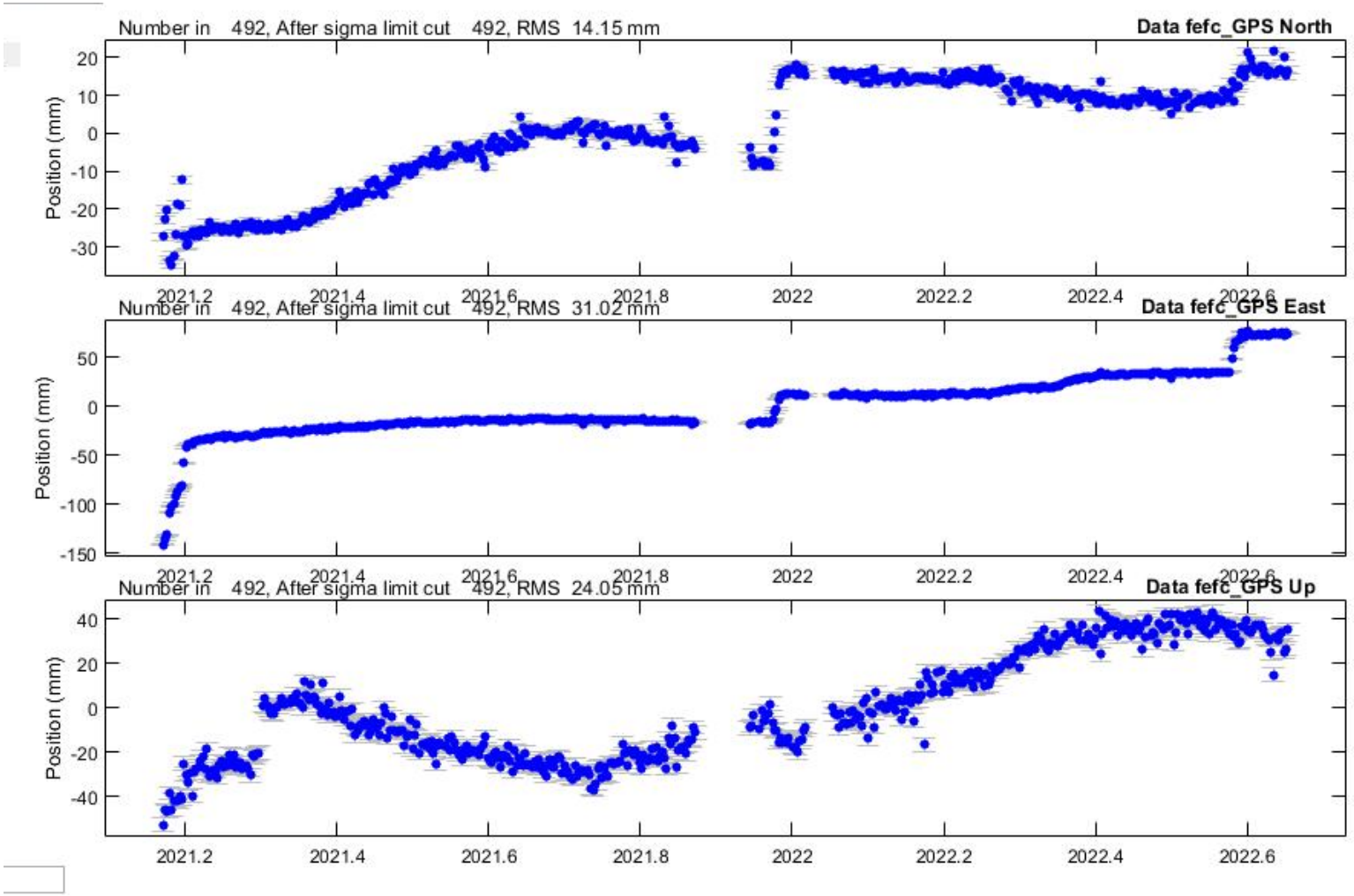
Time Series: KRIV



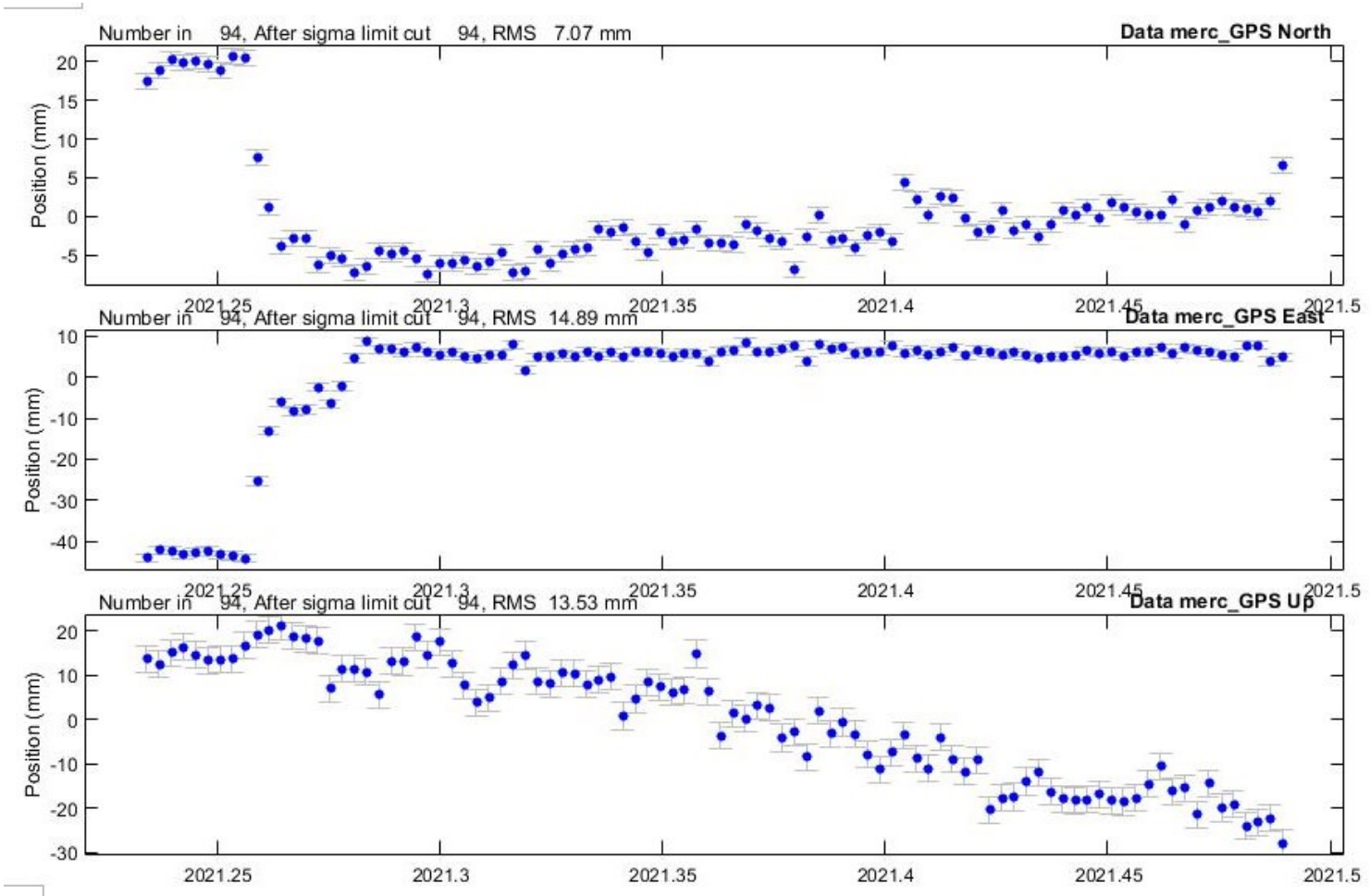
Time Series: REYK



Time Series: FEFC



Time Series: MERC

