Special Issue "Selected Papers from “The 31st Nordic Conference on Meteorology (NMM31)”"

- Print Special Issue Flyer
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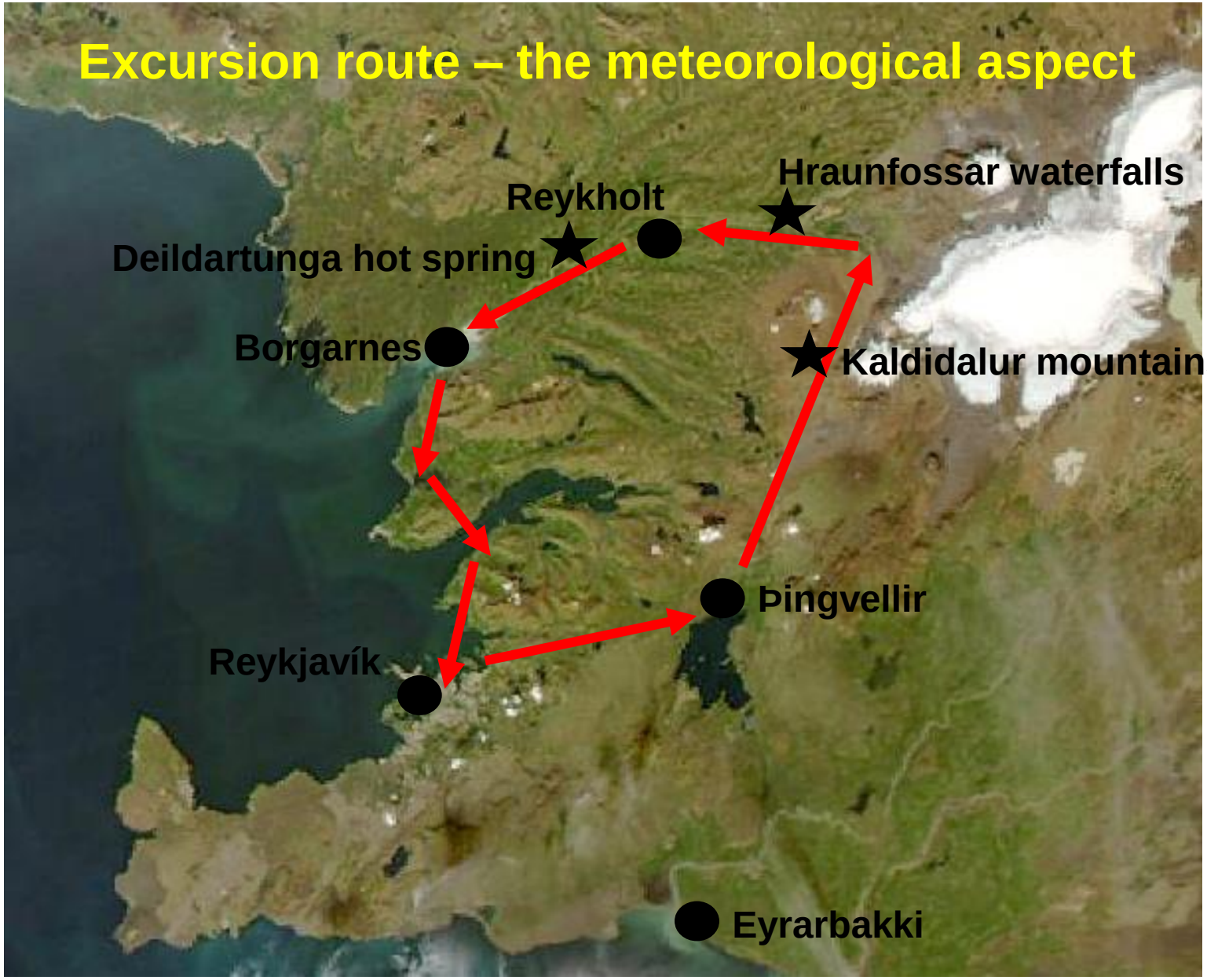
- Keywords
- Published Papers

A special issue of *Atmosphere* (ISSN 2073-4433). This special issue belongs to the section "Climatology and Meteorology".

Deadline for manuscript submissions: **15 September 2018**


Excursion route – the meteorological aspect
Hraunfossar waterfalls
Reykholt
Deildartunga hot spring
Borgarnes
Kaldidalur mountains
Þingvellir
Reykjavík
Eyrarbakki


Excursion route
Reykholt
Hraunfossar waterfalls
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Borgarnes
Kaldidalur mountains
Þingvellir
Reykjavík
Eyrarbakki

Snorri Sturluson

A wealthy politician and an outstanding scholar in Iceland.

Family relations

Ólafur, Haraldur, Eiríkur Hákon, Hálfdán, kings of Norway

↓

Magnús with naked legs king of Norway

↓

Þóra Magnúsdóttir

↓

Jón Loftsson

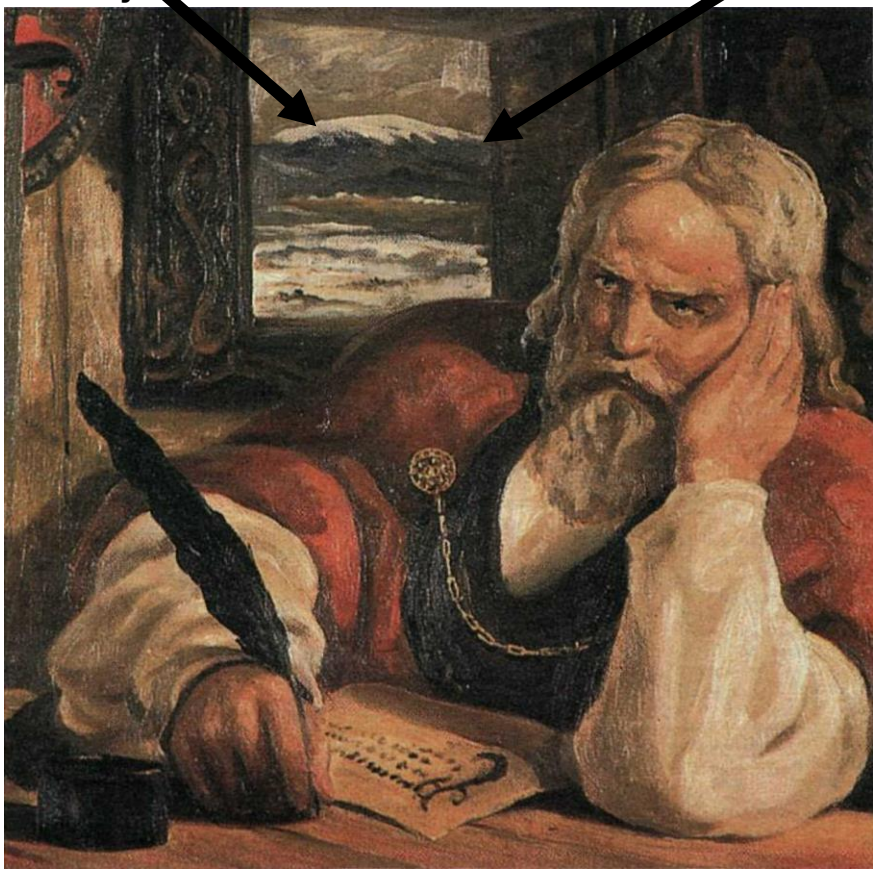
Egill Skallagrímsson

6 generations

→ Snorri Sturluson

Flosaskarð dust source

Eiríksjökull table mountain



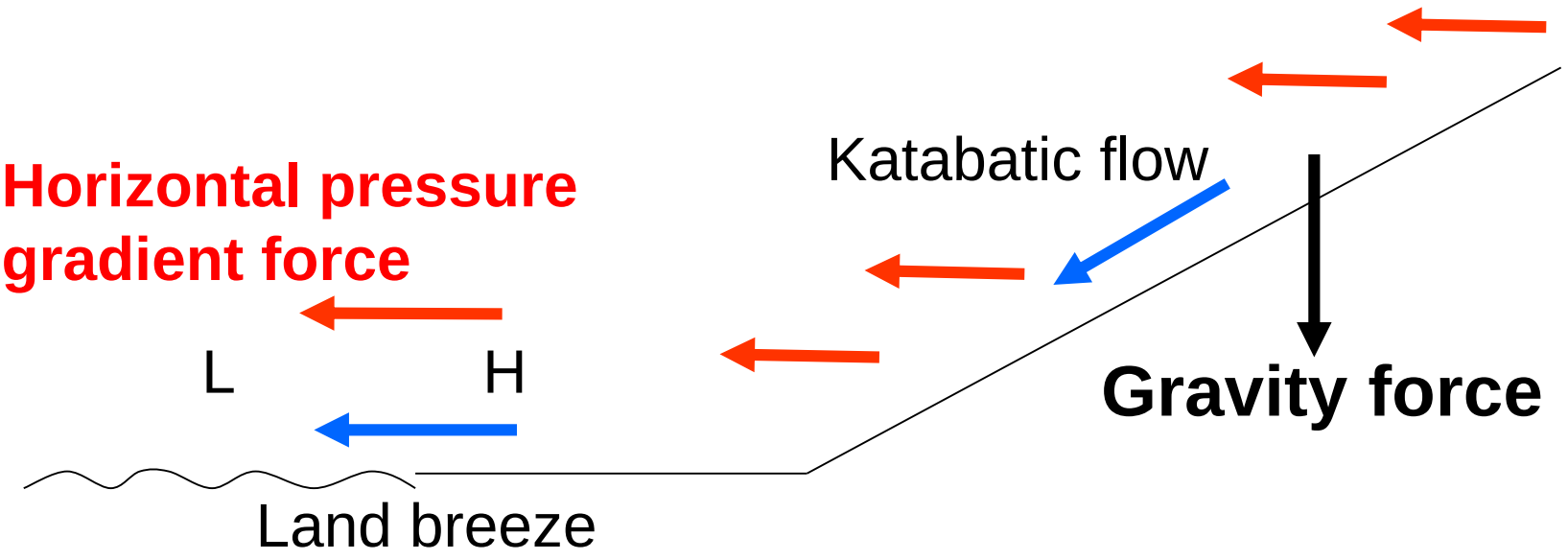
Snorri Sturluson (1179-1241)
Author of Egils Saga

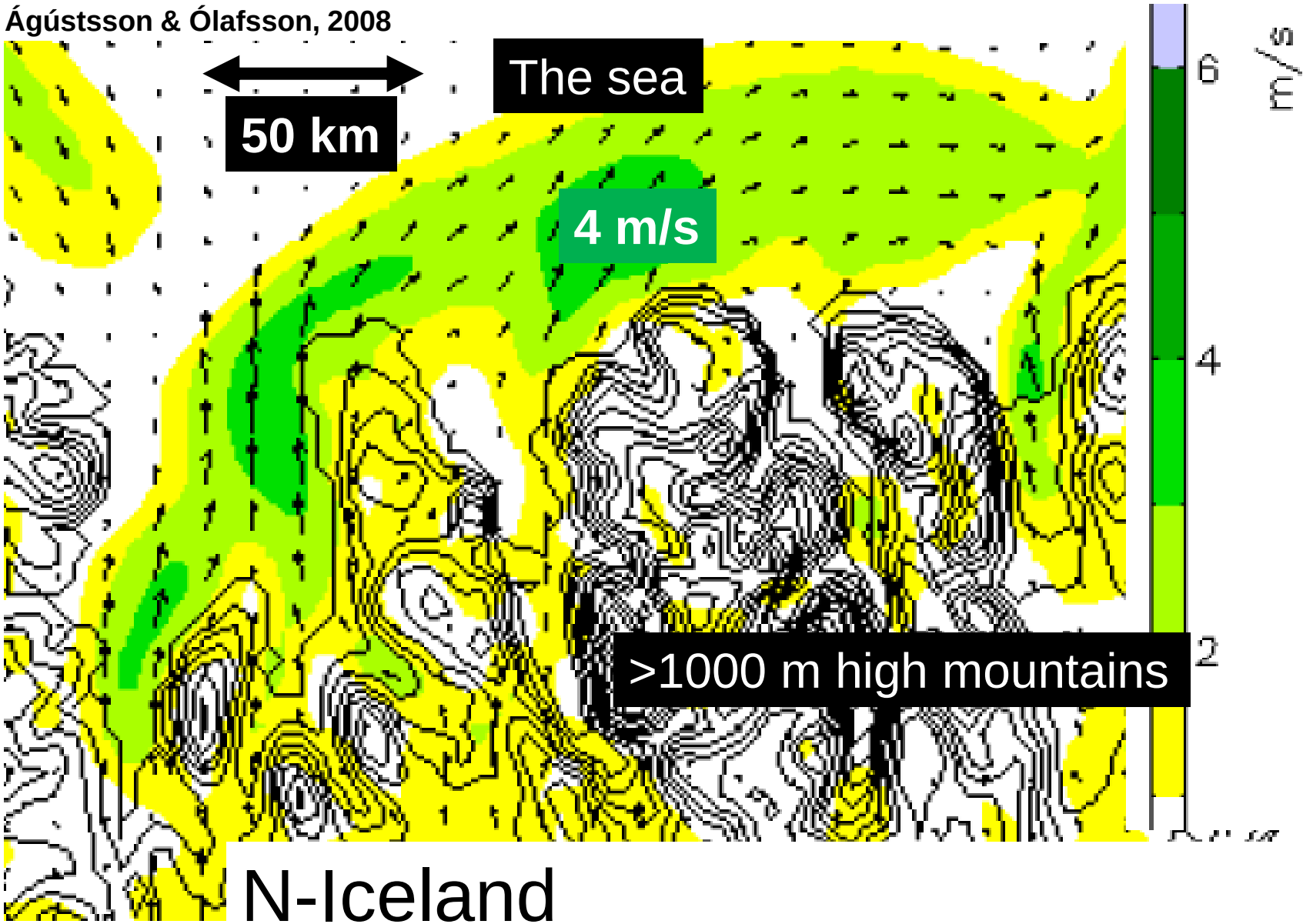
Egil´s saga (English transl. W. C. Green, 1893)

The weather was calm, a fell-wind blew by night, a sea breeze by day. One evening Egil sailed out to sea, but the fishermen were then rowing in to land, those, to wit, who had been set as spies on Egil's movements. They had this to tell, that Egil had put out and sailed to sea, and was gone. This news they carried to Bergonund. And when he knew these tidings, then he sent away all those men that he had had before for protection. Thereafter he rowed in to Alrekstead, and bade Frodi to his house, for he had a great ale-drinking there. Frodi went with him, taking some men. They were feasted well there, and they made merry, with no fear of danger…. There too was no lack of drink.

