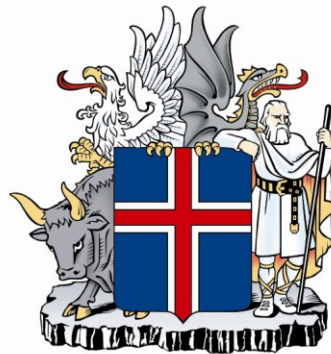


Radioecology and Radiation Emergency Preparedness in Iceland for 25 years A tribute to NKS

S.E. Pálsson, K. Guðnason and Ó.H. Halldórsson
XVI Conference of the NSFS
22 – 25 August 2011, Reykjavík, Iceland



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Iceland 65° N

66,5° N

24,5° W

-2 / 11 °C

Unvegetated: 63 %

Basaltic rock,
low in U
concentration

13,5° W

Lakes: 3 %

-0 / 11 °C

Vegetated: 23 %

Glaciers: 12 %

Population (1 Dec 2010):
318452

63,5° N

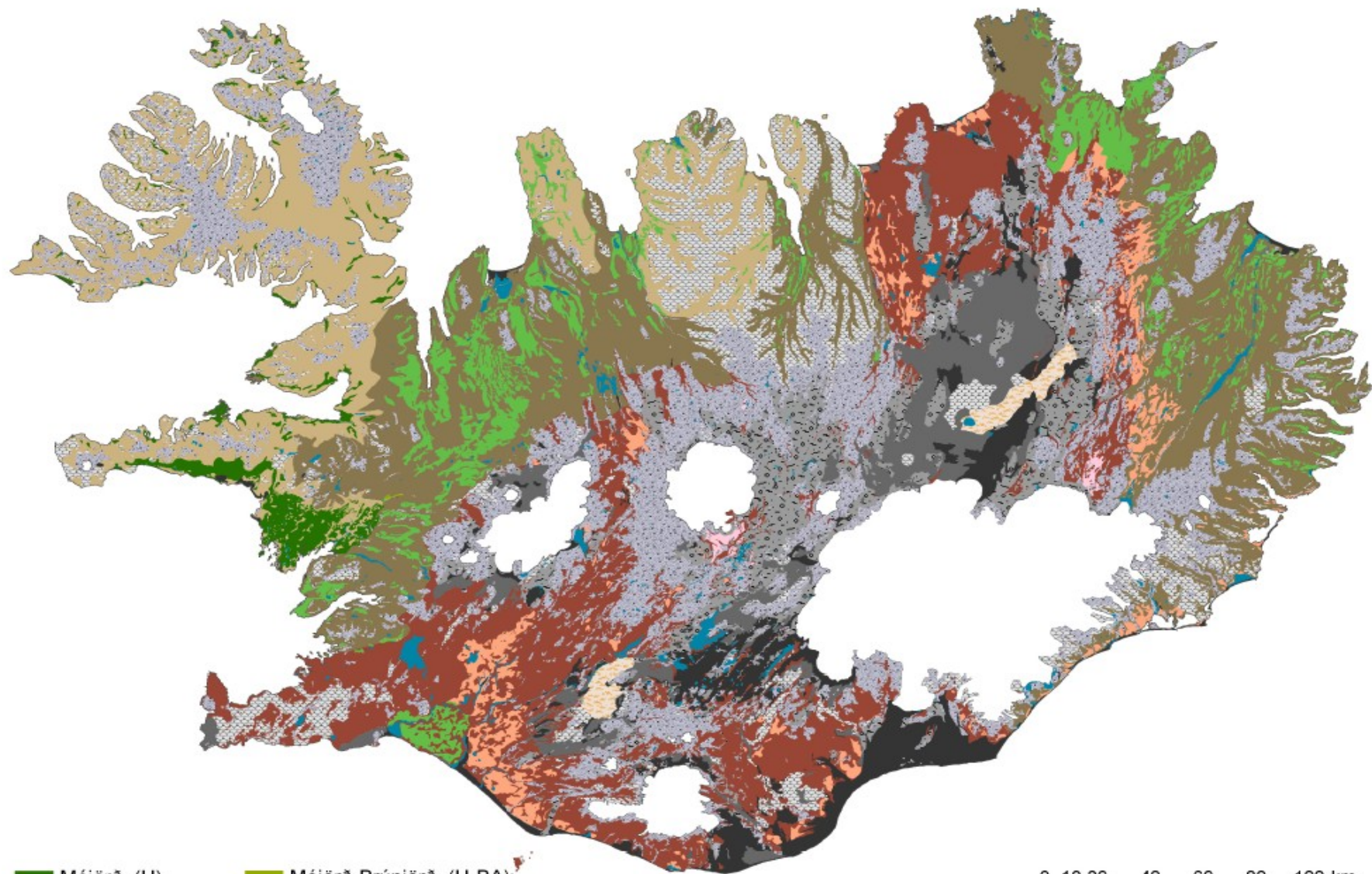
Area: 103 000 km²

The soils: Andosols

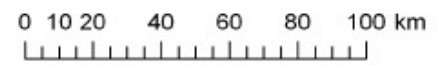


- Icelandic soils are unique in Europe:
 - Volcanic
 - Lack of illitic minerals
 - Can thus have Cs available for plant uptake for a long time after fallout



