

# Hazard due to eruptions and floods from Katla and Eyjafjallajökull, south Iceland



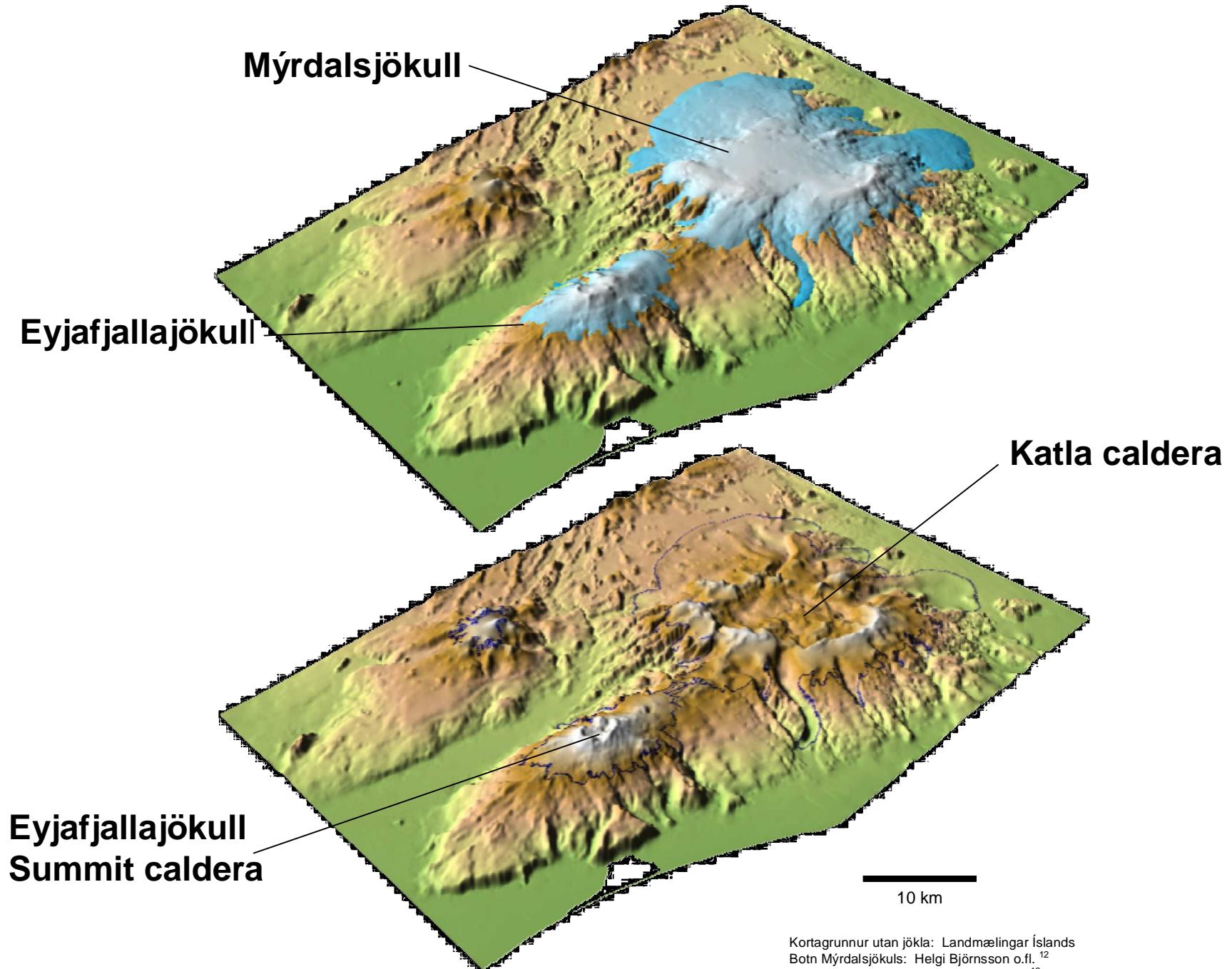
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3: Civil Protection Department, National Commissioner of the Icelandic Police

4: Icelandic Meteorological Office    5: Institute of Natural History

This presentation is a summary of project funded by the Government of Iceland. The results are found in a special publication available on the web-page of the Civil Protection Department of the National Commissioner of the Icelandic Police – see end of presentation for details



Kortagrunnur utan jökla: Landmælingar Íslands  
Botn Mýrdalsjökuls: Helgi Björnsson o.fl.<sup>12</sup>  
Botn Eyjafjallajökuls: Sara M. Strachan<sup>13</sup>

# **Eruptions and associated floods caused by ice melting a major hazard**



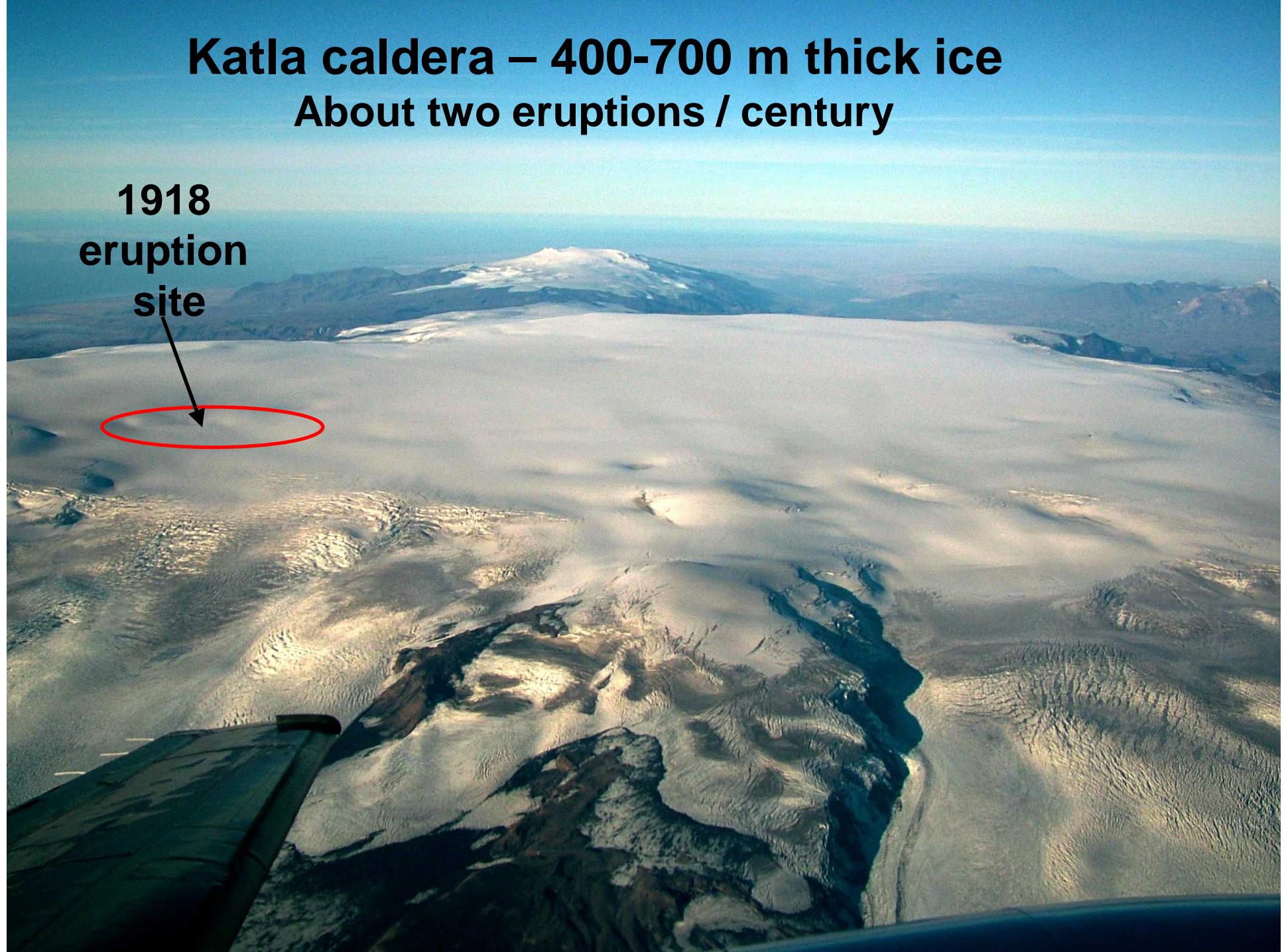
- Unrest (seismicity, inflation, geothermal activity)
- Catastrophic floods to the east well known
- New: floods to west more frequent than previously thought