fell-wind = fjallvindr = katabatic wind

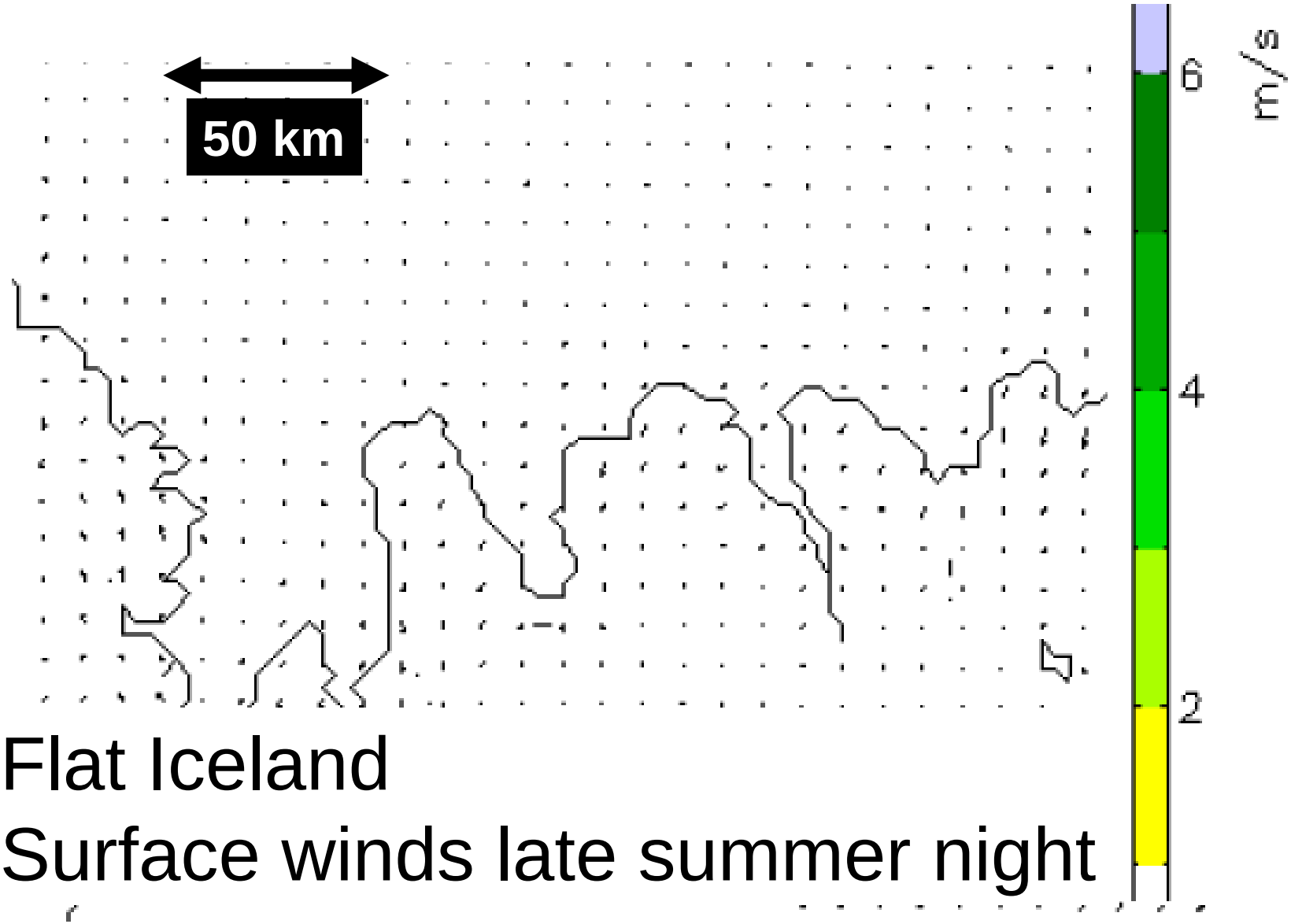
Land-breeze is not exactly the same as katabatic flow





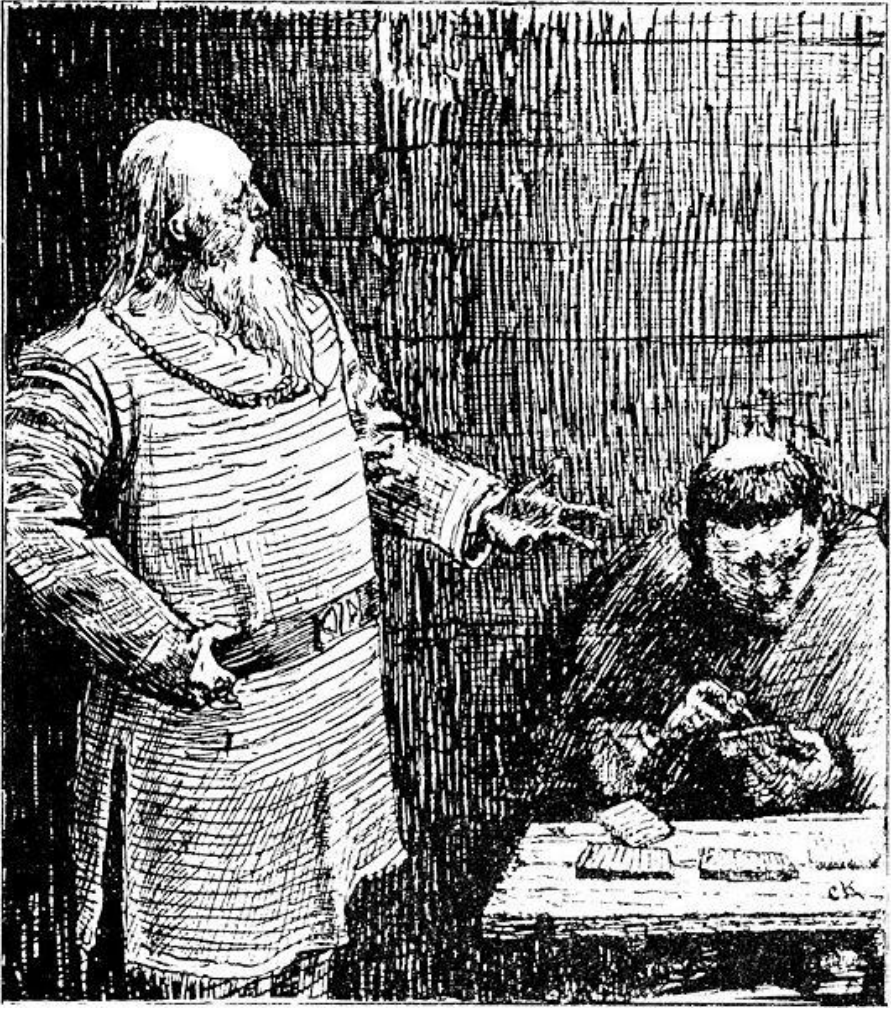
N-Iceland

Surface winds late summer night



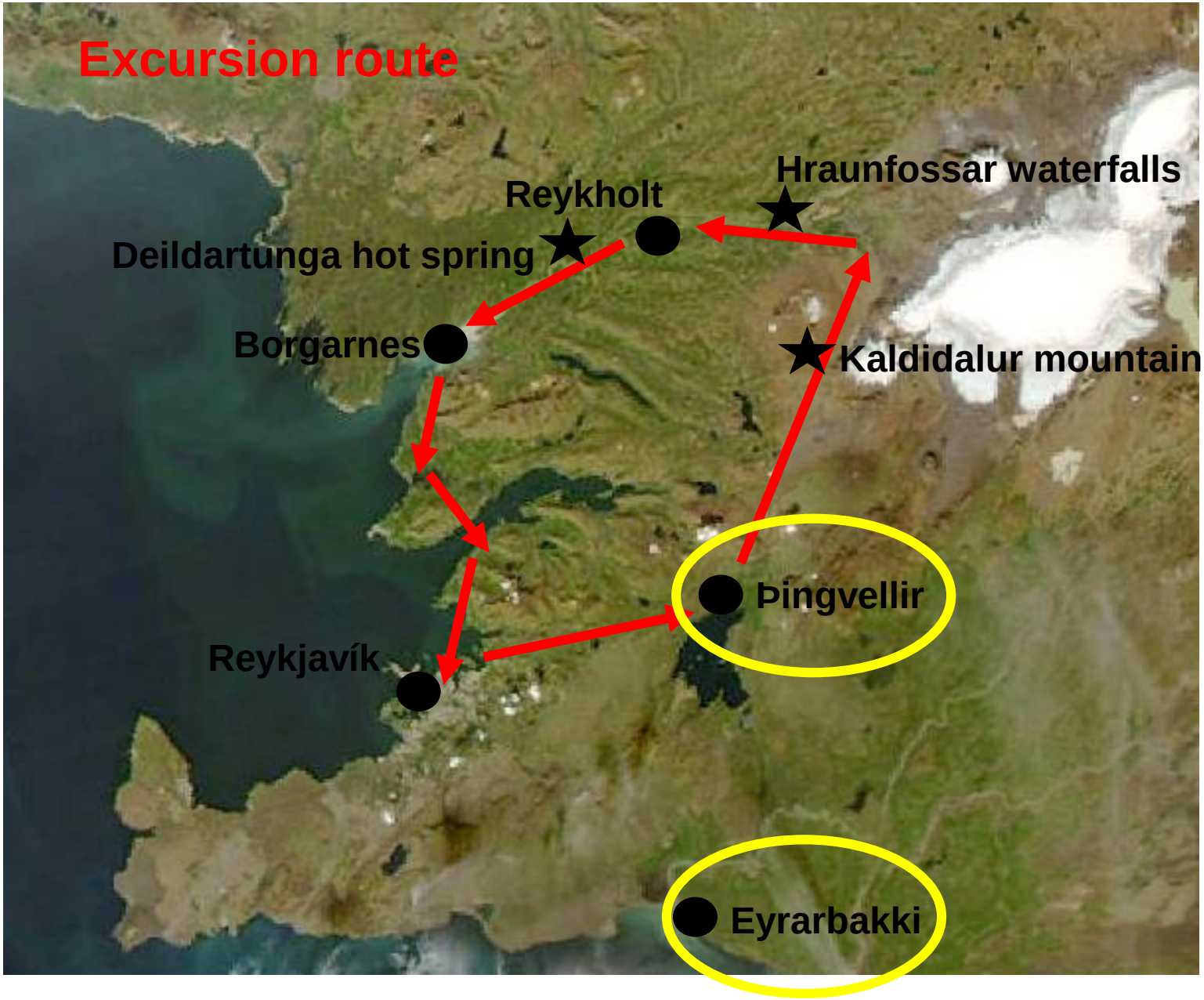
Flat Iceland

Surface winds late summer night



These men knew about thermally driven coastal winds, their knowledge was solid on nighttime flows, more solid than some modern textbooks

The alleged land-breeze in Iceland (and most likely Norway too) is not land-breeze, but katabatic wind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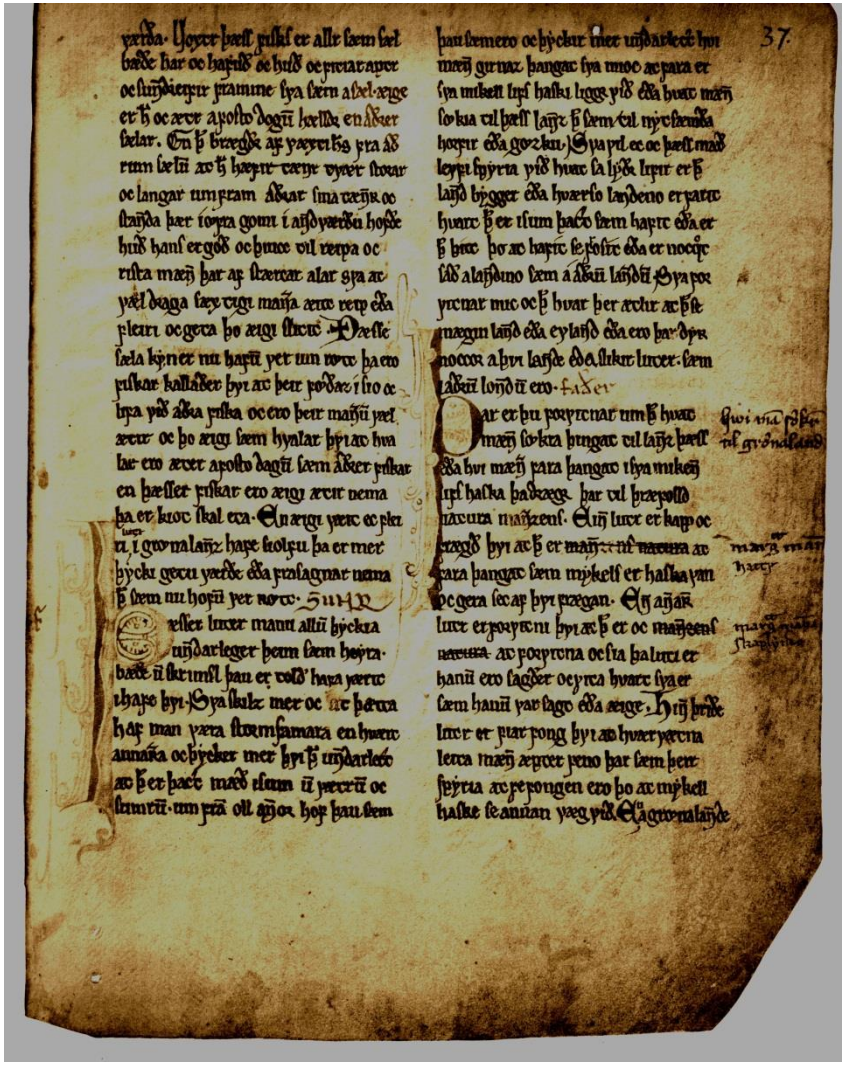
Eyrarbakki

Geophysical information from the speeches at Þingvellir 1000 years ago

- „Four days ago I was drinking in the palace of king Haakon“
- „What caused the anger of the Gods when the lava, on which we are standing now, came up from the earth?

The King’s Mirror (Konungsskuggsjá)



Written around 1240

The King’s mirror has a chapter on meteorology:

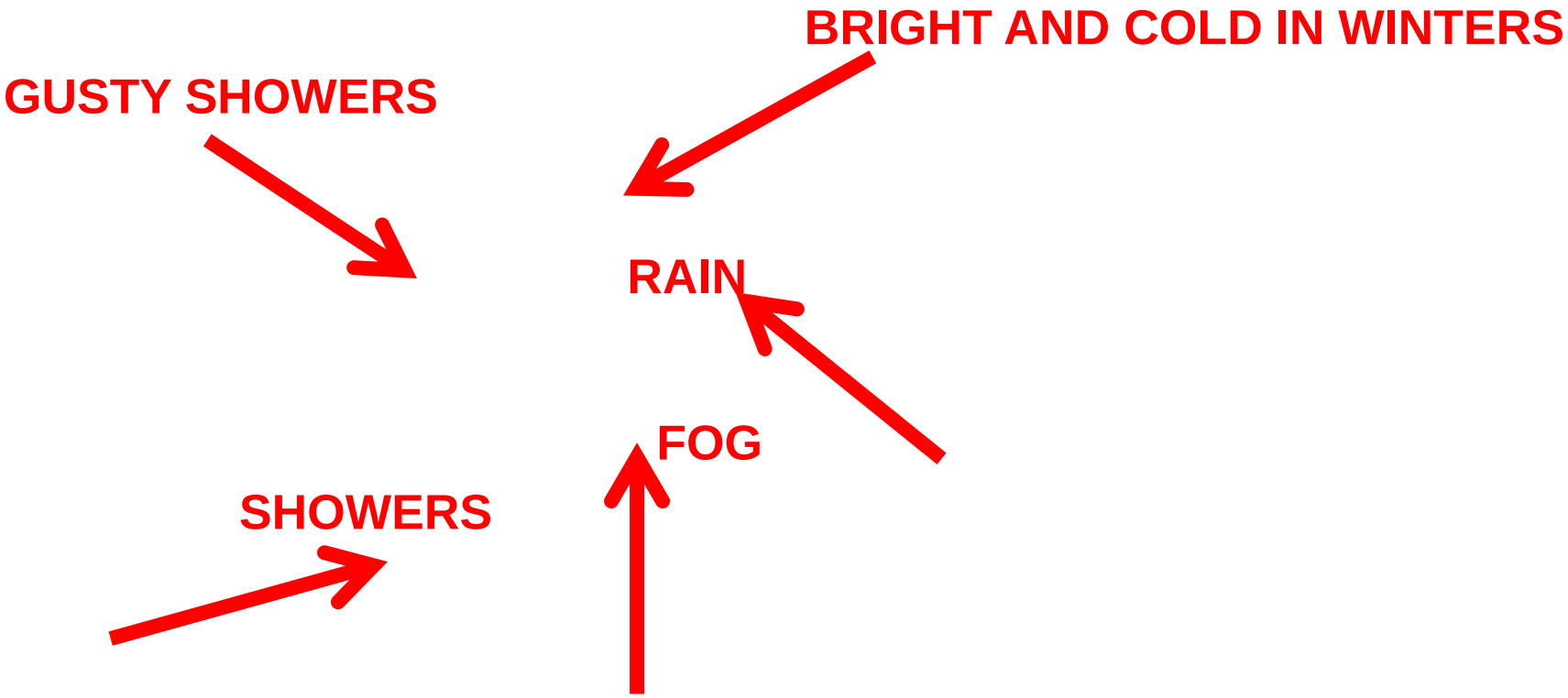
Rain is associated with southeasterly winds

