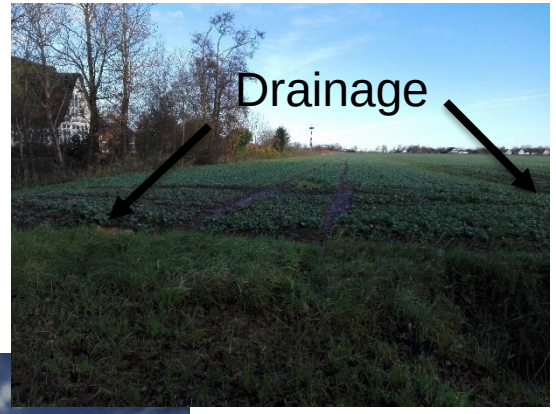
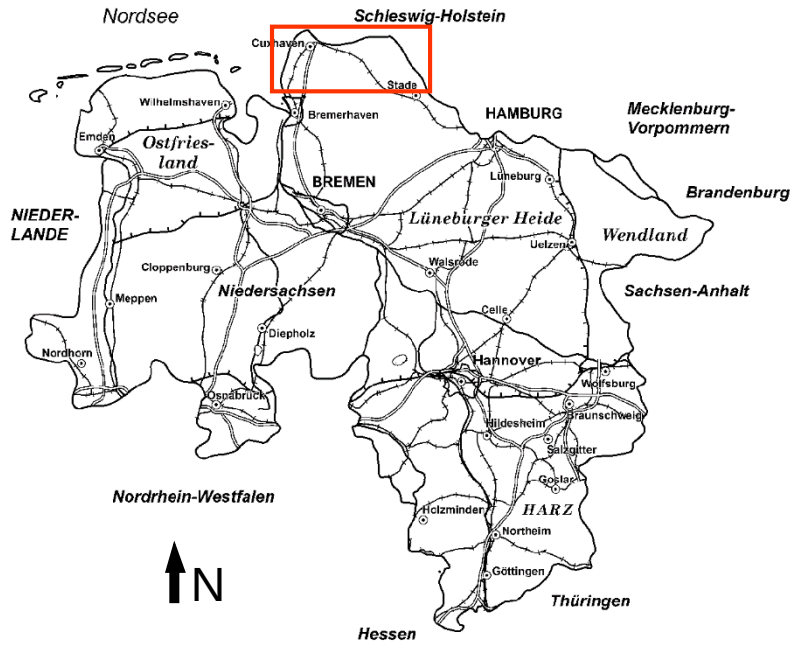
Pilot area GE 2:

- **Impact of MAR on salt-/freshwater distribution and freshwater availability in a coastal aquifer of Lower Saxony**





