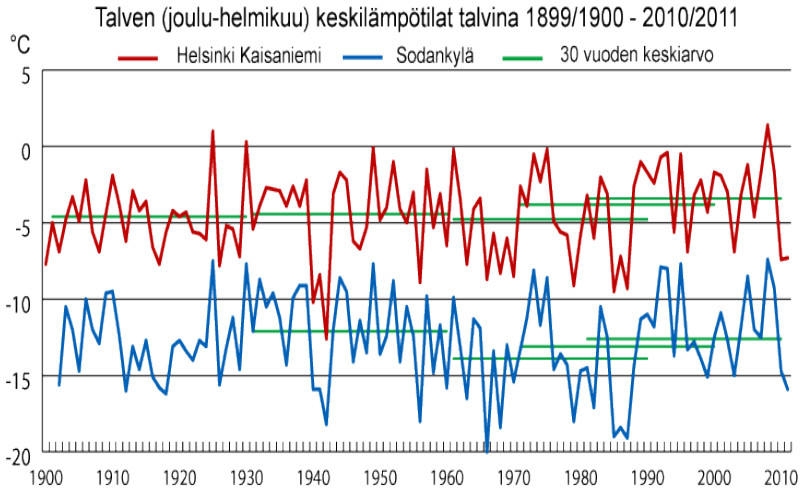
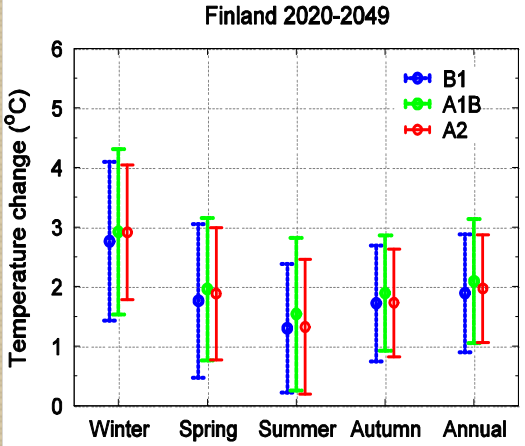
The future of the Finnish national road network under changing climate

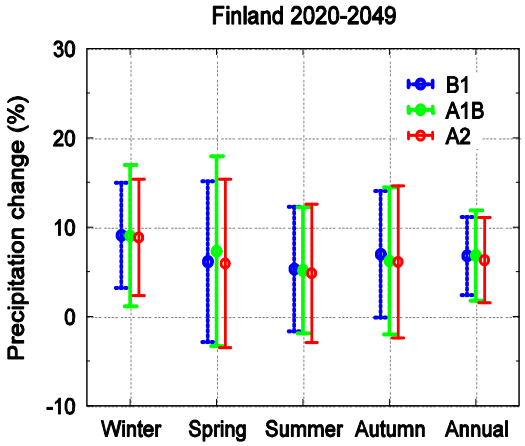
Erik Schou
Gudina L. Feyisa
Karoliina Pilli-Sihvola

NONAM summer school 26.8.2011

Copenhagen


Talven (joulu-helmikuu) keskilämpötilat talvina 1899/1900 - 2010/2011
°C
Helsinki Kaisaniemi
Sodankylä
30 vuoden keskiarvo
5
0
-5
-10
-15
-20
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010


Finland 2020-2049
Temperature change (°C)
B1
A1B
A2
6
5
4
3
2
1
0
Winter
Spring
Summer
Autumn
Annual


Finland 2020-2049
Precipitation change (%)
B1
A1B
A2
30
20
10
0
-10
Winter
Spring
Summer
Autumn
Annual