## **Tasks of hazard assessment for area to the west of the volcanoes:**

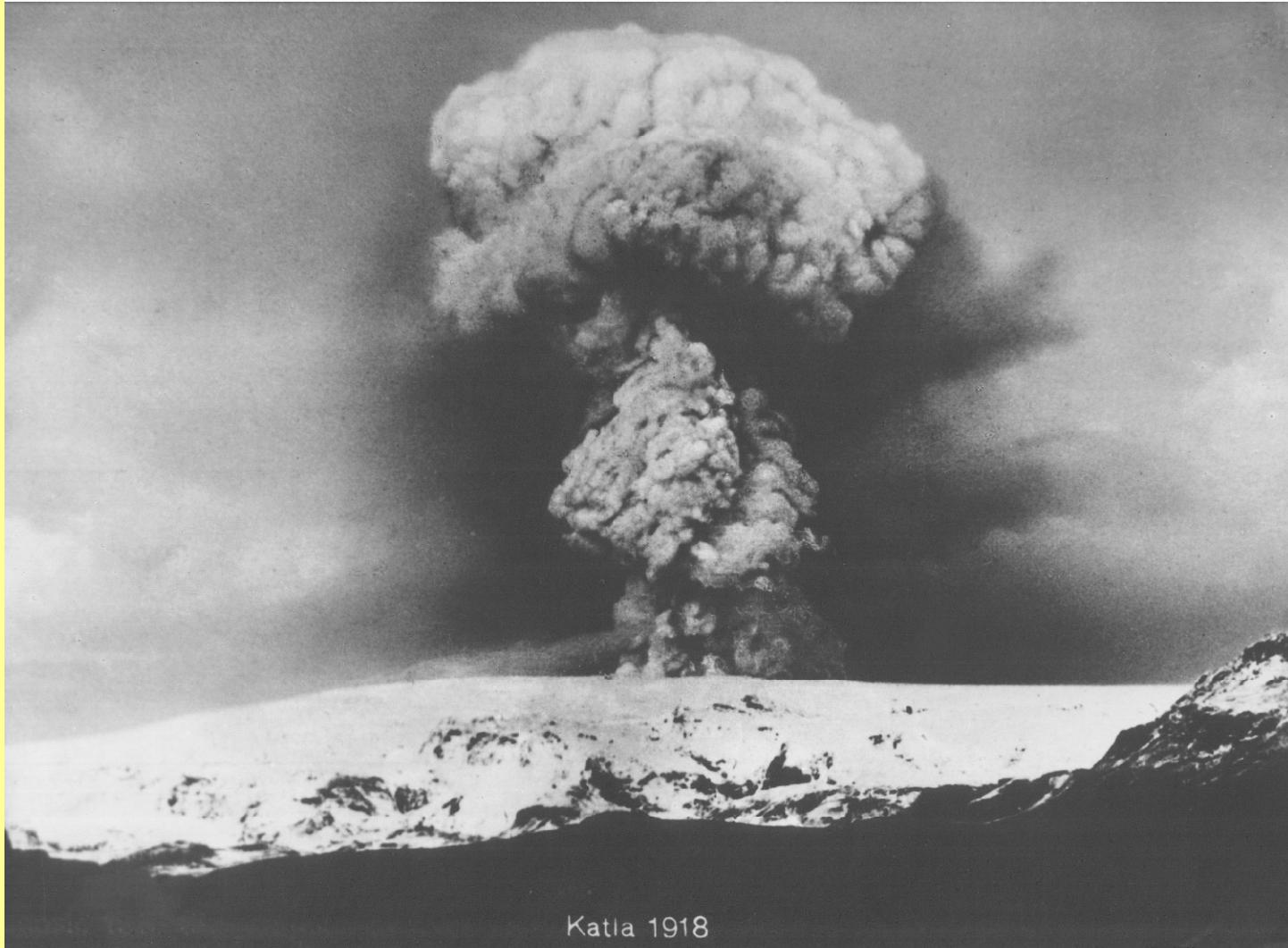
- Estimate eruption frequency for sectors of the volcanoes
- Estimate likely flood magnitude
- Estimate which areas would be affected by floods