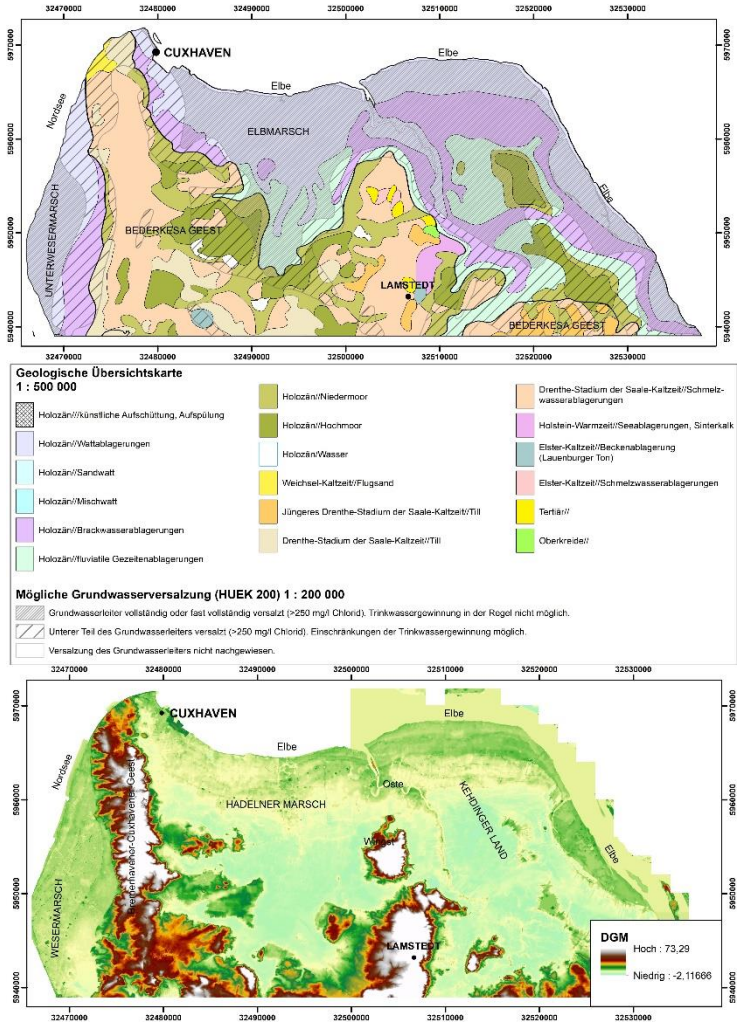
Nico Deus

State Authority for Mining, Energy and Geology

Pilot area GE-2

Challenges:

- Seawater intrusion due to climate change
- Increasing water demands
- Buffering of freshwater for dry periods



Marsh area

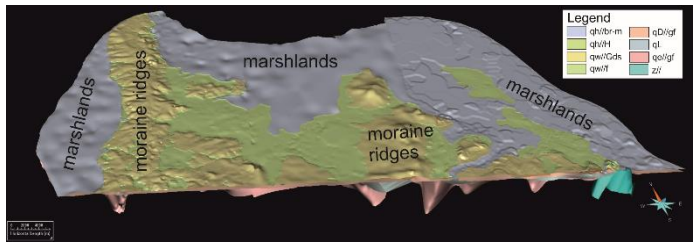
- low groundwater recharge,
- Groundwater level between -1 & 1m NHN
- Extensive drainage,

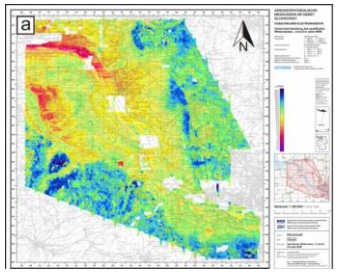
Moraine area

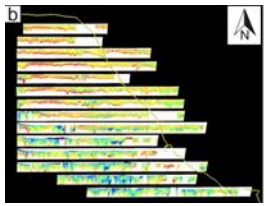
- High groundwater recharge,
- Groundwater level between 5 to 15m NHN

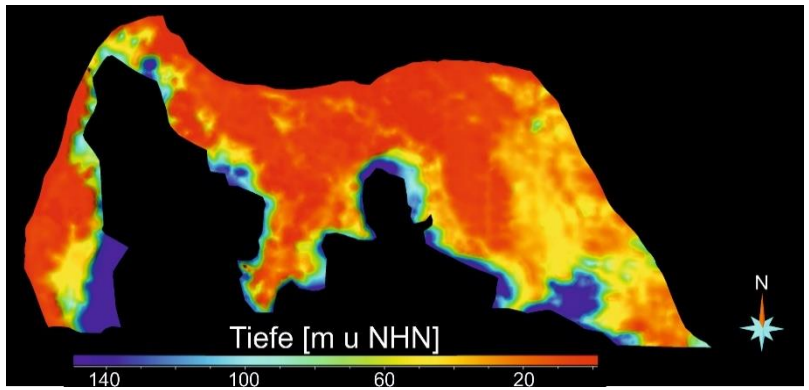
Pilot area GE 2:

Effects of climate change on the salt-/fresh water distribution in coastal aquifers of Lower Saxony**?**









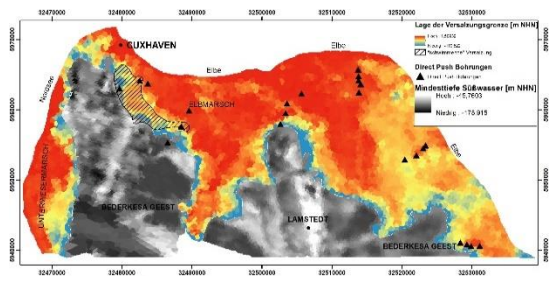
Deducing the distribution of Salt- & fresh water as input for the flow model

Modeling the impact of climate change on the salt-/fresh water distribution

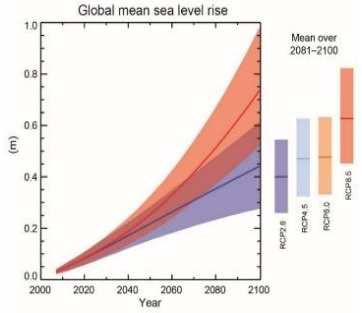
Landesamt für Bergbau, Energie und Geologie
GEOZENTRUM HANNOVER

Niedersachsen. Klar.

