

Photo: B.  
Pálmason



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# Monitoring and detection of Eyjafjallajökull and volcanic ash

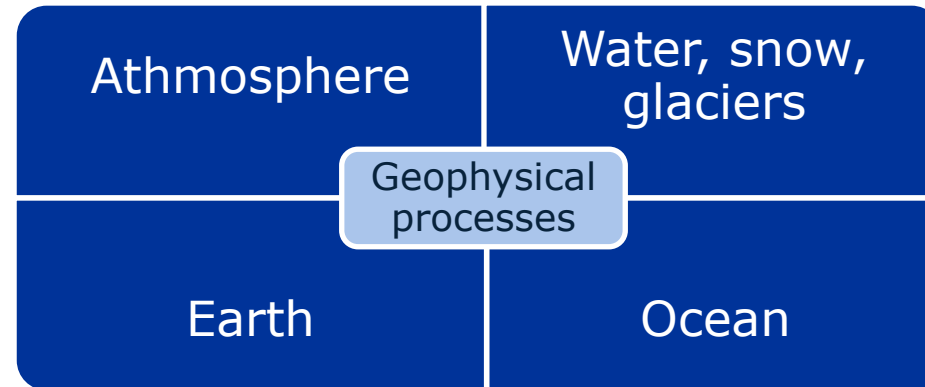
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Sigrún Karlsdóttir, Halldór Björnsson, Þórður Arason, Guðrún  
Nína Petersen, Hróbjartur Þorsteinsson and Halldór Pétursson  
Atlantic Conference on Eyjafjallajökull and Aviation, 15. – 16.  
September 2010

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# Tasks of the Icelandic Meteorological Office

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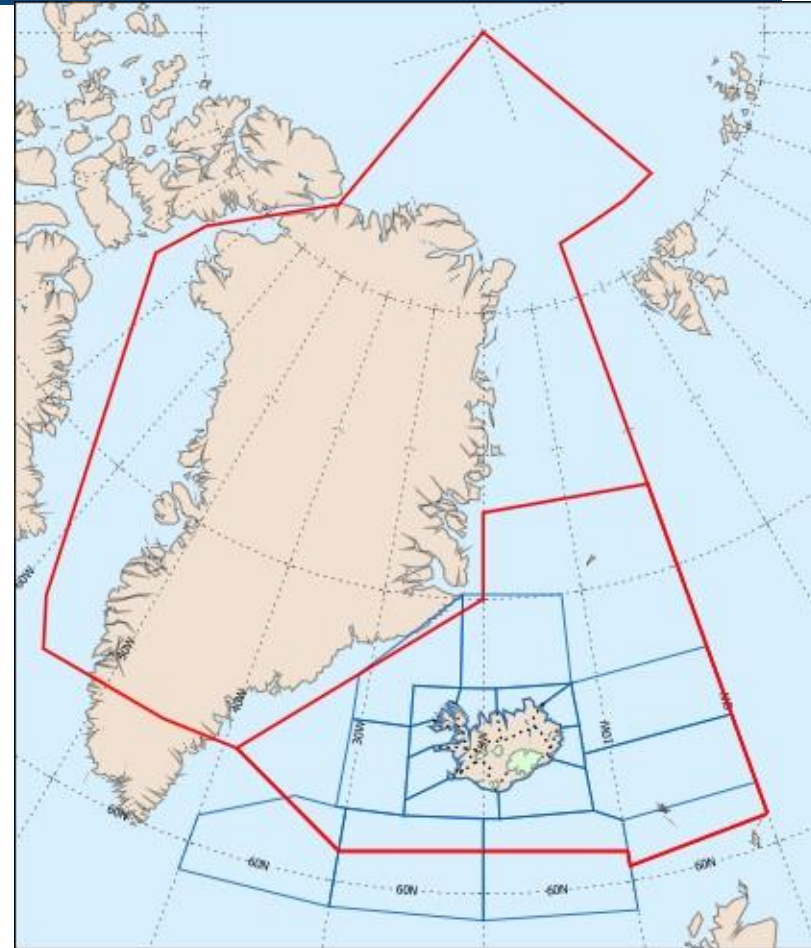


## Responsibilities:

- ▶ Monitoring, forecasting and issuance of warnings in the field of
  - ▲ Meteorology
  - ▲ Seismology and volcanic eruptions
  - ▲ Glaciology
  - ▲ Hydrology
  - ▲ Risk assesment of natural hazards, e.g. floods and avalanches, etc.

