Impact of climate change and natural hazards on the quality of surface water

Gunnel Göransson
Swedish Geotechnical Institute (SGI)

Paul Frogner-Kockum, Thomas Rihm, David Bendz: SGI
Marie Haeger-Eugensson, Christina Wolf: IVL Swedish Environmental Institute
Magnus Larson: Lund University
Rodney Stevens: Gothenburg University
Climate and natural hazards

Global temperature increase

Regional changes in precipitation

Arvika, Sweden, Dec 2000
Impact of Climate Change on the Quality of Urban and Coastal Waters - Diffuse Pollution (diPol)

An EU Interreg IVB North Sea Region Programme project

One of the diPol goals:
- to collect knowledge on the impact of CC on urban water quality

19 Partners from Germany, the Netherlands, Denmark, Norway and Sweden
Climate change impact
The river Göta älv, SW Sweden

Study site Gothenburg area
Climate change at a regional scale

Temperature

Mean wind speed

SNY=Standard normal year: mean 1960-1980

(Haeger-Eugensson et al. In prep.)
Climate change at a regional scale!

Precipitation intensity

Total monthly precipitation

SNY=Standard normal year: mean 1960-1980

(Haeger-Eugensson et al. In prep.)
Impact on water quality

- First flush sampling
- Event based sampling
- Climate related sampling
Rain and flow

Acc. precipitation (mm)

Days prior to sampling

Discharge (m³/s)

Days prior to sampling

Spring flood
Dry period
Wet period

Spring flood Mölndalsån stream
Dry period Mölndalsån stream
Wet period Mölndalsån stream

Rain and flow

Swedish Geotechnical Institute
Nordrocs Oslo 18-21 September, 2012
Suspended sediment concentration

(Frogner-Kockum et al. In prep.)
Additional sampling

Air sampling

Groundwater sampling

Surface material sampling
Example Cu and (PAH) kg/y

(Rihm and Göransson, 2012; Stevens et al. In prep.)
Stakeholder participation

Diagram showing Stakeholder participation:
- Land-use
- Laws and regulation
- The natural environment
- People
- Activities
- Existing units
- Communication

Complex systems

Existing units

Land-use

People

Activities

Communication

Laws and regulation

The natural environment
Main findings - Swedish site

(Stevens et al. In prep.)
Natural hazards - Landslides
The river Göta älv, SW Sweden
The Göta älv River Valley

Documentet slides

Env. hazardous activities

(www.swedgeo.se)
1957 Göta landslide
Göta Sulphite industry (pulp mill)
Landslide in an industrial site
Analytical solution for the transport
Estimating the risk

Few studies and little data

A probabilistic approach

To be continued…

(Åkesson, 2010)
Some final words

• CC may increase flood frequency and landslide frequency

• Gothenburg area: clear increase in precipitation since 1980

• Indications that more rain yields elevated concentrations in surface waters

• Landslides (and bank erosion) can release large amounts of pollutants

• Interactions between aquatic and terrestrial systems can only be explored using integrated methods

• Risk assessment should be done in a large perspective, taking into account driving variables
Thank you for your attention!

gunnel.goransson@swedgeo.se