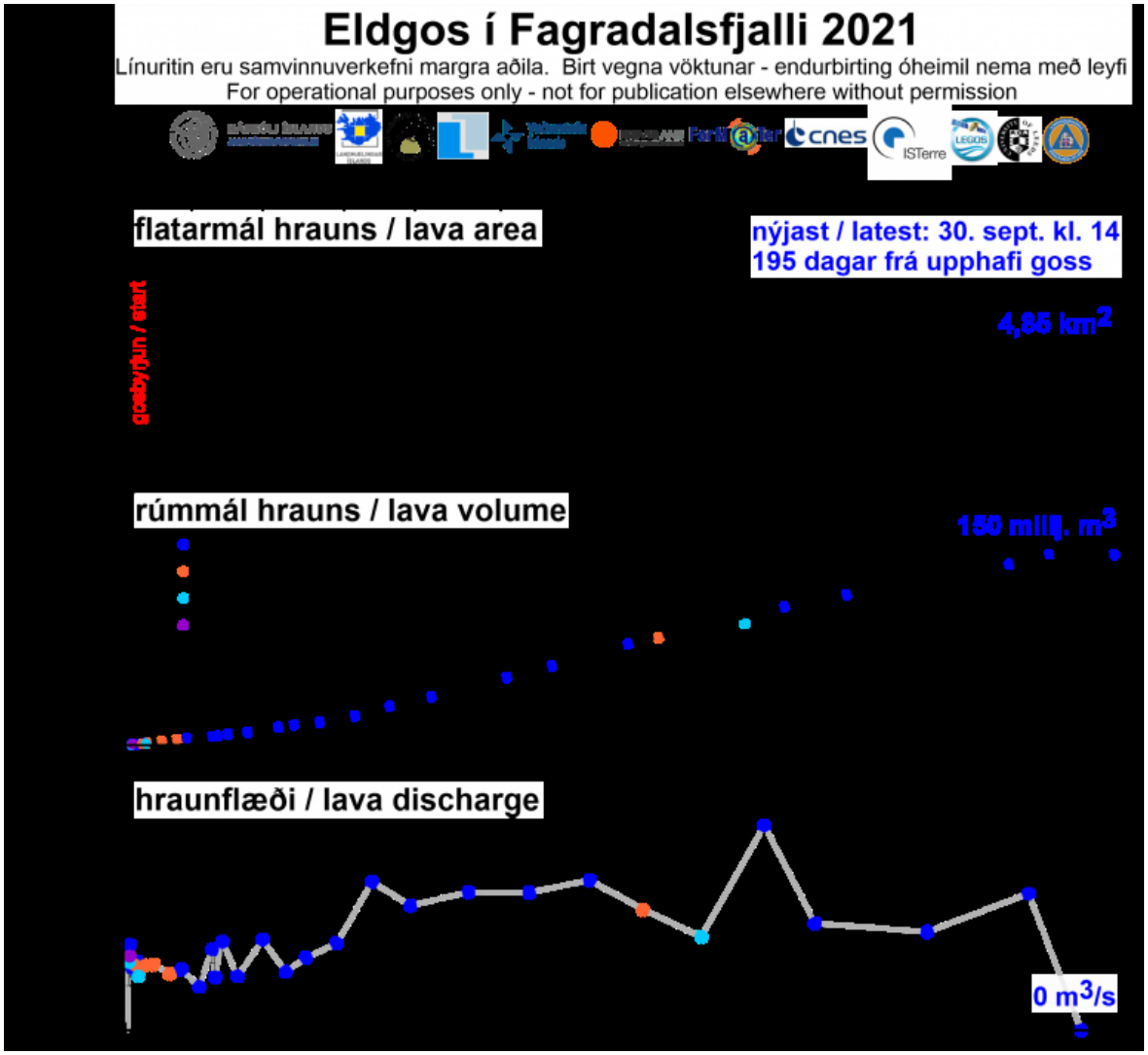


Monitoring the eruptions

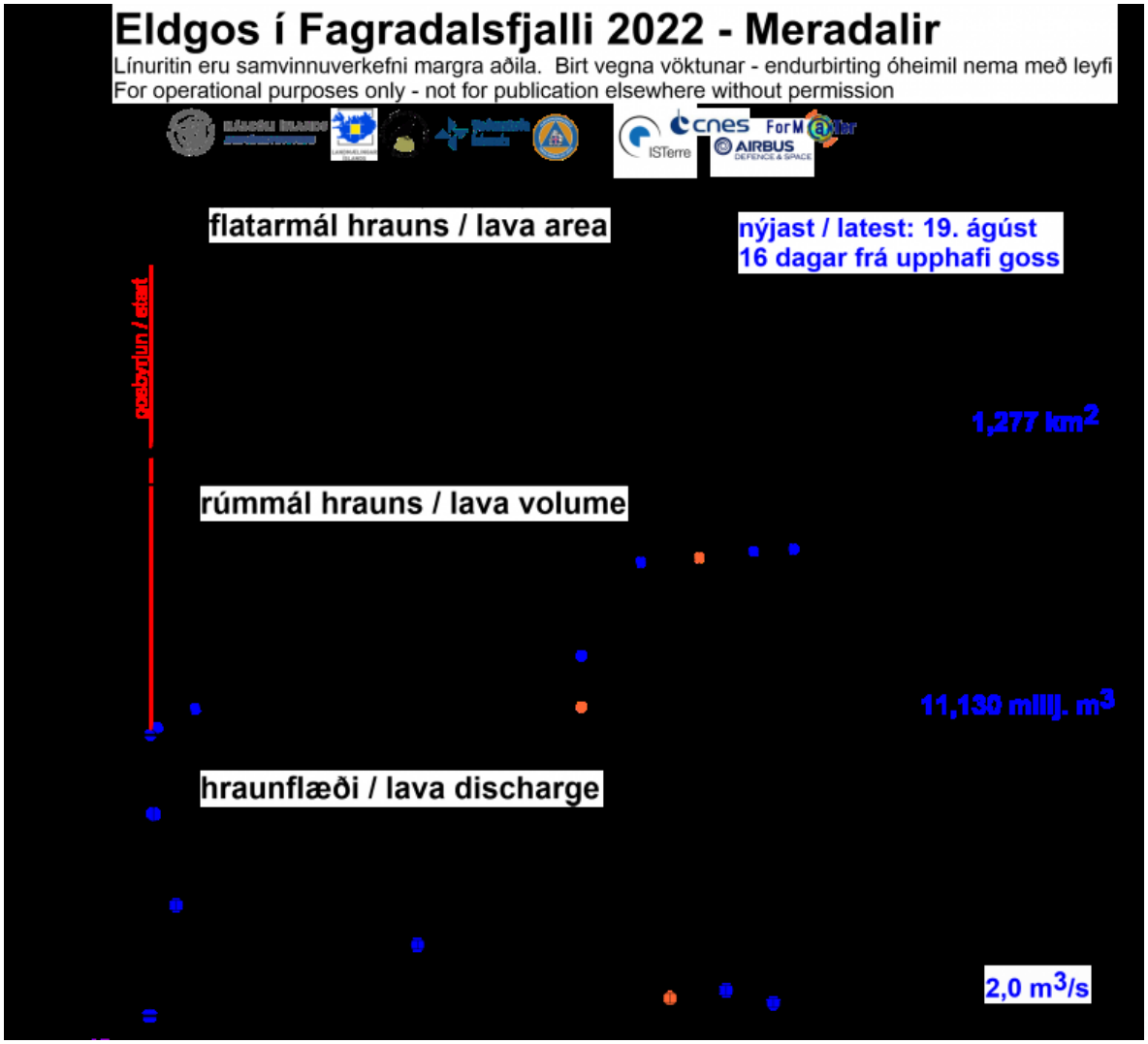
- Close cooperation between NLSI, INH and IES
- DSM models and orthophotos of the eruption side for near real time volume and area estimation
- Establishment of common reference frame for response and research
- Coordination of GCP measurements in the area
  - For aerial flight and drone flight
  - Over 100 GCP established
  - Many have gone under lava
- Over 30 flights and models