# Meteorological monitoring and forecast

- ▶ IMO monitors and issues forecast for
  - ▲ land and sea
  - ▲ large airspace
  
- ▶ IMO is a State Volcano Observatory
  - ▲ Pre - eruption activity
  - ▲ Eruption monitoring
  - ▲ Airborne volcanic ash

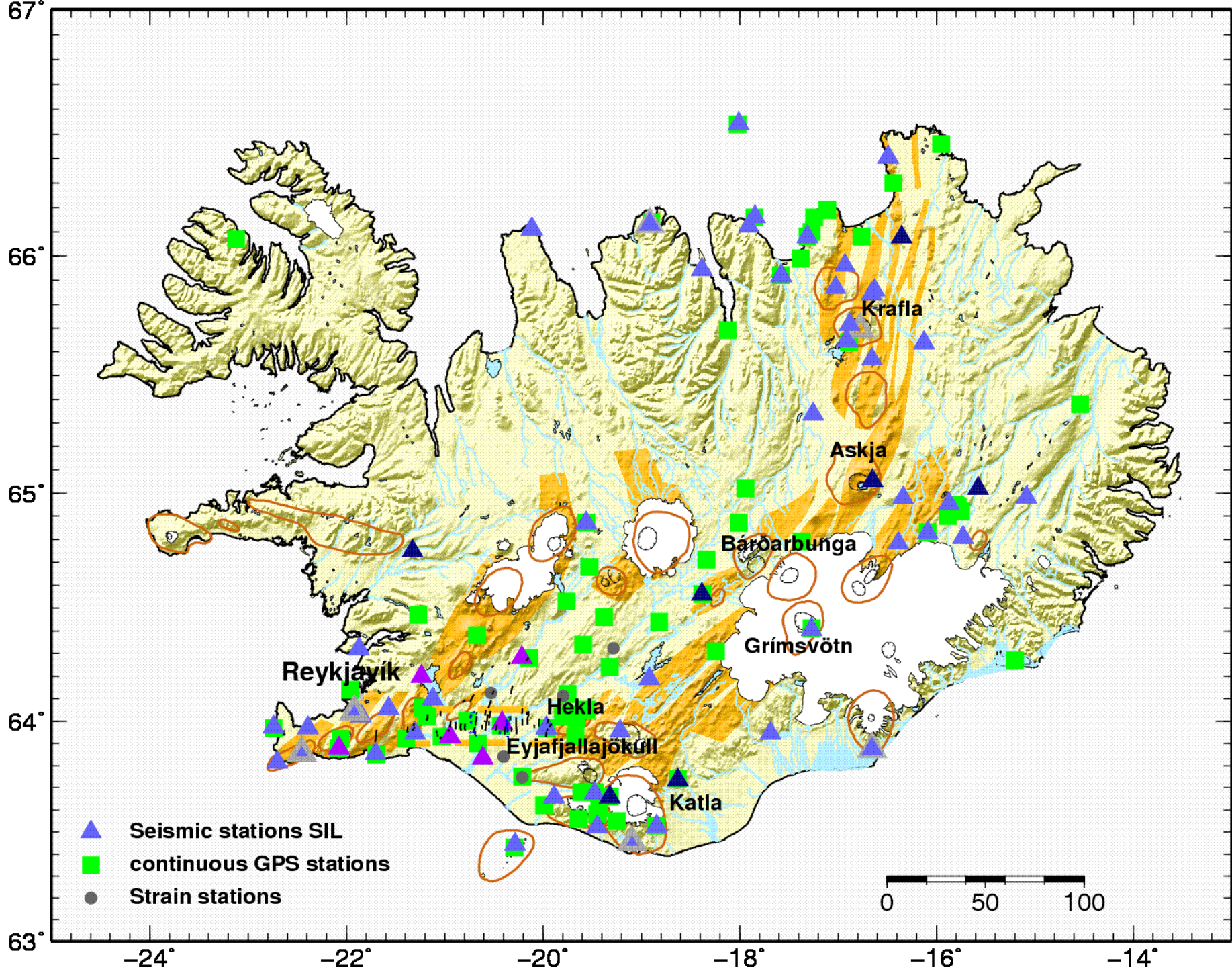


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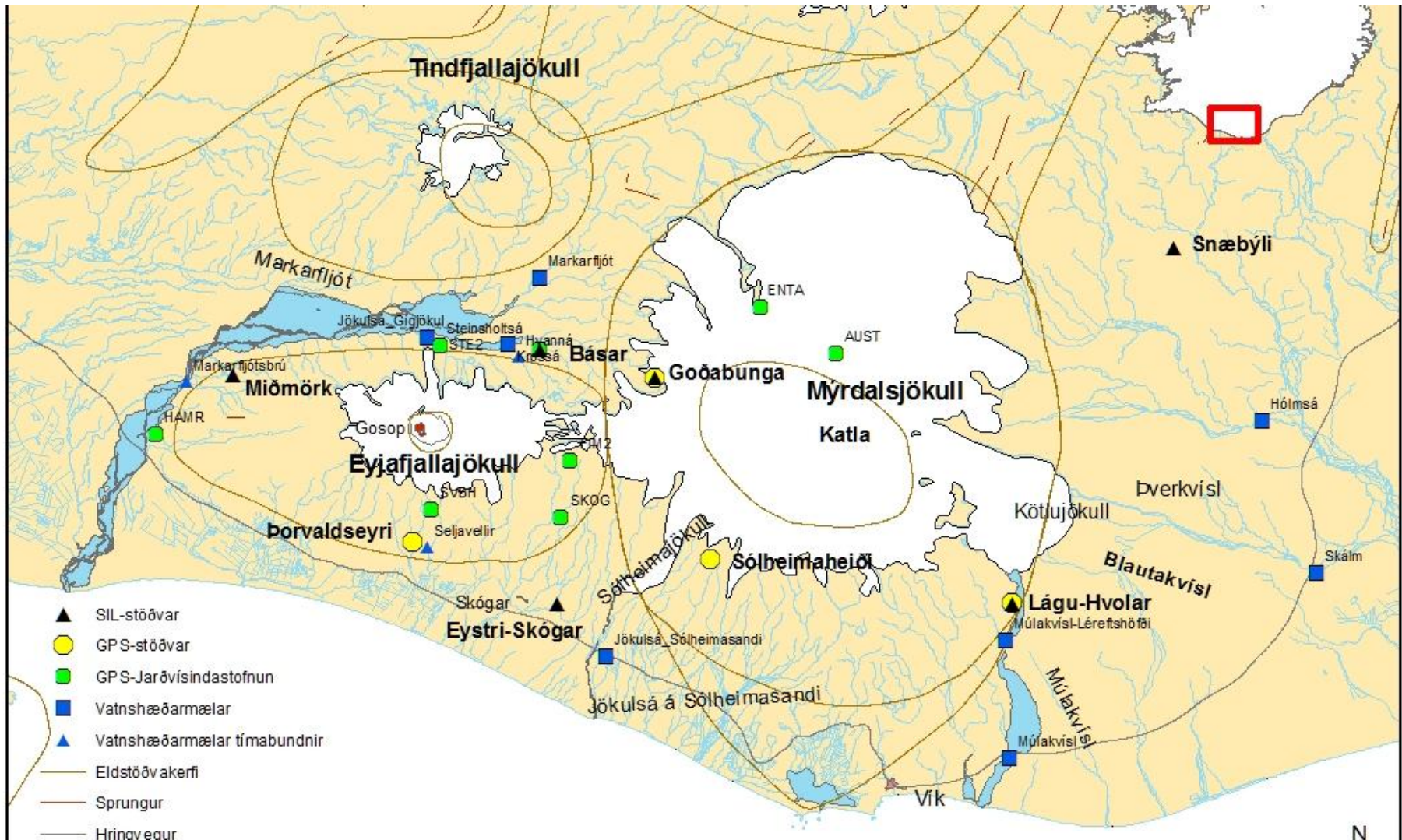
# Source term monitoring Overview