**Katla caldera – 400-700 m thick ice**  
**About two eruptions / century**

1918  
eruption  
site



## Katla - Large phreatomagmatic eruptions



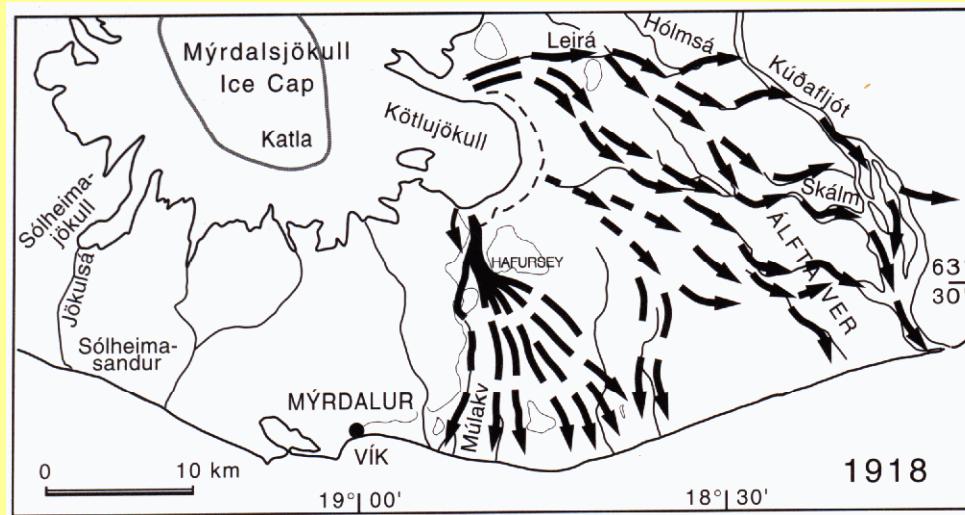
Katla 1918

**Katla eruption 1918**

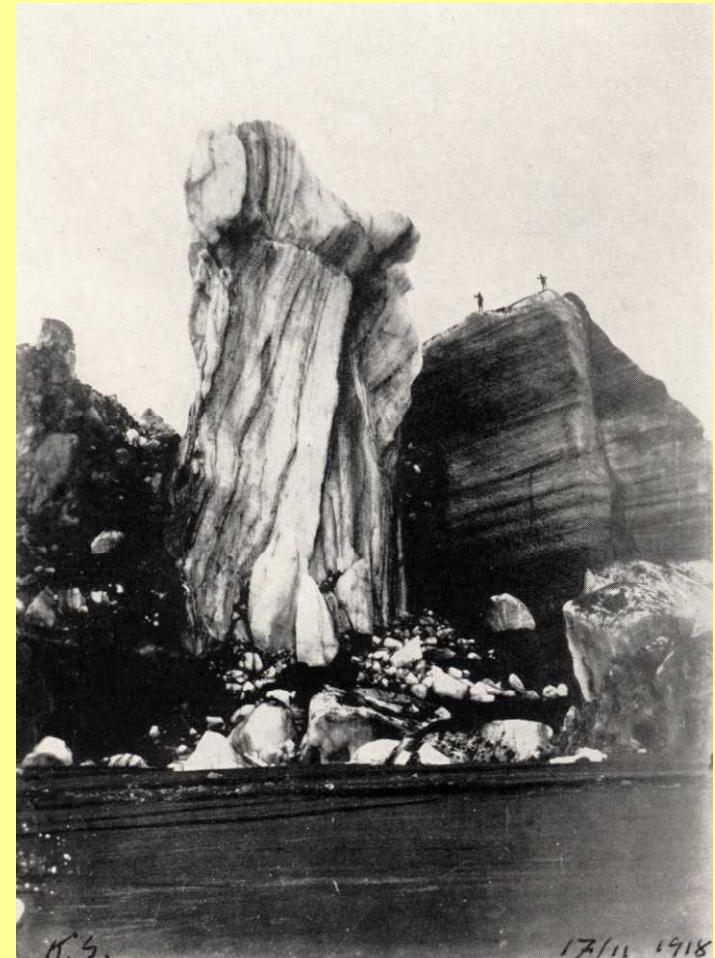
# Katla eruptions cause catastrophic jökulhlaups - the 1918 event the largest of its kind in the 20<sup>th</sup> century

Peak discharge  $100\text{-}300 \cdot 10^3 \text{ m}^3\text{s}^{-1}$

- ~1 km<sup>3</sup> of sediments transported
- 3 km long peninsula formed at coast
- Katla jökulhlaups one of the largest volcanological hazards in Iceland



From Larsen (2000)