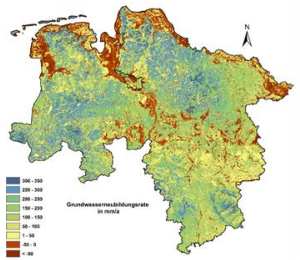
Modelling the climate change induced variations in salt-/freshwater distribution

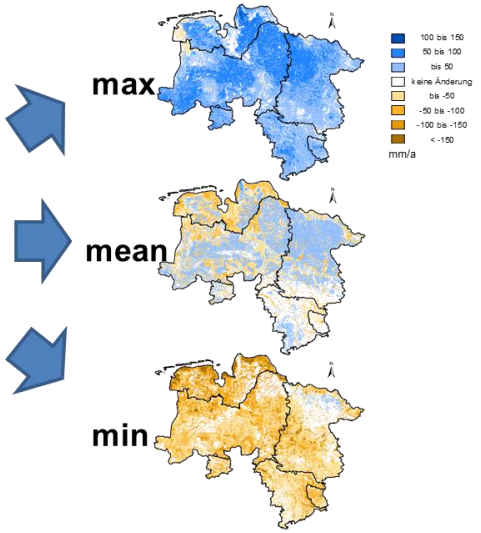


Status quo



Sealevel rise



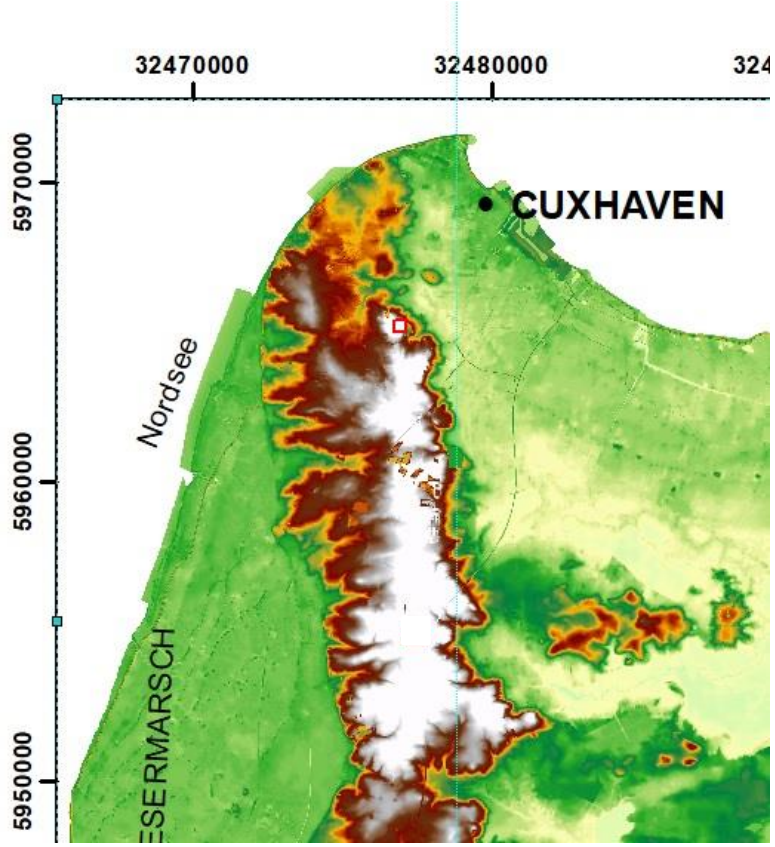


Changes of simulated groundwater recharge rates from mGROWA18 for the period 2071 - 2100

- Extraction rates
- Drainage
- Groundwater level
- Groundwater characteristics
- Chloride concentrations from HEM data

Climate szenario: RCP 8.5 (IPCC report, 2013)