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- ▶ Earth science
  - ▲ Seismic monitoring (SIL network)
  - ▲ GPS measurements
  - ▲ Strain measurements
- ▶ Hydrology
  - ▲ Gauge meters
  - ▲ Heat and conductivity measurements
  - ▲ **Show early signs of volcanic activity under the ice caps.**
- ▶ Atmosphere
  - ▲ Weather radar
  - ▲ Direct and indirect plume measurements
  - ▲ lightning sensors
  - ▲ radiosondes
  - ▲ SO<sub>2</sub> measurements



# Geophysical monitoring networks around Eyjafjallajökull and Katla

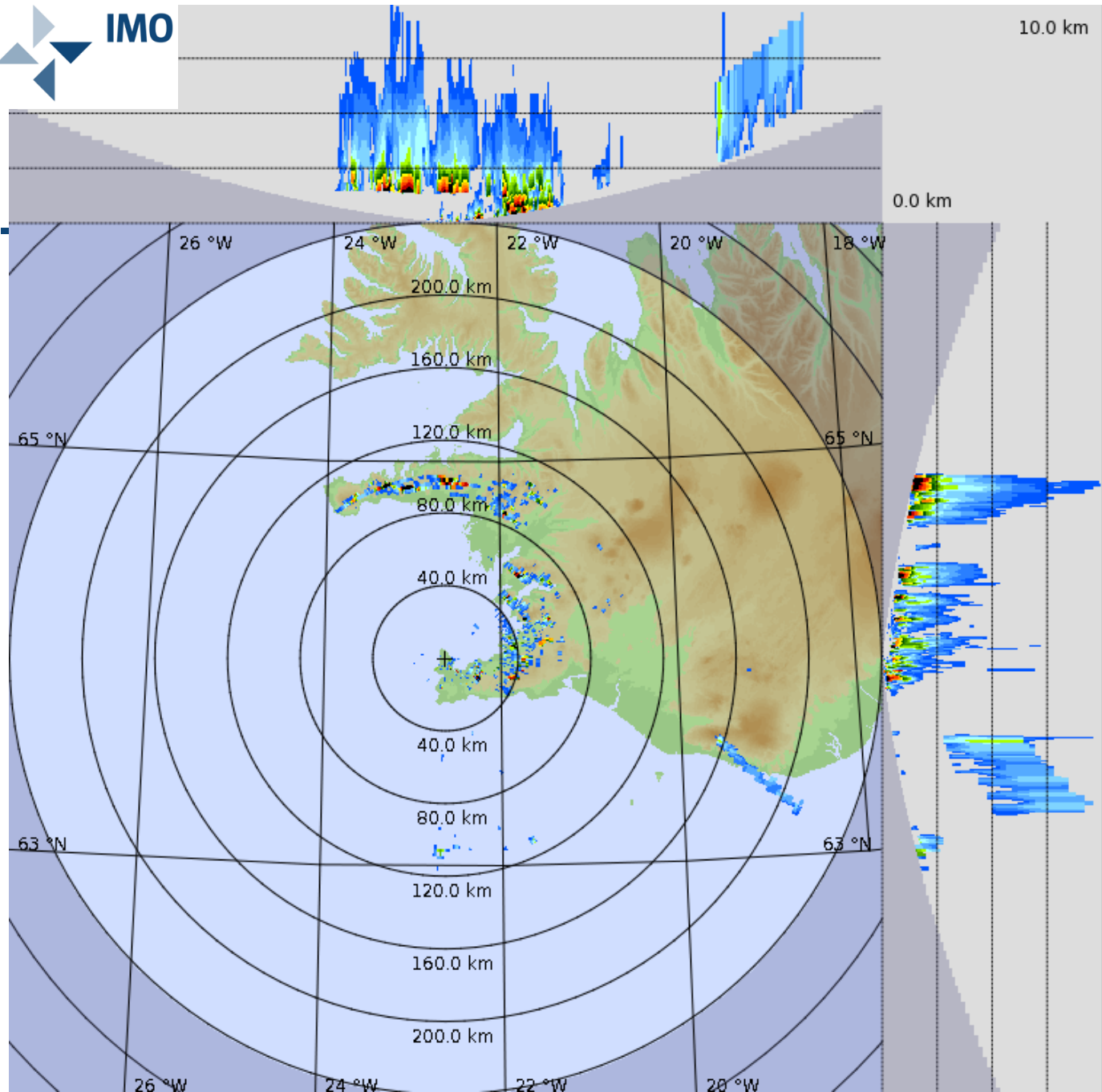


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# Plume height information