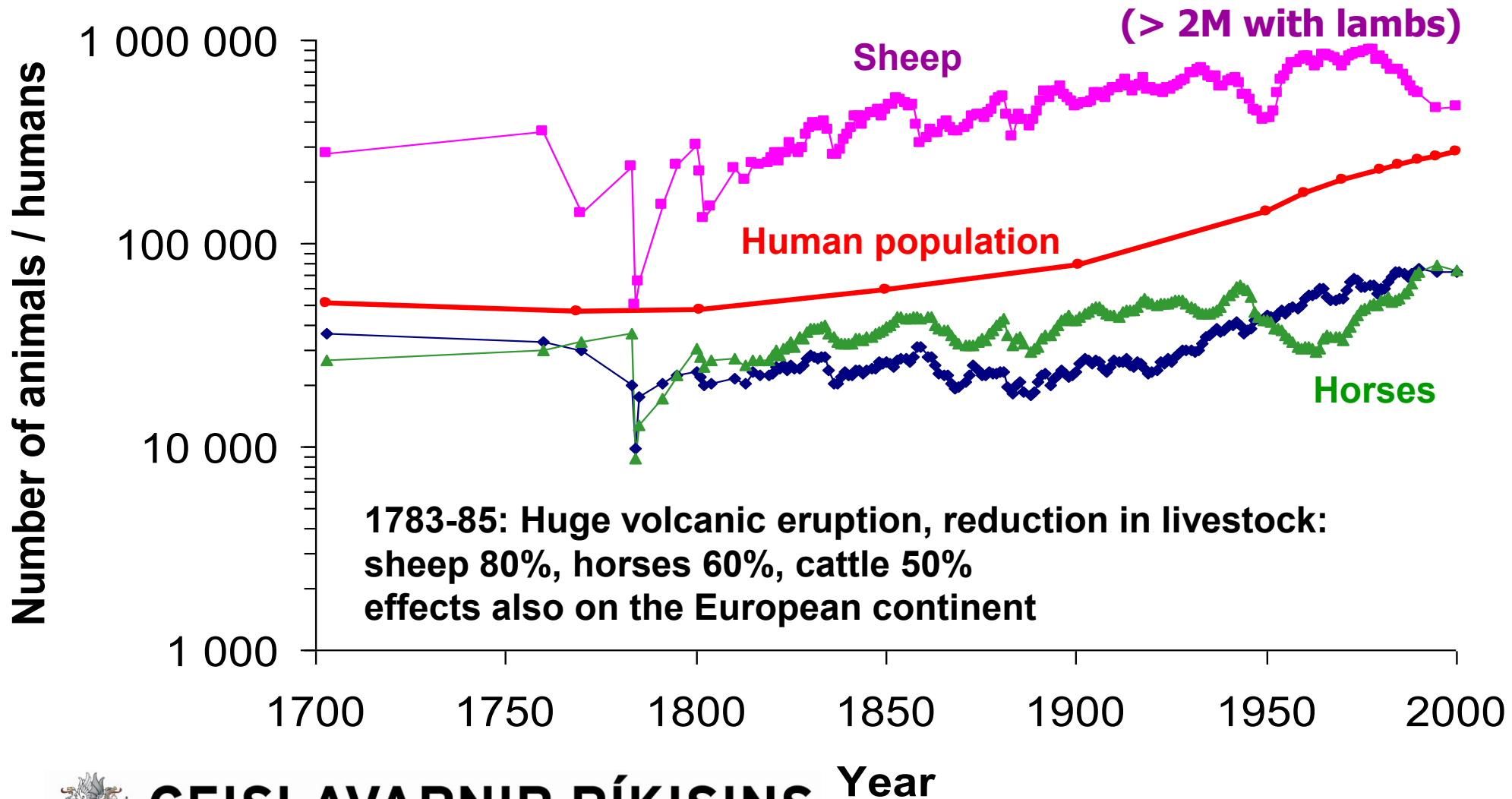


- | | | |
|--|---|--|
|  Mójörð (H) |  Mójörð-Brúnjörð (H-BA) |  Sandjörð-Bergjörð (SV-L) |
|  Svartjörð (HA) |  Votjörð-Brúnjörð (GA - BA) |  Frerajörð-Votjörð (C-GA) |
|  Brúnjörð (BA) |  Brúnjörð-Svartjörð-Mójörð (BA-HA-H) |  Vatn |
|  Sandjörð (SV) |  Brúnjörð-Svartjörð-Votjörð (BA-HA-GA) |  Jökull |
|  Bergjörð (L) |  Melajörð-Malarjörð (MV - GV) | |
|  Vikurjörð (PV) |  Melajörð-Sandjörð (MV-SV) | |



© Landbúnaðarháskóli Íslands 2009
 Ólafur Arnalds, Hlynur Óskarsson,
 Fanney Ósk Gísladóttir og Einar Grétarsson

Number of livestock / people 1703 - 2000



1783-85: Huge volcanic eruption, reduction in livestock:
sheep 80%, horses 60%, cattle 50%
effects also on the European continent



Importance of Nordic co-operation for the Icelandic society

- Co-operation and co-development with the other Nordic countries, even though the conditions were often different.
- **Example:** The early use of **Nuclear Power** in the Nordic countries was followed closely
- An offer was received from General Electric at the beginning of **1958** for the construction of a small NPP (26,2 MW thermal) for generation of electricity and heating
- Plant was to be in Heimaey, the largest of Vestmann Islands



Potential problems with a NPP in a geologically active area (Iceland)

The construction of an NPP was not considered economically feasible, which was just as well.

Heimaey made world news in 1973, with a volcanic eruption at the edge of town and the whole Island had to be evacuated in a few hours.



EMERGENCY PREPAREDNESS & MEASUREMENT TECHNOLOGY



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Using the Internet: Moving Iceland into the centre of information exchange

Nordic System for Data and Information Exchange

Report from meetings with the authorities, and proposal for further work

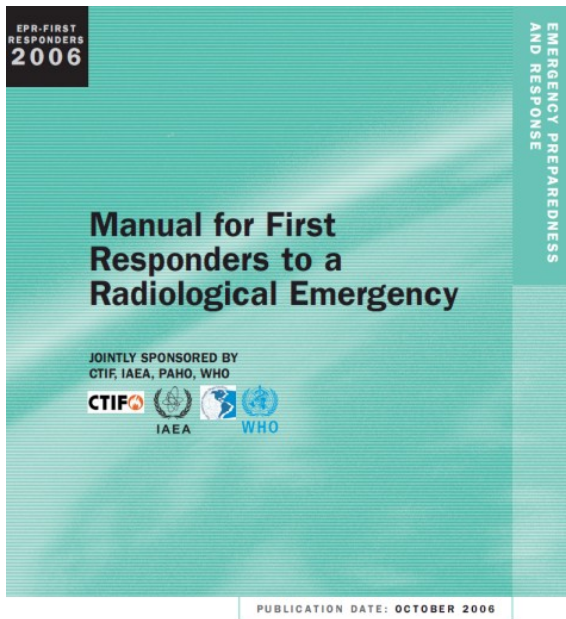
Tord Walderhaug, Geislavarnir ríkisins

NKS/EKO-4.2(96)1

November 25 1996



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NKS activities

Report on Internet and mobile phone technology (before “smartphones”)

CommTech – seminar
On developments in communication technology



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Gamma Spectrometry

- Intercomparisons using environmental samples
- **GammaSem** and **GammaWorkshops**
- Measurements for emergency preparedness, **EMARAD**
- Mobile measurements: **MGS** (ModMeth Gamma Spectrometry), **UGS** (Urban Gamma Spectrometry), **ASS** (Area Specific Stripping corrections)
- Use of computer generated spectra for training dealing with emergency situation (latest: **RemSpec**, **MaIRad** and **OrpEx**).
Not only first class exercise material but also valuable for training



Emergency management

- Airborne dispersion (latest example: **NetMet**)
- Assessment of potential releases from nuclear powered vessels (lates examples: **NucVess** and **MareNuc**)
- Sharing experiences and lessons learned during exercises (**NordEx12**, **REFOX**)