Managed Aquifer Recharge

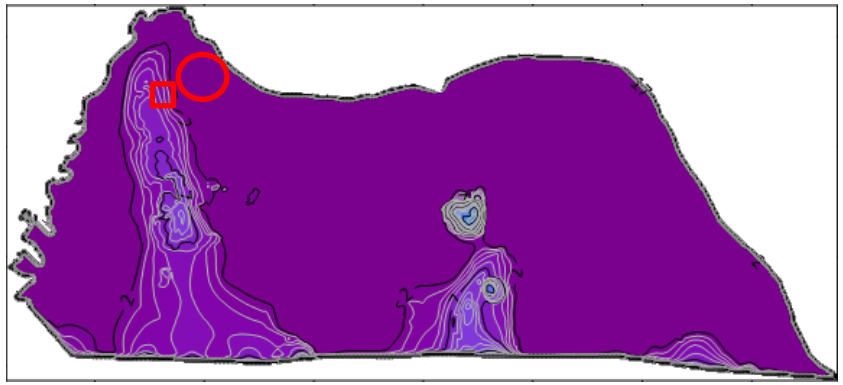


Possible locations (min. 400 x 400 m)

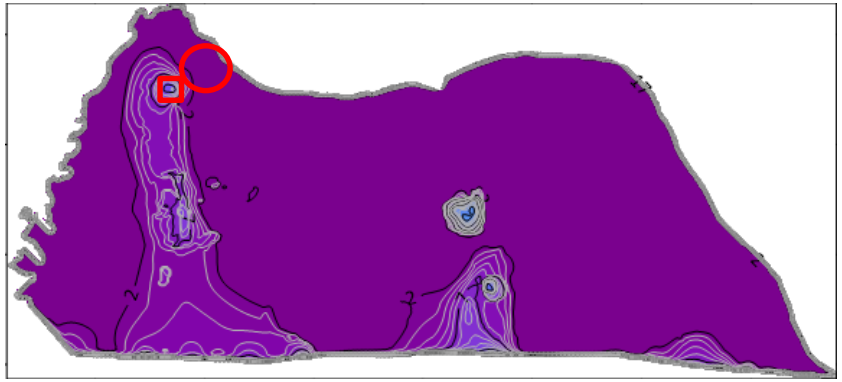
- *Calibrated model (2009-2013)*
- *All boundaries are kept constant*
- *Recharge was changed to consider effect of climate change*
- *Average recharge 2010-2040.*
- *20 Mio m^3 per year water recharge by MAR*

