Climate adaption for Icelandic roads

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VEGAGERÐIN

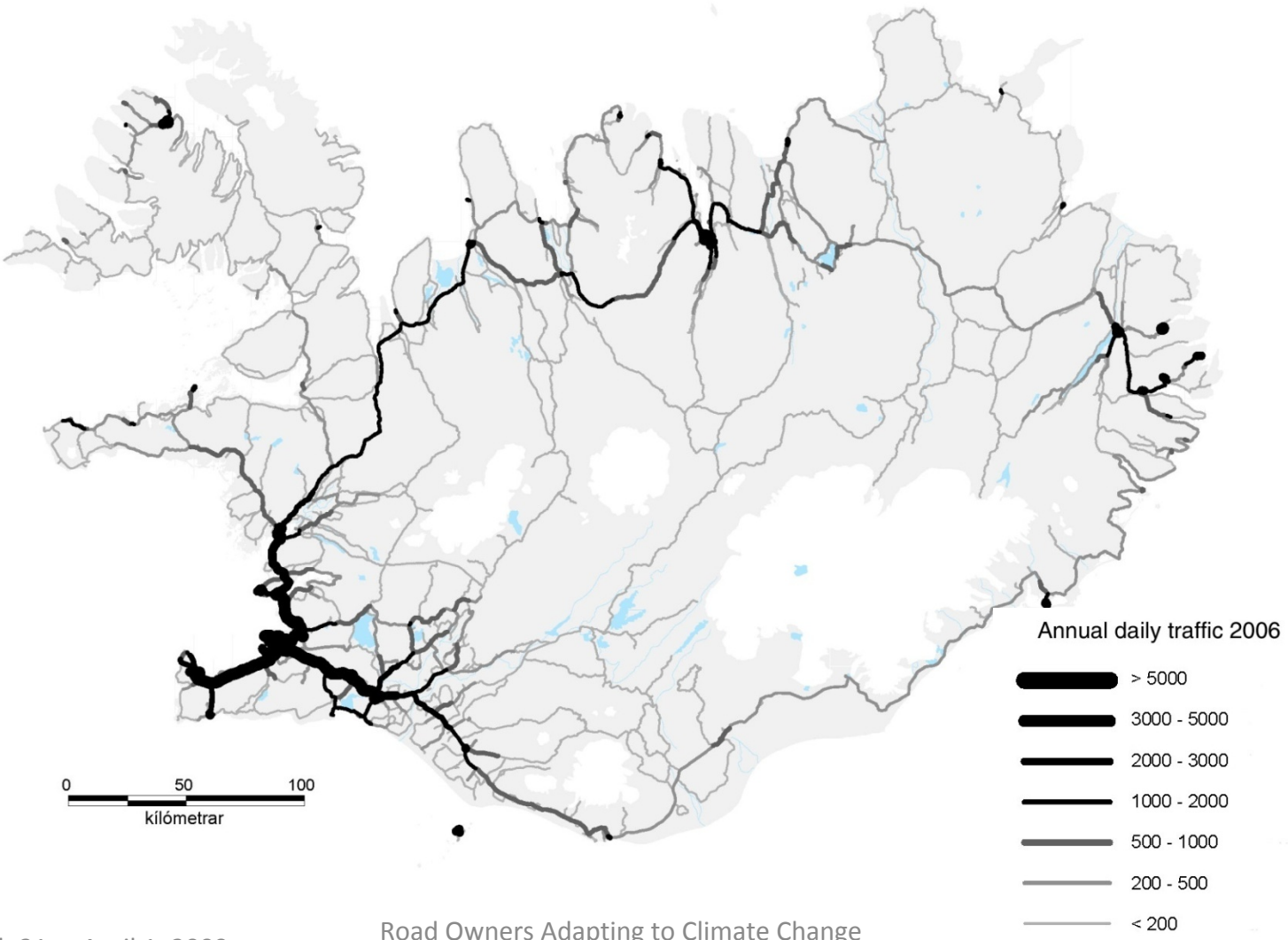
Roadex IV Workshop
Inverness, October 19th 2010