Hostile takeover of a ship with radioactive cargo out at (rough) sea



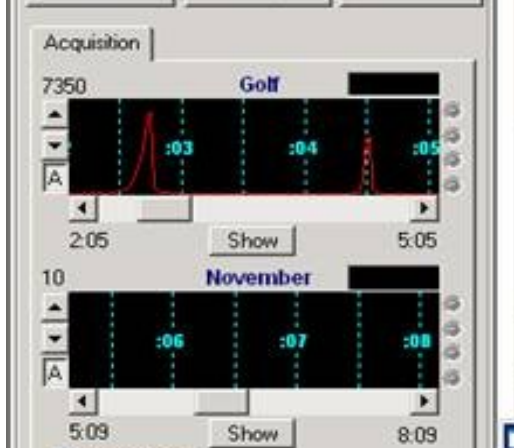
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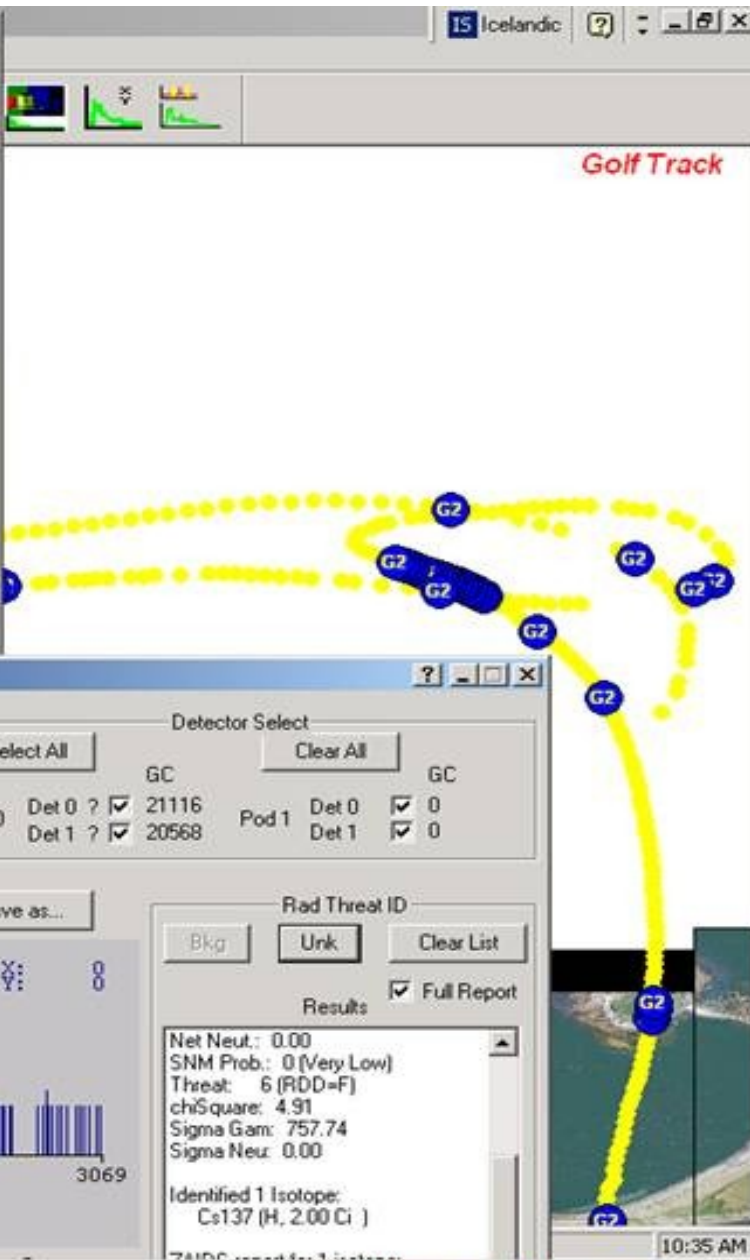
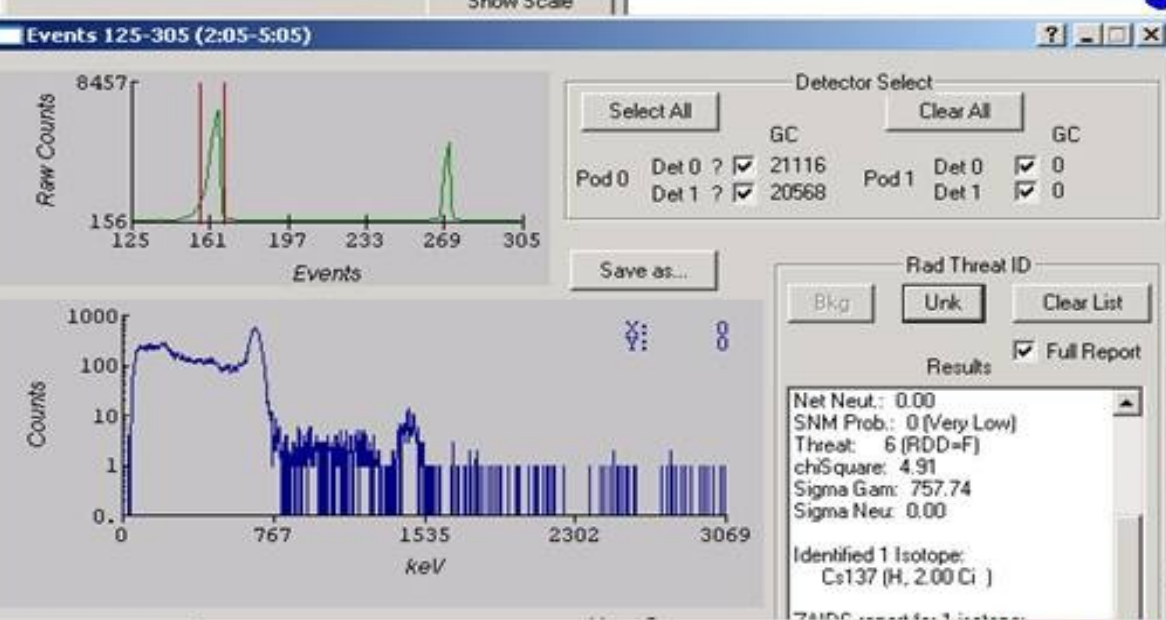
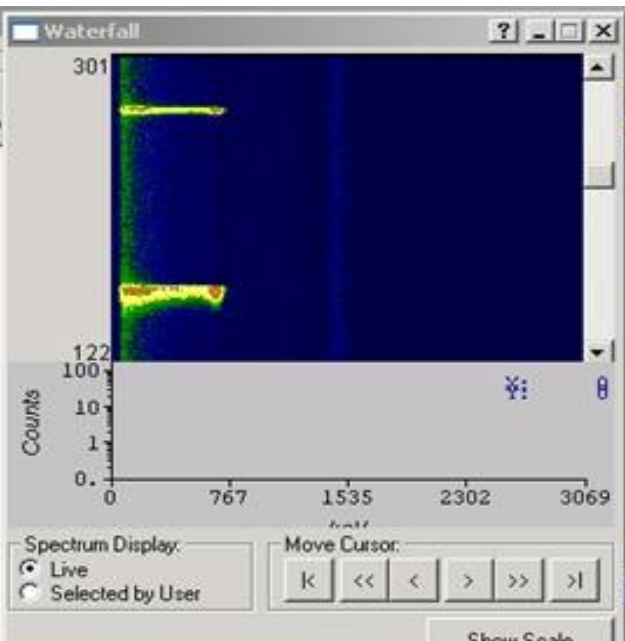