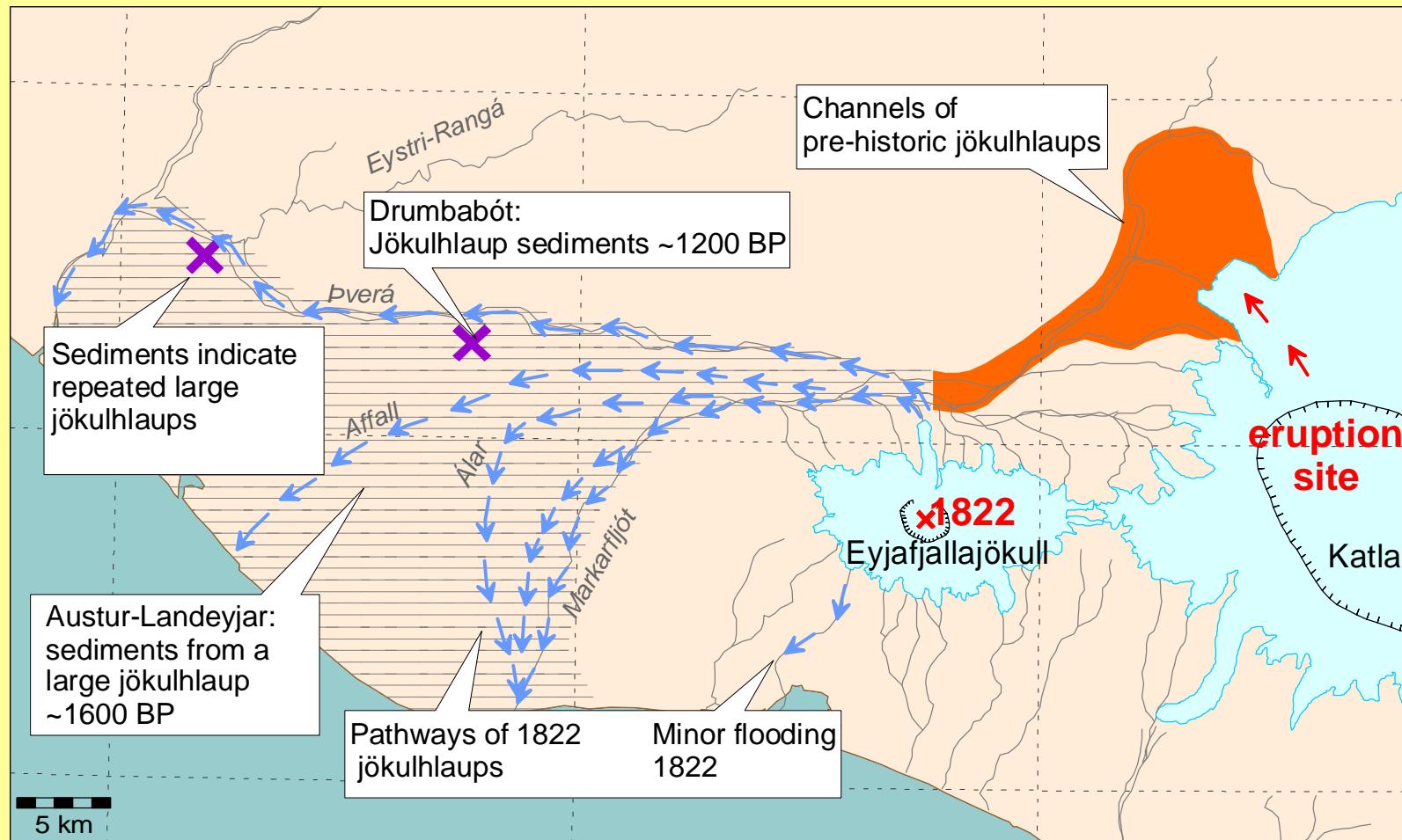
Kjartan Guðmundsson 1918

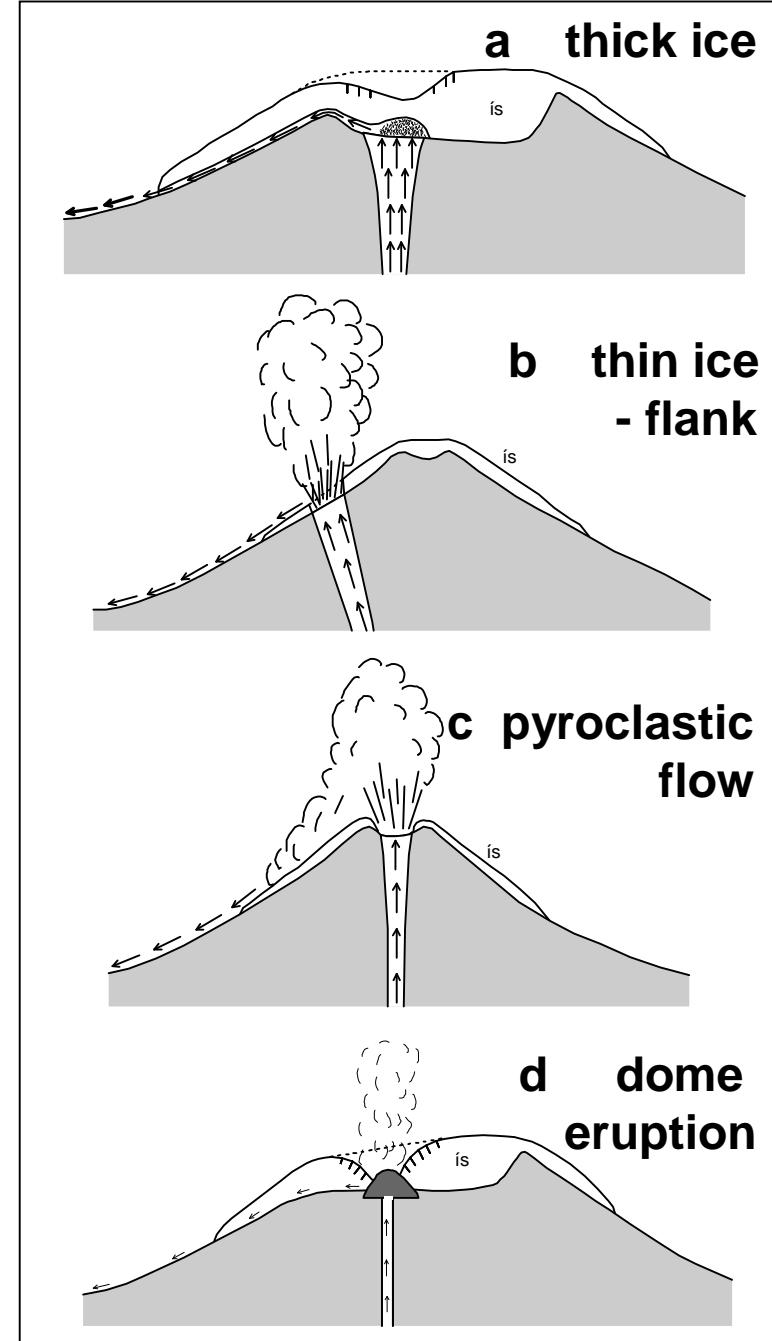
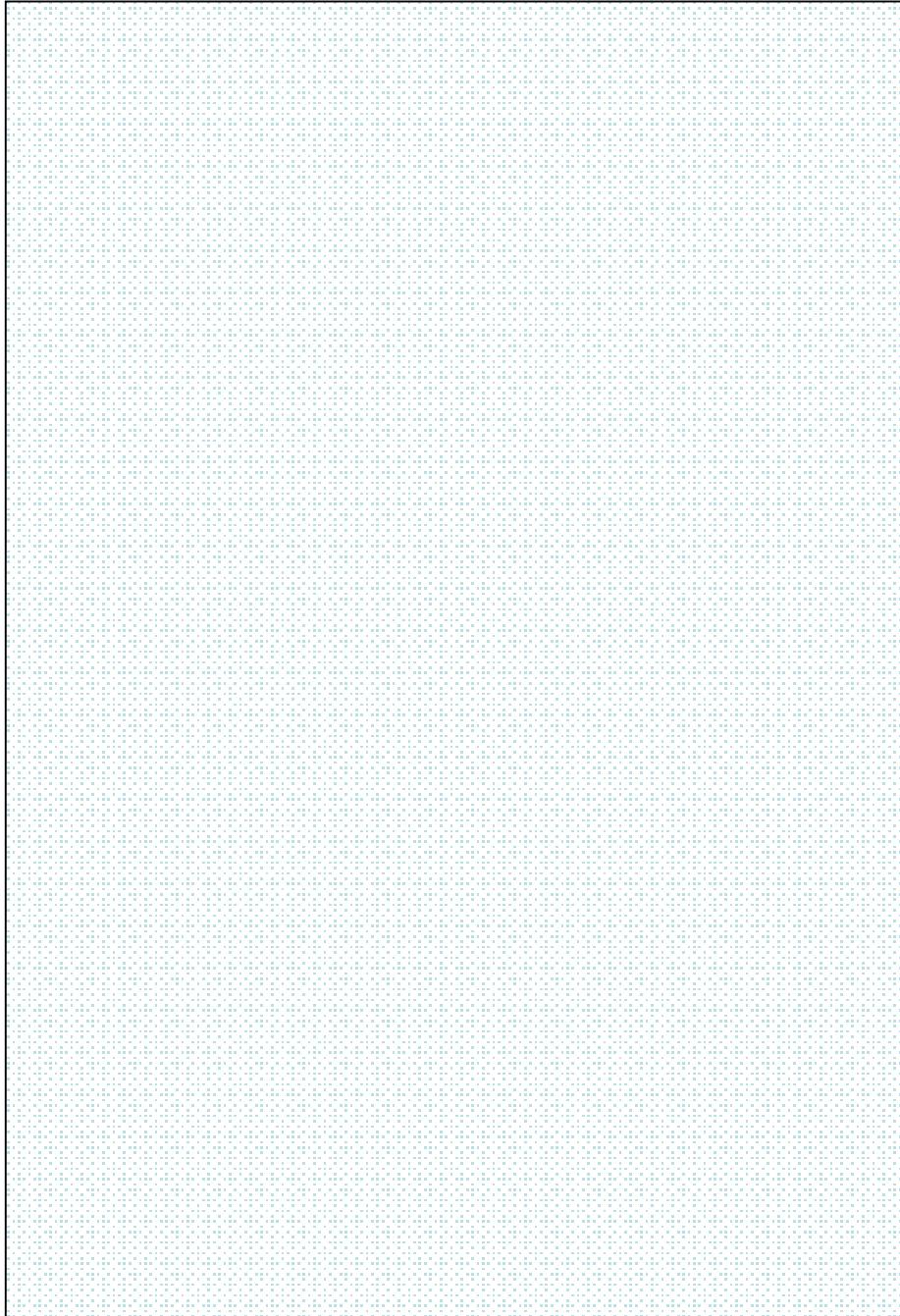
# Eyjafjallajökull - ice covered stratovolcano

Eruptions once every few hundred years



# Evidence for hazardous floods towards west

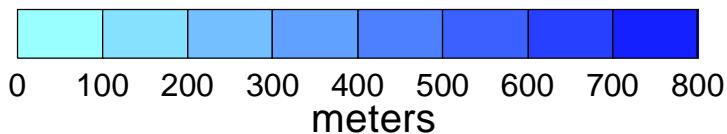




# Ice thickness in Eyjafjallajökull and Mýrdalsjökull

Radio-eccho soundings (Helgi Björnsson et al., 2000; Sara Strachan, 2001)