Fog is associated with southerly winds

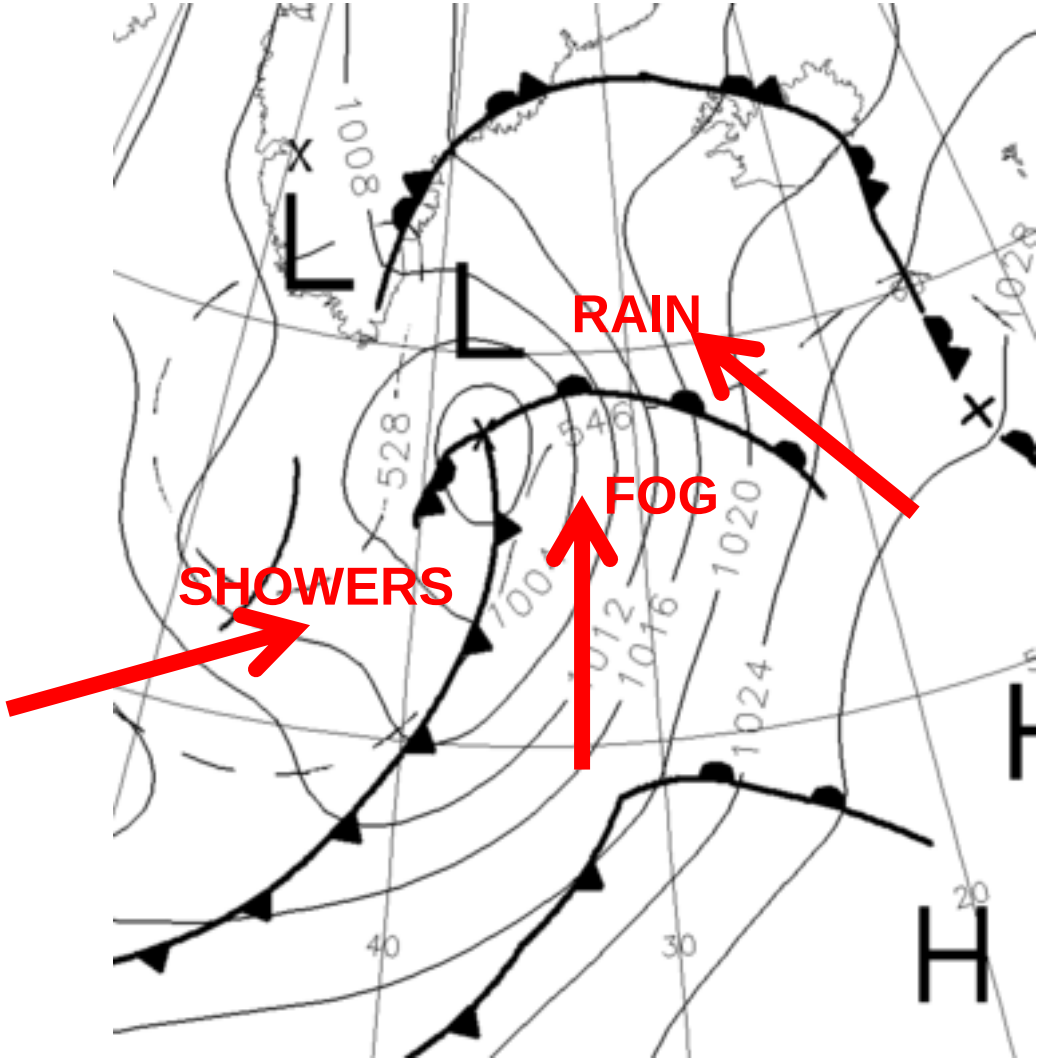
Rainshowers are associated with southwesterly winds

See Páll Bergþórsson; The Wineland Millenium, 2000

Absract from the King's Mirror



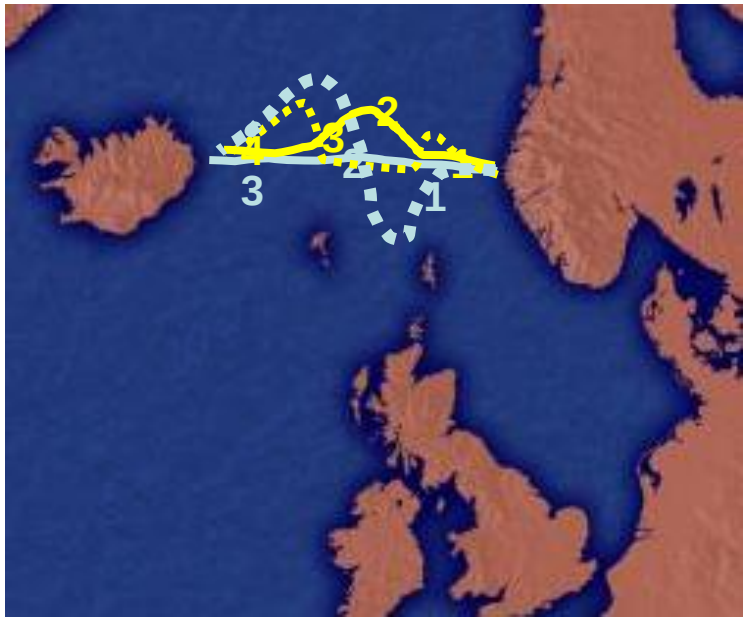
This is the Norwegian cyclone and airmass model

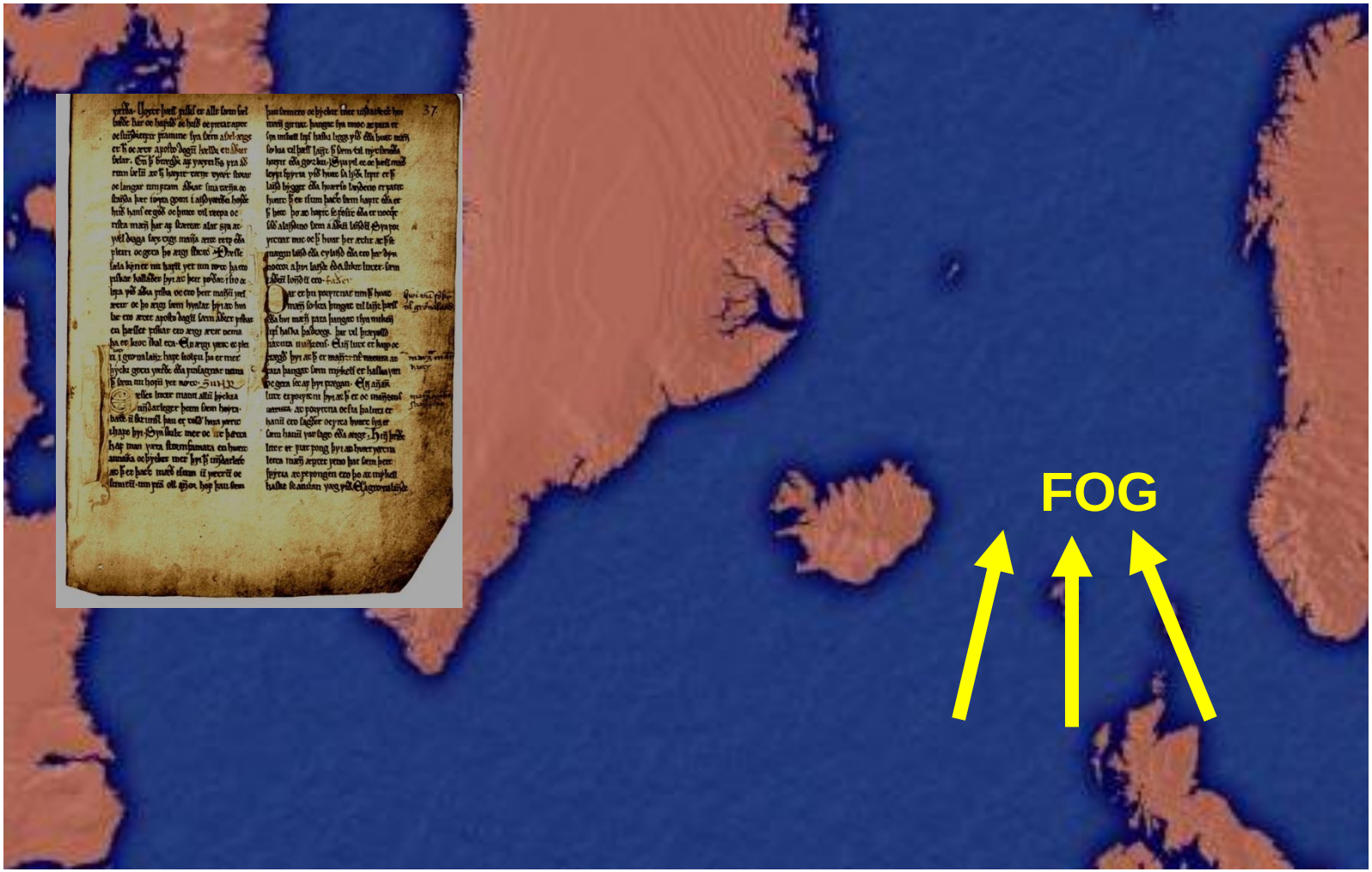


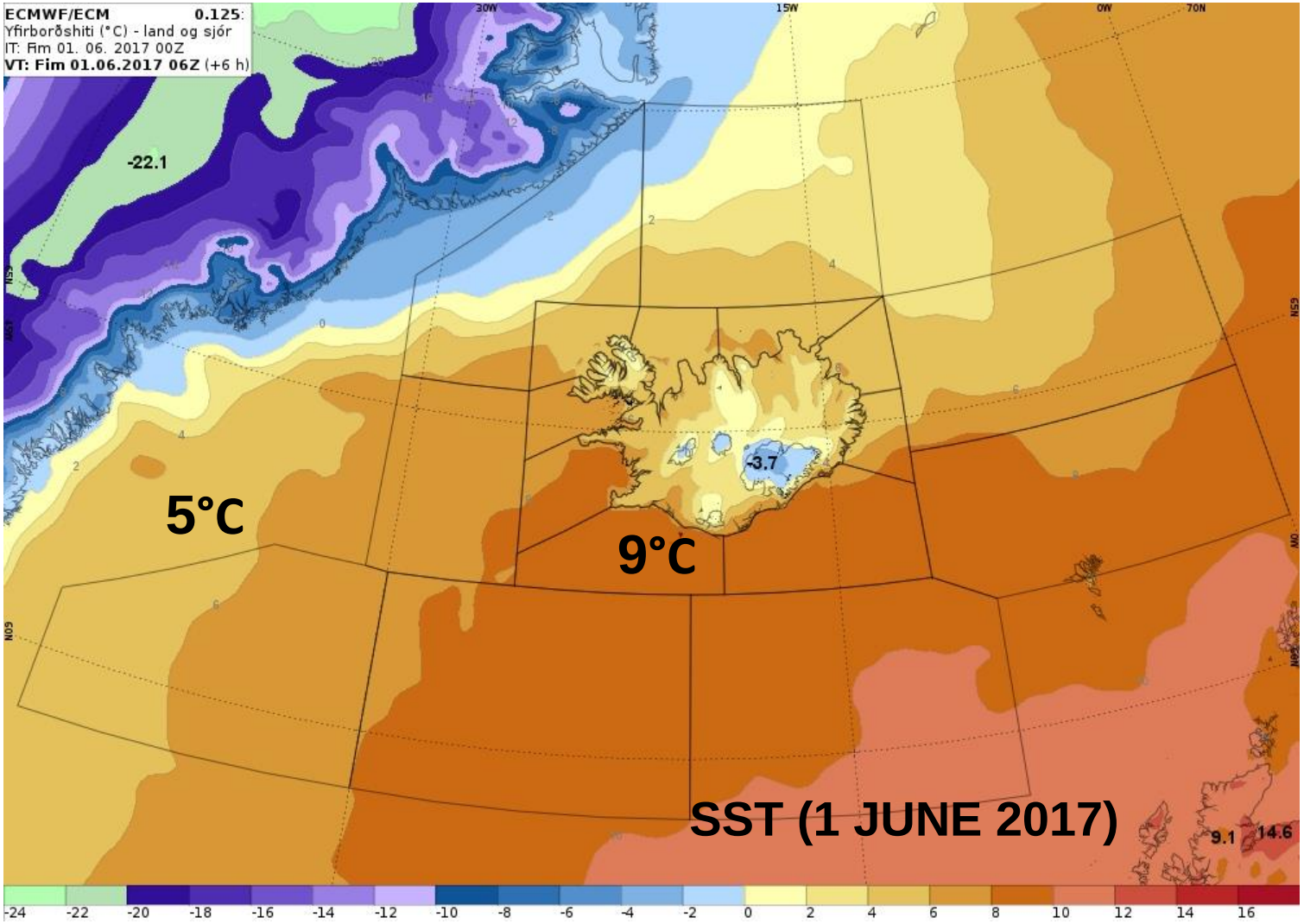
There is a lot of RE in REsearch

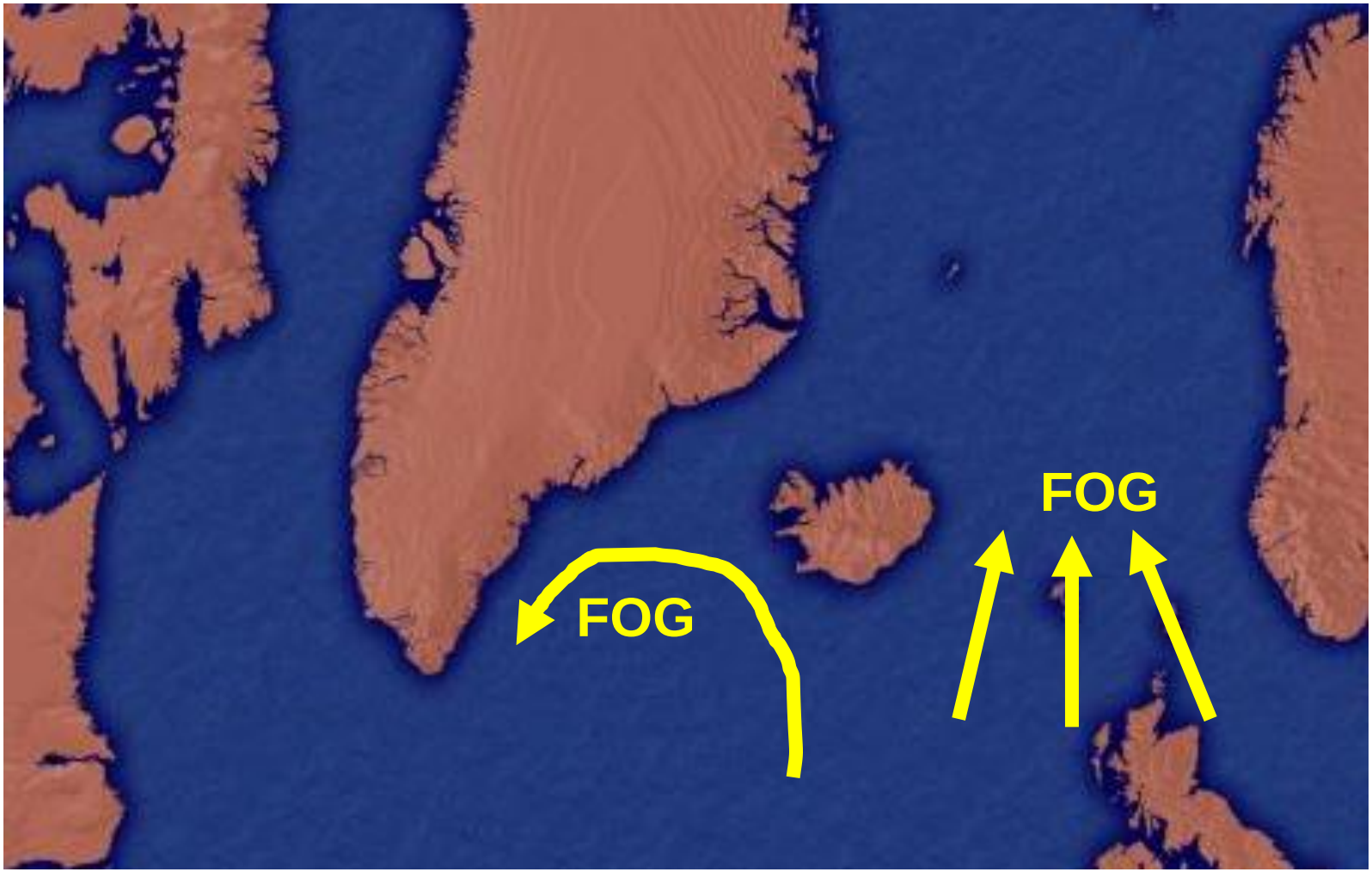
Using the rules of the King's Mirror, it becomes apparently quite easy to navigate across the ocean