General information on Iceland

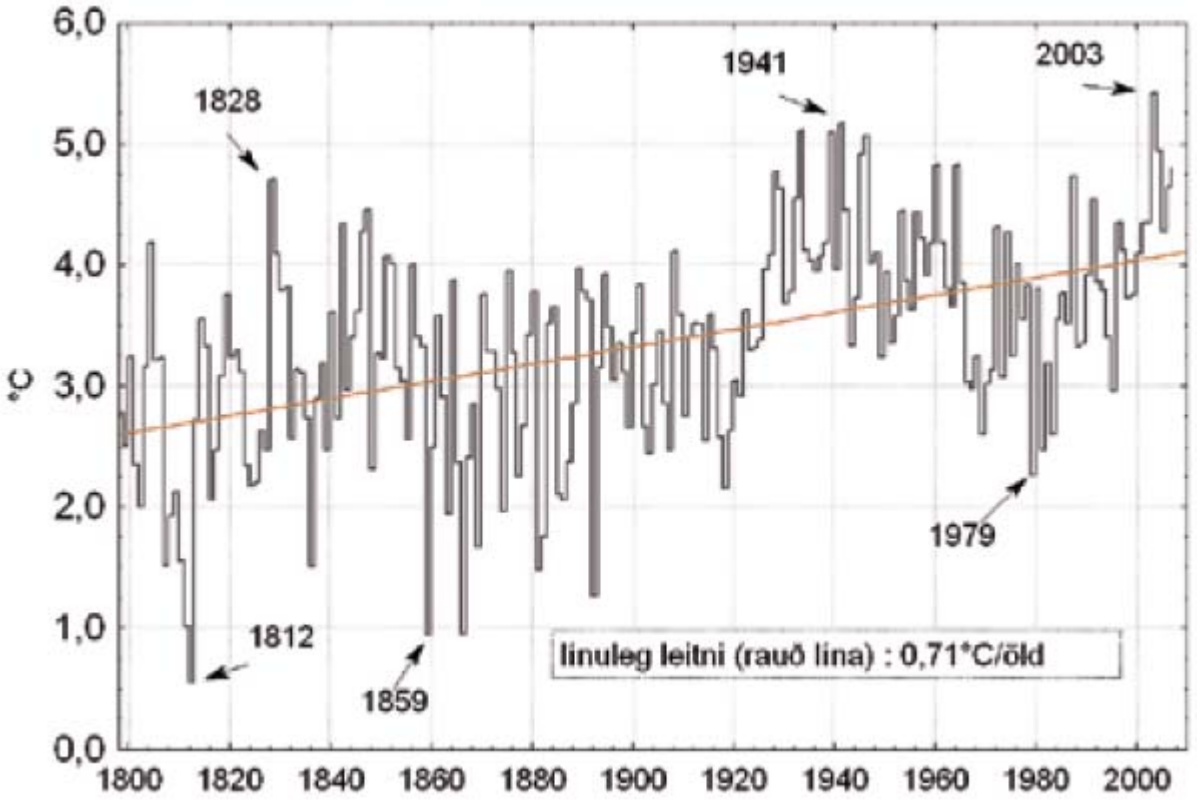
- Population 0,3 million
- Climate: Maritime
  - cool summers
  - mild winters
- Passenger cars pr. 1000 inhabitants: 599
- Strong road transport dependece:
  - No railway
  - No short sea shipping

The Road system

Road traffic



Annual temperature since 1800



Possible temperature development towards 2100

Scenario

- A possible temperature increase of 1,4° - 2,4° by year 2100 (scenarios B1 – A2)
  - Different scenarios and model results
  - More increase in the winter than in the summer
- Indications for a 4 – 8 % increase in precipitation for each degree in temperature increase
  - More increase in summer than in winter
  - Indications for more frequent and larger extreme precipitation events
- More frequent freeze-thaw cycles in winter
- More winter storms