Water divides in glaciers

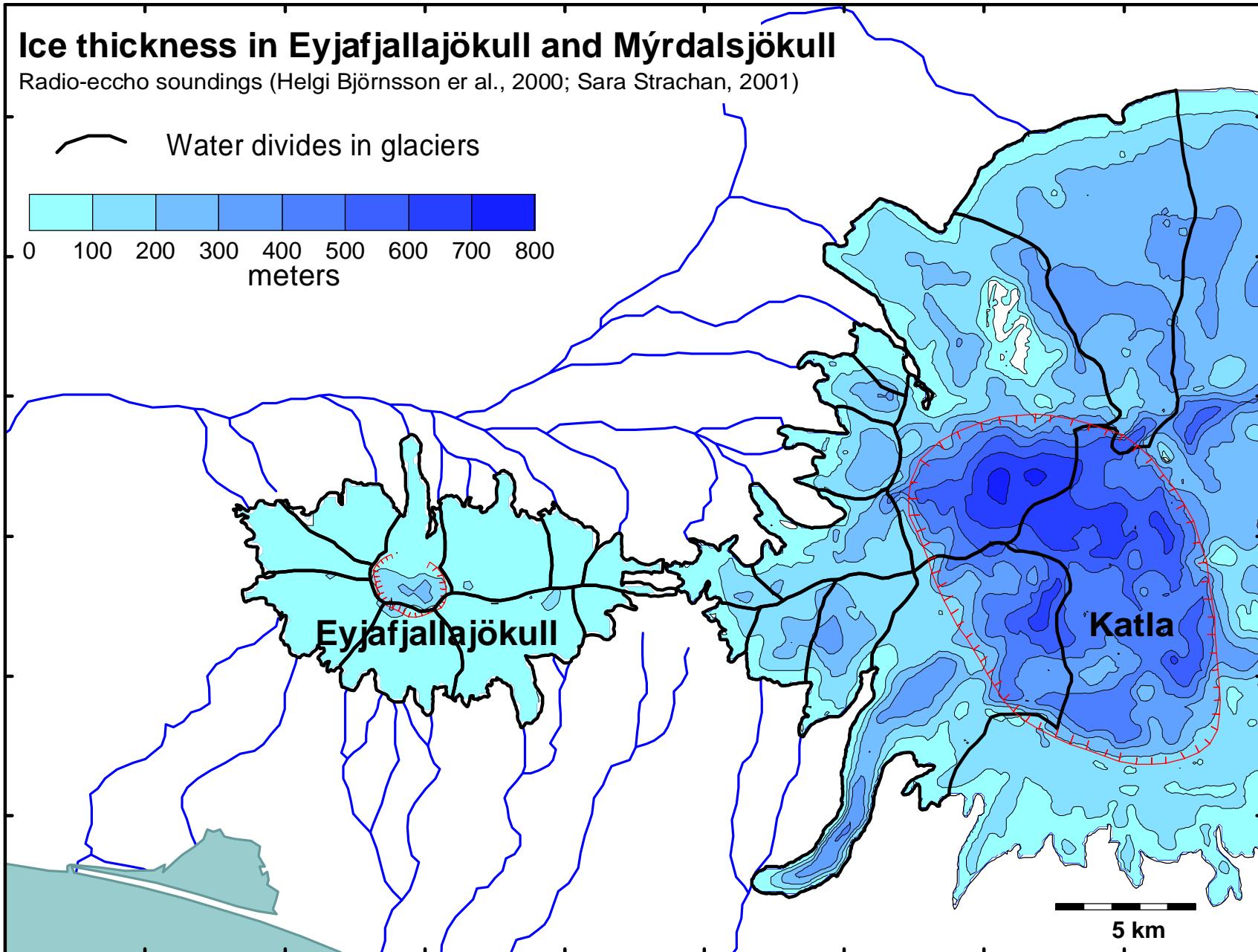


0 100 200 300 400 500 600 700 800  
meters

Eyjafjallajökull

Katla

5 km



## Recurrence time of eruptions

- █ < 100 years
- █ 100-1.000 years
- █ 1.000-10.000 years

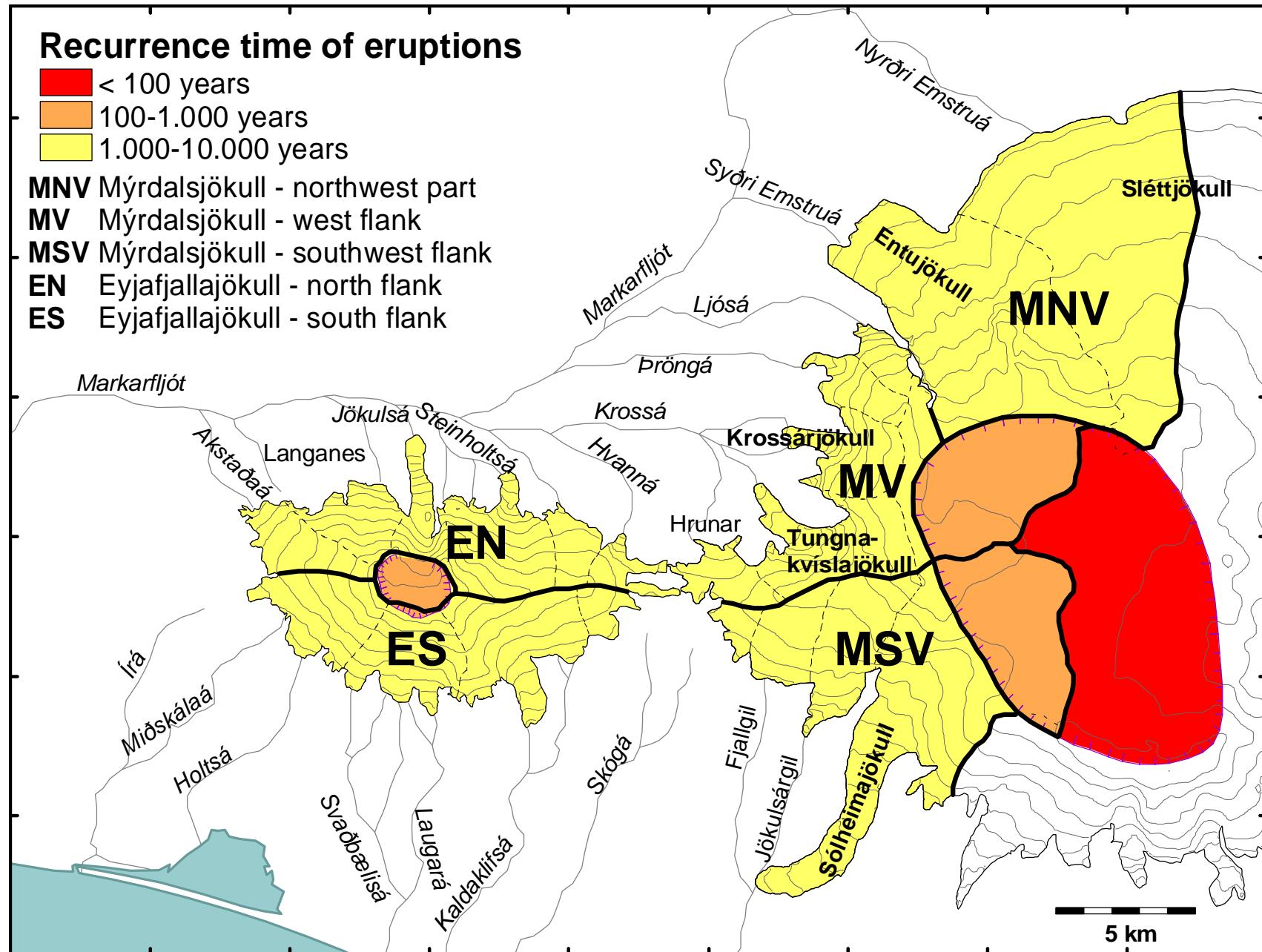
**MNV** Mýrdalsjökull - northwest part

**MV** Mýrdalsjökull - west flank

**MSV** Mýrdalsjökull - southwest flank