Managed Aquifer Recharge

Head at -20 m ASL without MAR

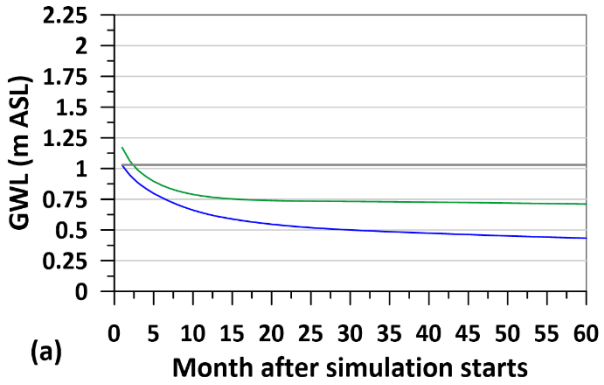


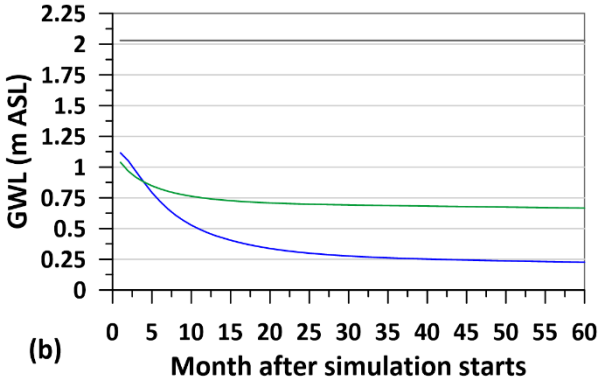
Head at -20 m ASL with MAR

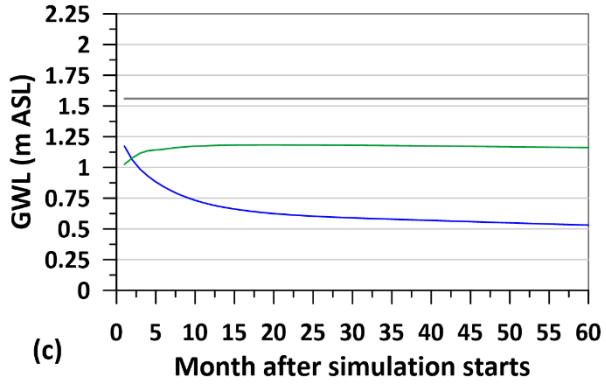


After 2 years

3 observation points







topographie

Gw level with MAR

Gw level without MAR

MAR location

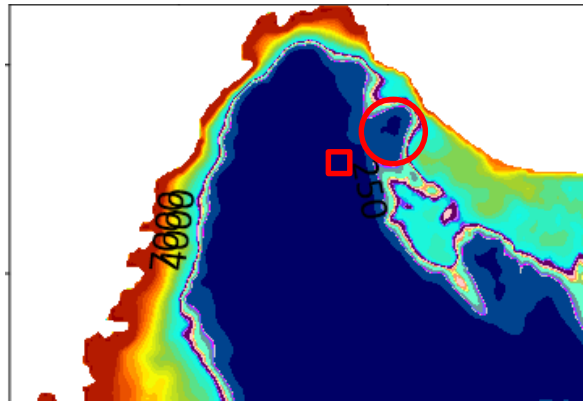
Location observation wells

Managed Aquifer Recharge

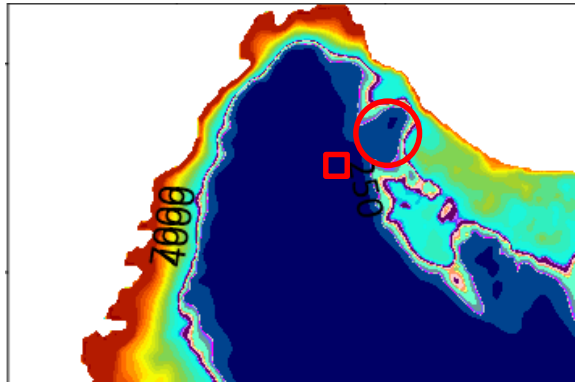
Chloride Concentration (mg/l)

10000
8000
6000
5000
4000
3000
2000
1250
1062,5
1000
812,5
765,625
625
531,25
500
0

Salinity at -20 m ASL without MAR

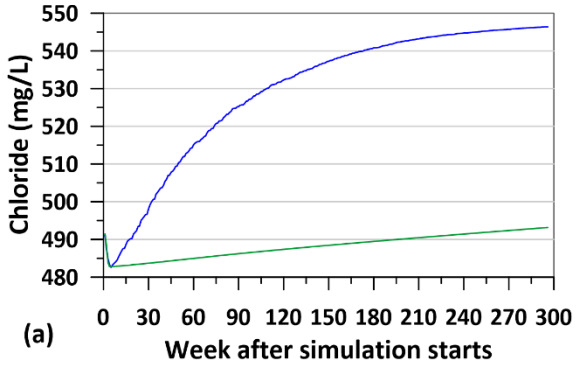


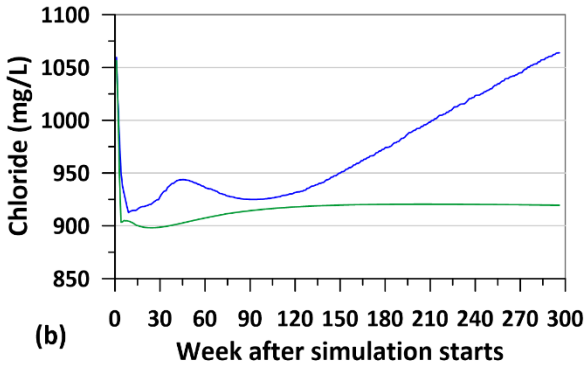
Salinity at -20 mASL with MAR

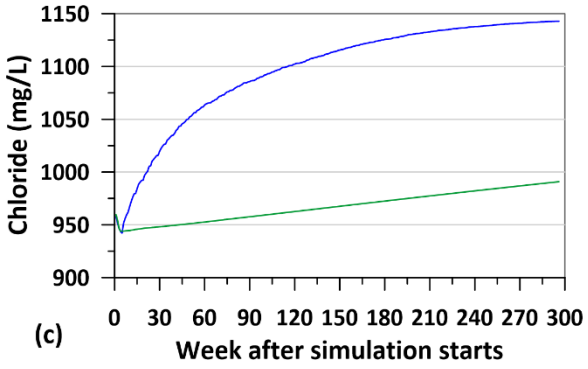


After 2 years

3 observation points







Chloride concentration with MAR

Chloride concentration without MAR

(a) 9 % reduction of chloride
(b) 14 % reduction of chloride
(c) 14 % reduction of chloride