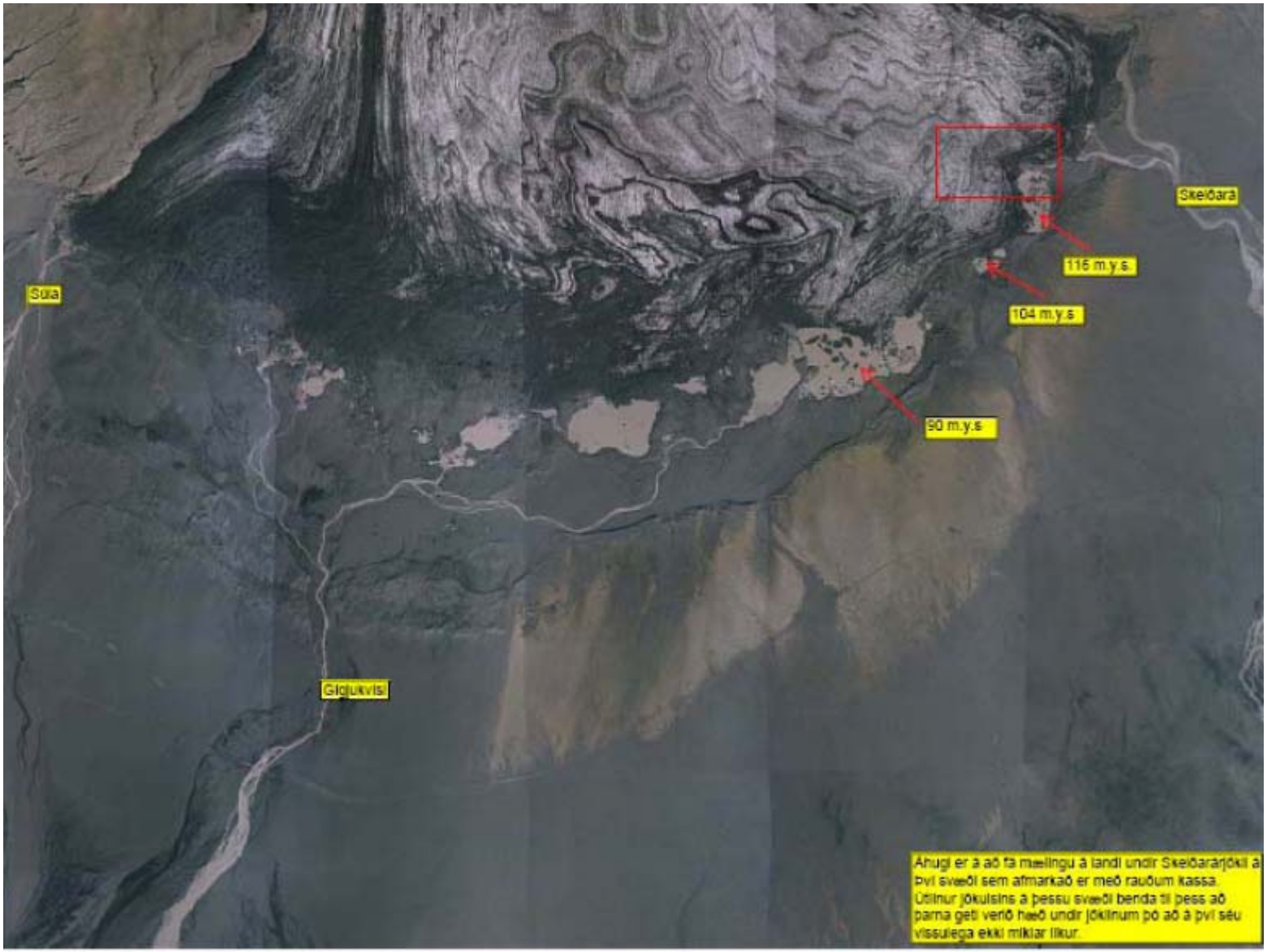
Main challenges for ICERA

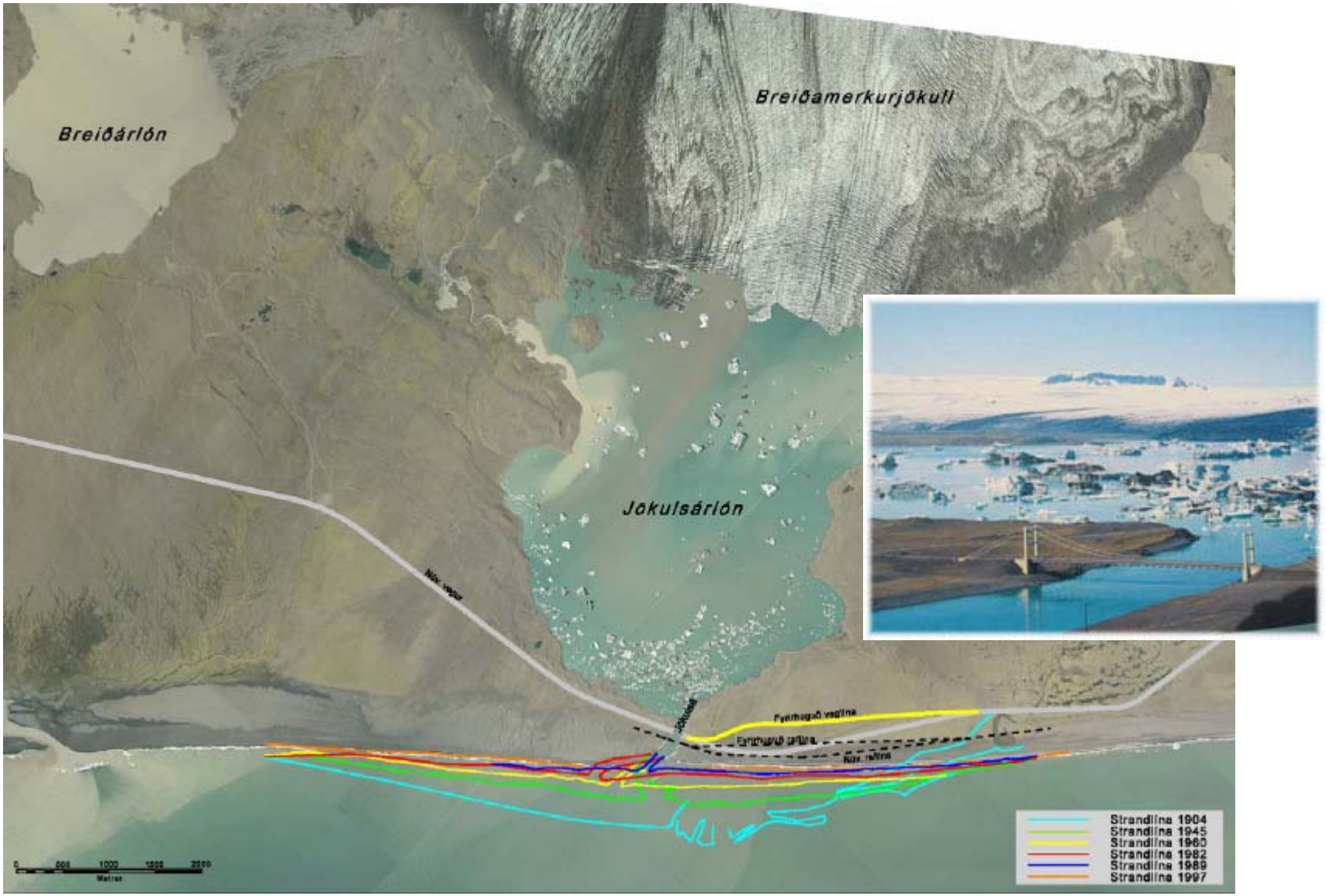
- Glacier retreat and river channel changes
- Frequent freeze-thaw cycles
  - Bearing capacity of roads
- River flooding
  - Special attention to sudden thaw periods with extreme precipitation in winter (on frozen ground)
- Winter service