**EN** Eyjafjallajökull - north flank

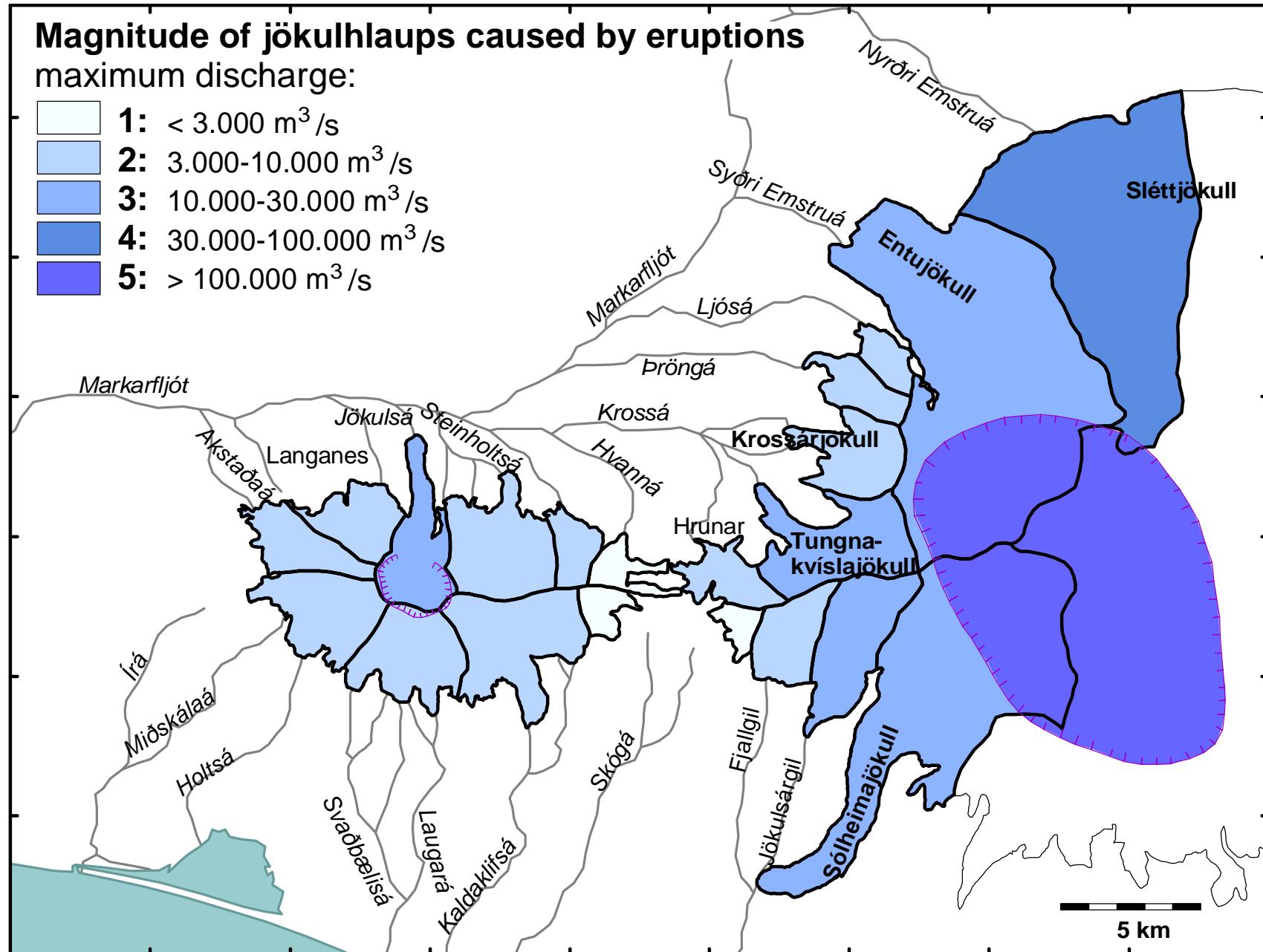
**ES** Eyjafjallajökull - south flank



# Magnitude of jökulhlaups caused by eruptions

maximum discharge:

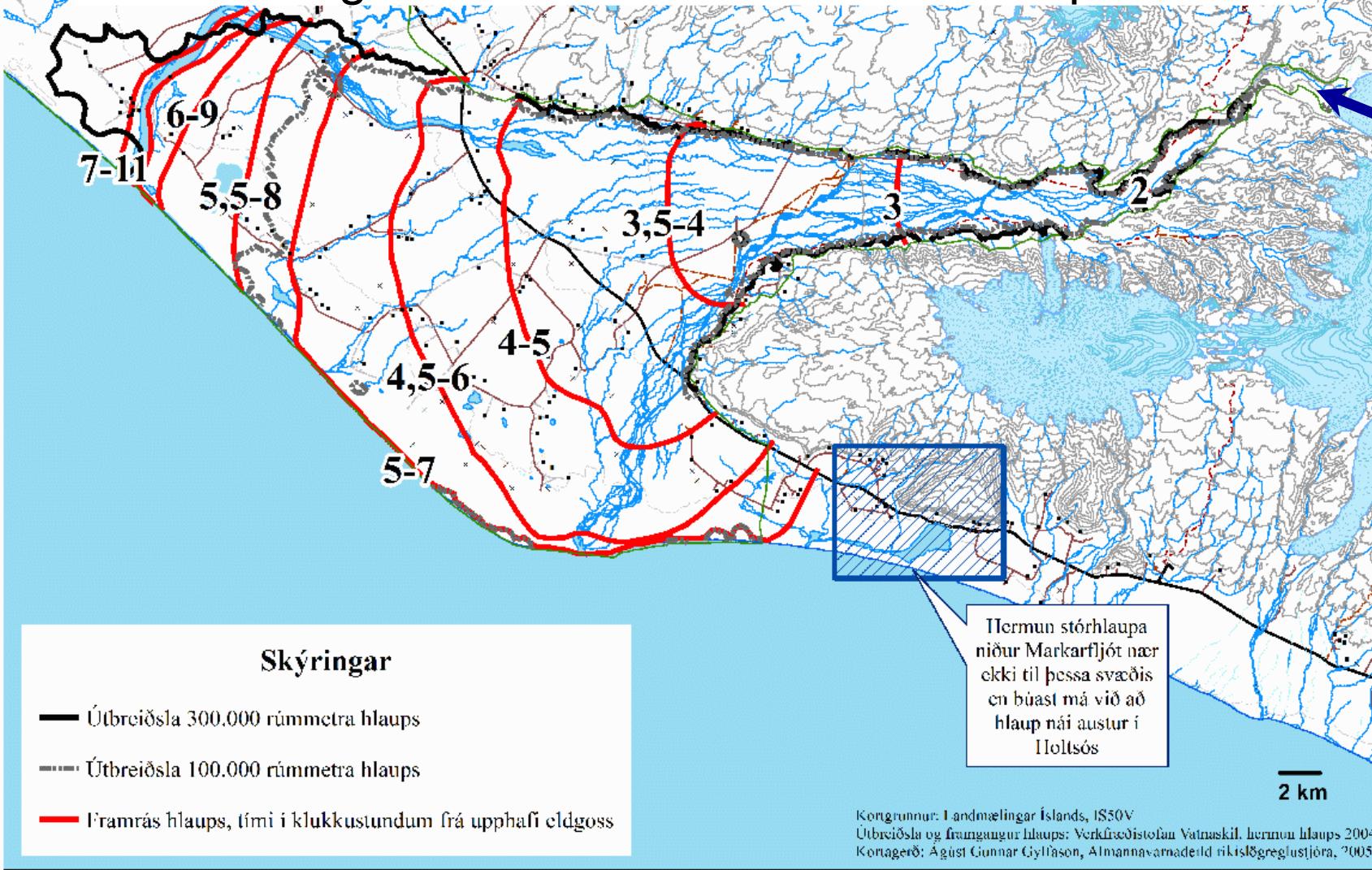
- 1: < 3.000 m<sup>3</sup>/s
- 2: 3.000-10.000 m<sup>3</sup>/s
- 3: 10.000-30.000 m<sup>3</sup>/s
- 4: 30.000-100.000 m<sup>3</sup>/s
- 5: > 100.000 m<sup>3</sup>/s