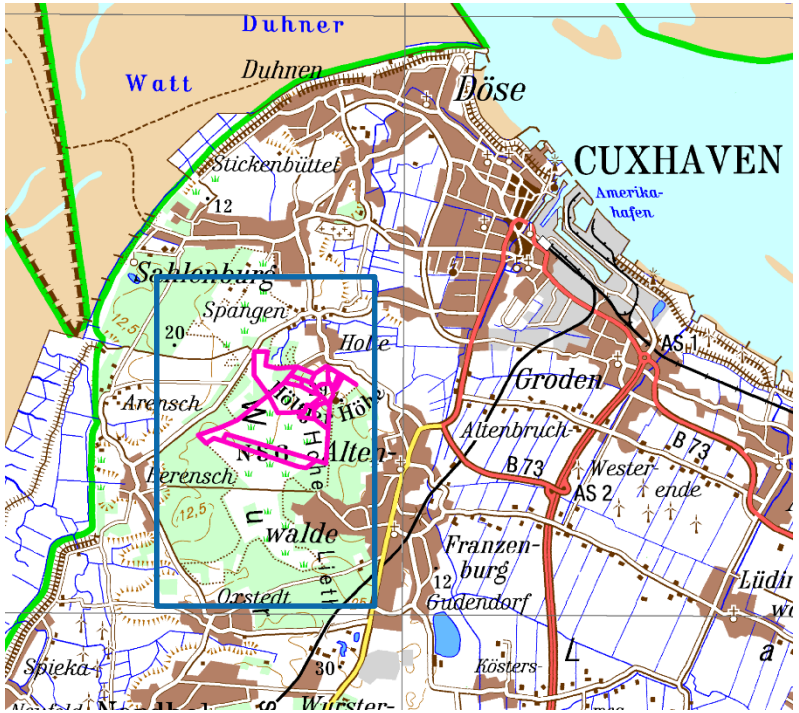
MAR location

Location observation wells

Managed Aquifer Recharge

Activities in topsoil extension:

- Refine the geologic model by using additional information like geophysical data (e.g. tTEM, NMR, drone coupled EM) ➡ in progress but waiting for geophysical data

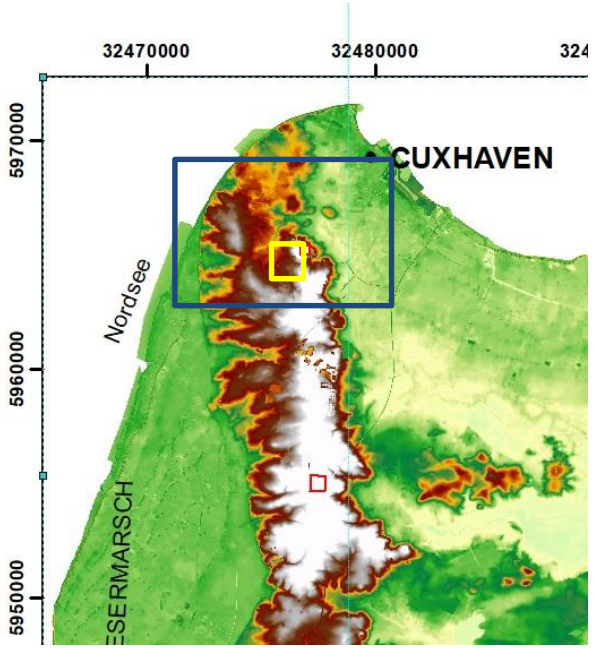


tTEM- survey area

Additional geophysical investigations (LIAG)

Geophysical measurements

- Generate a local high resolution groundwater model ➡ starts 01/2021



model area

MAR location

- Implement several MAR scenarios with different freshwater injection rates
  ➡ starts 04/2021

Thanks for your attention!

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