Experiment:
4 ships depart from Norway towards Iceland on 4 different days in June - they all arrive safely in less than 5 days

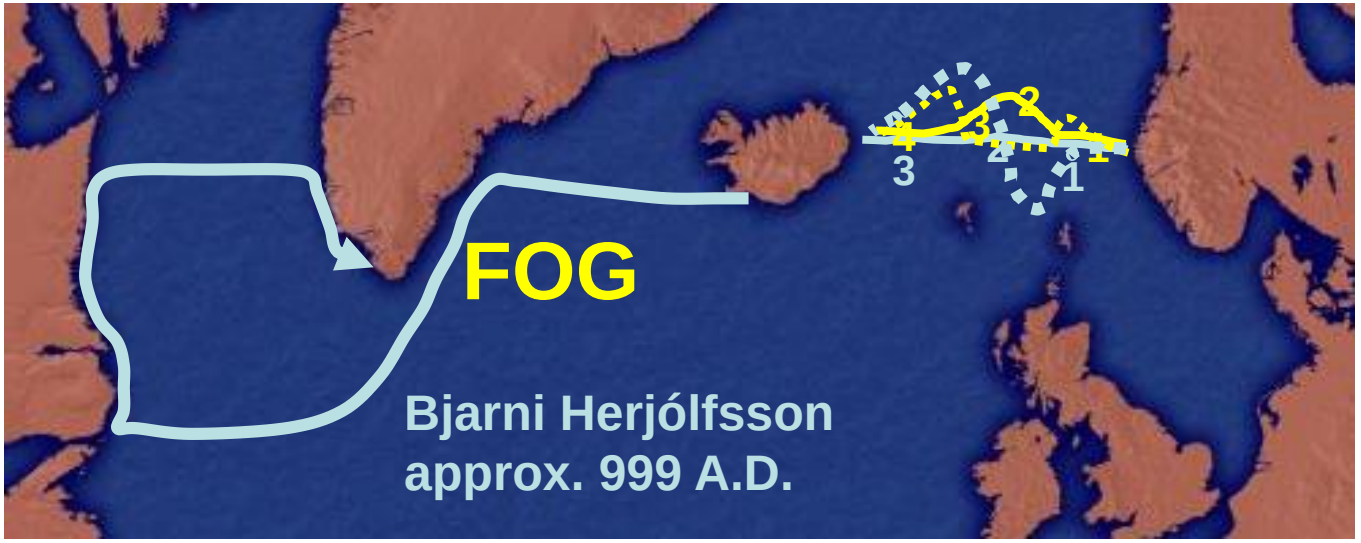



FOG


ECMWF/ECM 0.125:
Yfirborðshiti (°C) - land og sjór
IT: Fim 01. 06. 2017 00Z
VT: Fim 01.06.2017 06Z (+6 h)
-22.1
-3.7
5°C
9°C
SST (1 JUNE 2017)
9.1
14.6
-24 -22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16


FOG
FOG

Bjarni Herjólfsson set off for Greenland. His ship sailed into fog and barrier winds blowing from the NE to the southeast of Greenland. Bjarni turned too far to the south, missed Greenland and ended up in Wineland (America).

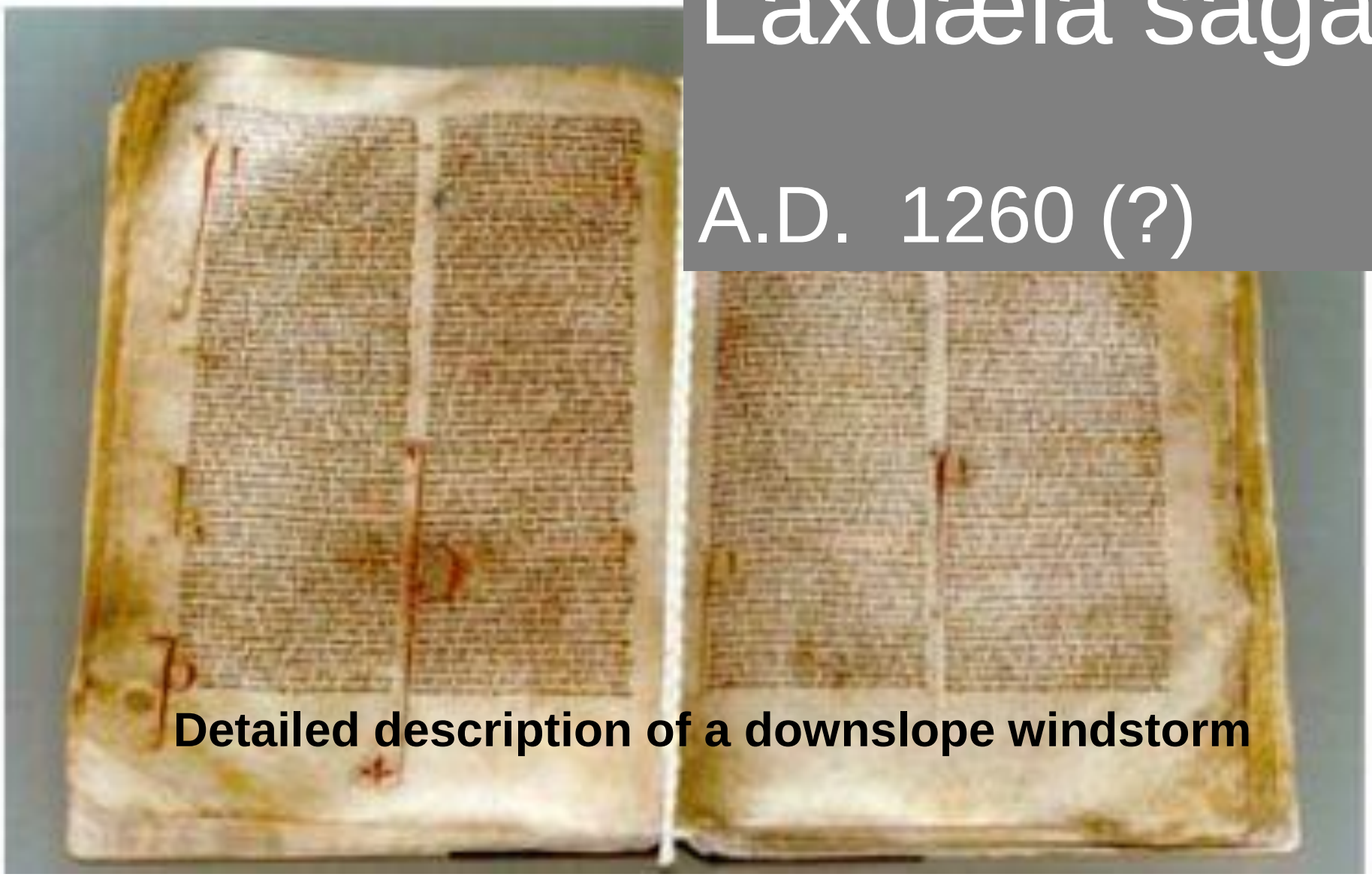


The first European settlements in N-America were a direct result of Bjarni Herjólfsson's lack of knowledge of mountain meteorology


Excursion route
Hraunfossar waterfalls
Reykholt
Deildartunga hot spring
Borgarnes
Kaldidalur mountains
Mt. Hafnarfjall
Notorious places for downslope windstorms
Mt. Esja
Þingvellir
Reykjavík
Eyrarbakki

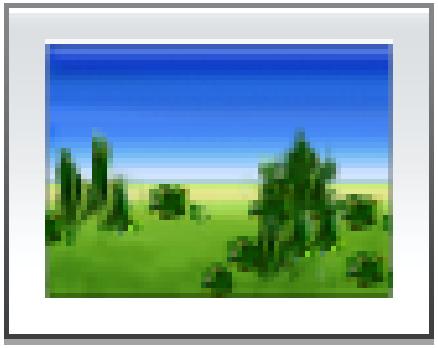
Laxdæla saga

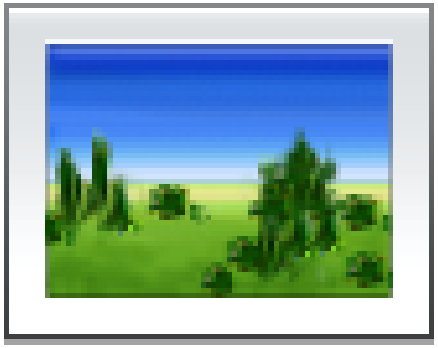
A.D. 1260 (?)



Detailed description of a downslope windstorm


Thank you
Photo: Olafur Sigurjonsson





- Is it all about having the low level cold air in place?
- Will we have to look for different kinds of extremes if (when) the sea ice disappears?

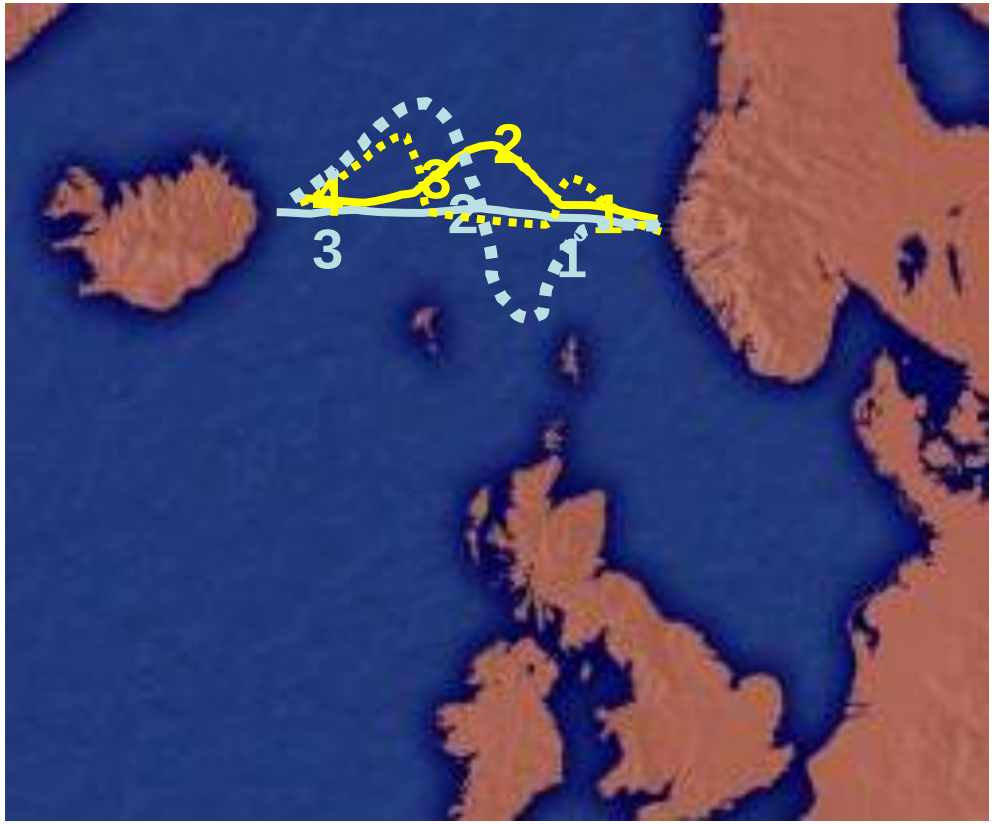
The End

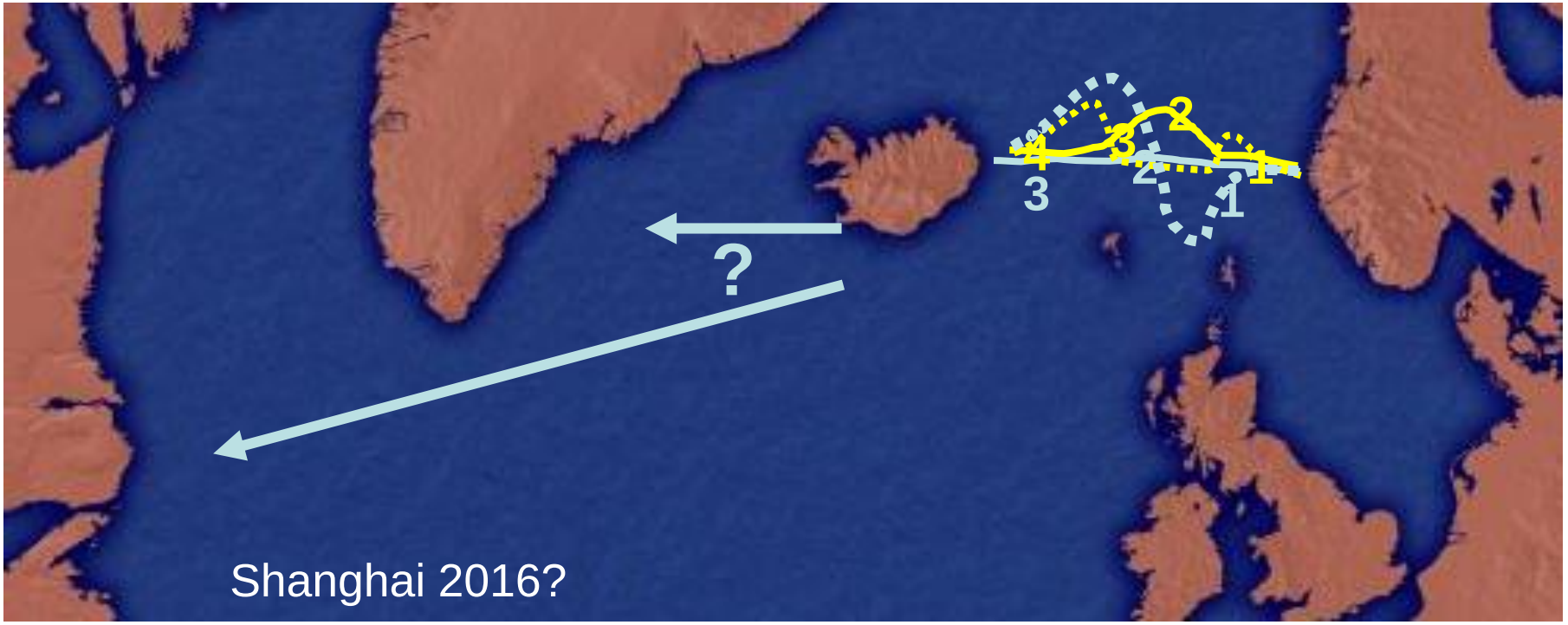
The navigators could

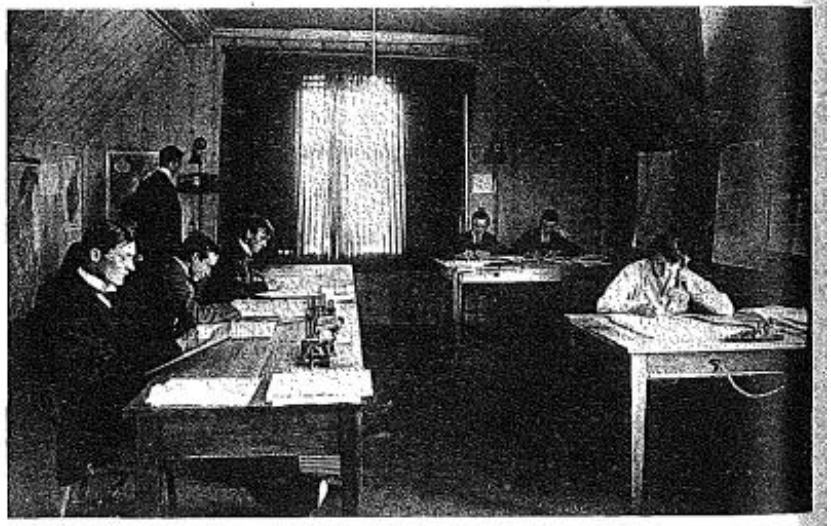
- tell the time of the day
- estimate the latitude (if not overcast)
- (- determine the wind direction from the clouds)

Using the rules of the King's Mirror, it becomes apparently quite easy to navigate across the ocean

Experiment:
4 ships depart from Norway towards Iceland on 4 different days in June - they all arrive safely in less than 5 days




?
3
2
1
Shanghai 2016?