# Catastrophic jökulhlaup (300,000 m<sup>3</sup>/s)

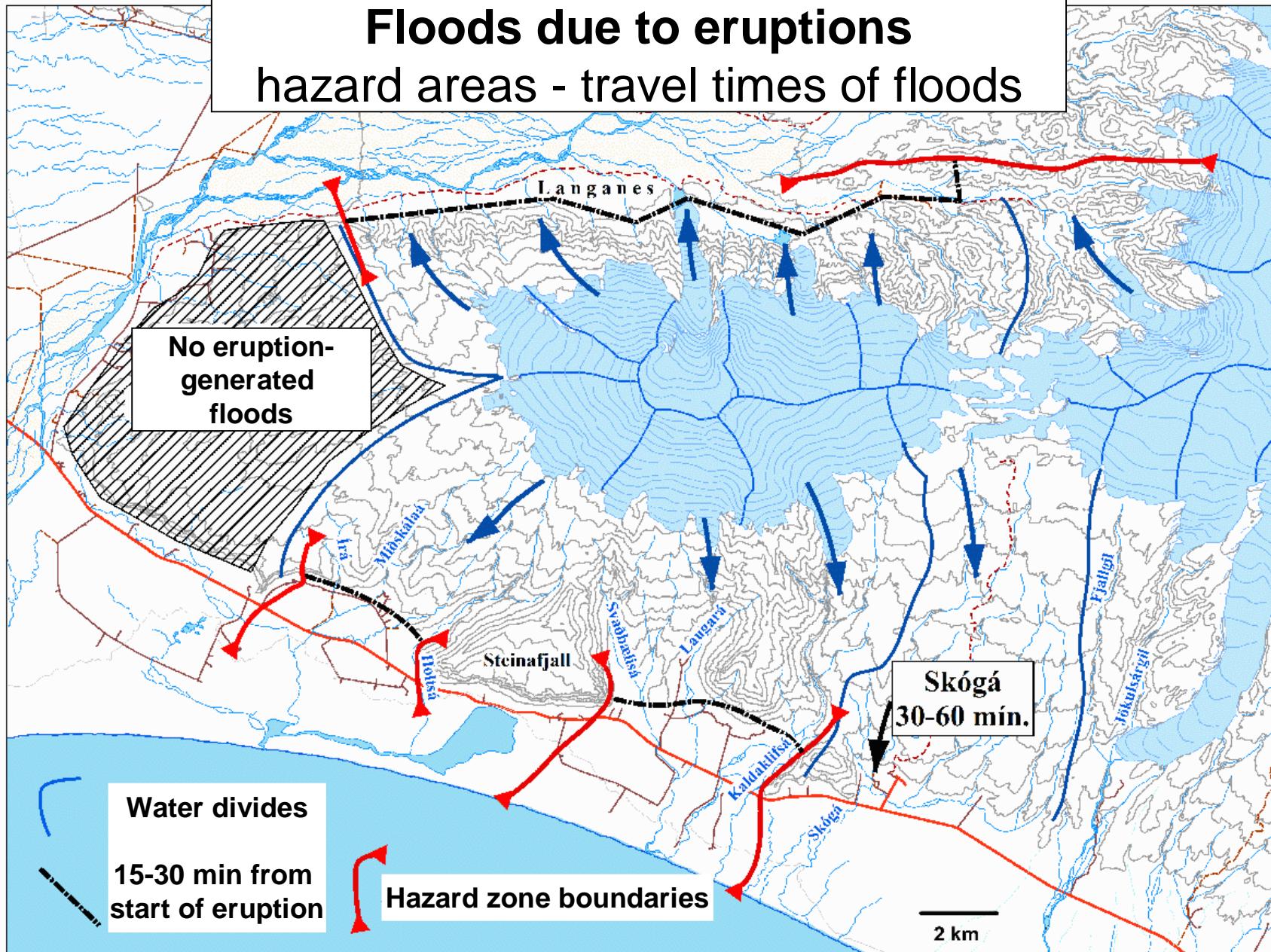
AQUARIVER flood simulation

Timing of flood wave from start of eruption



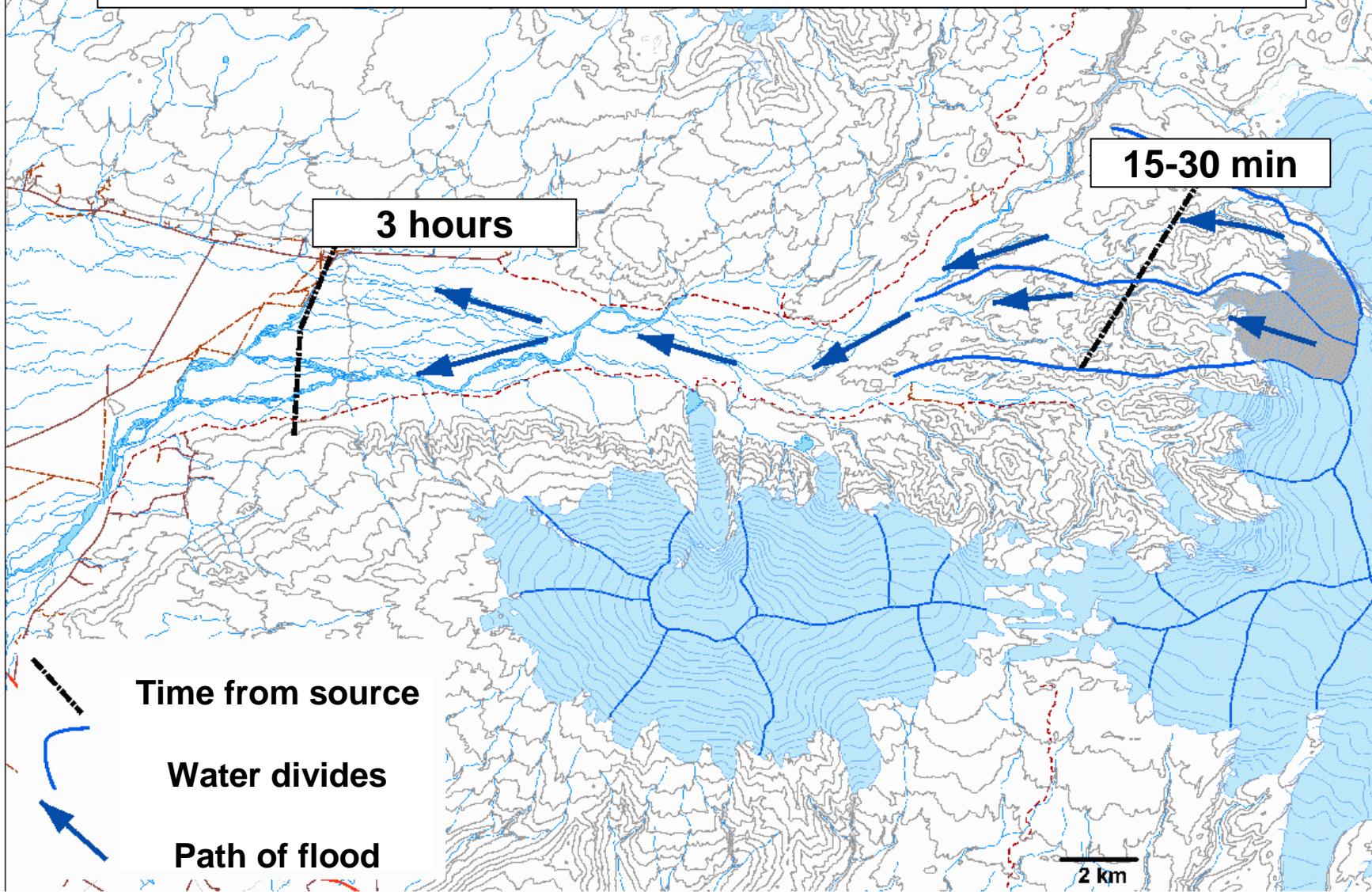
# Floods due to eruptions

## hazard areas - travel times of floods



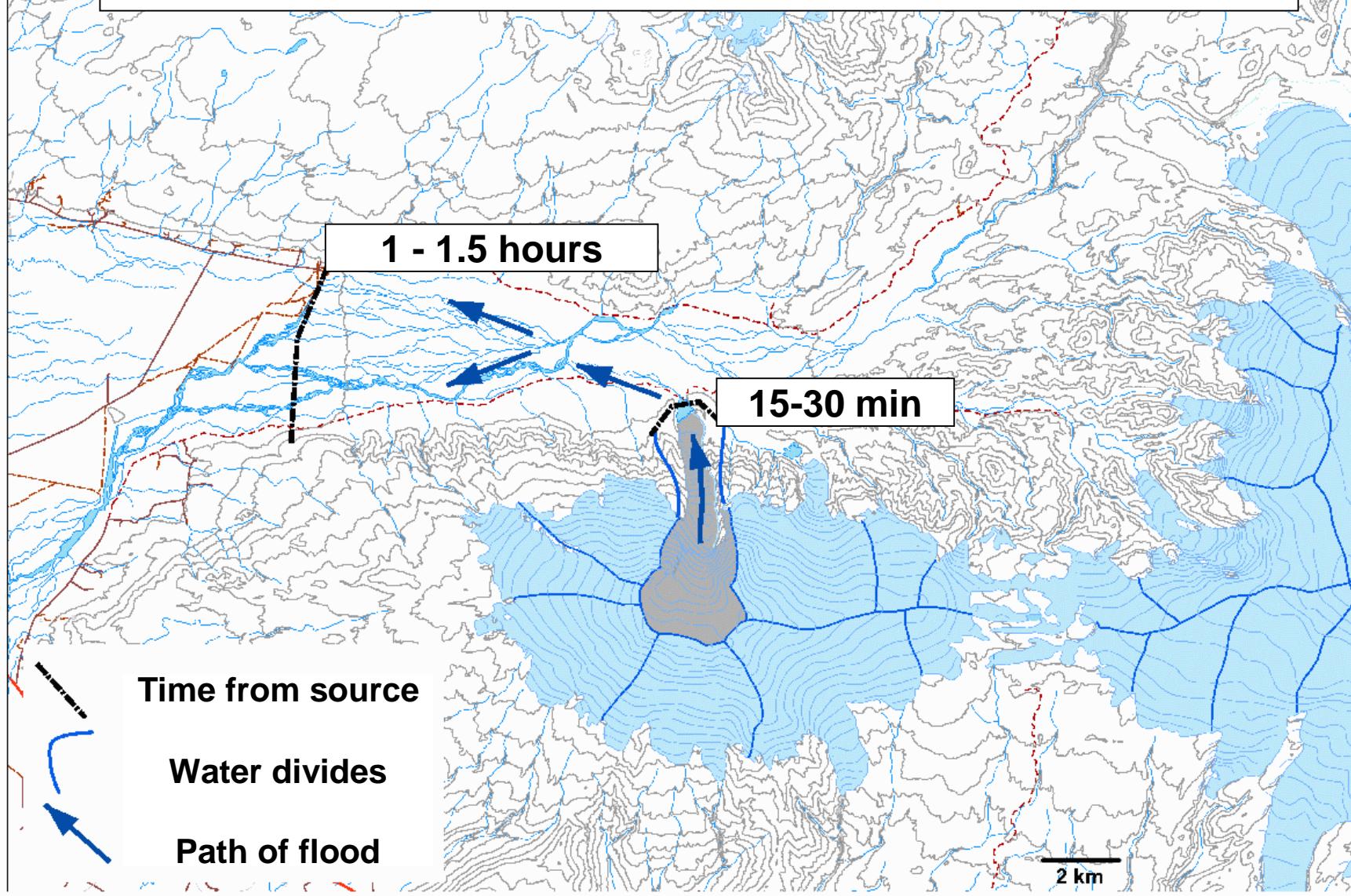
## Floods from Ljósá and Þróngá – path and travel times

recurrence time of eruptions 1,000-10,000 years



# Floods Eyjafjallajökull caldera – path and travel times

reccurence time of eruptions 100-1,000 years



## Results - Hazard assessment

- Recurrence time of eruptions varies between areas - from 50 to 10,000 years
- Recurrence time of large floods to west 500-800 years
- Largest pre-historic floods from Katla caldera ~250,000 m<sup>3</sup>/s (2 x Amazon River)
- Magnitude of floods due to eruptions on flanks of volcanoes mostly 3,000-10,000 m<sup>3</sup>/s
- GIS presentation important to convey information to inhabitants and authorities

This presentation is a short summary of:

Magnús T. Guðmundsson, Jónas Elíasson, Guðrún Larsen, Ágúst Gunnar Gylfason, Páll Einarsson, Tómas Jóhannesson, Kristín Martha Hákonardóttir og Helgi Torfason. 2005: **Yfirlit um hættumat vegna eldgosa og hlaupa frá vesturhluta Mýrdalsjökuls og Eyjafjallajökli.** (in Icelandic), (Overview of hazard due to volcanic eruptions and jökulhlaups from the western part of Mýrdalsjökull and Eyjafjallajökull) In: Magnús T. Guðmundsson and Ágúst Gunnar Gylfason (editors): Hættumat vegna eldgosa og hlaupa frá vestanverðum Mýrdalsjökli og Eyjafjallajökli, 11-44. Ríkislöggreglustjórn og Háskólaútgáfan.

In addition to the above overview, the publication on hazard assessment has 11 specialized papers on various aspects of hazard assessment for the area. All the papers are available on the web-page of the Civil Protection Department of the National Commissioner of the Icelandic police (Ríkislöggreglustjóri, Almannavarnadeild):

<http://www.almannavarnir.is/>

or

[http://www.almannavarnir.is/displayer.asp?cat\\_id=183](http://www.almannavarnir.is/displayer.asp?cat_id=183)