  - Increasing traffic and service demand may be the critical factor for service development
  - Snow ploughing on mountain passes

Uncertain impacts

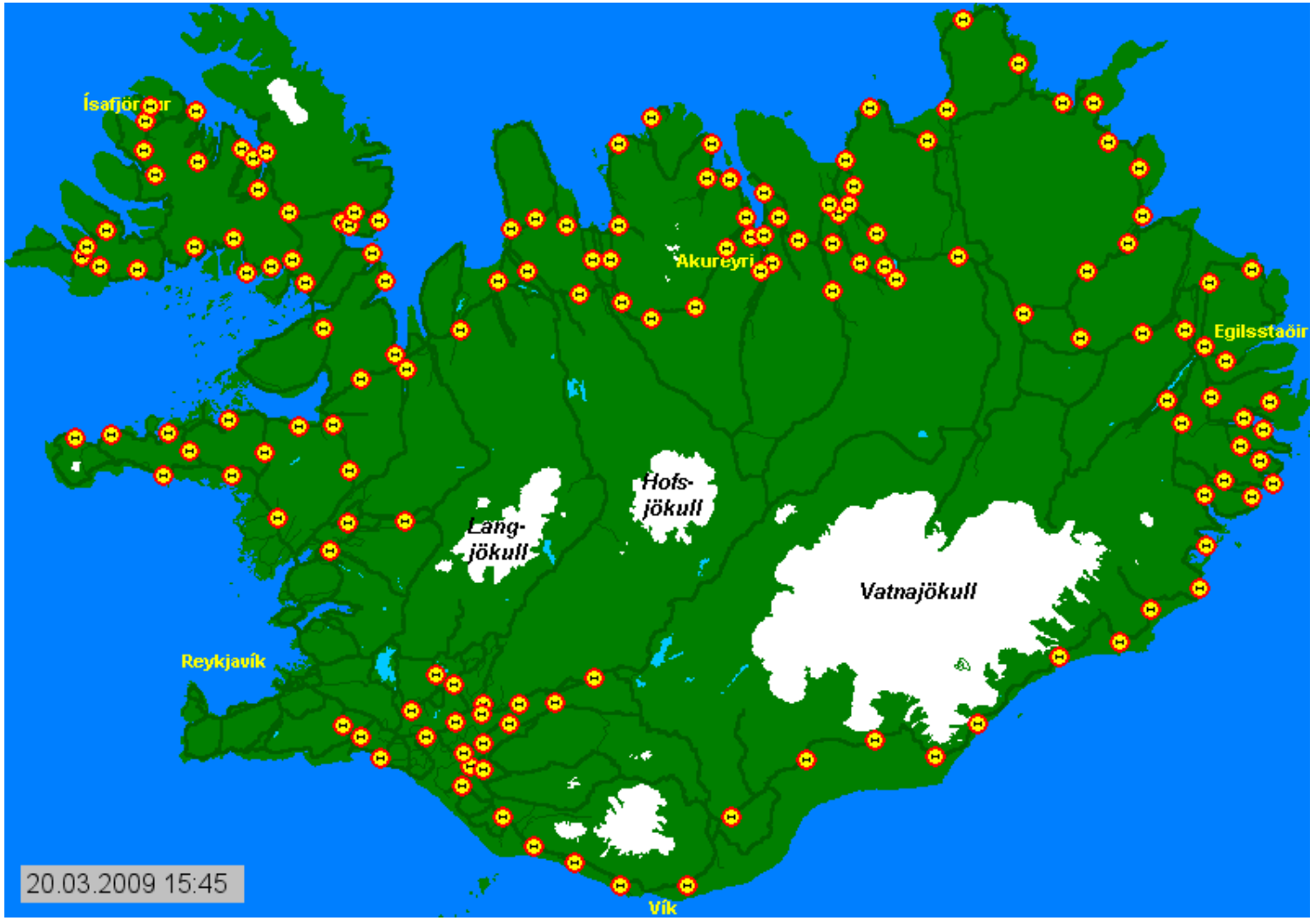
- Snow avalanche, slush flow, mud slide
  - More and more exposed sites are being bypassed by tunnels
- Groundwater levels and water in the road structure
- Sea level rise, +50 cm already accounted for