The Bergen School of Meteorology[1]

The Cradle of modern weather-forecasting

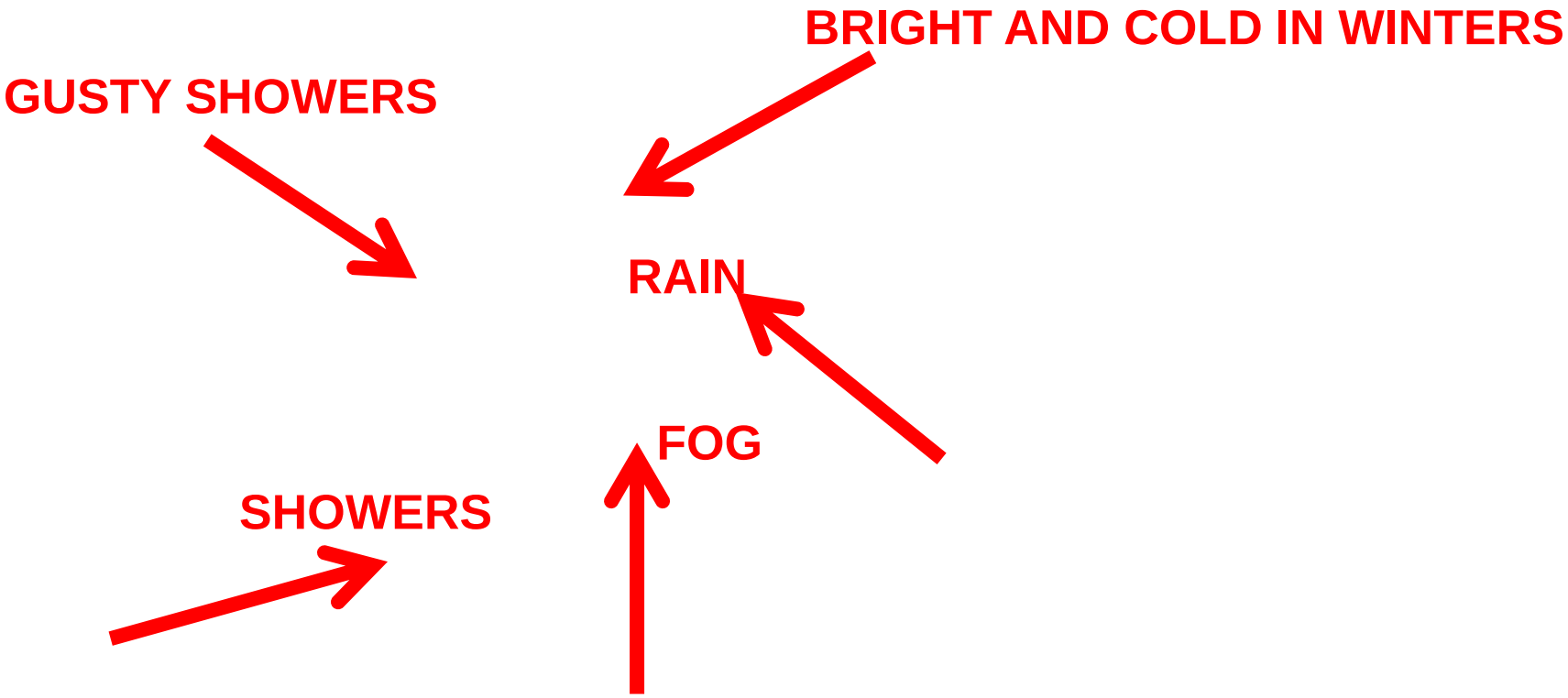
Vilhelm Bjerknes and his jolly team in 1917-1926

- Jacob Bjerknes
- Halvor Solberg
- Tor Bergeron
- Carl-Gustaf Rossby
- Sverre Petterssen
- Erik Palmén
- Erik Björkdal
- Svein Rosseland
- Carl Ludvig Godske
- Johan Sandström

Therefore, to complete the system of equations and obtain 6 equations and 6 variables:

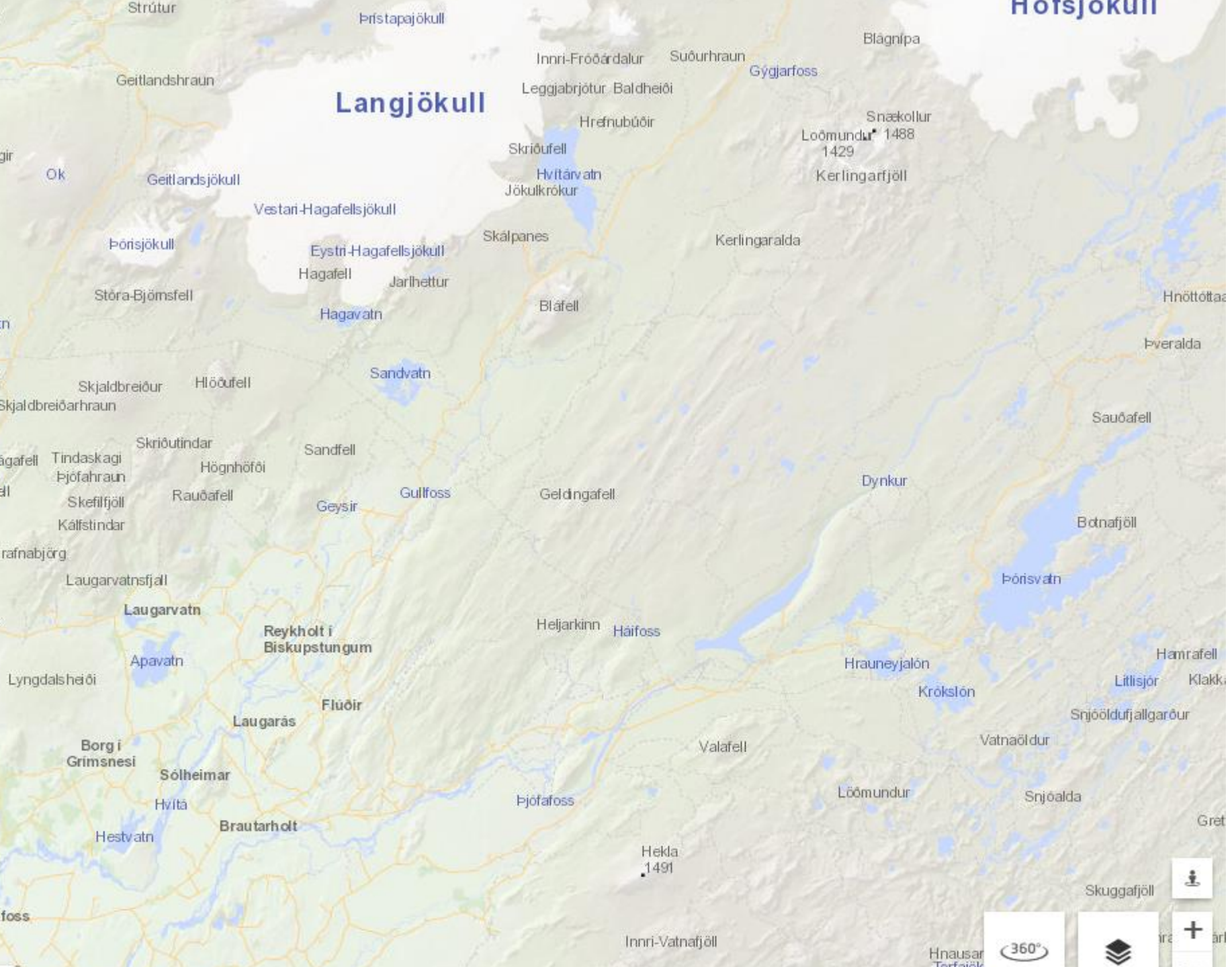
- $\frac{dv}{dt} = -(1/\rho)\nabla p - g(r/r) + (1/\rho)\left[\nabla \cdot (\mu \nabla v) + \nabla(\lambda \nabla \cdot v)\right]$
- $c_v \frac{dT}{dt} + p\frac{d\alpha}{dt} = q + f$
- $\frac{d\rho}{dt} + \rho \nabla \cdot v = 0$
- $p = \rho RT.$

Absract from the King's Mirror



One thousand years of Meteorology: What works and what is forgotten?

Haraldur Ólafsson
Bergen School of Meteorology &
University of Iceland


Strútur
Þrístapajökull
Hofsjökull
Blágnípa
Innri-Fróðárdalur
Suðurhraun
Gýgjarfoss
Geitlandshraun
Leggjabrjótur
Baldheiði
Langjökull
Hrefnubúðir
Snækollur
Loðmundur
1488
1429
Skriðufell
Hvítárvatn
Kerlingarfjöll
Ok
Geitlandsjökull
Jökulkrókur
Vestari-Hagafellsjökull
Skálpanes
Kerlingaralda
Þórisjökull
Eystri-Hagafellsjökull
Hagafell
Jarlhettur
Stóra-Björnsfell
Hagavatn
Bláfell
Hnöttóttaa
Þveralda
Sandvatn
Skjaldbreiður
Hlöðufell
Skjaldbreiðarhraun
Sauðafell
Skriðutindar
Sandfell
Tindaskagi
Högnhöfði
Þjófahraun
Dynkur
Rauðafell
Gullfoss
Geldingafell
Skefilfjöll
Geysir
Kálfstindar
Botnafjöll
Laugarvatnsfjall
Þórisvatn
Laugarvatn
Heljarkinn
Háifoss
Reykholt í Biskupstungum
Hamrafell
Apavatn
Hrauneyjalón
Lyngdalsheiði
Litlisjór
Króksfón
Flúðir
Snjóöldufjallgarður
Laugarás
Vatnaöldur
Borg í Grímsnesi
Valafell
Sólheimar
Löðmundur
Hvítá
Þjófafoss
Snjóalda
Brautarholt
Hestvatn
Hekla
1491
Skuggafjöll
Innri-Vatnafjöll
360°

Outline

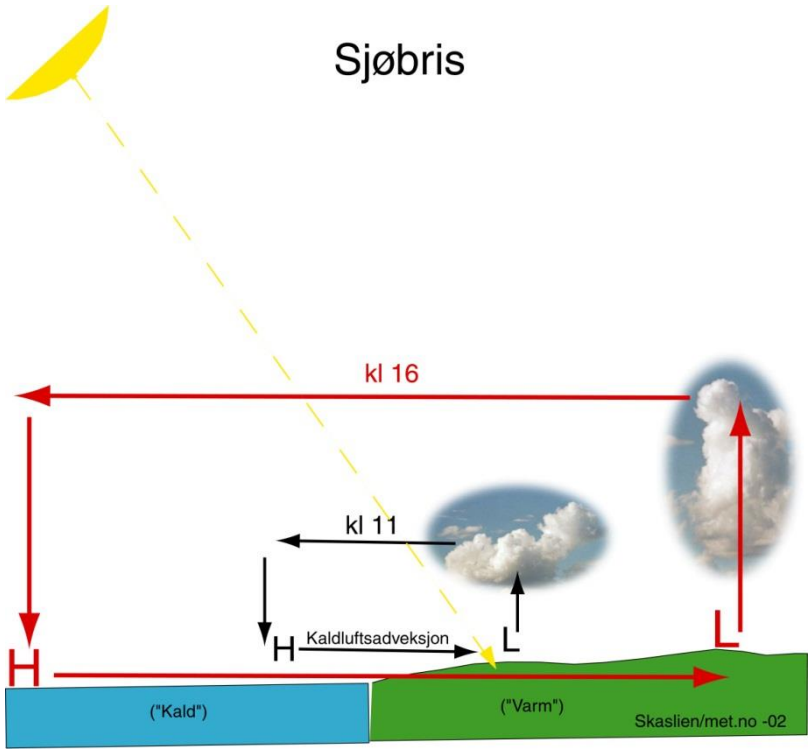
- The katabatic wind in a.d. 1000 (a.d.1230) (Egils saga)
- Konungsskuggsjá (The king´s mirror), 13th century
- The Bergen school in 1917
- Some late meteorological concepts (21st century)

The Mt. Eyjafjallajökull ash plume on 1 May 2010. (Photo: Bernadett Weinzierl)

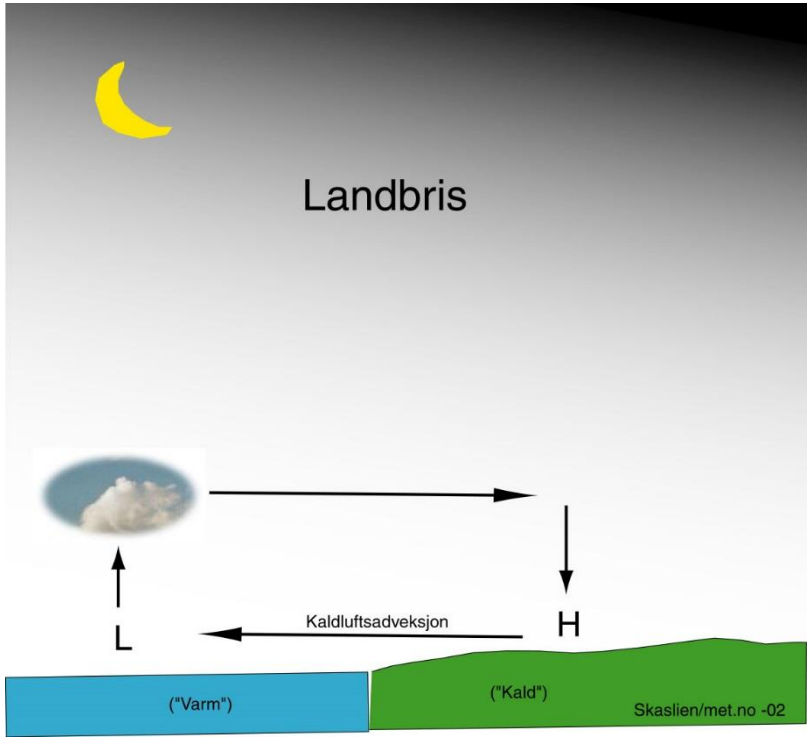
Meteorology in the Middle Ages and the 21st century

