Water and climate change – recent concerns

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Three main concerns:

Water availability

See level rise

Climate and energy
Changed water availability according to 12 climate models
Water resources today

Future change
The sea level will rise **18 - 59 cm** until 2100

+ some **20 cm** for local effects in the North Sea

"Dynamical processes related to ice flow not included in current models but suggested by recent observations could increase the vulnerability of the ice sheets to warming, increasing future sea level rise. Understanding of these processes is limited and there is no consensus on their magnitude."

**May lead to additional 20 cm**
Modelled and observed extension of the Arctic sea ice

Source: Genomgång av forskning sedan IPCC AR4/WGI 2007
Markku Rummukainen Erland Källén

MISTRA SWECIA
Stockholms universitet SMHI
West Antarctic warming

Decadal temperature trend for 1969-2000

Antarctic Peninsula

West Antarctica

East Antarctica

trend °C/decade

Steig et al. 2008
“It is the Delta Committee’s conclusion that a regional sea level rise of 0.65 to 1.3 meters should be expected for 2100, and from 2 to 4 meters in 2200. This includes the effect of land subsidence. These values represent plausible upper limits based on the latest scientific insights.”
The Dutch Delta Committee, 2008
Megacities 1950

Source: U.N. Population Division
Population Trends

Megacities 2015

Population worldwide in cities

- 1950: 30%
- 2007: 50%
- 2030: 60%

Source: U.N. Population Division
Even Stockholm has small margins…
The catchment of Lake Mälaren
A flood in Stockholm in 1924
Stockholm today

Foto: Sten Bergström, SMHI
Uplift of land in Scandinavia
Sea levels in Stockholm since 1889
Hydropower - a part of the solution?
Nordic hydropower in % of total electricity production

<table>
<thead>
<tr>
<th>Country</th>
<th>%</th>
<th>TWh</th>
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<tbody>
<tr>
<td>Norway</td>
<td>100%</td>
<td>123 TWh</td>
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<tr>
<td>Sweden</td>
<td>45%</td>
<td>66 TWh</td>
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<tr>
<td>Finland</td>
<td>12%</td>
<td>8 TWh</td>
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(approximate figures)
Nordic-Baltic projects on the impact of climate change on renewable energy

Climate Water and Energy 2001-2002

Climate and Energy 2003-2006

Climate and Energy Systems 2007-2010

To order http://www.norden.org/pub/sk/showpub.asp?pubnr=2007:003
Conclusions from the CE-project

- Hydropower production is expected to increase in the Nordic area (But this is not the case for the rest of Europe!)
- The annual rhythm in river flow will be more favourable for production
- Impact on dam safety is not self-evident and has to be analysed carefully
- The development of the future European energy market will have strong impact on the Nordic hydropower industry
Wind power is on the move – it requires hydropower for regulation!
Downscaling and uncertainty

Global modelling

Regional modelling

Local-regional studies
### New regional climate scenarios from ENSEMBLES

<table>
<thead>
<tr>
<th>Institute</th>
<th>Scenario</th>
<th>Forcing GCM</th>
<th>Regional model</th>
<th>Resolution</th>
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Seasonal cycle of monthly mean changes in precipitation under the A1B emission scenario by the end of the 21st century (2071-2100) in southern Sweden. (Global climate models)

One last question:

How can we develop a strategy for risk assessment and climate adaptation that, in a reasonable way, accounts for all the inherent uncertainties in the climate projections?
Sverige inför klimatförändringarna – hot och möjligheter

the Swedish Commission on Climate and Vulnerability, 2007