Glacial river changes

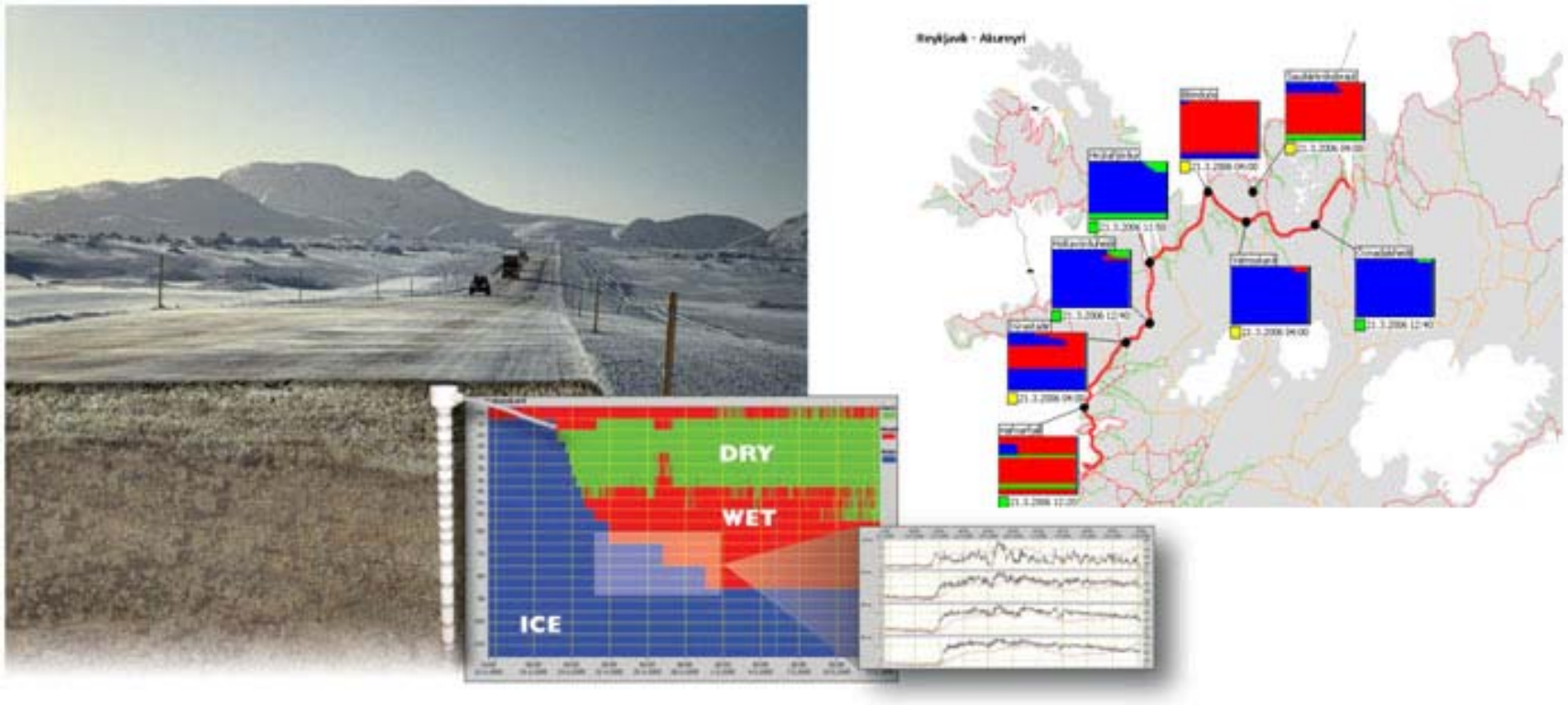

Skeiðara
116 m.y.s.
104 m.y.s
90 m.y.s
Sua
Gígjukvísl
Áhugi er á að fá mælingu á landi undir Skeiðarárjökli á því svæði sem afmarkað er með rauðum kassa. Útlínur jökulsins á þessu svæði benda til þess að parna geti verið hæð undir