Thermally driven Coastal Flows

Modern texts on thermally driven coastal winds



Sea breeze

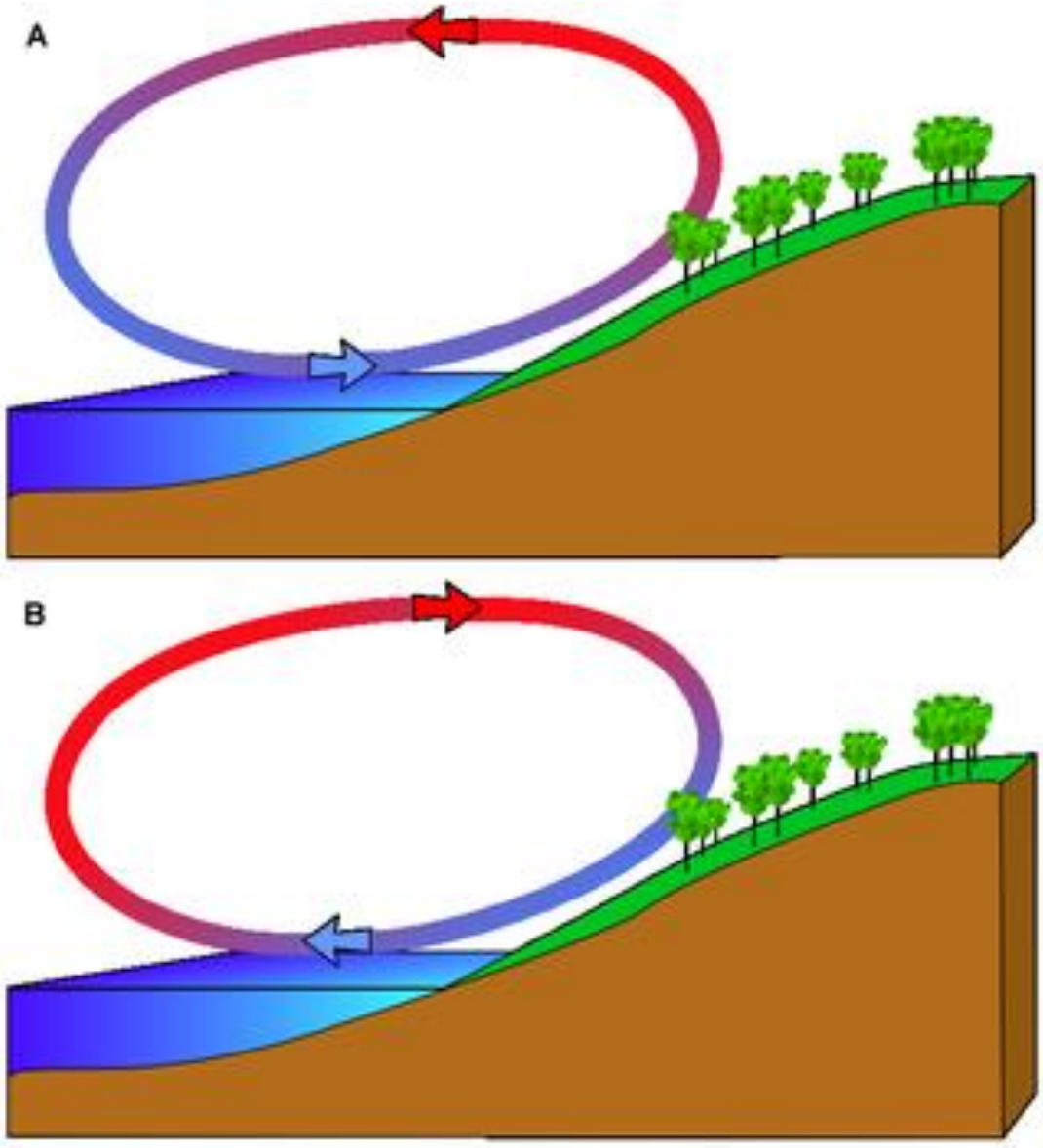


Land breeze

(met.no)

Wikipedia:

NB: Sloping land!



A: Sea breeze, B: Land breeze

Land breeze (Wikipedia)

Land breezes

At night, the land cools off quicker than the ocean due to differences in their specific heat values, which forces the dying of the daytime sea breeze. **If the land cools below that of the adjacent sea surface temperature, the pressure over the water will be lower than that of the land, setting up a land breeze** as long as the environmental surface wind pattern is not strong enough to oppose it. If there is sufficient moisture and instability available, the land breeze can cause showers or even thunderstorms, over the water. Overnight thunderstorm development offshore can be a good predictor for the activity on land the following day, as long as there are no expected changes to the weather pattern over the following 12-24 hours. The land breeze will die once the land warms up again the next morning.

Egill Skallagrímsson
(10th Century)

A very good poet, mercenary in England and Continental Europe, greedy, strong and clever

Egil´s father and grandfather fled from Norway to Iceland around 880 AD.

Egill claimed an inheritance in Norway on behalf of his wife

Eirik bloodaxe, king of Norway

(10th century)

Greedy, strong, ill-tempered and maybe not excessively clever

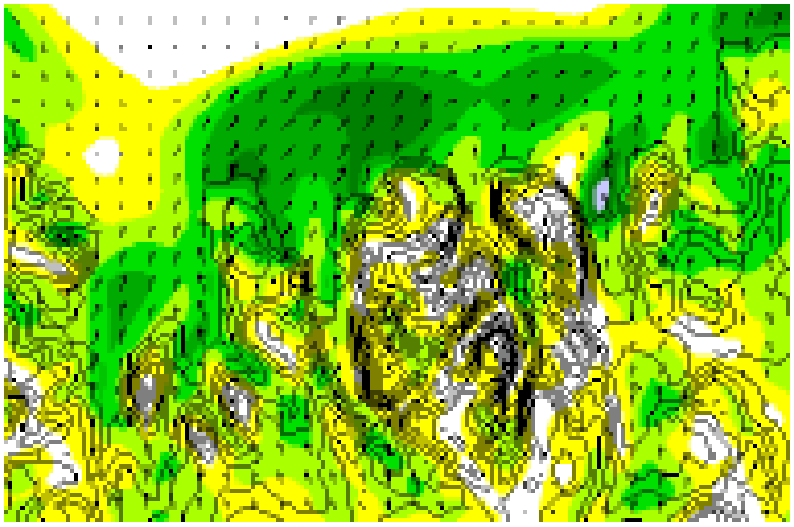
Prevents Egill from collecting the money

Who is right, Snorri and Egill or the spirit of the modern textbooks?

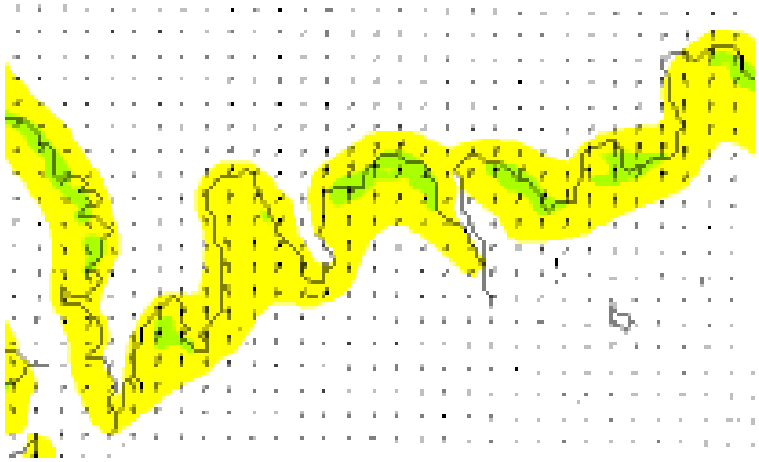
We simulate the thermally driven winds

Numerical model (MM5), Dx=3km, starting from rest with clear skies over Iceland in June

Surface winds in December



”True” topography



Flat

Ágústsson & Ólafsson, 2008

Egil´s saga (English transl. W. C. Green, 1893)

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Where is the katabatic flow going to bring Egill?

They thought that the katabatic wind would bring Egill far away – to England or Iceland!

”Egil sailed out to sea for the night, as was written above. And when morning came the wind fell and there was a calm. They then lay drifting, letting the ship ride free for some nights. But when a sea-breeze came on, Egil said to his shipmen, ’We will now sail to land,…”

Egill returned and killed all the king´s men, Egill raises a curse-pole and sets the curse that Eirikur blood-axe will lose his kingdom.

He did very soon thereafter

Lack of knowledge of meteorology is used to illustrate the stupidity of the king´s men

Meteorology in the Middle Ages

PART III
The early discoveries of the Bergen Cyclone Model and America

How did the vikings find their way across the ocean?

Recent paper on medieval history:

The Vikings and earlier seafarers used a number of navigational aids including using special sundials,

the stars,

migration paths of birds

whales,

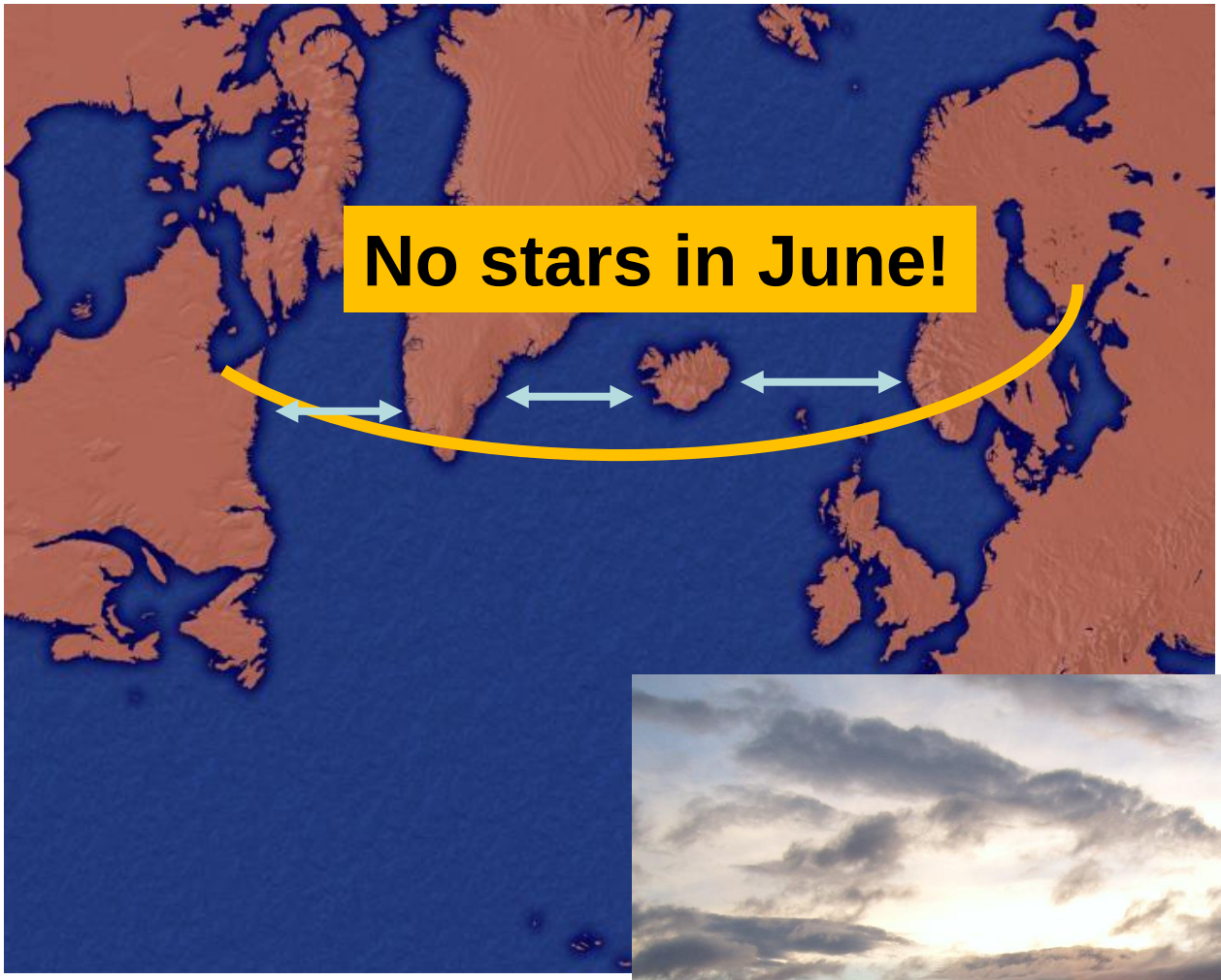
coastlines,

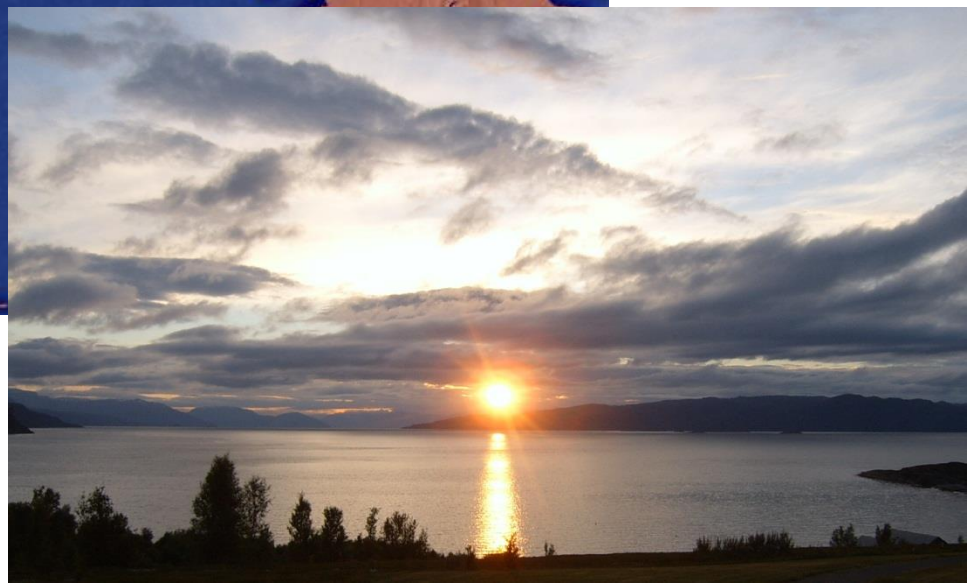
distant clouds over islands,

and so on.

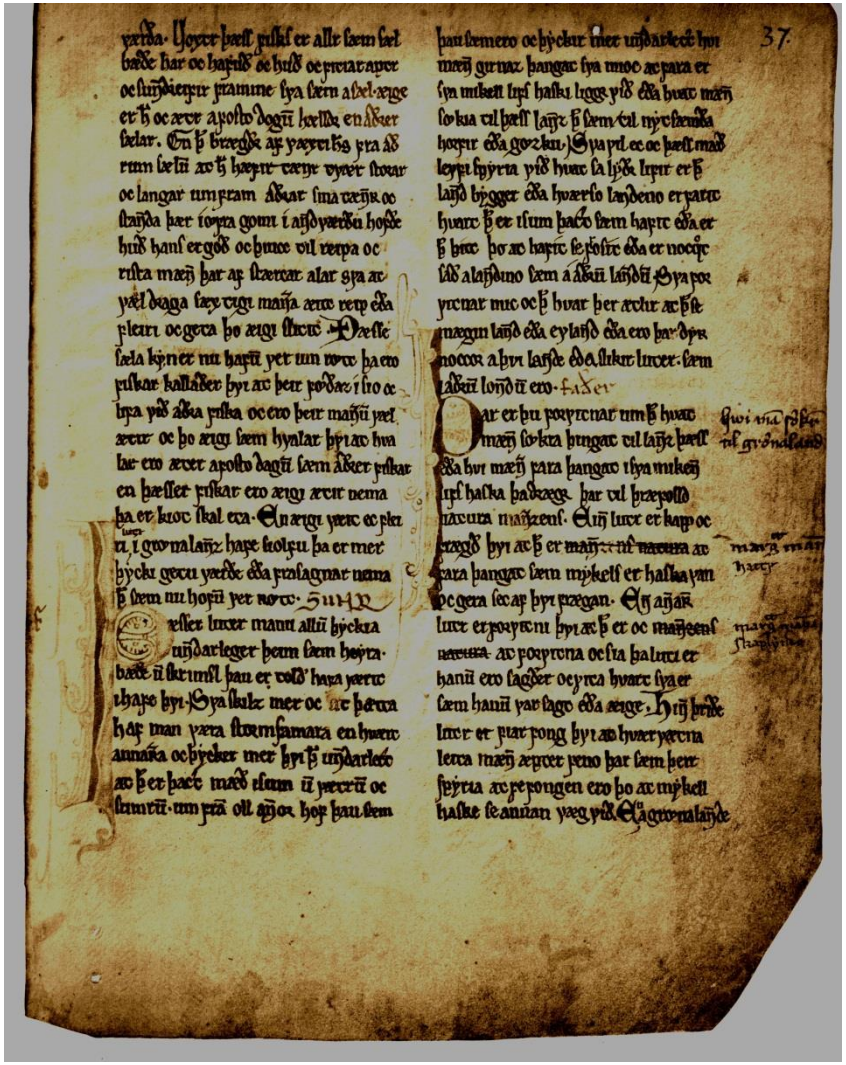
The sunstone could have been another important tool in their navigational aids kit.