Event: 471 Not Connected
 Start Stop Reset

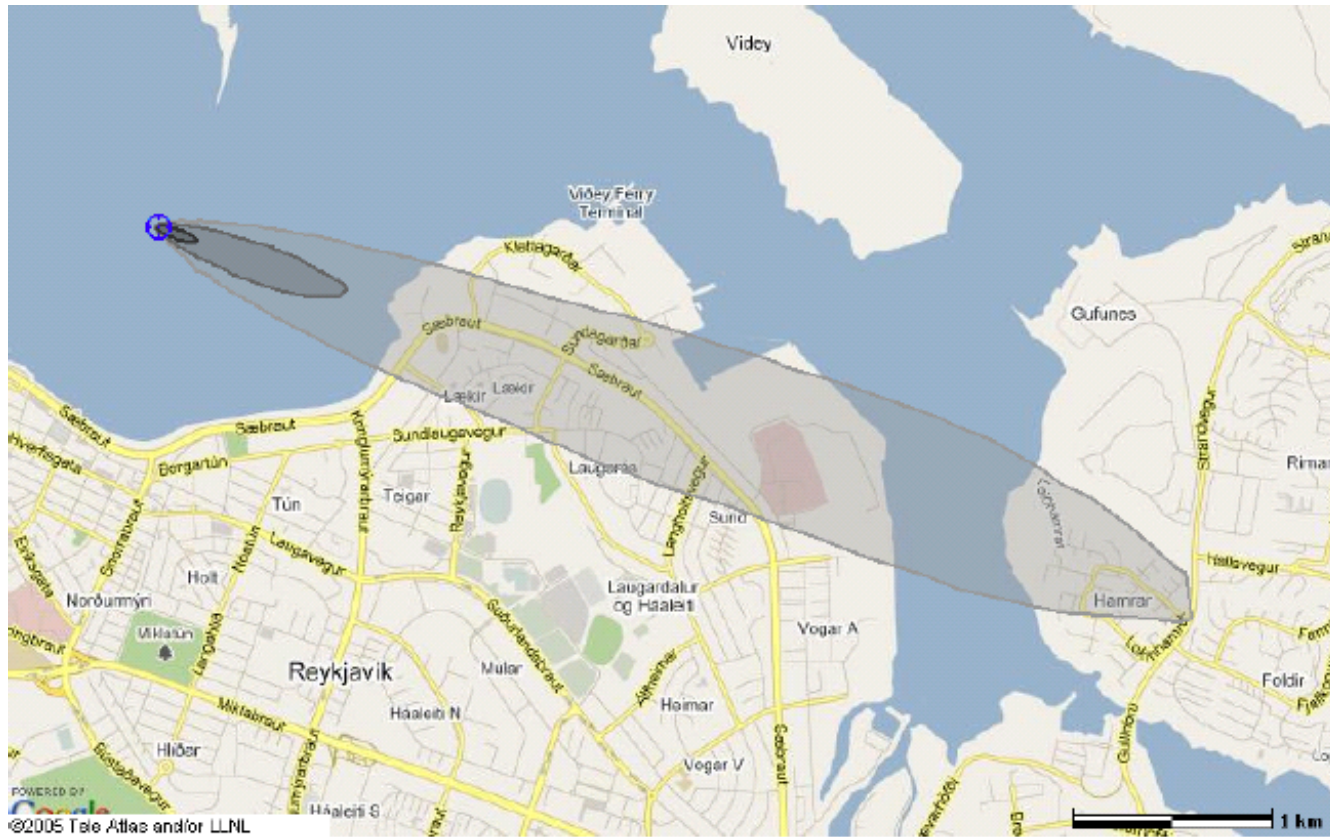


Alarm History

Event	AL...	ID	GPS Time
154	G...		15:05:55
155	G...	CS 5	15:05:56
156	G...	CS 5	15:05:57
157	G...	CS 5	15:05:58
158	G...	CS 5	15:05:59
159	G...	CS 5	15:06:00
160	G...	CS 5	15:06:01
161	G...	CS 5	15:06:02
162	G...	CS 5	15:06:04
163	G...	CS 5	15:06:04
164	G...	CS 5	15:06:05
165	G...	CS 5	15:06:06
166	G...	CS 5	15:06:07
213	G...	AM 2	15:06:54
214	G...	AM 2	15:06:56
233	G...	AM 2	15:07:14
265	G...	AM 1	15:07:47



Total deposition



Effects and Actions

	Description	Level (MBq/m ²)	Extent	Area	Population
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>1	0.2km	0.008 km ²	0
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.10	1.0km	0.1 km ²	0
	No guidelines specified. Possibly contaminated area. Use to confirm with monitoring surveys.	>0.01	5.6km	3.4 km ²	7,010

Note: Areas and counts in the table are cumulative. Population Source = LandScan2005.



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RADIOECOLOGY



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Radioecology: What is the difference between **reindeer** and **sheep**?

EKO-2 (sheep project)

EcoDoses

PardNor

RadPast (natural radionuclides)