jökulnum þó að á því séu vissulega ekki miklar líkur.


Breiðárlón
Breiðamerkurjökull
Jökulsárlón
Strandlína 1904
Strandlína 1945
Strandlína 1960
Strandlína 1982
Strandlína 1989
Strandlína 1997

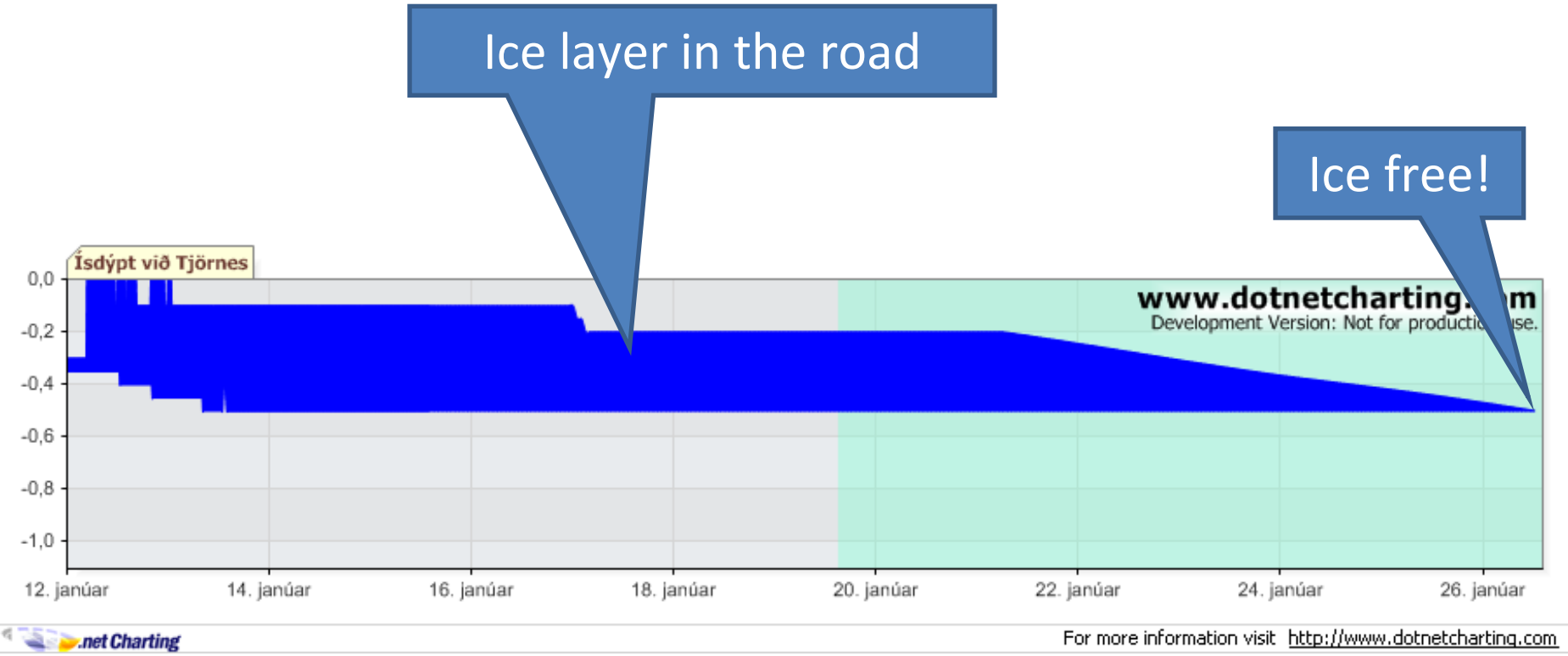
Frequent mid-winter axle-load restrictions, December -April