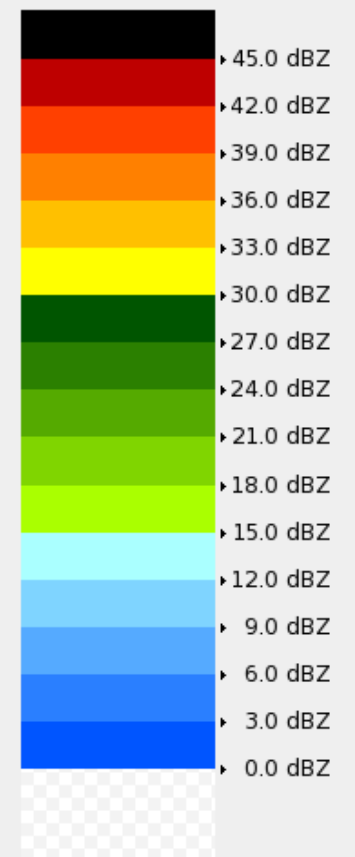
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- ▶ Plume height estimation is currently the most important real-time input data into the dispersion models.
- ▶ Primary instrument is a single C-band Doppler weather radar located in Keflavik, surveillance flights and pilot reports (PiReps), and other methods include theodolite estimation.
- ▶ Some difficulties
  - ▲ Inconvenient positioning of radar.
  - ▲ Cloudy conditions obscure observations incl. radar.
  - ▲ Interaction with wind is ill-understood - hard to extract a meaningful top height.
  - ▲ Dry ash has low reflectivity