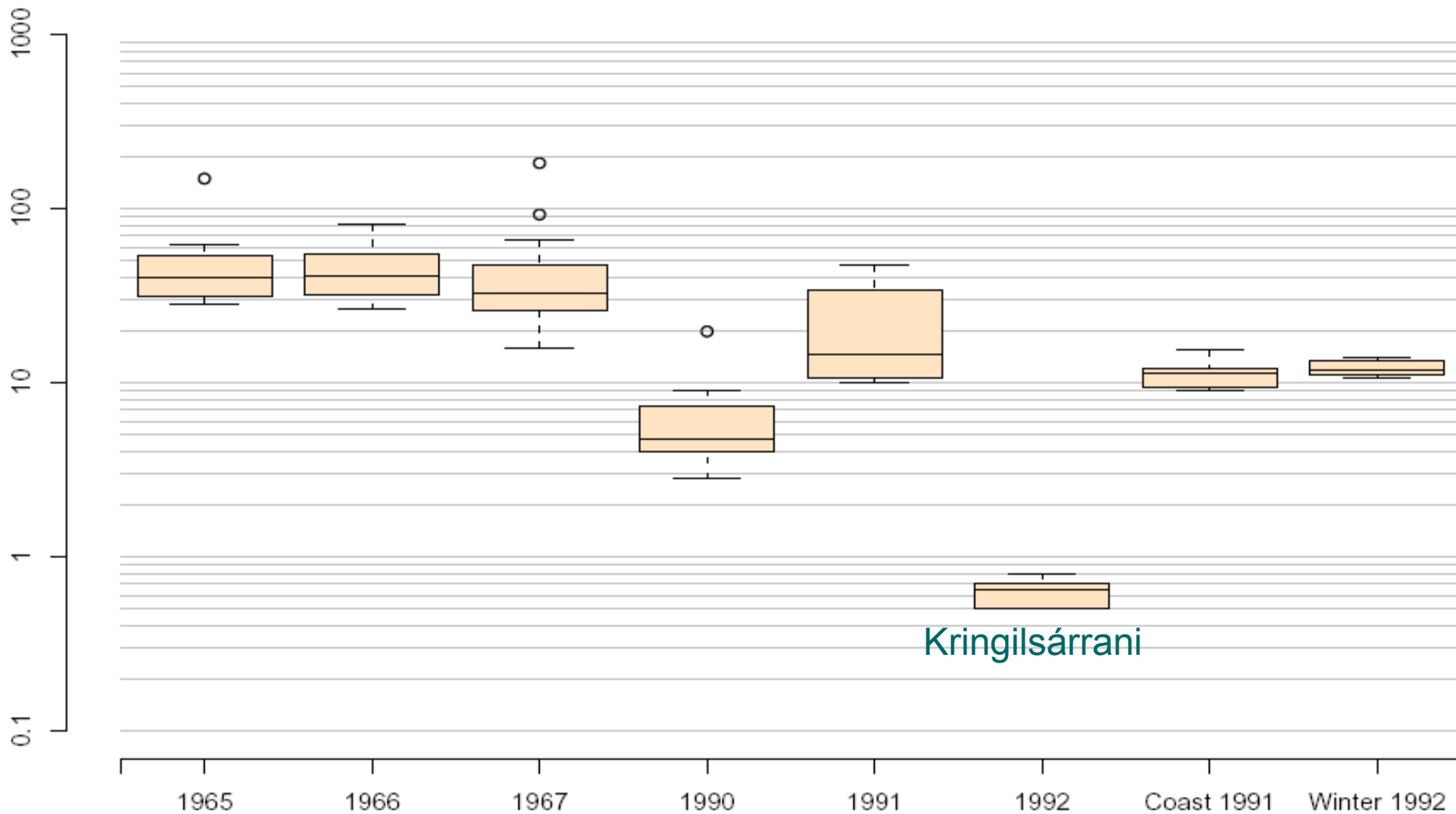
Courses

Seminars

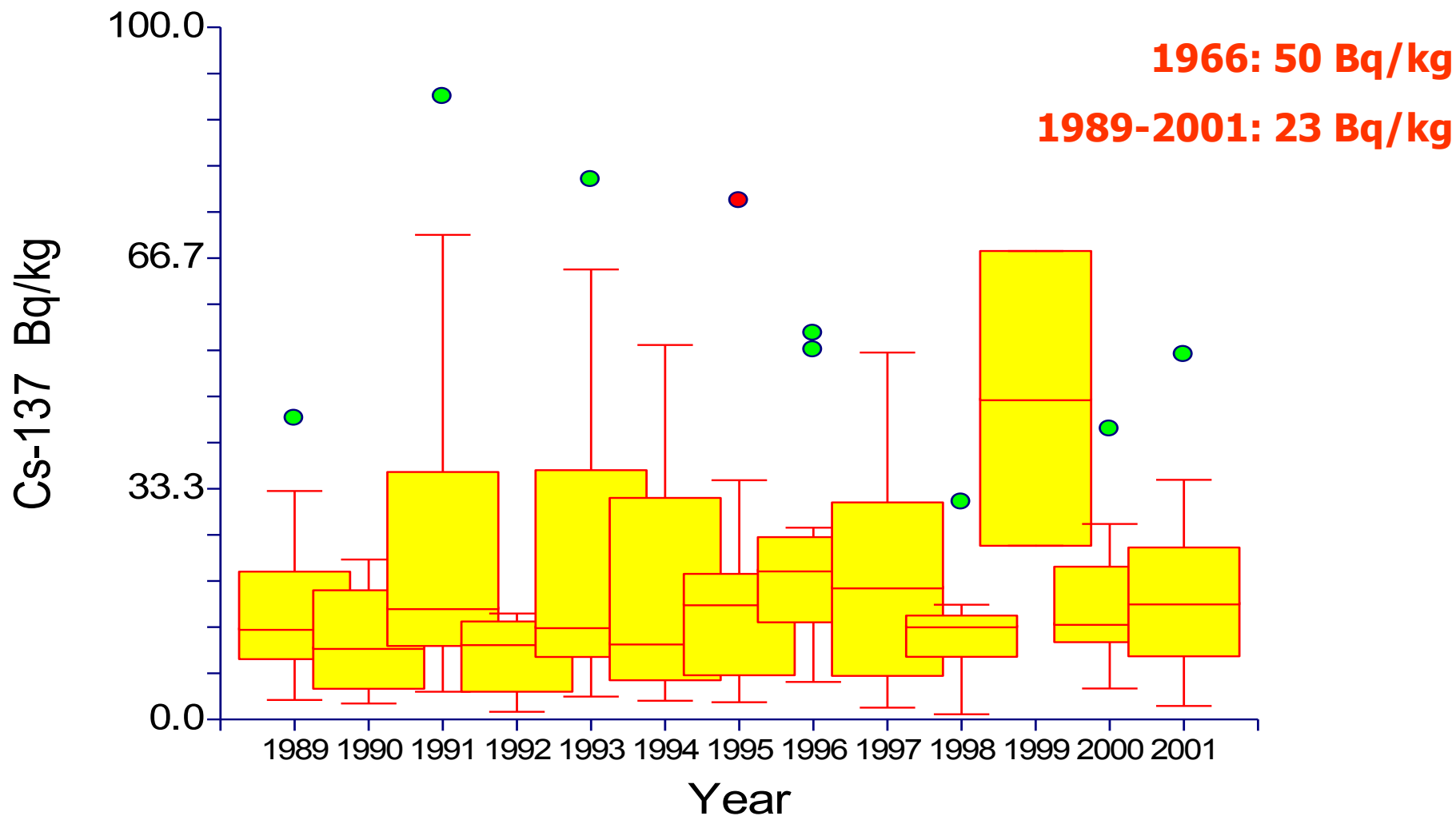


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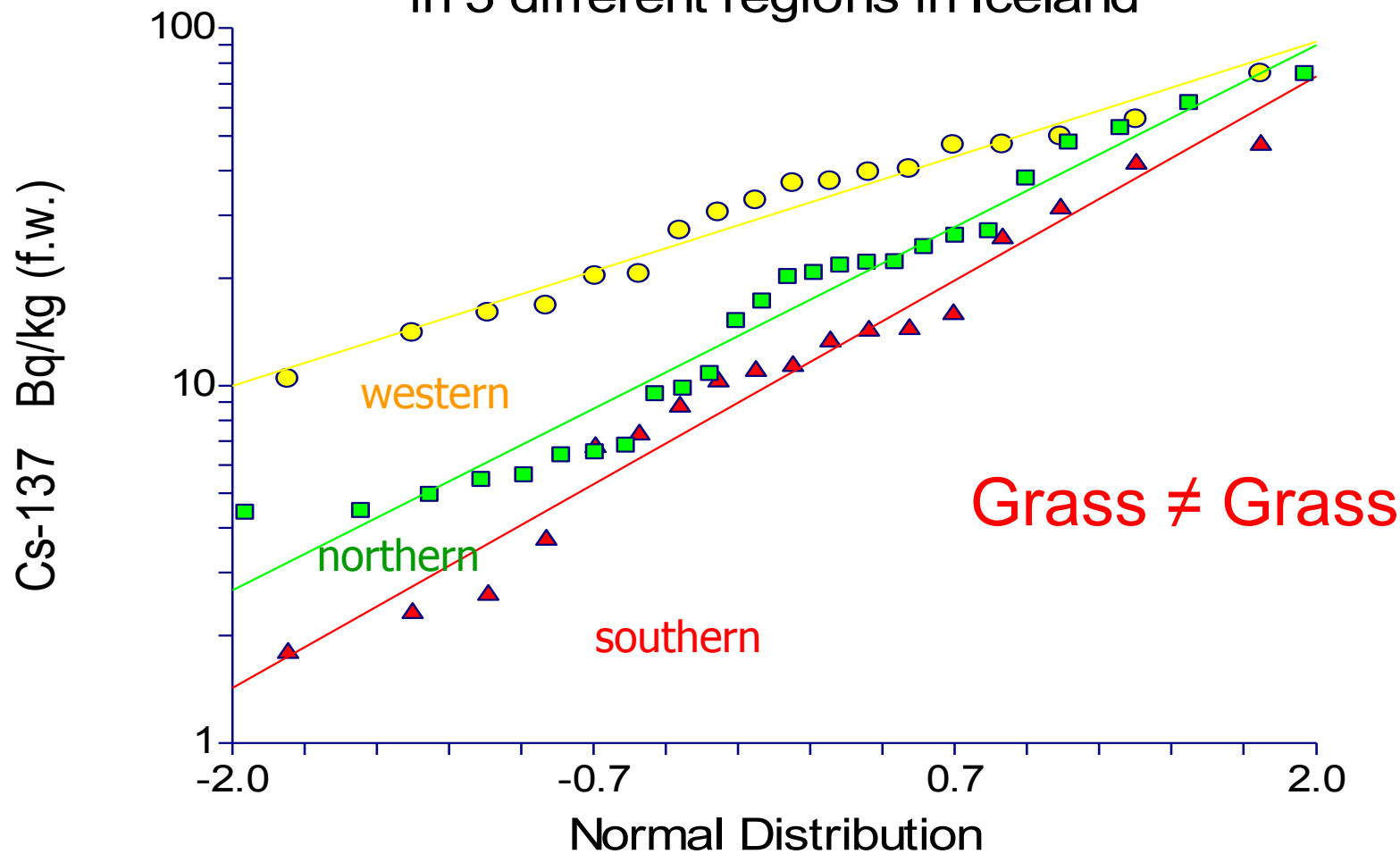
Cs-137 in reindeer meat in Iceland (Bq/kg)