When traveling across the oceans, the Vikings always took the shortest route from shore to shore


No stars in June!



The King’s Mirror (Konungsskuggsjá)



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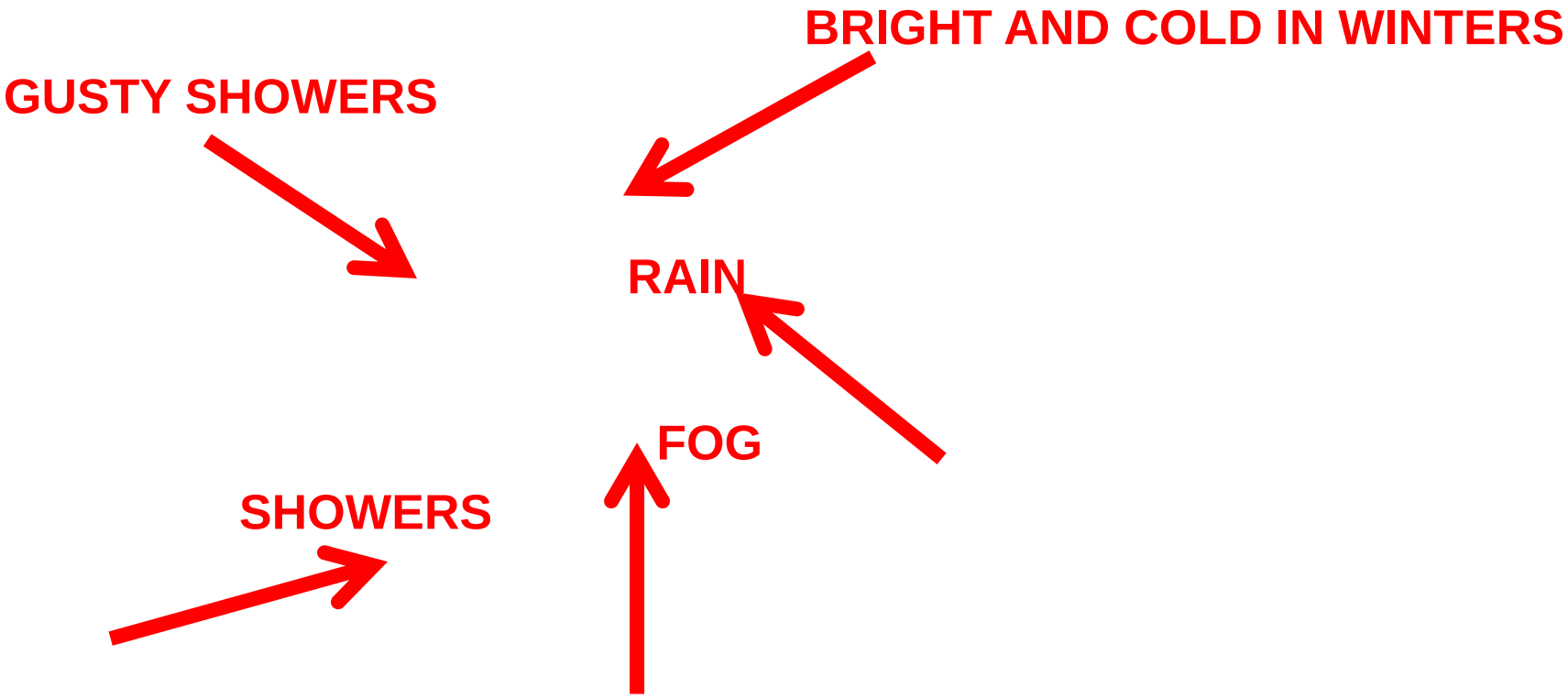
Absract from the King's Mirror



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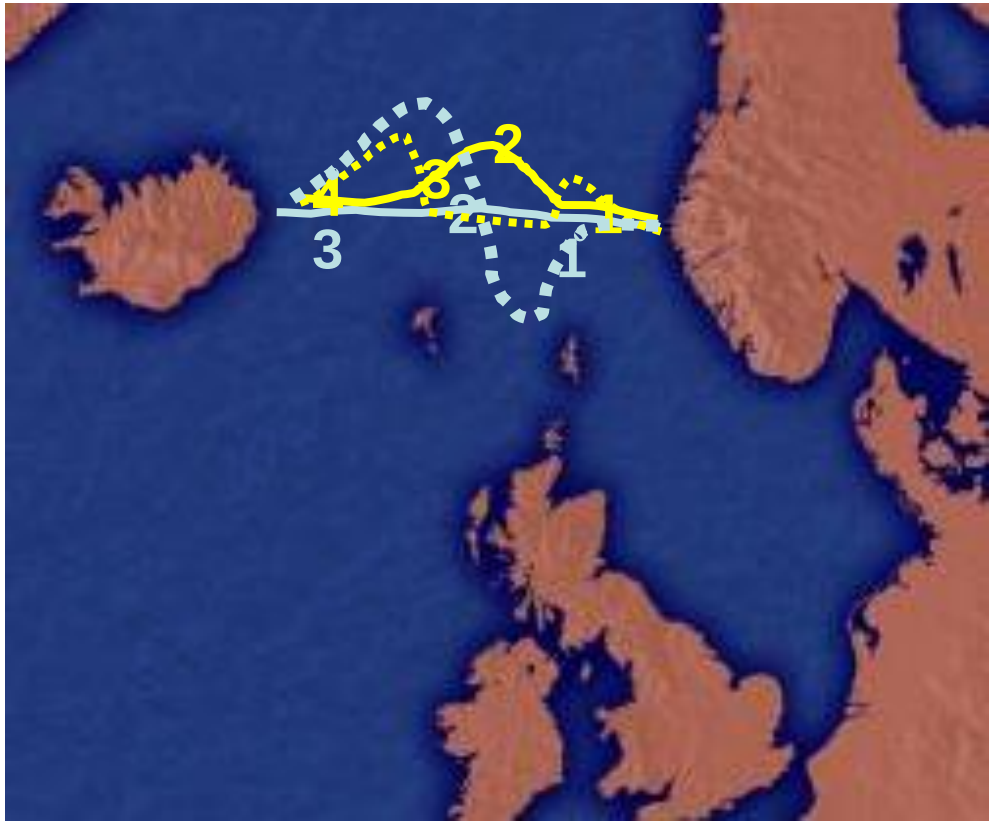

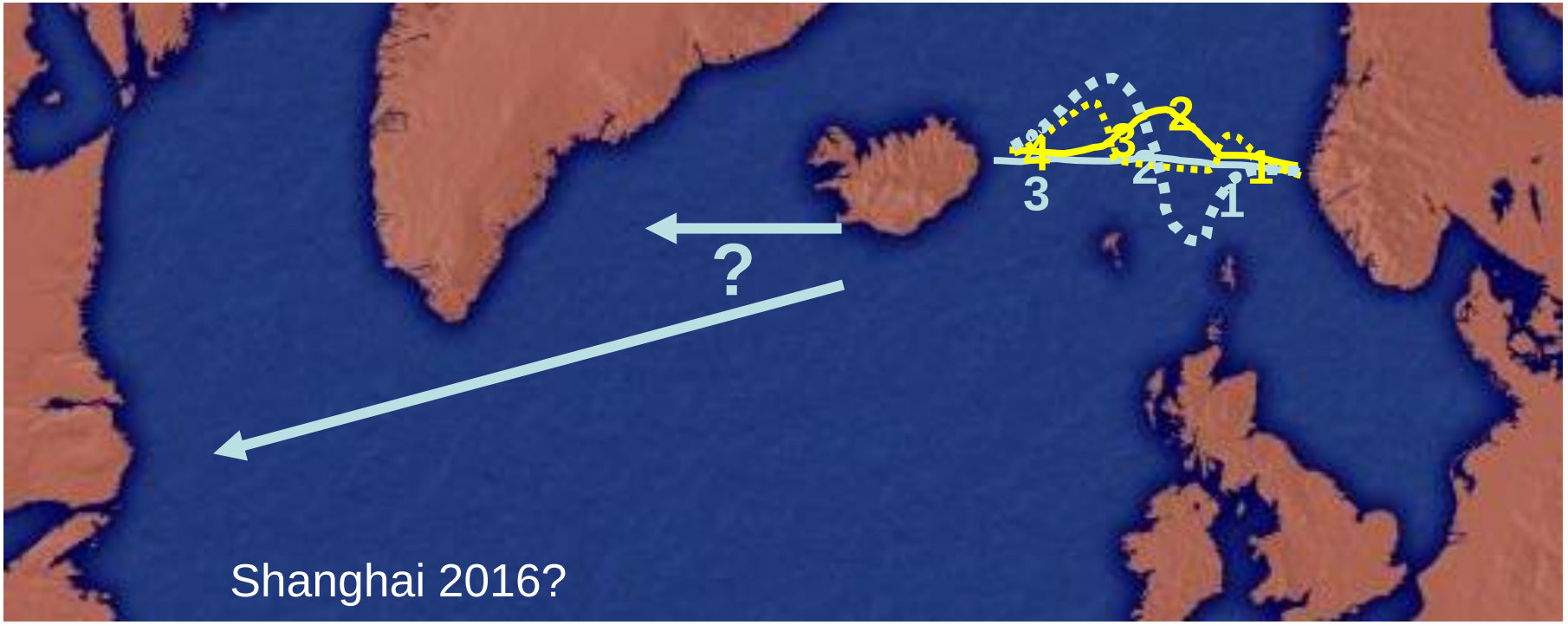
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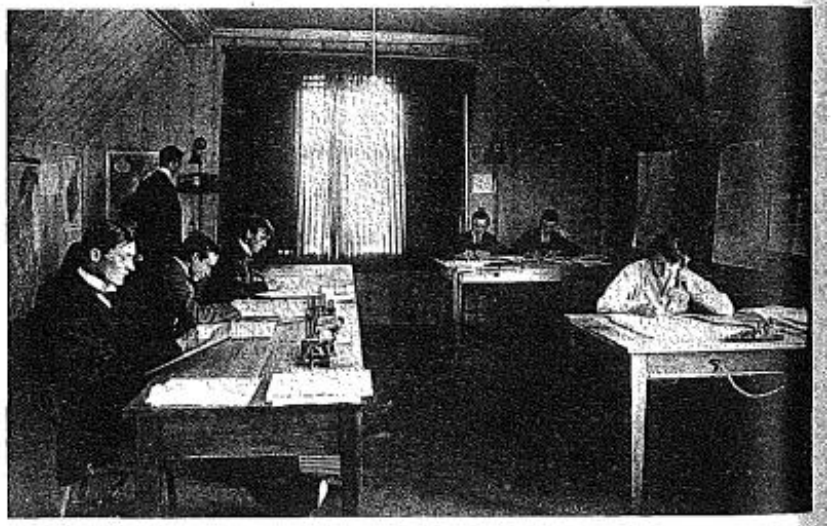
3
2
1
Shanghai 2016?



The Bergen School of Meteorology[1]

The Cradle of modern weather-forecasting

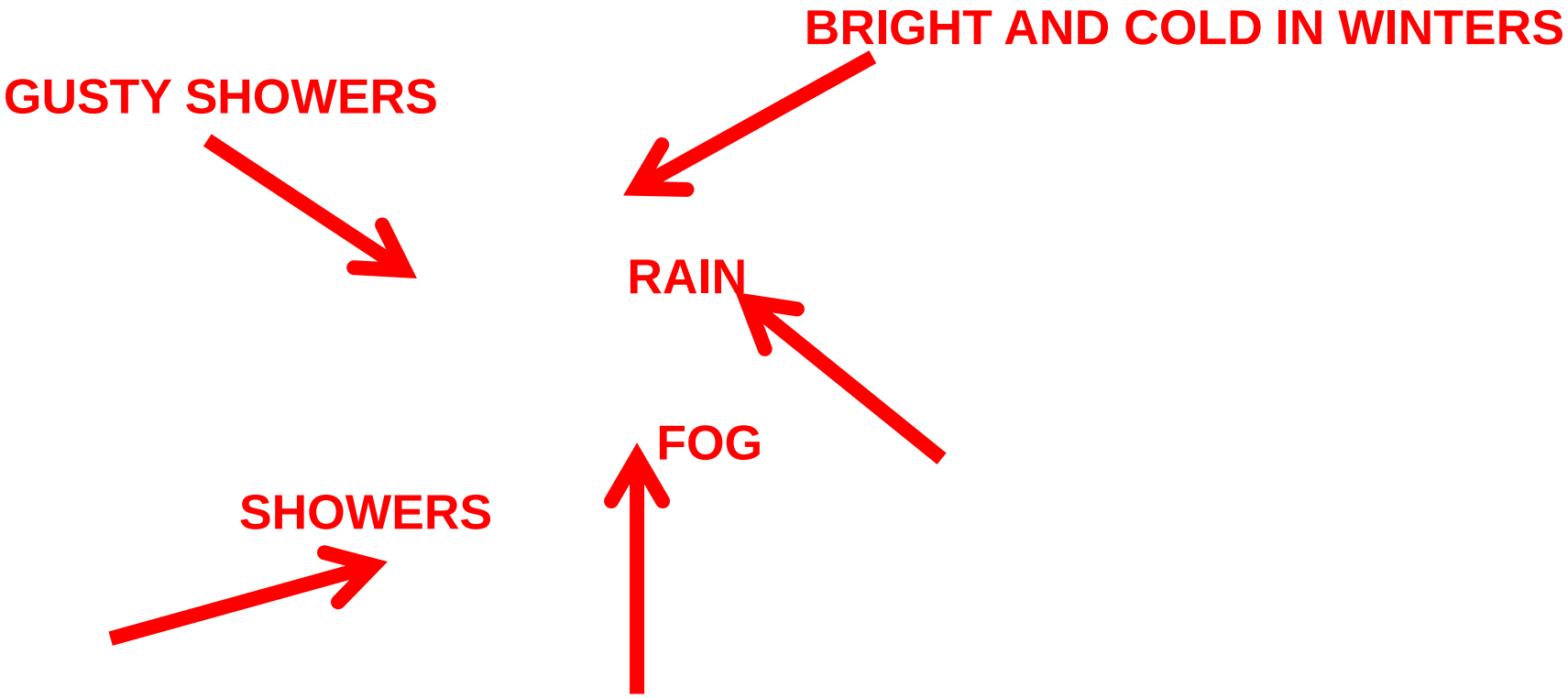
Vilhelm Bjerknes and his jolly team in 1917-1926