Pictures from GCP field work

First eruption statistics



Second eruption statisctics

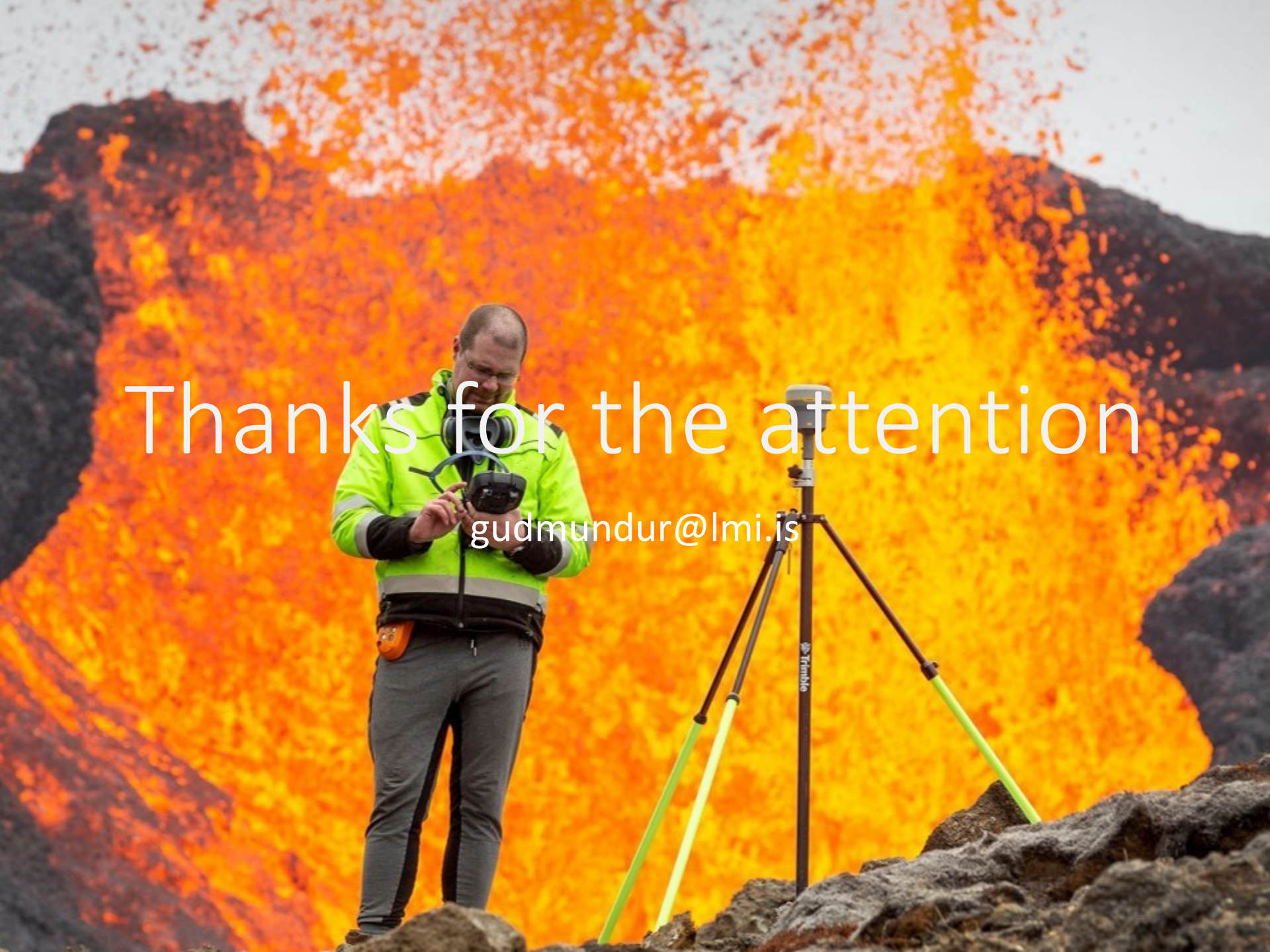


Other products

- Time series of outlines and orthophotos
- 3D models

Following geodetic work

- Re-measurement of geodetic infrastructure in the area
  - Levelling
  - GNSS benchmarks
- Modeling of the total deformation in the area as a patch for the ISN2016
  - GNSS time series
  - INSAR
  - Benchmarks
- Reporting and papers



Thanks for the attention

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