Real-time freeze-thaw measurement



New freeze-thaw forecast model

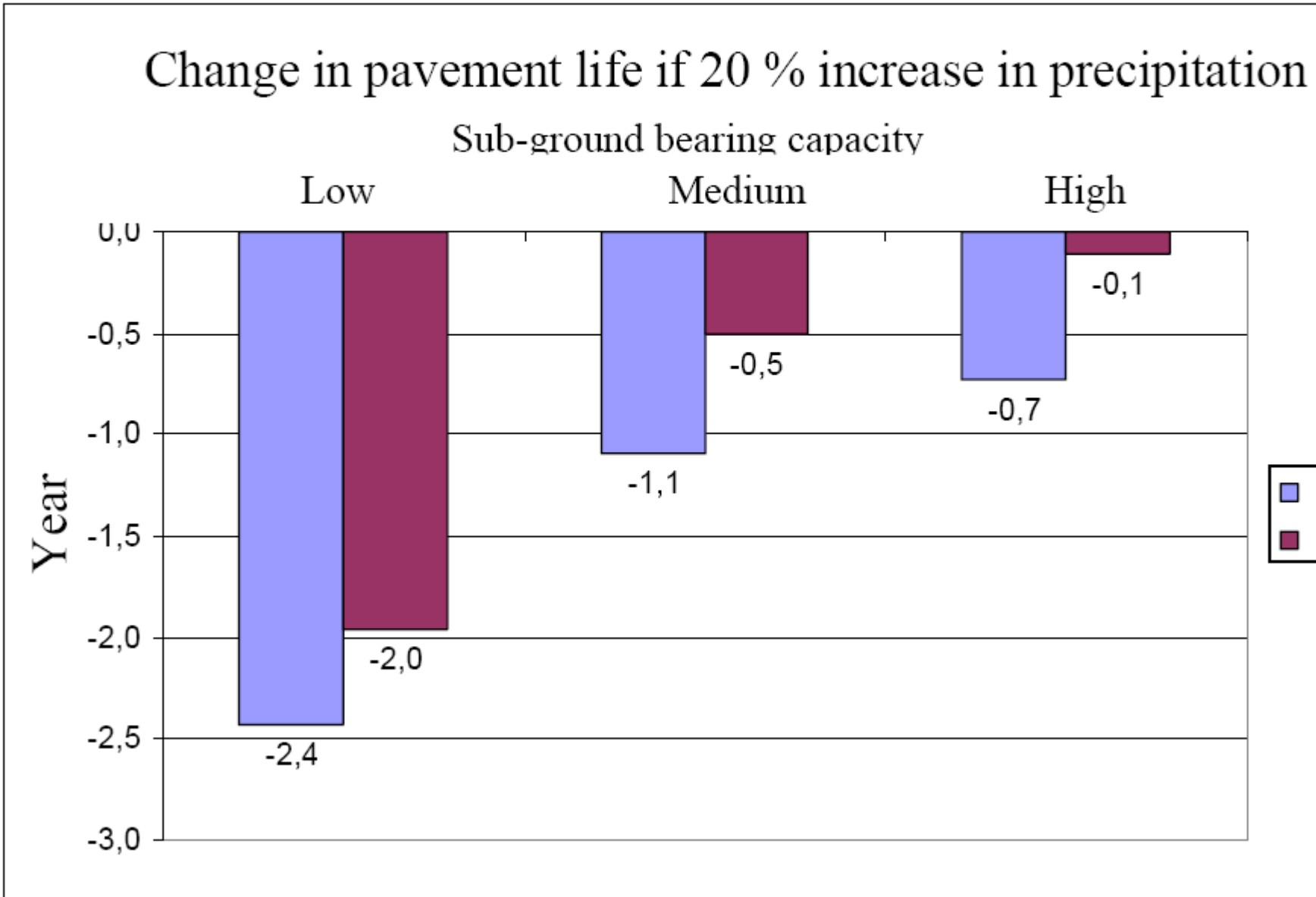


Past (measurements)