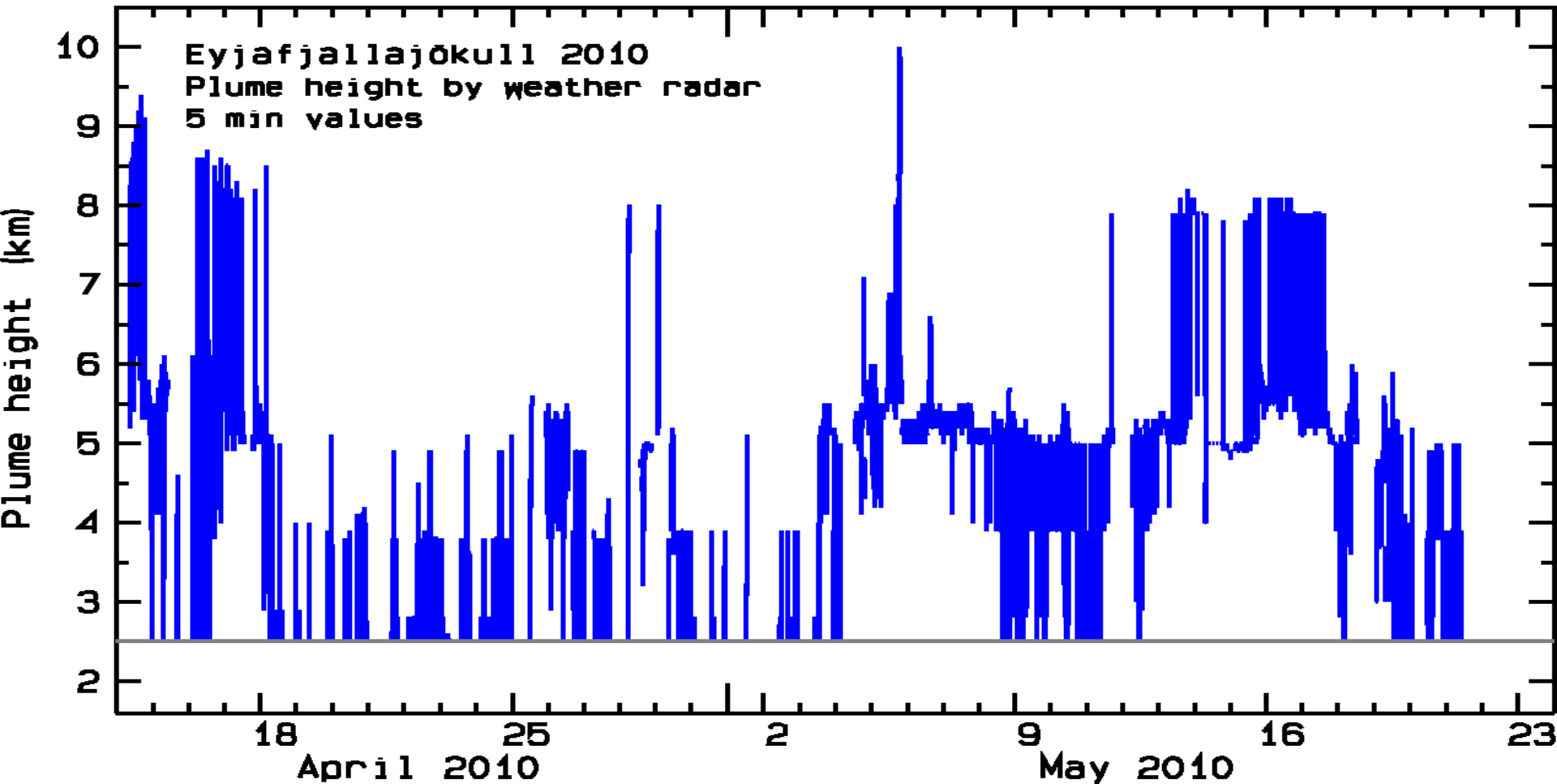
Info Layer Navigate

MAX (dBZ)  
19:00 / 05-May-2010  
Keflavik



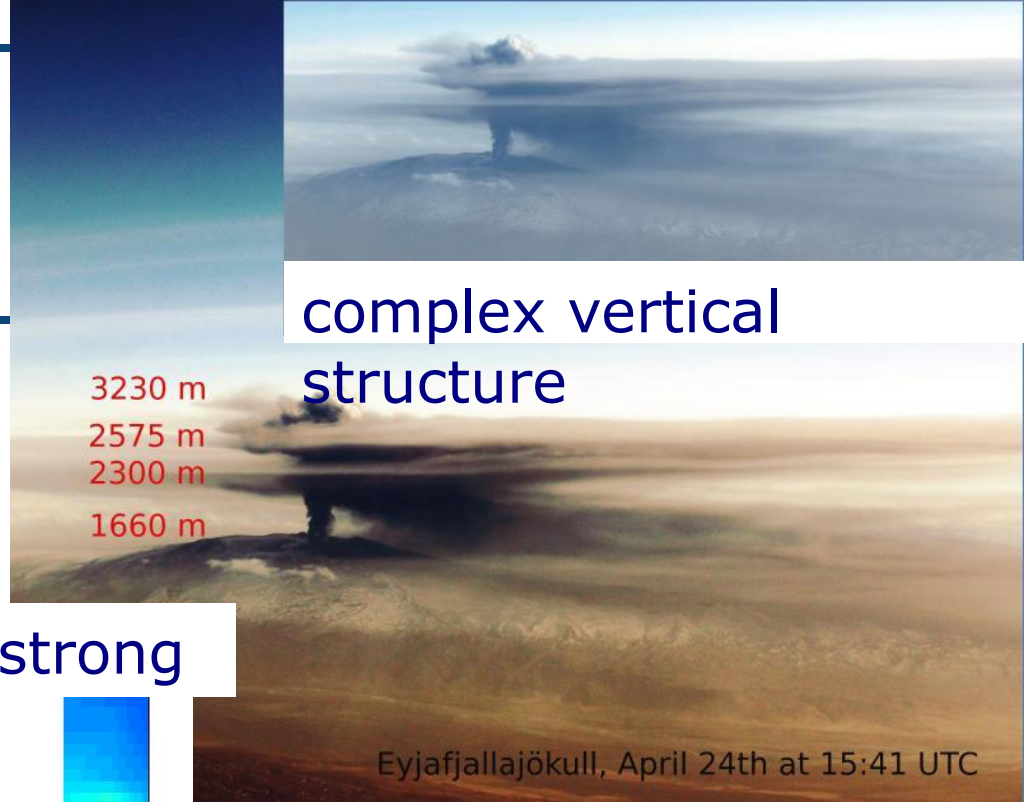
Pdf File: 240km.max  
Clutter Filter: None  
Time sampling:50  
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Range: 240 km  
Height: 0.000 kmto 10.000 km  
Hor Res: 0.800 km/pixel  
Vert Res: 0.067 km/pixel  
Data: Radar Data  
Rainbow® SELEX-SI