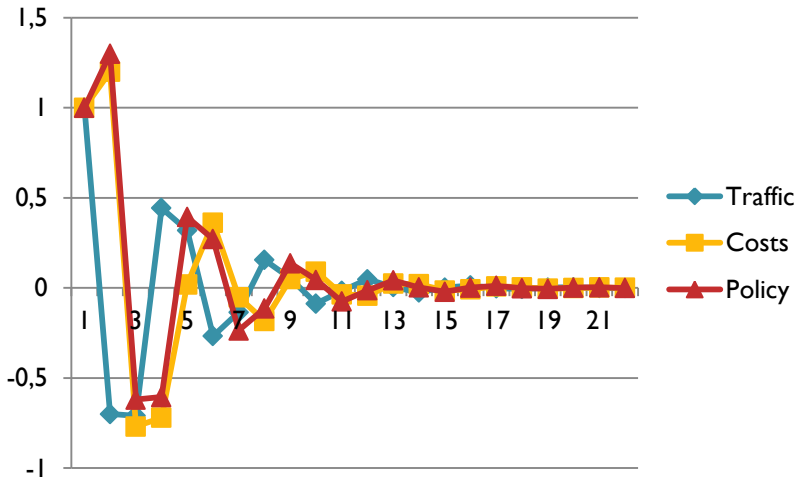

Eurooppa- ja TEN-tieverkko
1.1.2010
E-tiet
TEN-tiet
E- ja TEN-tiet


E75
E8
82
Rovaniemi
E75
E63
Oulu
22
89
Kajaani
Kokkola
E8
E75
Vaasa
Kuopio
9
Joensuu
6
9
E8
E12
Jyväskylä
5
Mikkeli
Pori
Tampere
Hämeenlinna
Lahti
6
13
Lappeenranta
E63
E12
E75
E18
E18
Kotka
Turku
Porvoo
Helsinki

Fuzzy cognitive map

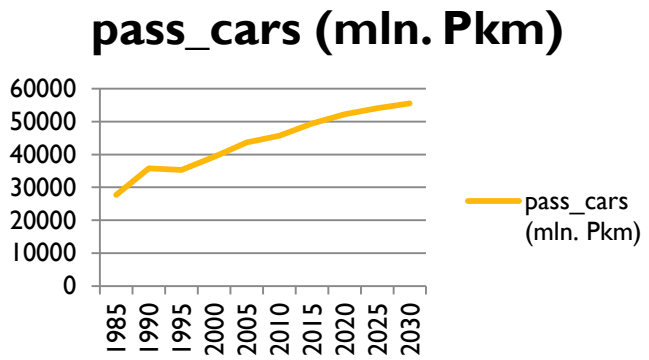
	CC	Policy	Traffic	Research Tech	Strat	Nat.feat	Costs	
		1	2	3	4	5	6	7	8
CC	1	0	0,2	0	0	0	0	0	0,7
Policy	2	0	0	-0,6	0,8	0	0	0	0
Traffic	3	0	1	-0,1	0	0	0	0	0,7
Research	4	0	0,1	0	0	0,8	0,4	0	0
Tech	5	0	0	0	0	0	0	0	-0,2
Strat	6	0	0	0	0	0	0	0	-0,3
Nat.feat	7	0	0	0	0	0	0	0	0,3
Costs	8	0	0	0	0	0	0	0	0

- Get a feel for complexity
- Black-box tendencies
- Numbers will steal attent.



Scenario development

- Climate change scenarios:
  - Time horizon: 2011 - 2050
  - Emission scenarios - GCM – regional downscaling to Finland
- Socio-Economic scenarios:
  - BAU: Statistical study about the projected growth in transport volume
  - Estimates about the technological development in asphalt, road maintenance
  - Change: 30% increase compared to BAU
- Spatial analogue?
- Stakeholder involvement:
  - Ministry of finance (€€€), Ministry of transport, National road administration, road users, people living next to the big roads (noise reduction vs. durability of asphalt), scientists in road technology, firms



Projection of passenger kilometers

Socio-economic scenario	Climate scenario	
	Worst case (4.4 C increase; 17 % increase in prec)	**Best case (1.5 C increase; 2% increase in prec)**
BAU	A	B
Change +30 %	C	D

Scenario combination	Impact		Adaptation measures	
	North	**South**	**North**	**South**
A	* CC: Possible increase in the amount of snow → more snow clearing → increase in operational costs S-E: increase in traffic volume → increased wear of roads → increase in maintenance cost.	** CC: Possibly less snow, more rain Increase in freeze/thaw cycles → less snow clearing, more salting needed, increase in frequency of extreme weather events (flooding)	Better road services, increase capacity to clear/salt roads	Better road services, increase capacity to clear/salt roads Adjustment of maintenance cycles Flexible system for idle costs
B				
C	**	*** CC: Less snow, more rain Increase in freeze/thaw cycles → less snow clearing, more salting needed, increase in frequency of extreme weather events (flooding)		
D				

Adaptive management plan

- More flexible management, learning by using experience from past events already happening and use that in future planning
- Reactive vs. proactive management → stakeholder participation to find out what the client is able to do
- Several options to adapt to future conditions: The roads need continuous maintenance → several options to adjust → low irreversibility of decisions

→ Option value: wait for better information. Whether to invest on maintenance now or wait for either technological development or information on climate change (reduced uncertainty) → possibility to save costs but also to have a lot higher costs. Depends on the current state of the world

Uncertainty

- Focus on temperature projection
- Short time horizon→
  - ⇨Emission scenario unc. (qual. unc.)↓
  - ⇨Nat. Var.↑→ Stochastic and statistical unc. ↑
  - ⇨Epistemic unc. still most important (Hawkins & Sutton 2009)
- Traffic volume: qualitative vs. Epistemic unc.? Reasonable forecasts should be possible (people are not going to abandon their cars over night…)