Box Plot of Cs-137 in lamb meat

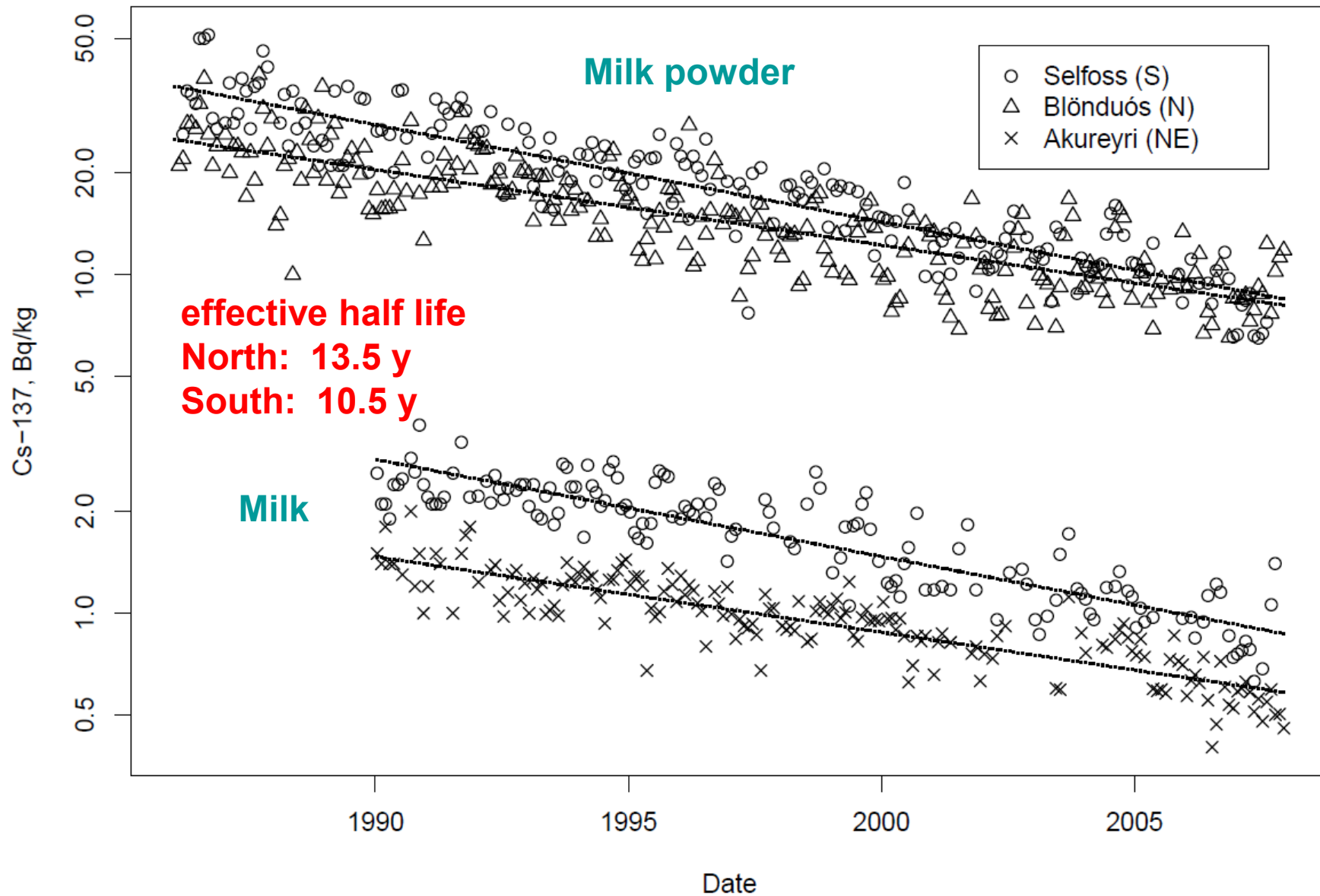


Normal Probability Plot of Cs-137 in lamb meat in 3 different regions in Iceland



Data from 1990 – 2000, decay corrected to 1995





Example from Iceland: Estimating fallout by sampling in a typical “flat” Icelandic landscape



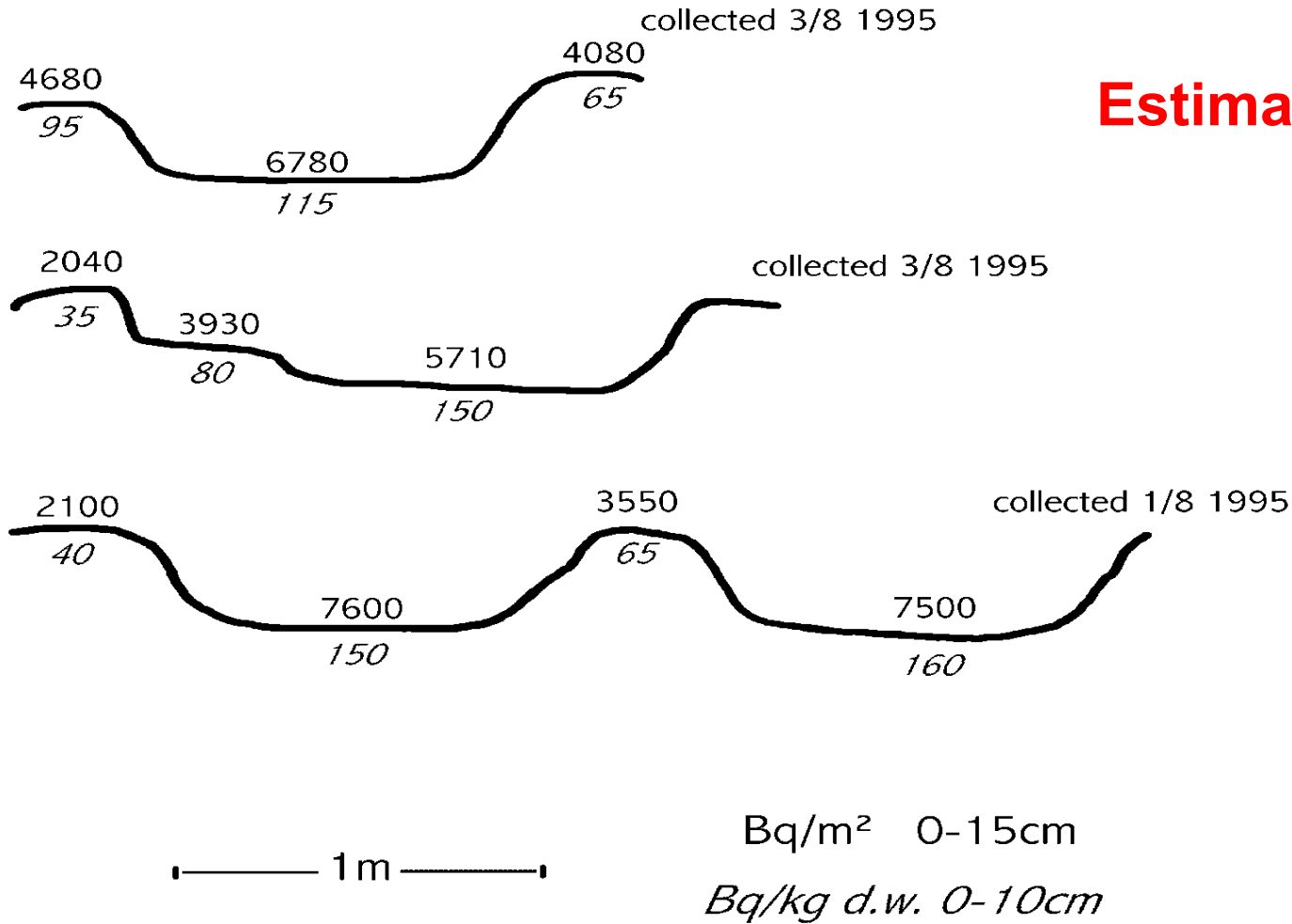
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8.9.2011