- Jacob Bjerknes
- Halvor Solberg
- Tor Bergeron
- Carl-Gustaf Rossby
- Sverre Petterssen
- Erik Palmén
- Erik Björkdal
- Svein Rosseland
- Carl Ludvig Godske
- Johan Sandström

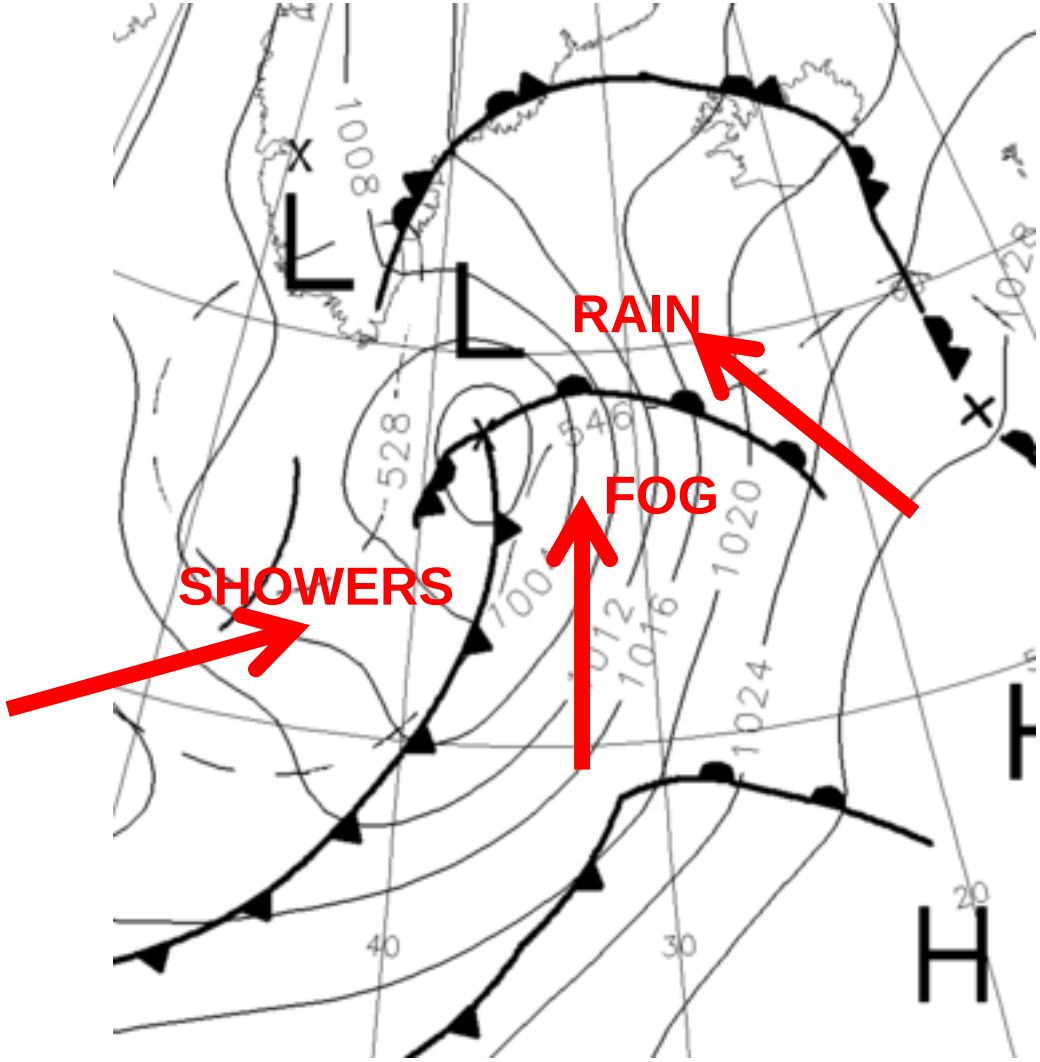
Therefore, to complete the system of equations and obtain 6 equations and 6 variables:

- $\frac{dv}{dt} = -(1/\rho)\nabla p - g(r/r) + (1/\rho)\left[\nabla \cdot (\mu \nabla v) + \nabla(\lambda \nabla \cdot v)\right]$
- $c_v \frac{dT}{dt} + p\frac{d\alpha}{dt} = q + f$
- $\frac{d\rho}{dt} + \rho \nabla \cdot v = 0$
- $p = \rho RT.$

Absract from the King's Mirror



This is the Norwegian cyclone and airmass model



There is a lot of RE in REsearch

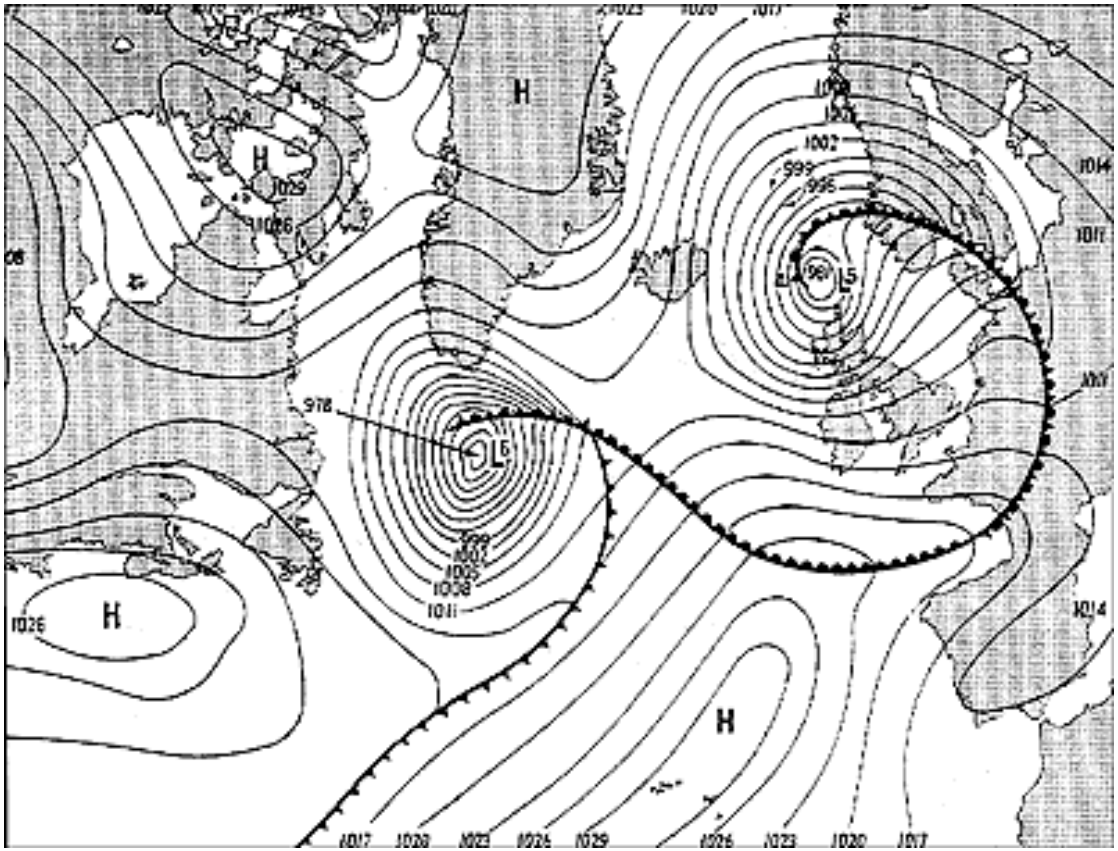
The Bergen School of Meteorology[1]

The Cradle of modern weather-forecasting

Vilhelm Bjerknes and his jolly team had a breakthrough

- **Recruitment of outstanding staff/students**
- **Solid theoretical background**
- **Strong national and INTERNATIONAL connections**
- **Simple and catchy CONCEPTS**

Why did the ideas the Bergen School live (air masses and fronts) – and not other works that may have been remarkably similar?



Was it because the CONCEPTS were sexy and catcy?

A few „new“ concepts introduced at the Bergen and Reykjavik schools

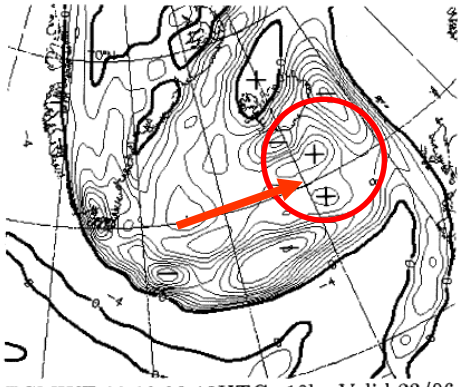
- Secondary gravity wave breaking
- Warm Bora
- Type E and S downslope windstorms
- Gustiness of rain
- The M-curve of orograhpic precipitation
- Quasi-geostrophic orographic flow
- The peninsula-effect on the sea breeze
- The Greenland heat pump
- The glacier rainband
- The orographic sea breeze pump
- **Forecasting error tracking**

Using fundamental dynamics and Quasi-geostrophic theory to track errors

Feel free to take it and find a good name

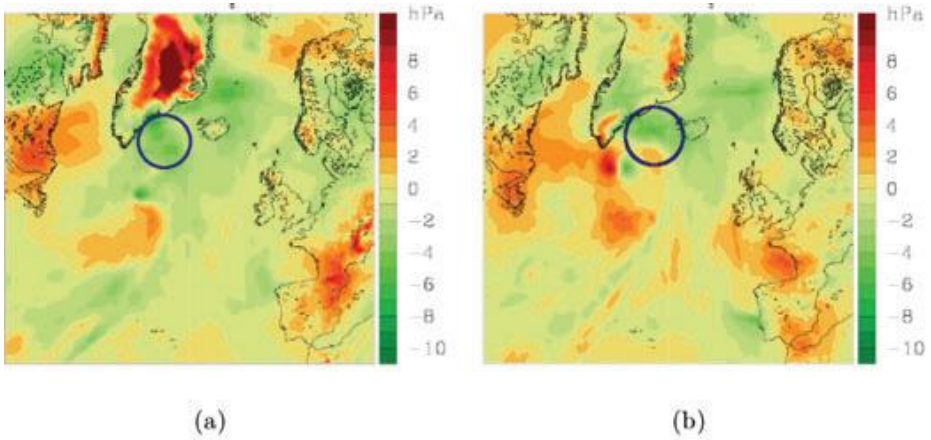
(The Shanghai tracker?)

ECMWF analysis for 22.02.96 12UTC

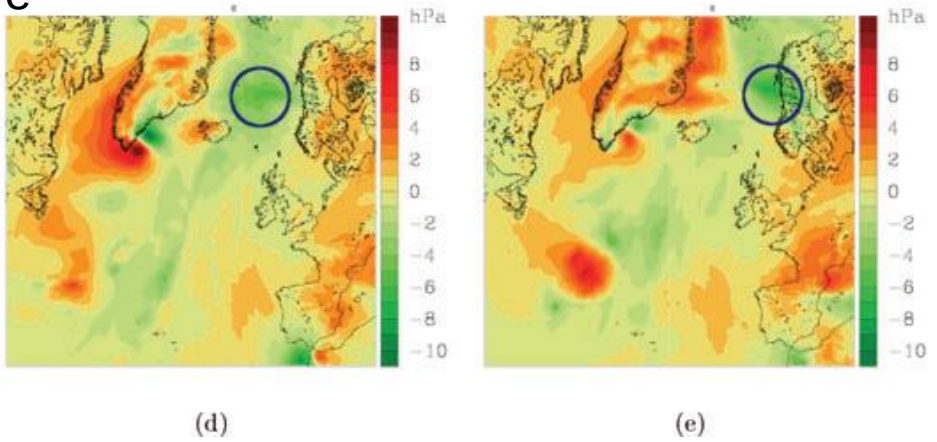


ECMWF 22.02.96 12UTC+18h. Valid 23/06

Vorticity tracking



Temperature anomaly tracking

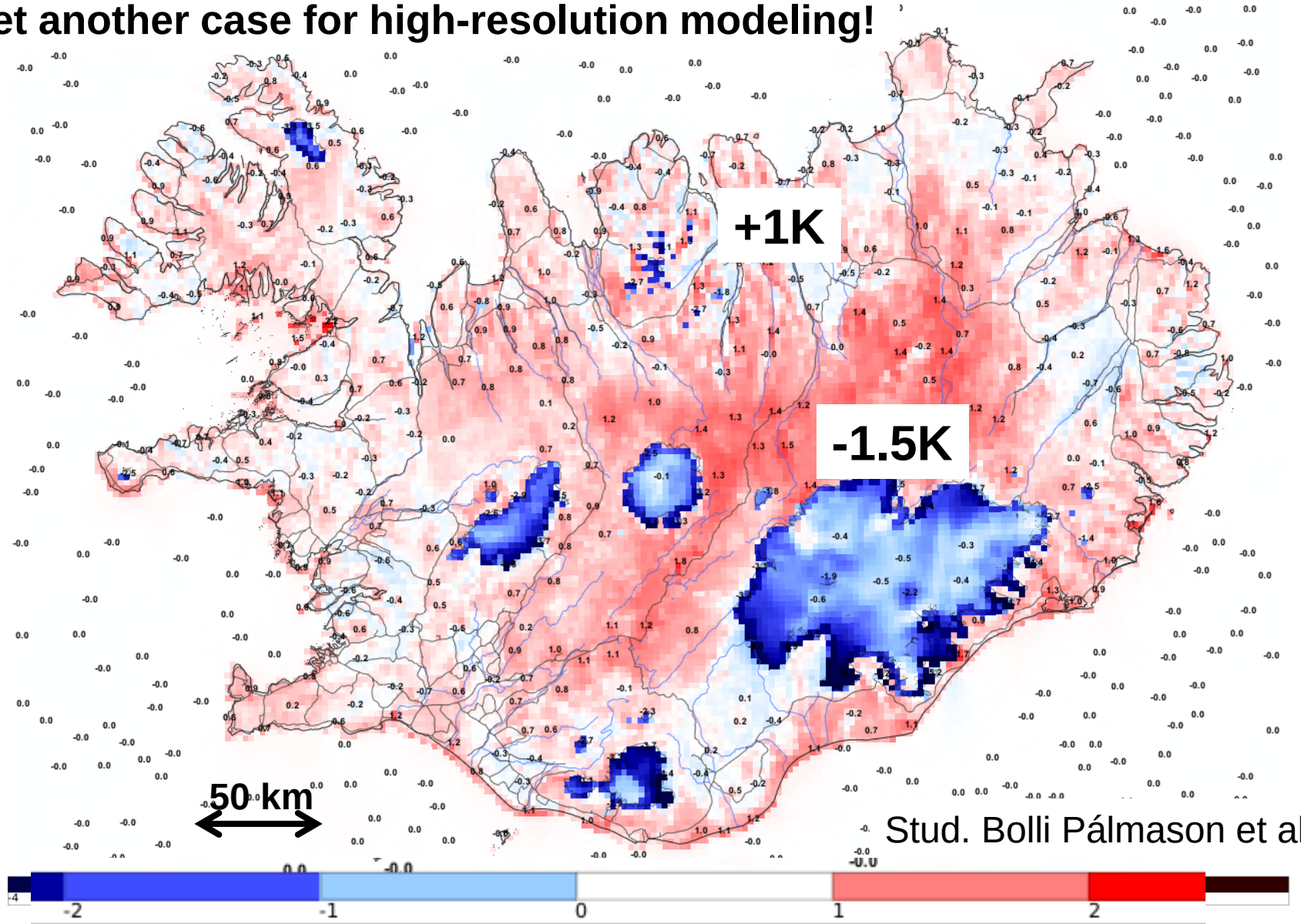


Ólafsson, Met. Apps. 1998

Steenesen, Ólafsson and Jonassen, Tellus 2011

Difference in summer T2 when changing the surface qualities in line to what may be extepcted in the future

Yet another case for high-resolution modeling!



Stud. Bolli Pálmason et al.