Summary

TopSoil Workshop on Groundwater Flooding

28-29 November 2017

Sinatur Hotel Haraldskær, Skibetvej 140, 7100 Vejle, Denmark

Day 1

I. DATA COLLECTION AND STUDIES

"Important data for understanding the groundwater challenges in the upper aquifer"
Jes Pedersen was leading this session.

Presentations:
Torben Sonnenborg (GEUS)
"Important data for understanding the groundwater challenges in the upper aquifer"
Cors van den Brink (Royal Haskoning DHV)
"How do the Dutchmen work with ground water problems"

We worked in tree groups. We were given 5 questions.

- **Which datatypes are in focus in your region?**

Boreholes: geology, logs, monitoring wells (information at the upper groundwater level)
Electromagnetic data
Geophysics: resistivity, seismics, Direct Push
Pumping Test Data
MRS Data (impact of noise should be investigated)
Relation between hydrological conductivity and electrical conductivity
Groundwater head – no monitoring system in urban areas
Urban models: lack of data
Urban models: infrastructure, borehole data
Monitoring of effects of lowering abstraction for shallow ground water
Why not monitoring of consequences of high ground water level for houses: humidity, fungi?
Hydraulic pressure in urban areas close to the sea
Pilot area in urban area – inhabitants want to get rid of surface water
GIS environmental data (National Terrain Model) is used for new urban areas, but not the heads of surface water
Lidar data, elevation model of resolution 1 m^2, can combines with water levels in lakes, streams etc., though no monitoring data to connect
Satellite data: not yet, but ideas are present for the use of these data: measuring of elevation og the peat area, slope of ground with iron lid og sewers, chlorophyll and humidity

- **Which datatypes will be of interest if you want to improve you models?**

Geotechnical boreholes
Data that can be used in urban areas
Data that can resolve the upper 10-20 m
Mapping of urban system
Event data
Better quality of data – procedure to check data (NL maybe has one!)
Better knowledge on drainage
Information on hydraulic properties of clay layers
Simultaneous measurements of stream stage and hydraulic head
In rural areas:
Water quality data, aquifer modelling of clay: drilling + groundwater head + geology
Density 2-5 km
SkyTEM data delivered by helicopter
In urban area:
Example from Gronninge: monitoring data rather den modelling
How shallow ground water and sea is connected?
GIS-based model that can be integrated with satellite data
National flood warning system: thunderstorm data combined with geohydrological model
Surface data: satellites/Lidar, humidity, ground water levels
Data of sewage system inspection, rainfall data, heads close to the sewage system

- **Do you have special focus points in data collection close to the sea, in open land or in towns?**

Sea:
Connection between lower parts of cities and sea
tidal fluctuation and ground water level
vertical electrode chain, Direct Push, Seismics
The problem: few boreholes

Towns:
seismics, GPR, well logs, groundwater levels and contamination
more knowledge about geology to understand the groundwater

Open land:
From the drain system

- **Do you have special focus or methods when you sampling data closer to the surface?**

The closer to the surface, the higher resolution is needed.
problems with the climate in the houses: humidity, fungi

- **Have you had experience with involving the public in data sampling?**

In Odense the surface water system is not known in details, only historical data

How do we make a map/model of the ground water level?
In Netherlands: a map made on the basis of soil type and model (?) information
No

II. MODELS

"New model tools"
Jørgen F. Christensen was leading this session.

Presentations:
Anders Juhl Kallesøe (GEUS)
"Sunds. Groundwater flooding and modelling"
Hans Jørgen Henriksen (GEUS)
"Adaptive modelling and participatory early warning and monitoring systems"

We worked again in tree groups. We had 5 questions to discus in the groups. We ran short of time due to a very interesting discussion and we had to skip the plenum summary of the group work. Here are some of notes from group 3:

- **How important is the geological model for a good hydrological model?**

The geological model is very important. It's essential; it's a first step in the modelling process.

- **How are climate models used in the hydrological models?**

They are used as a scenarios:
- Sewage system in SOBEC (?)
- Test which scenario can be handled. Test the model. In political discussion about adaptation costs vs. risks. Sometimes it can be handled, sometimes is bad luck…

Dutch national strategy: adaptive strategy, based on a worst case scenario (GE-scenario)
Danish situation: national coordinated strategy, but adaptation plan is done by every municipality alone.

- **How do you incorporate future changes in groundwater extraction, sewer renovation and local rainwater drainage in your hydrological model?**

In NL: Models are used to calculate how low extraction can go without houses in area get water in the cellars. Work together with stakeholders (unintentional abstraction f.i. sewers). The sewage company has a legal duty to reduce unintentional abstraction, but this might cause (new) problems in urban areas. Model is set up in close cooperation and is adapted if necessary.
In DK: Sewage treatment company has no responsibility for the rising ground water caused by sealing the sewer.

- **What strategy do you have for updating your models?**

There is no strategy in DK. Models are set up for the project, are project-based. When the project ends, models die.
In NL are project MIPWA (Development of a Methodology for Interactive Planning for Water

Management), which is run by water board, water companies and some provinces. They pay each year to keep the model up to date. This consortium regularly updates the model. Rinke knows who I responsible!

- **When do you think that adaptive modelling will become main stream?**

In the near future, we are gathering more and more data, also public data. Data are more accessible, helps to build better models A&D adapting models. When dominant process ask for adaptive modelling.

Day 2

III. HOW TO HANDLE RISING GROUNWATER

Which actions can affect rising groundwater?

Presentations:
Johan Linderberg (VandCenterSyd)
"Challenges with rising groundwater level in the city"
Anne Helbig (Gemeente Groningen)
"Groundwater in an urban context"
Rikke Krogshave Laursen (SEGES)
"Consequences of rising groundwater level – from the agricultural point of view"

The discussions were carried out during and after the presentations.

Johan Linderberg talked about a situation in Odense, where groundwater level is raising due to the reduction in groundwater abstraction and climate changes. This has caused problems where there is build houses in areas, which historically is very wet, and not suitable for buildings. More than that, there are still projects, which are being developed in the old wet areas. We discussed the lack of communication between the planners and the experts on the ground water modelling and we agreed that better communication should be created to avoid problems with rising groundwater. Many of Denmark's cities have to deal with such problems. The solution could be the risk model or a risk map, where the potential flooded areas would be marked. Maybe the cost of the insurance in such a risk zone should be higher.

Anne Helbig has presented the ground water monitoring system in Gronninge. The town is built under the sea level. There are more than 150 monitoring wells placed in the town, where the water level is measured and the warning can be send to the citizens, when the flooding event is expected. The municipality is responsible for the maintenance and data collection. The municipality is also responsible for the damage, even if they warn about the flooding problems. Though it is not municipality's responsibility, if this is a structural problem, related to the buildings construction. Anne presented a platform, where all can share observations, which I based on google maps.

Rikke Krogshave Laursen has presented the agricultural aspect. Due to rising of groundwater level, many fields are being flooded. Wet soil cannot be sowed. Soil around the wet area became more compact because of heavy machines. This causes damages in soil and delays in farmers' work. The higher groundwater level makes plants roots to grow shorter and plants cannot develop their optimal height. There grow more weeds if plants are smaller, the nutrient uptake decreases and yield reduces.