Sigurður Emil Pálsson

23

Estimating deposition



SEP/jp 1997

Variations in Cs-137 concentration in soil samples between top of hummocks and adjacent low areas. Above the line is concentration per unit area down to a depth of 15 cm. Below the line is concentration per unit mass (dry weight) down to a depth of 10 cm.



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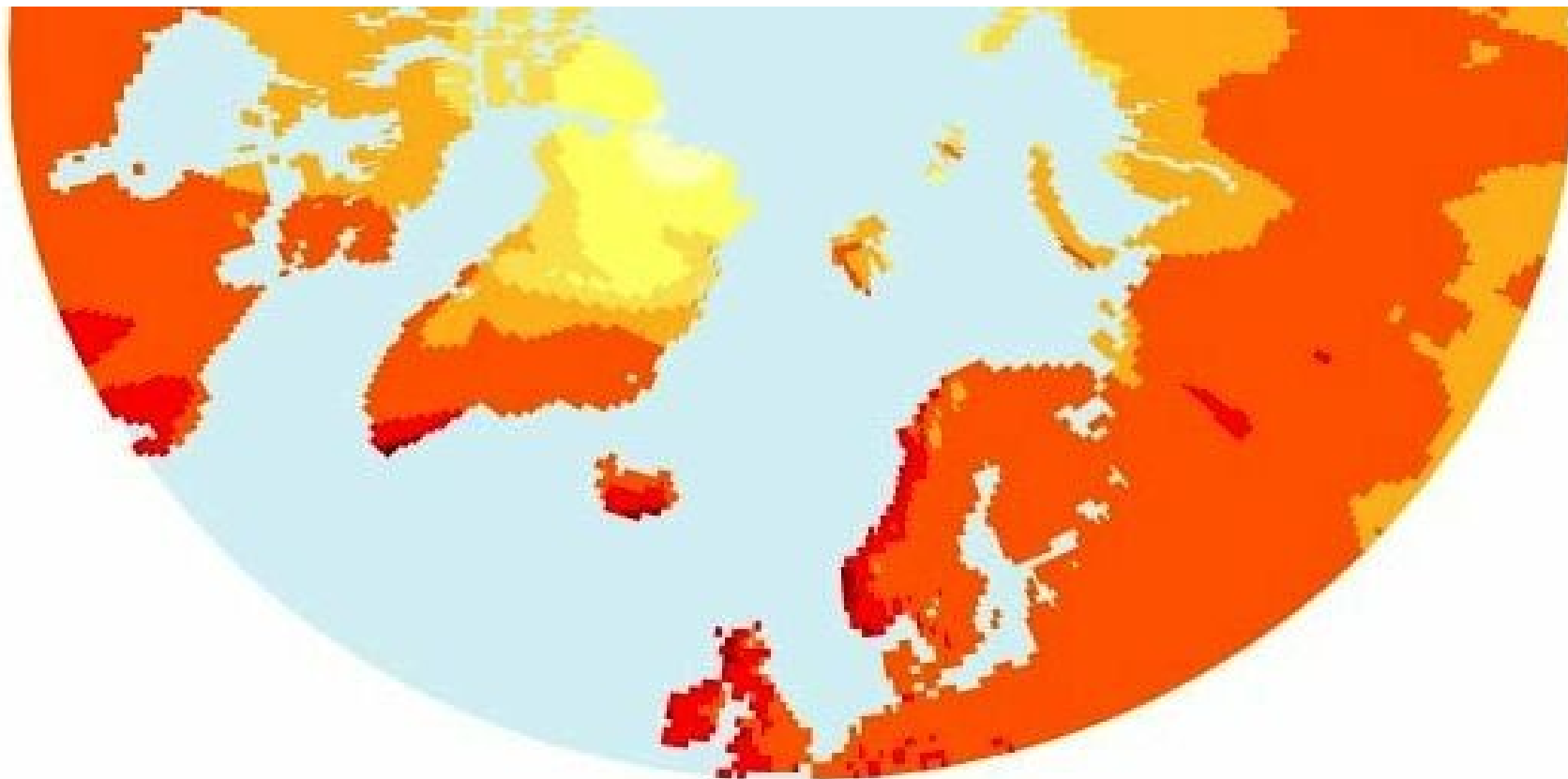


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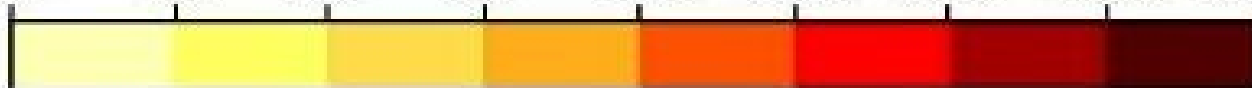


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Cs-137 fallout - AMAP assessment