# Plume height during eruption

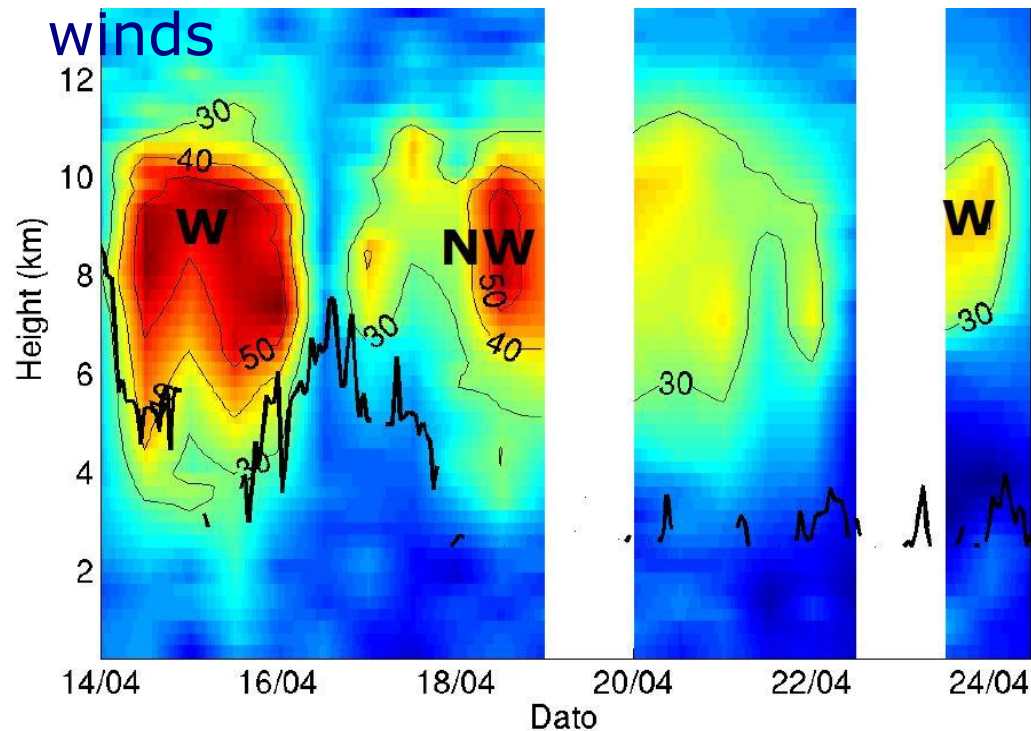


Dry ash shows poor radar reflectivity

**IMO researchers are looking carefully at the plume.**



plume height modulated by strong winds



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- ▶ IMO informes London VAAC every 3 hr, and more frequently if needed about:
    - ▲ Plume height
    - ▲ Plume activity (height and variation in height)
    - ▲ Color/shade of the plume
    - ▲ lightning activity
    - ▲ seismic and hydrological activity
    - ▲ surface and upper air observations (e.g. PIREP)
  - ▶ Discussions between the forecasters of IMO and London VAAC about the situation.

# Ash resuspension – possible problem



On June 4-5th, ash suspension was serious and a SIGMET was issued. Measurements and modelling development ongoing.

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# Next steps to improve monitoring of ash plumes

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- ▶ ICAO has agreed to invest in and deploy portable high frequency dual polarization Doppler radar for accurate plume height measurements and potential assessment of the mass transport; timescale 7-8 months.
- ▶ PM10 ash sensor network being investigated
- ▶ Lidar for airborne ash measurements at Keflavik airport, on loan from UK, arrives in September
- ▶ Ash concentration measurements from a piston plane in cooperation with Icelandair
- ▶ Portable radiosonde station for atmospheric conditions at eruption site – on loan from UK
- ▶ SO<sub>2</sub> measurements at eruption site in cooperation with NOVAC (Differential Optical Absorbtion Spectrometer, DOAS)

# Other activities that aim to improve the monitoring of volcanic activity in Iceland

## ▶ Geophysics

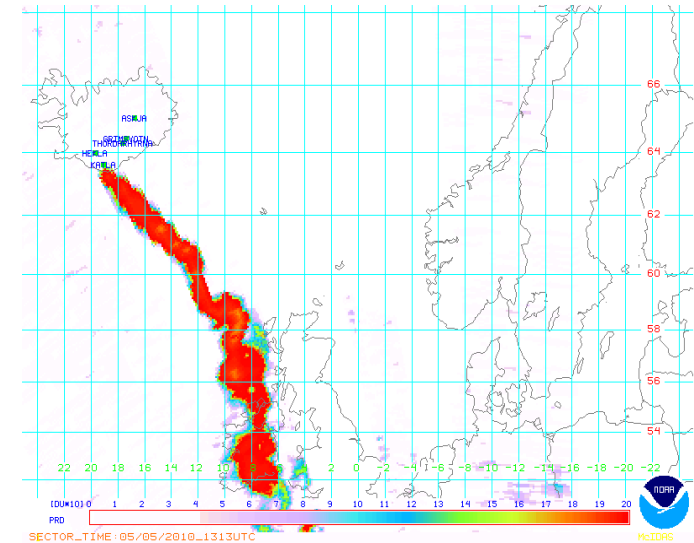
- ▲ Expanded seismic and GPS network (EPOS)
- ▲ Borehole strainmeter measurements
- ▲ Research activity to improve understanding of the volcanic behavior

## ▶ Hydrology

- ▲ Improved heat and conductivity measurements
- ▲ Denser gauge network around glacial volcanoes

## ▶ Atmosphere

- ▲ Gas emission monitoring and modelling
- ▲ New C-band radar in NA- Iceland to cover volcanoes in N- and A-Iceland
- ▲ Drop-sondes for inside plume conditions or 50-100 km downwind
- ▲ Network of visible and/or IR cameras



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# Thank you

Photo: Þ.M. Pétursson