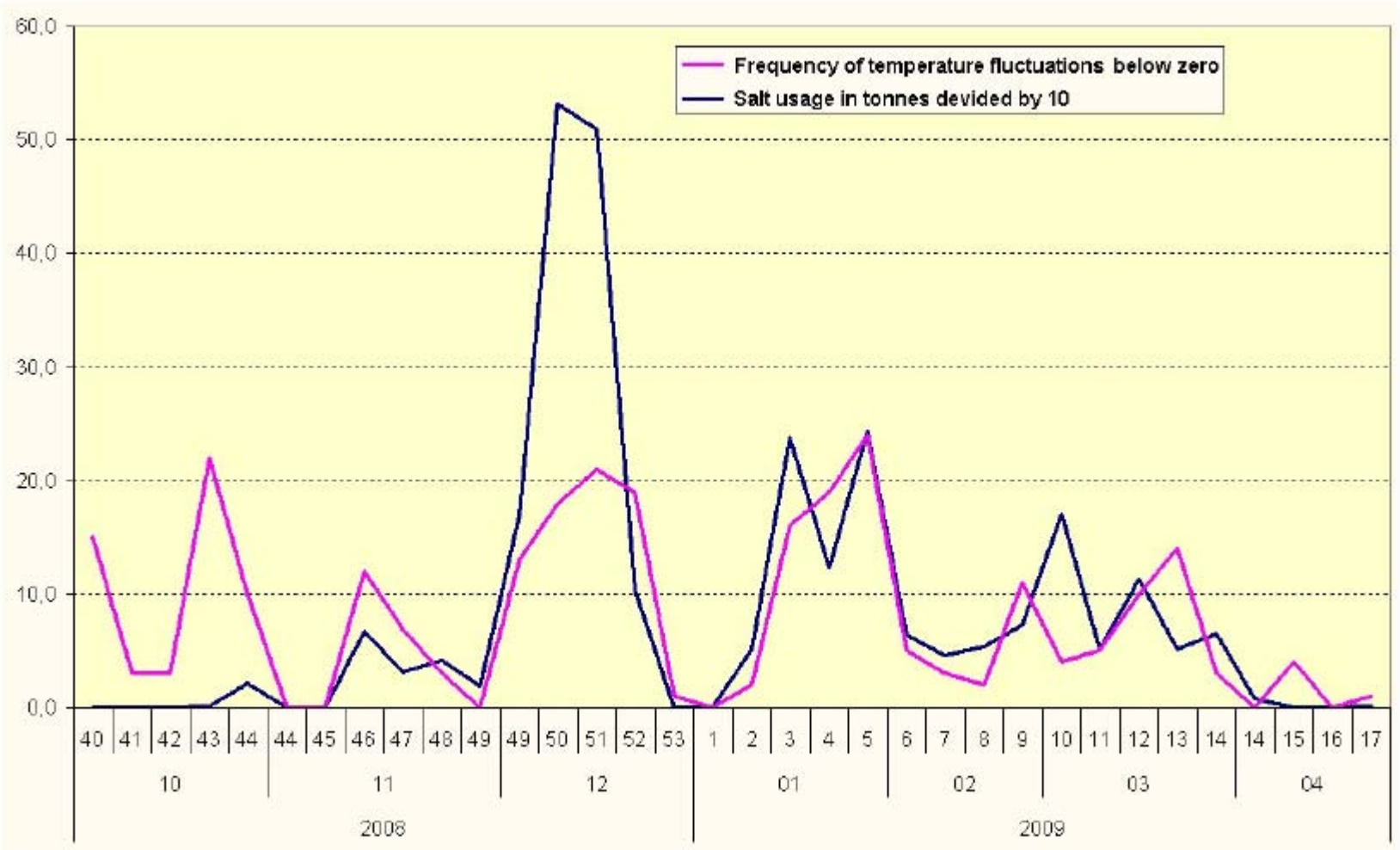
Future (prognosis)

E136 – Demonstration section

Change in pavement life



Spring-thaw flooding


Frequency of temperature fluctuations below zero
Salt usage in tonnes devided by 10
60,0
50,0
40,0
30,0
20,0
10,0
0,0
40 41 42 43 44 44 45 46 47 48 49 49 50 51 52 53 1 2 3 4 5 6 7 8 9 10 11 12 13 14 14 15 16 17
10
11
12
01
02
03
04
2008
2009

Adaptation strategy for ICERA

- The consultant has observed that responsible units react autonumously when faced with the challenges
  - "Business as usual" strategy does not mean status quo
  - This has happened long before the CC adaptation projects and strategies became "popular"
- However, a structured approach is sought

The role of the adaptation coordinator

- Raise awareness and educate
- Circulate best practice information and research results
- Identify missing data and the need for new data collection
  - New weather stations for long term monitoring
  - Registration of disruption

The role of the organisation

- Motivate staff
- Move from “static” to “dynamic” thinking
- Update procedures
- Update design values when propriate

	New structures	Existing structures
	Planning, design, dimensioning	Maintenance, operation, service
Road structure, pavements	Identify responsible unit Identify current procedures Evaluate Adopt new routines	
Winter service		
Bridges, waterways		
Coastal structures