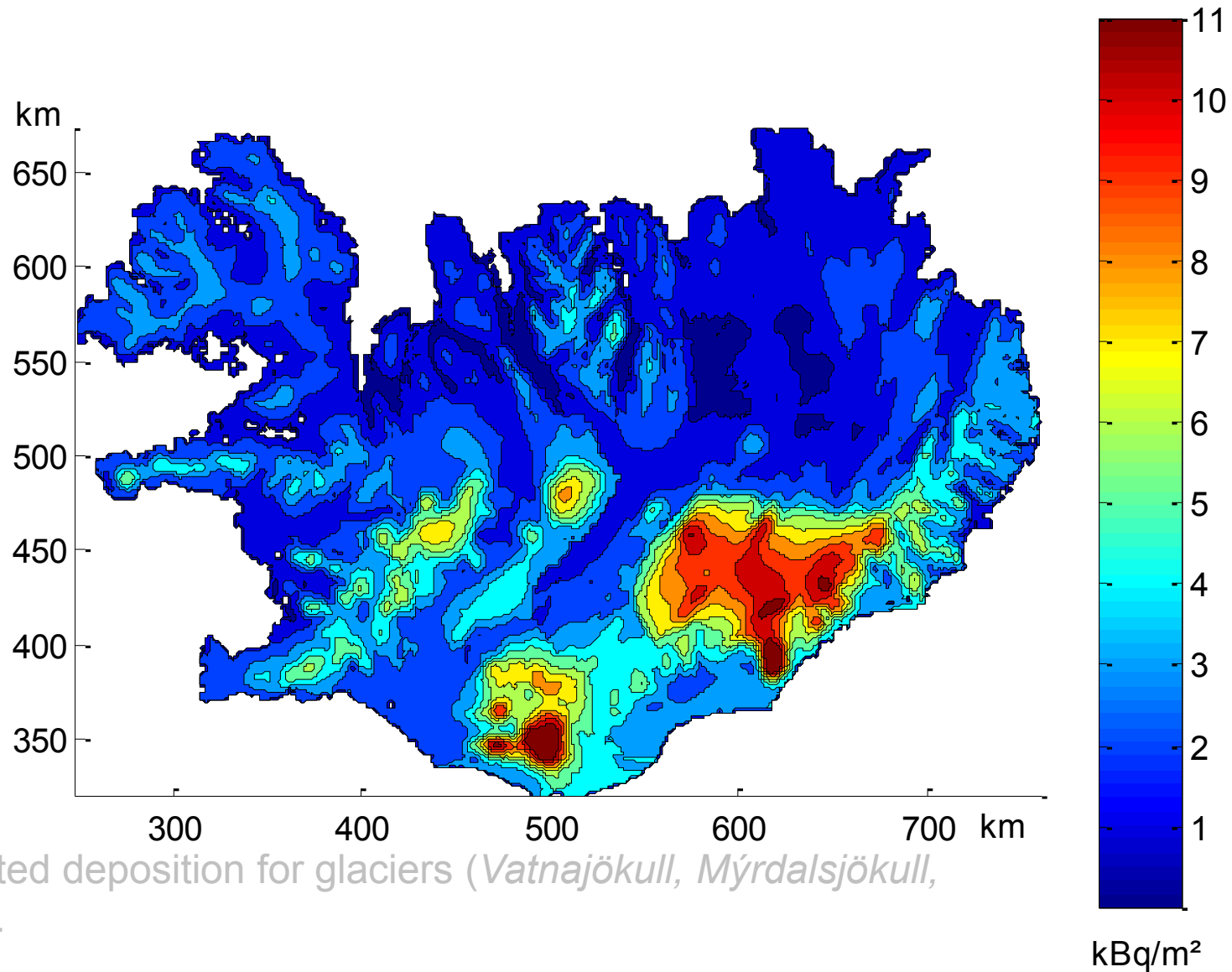


50 100 250 500 1 000 2 500 5 000 10 000 25 000 Bq/m²



Estimated Cs-137 deposition in Iceland (decay corrected to 2002).

(based on precipitation model using 1971-2000 data and 1x1 km grid cells)



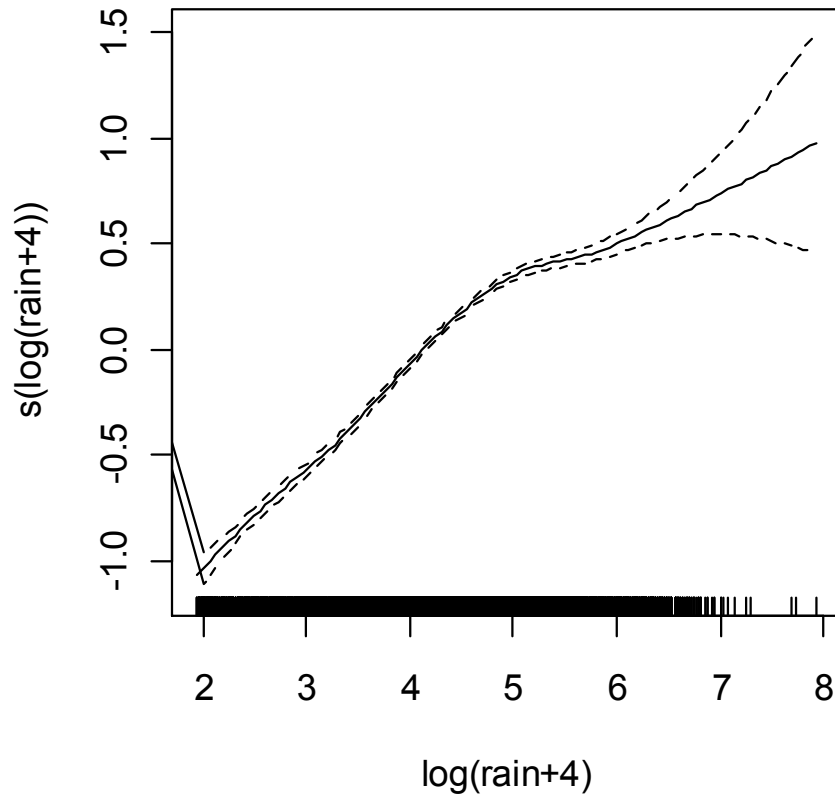
Highest estimated deposition for glaciers (*Vatnajökull*, *Mýrdalsjökull*, *Eyjafjallajökull*).

Agricultural areas have generally low deposition

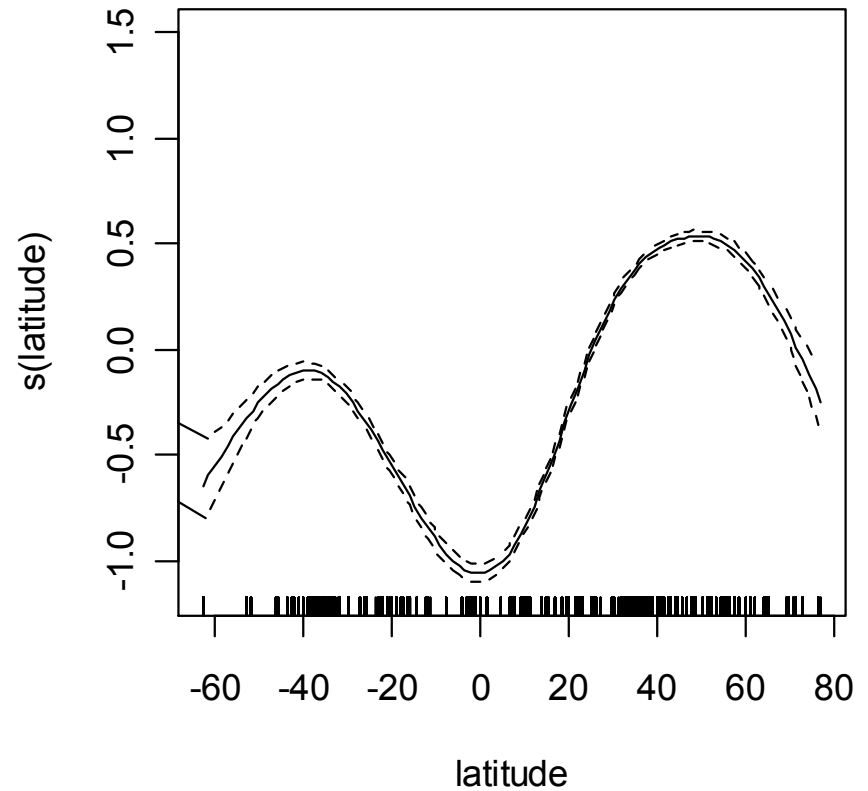
NKS-B DepEstimates

(invited paper after ICRRER conference in Canada)

Precipitation



Latitude



Final words

- The final report is not always the most important product, it is the dialogue and process.
- DepEstimates is one example of an activity where people working individually in different Nordic countries could meet and join forces.
- How many work at Geislavarnir, <10 or >100?
- Thank you, colleagues, and may you enjoy your stay in Iceland!

