




Local Climate Proof Fresh Groundwater Supply

adaptation water management strategy with national impact

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freshsalt.deltares.nl

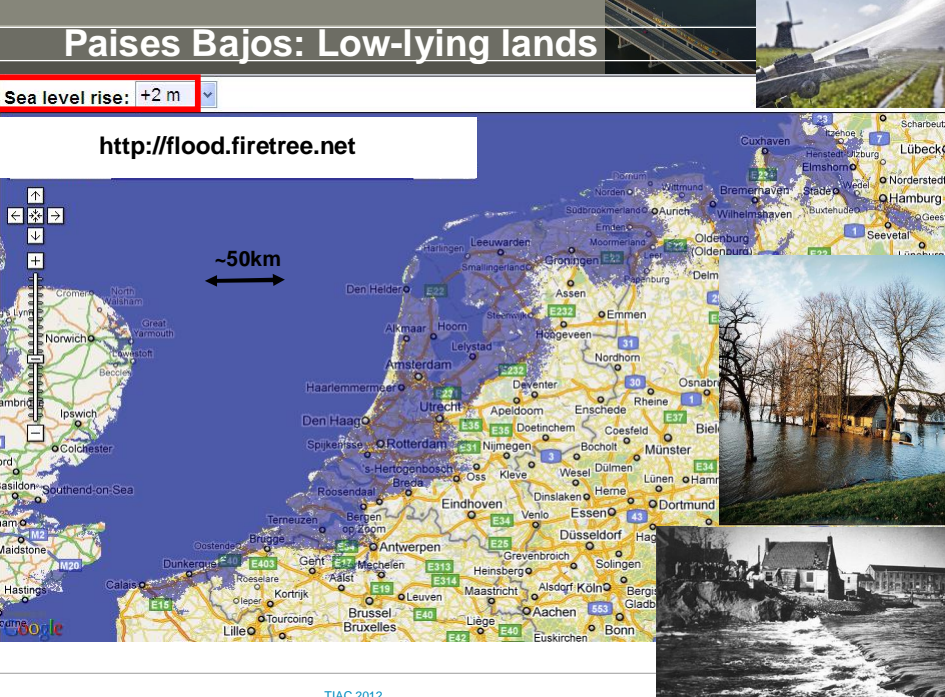
Partners: **KWR**




TIAC2012: 24-27 April 2012 IV Int. Conf. on Technology on Seawater Intrusion in Coastal Aquifers

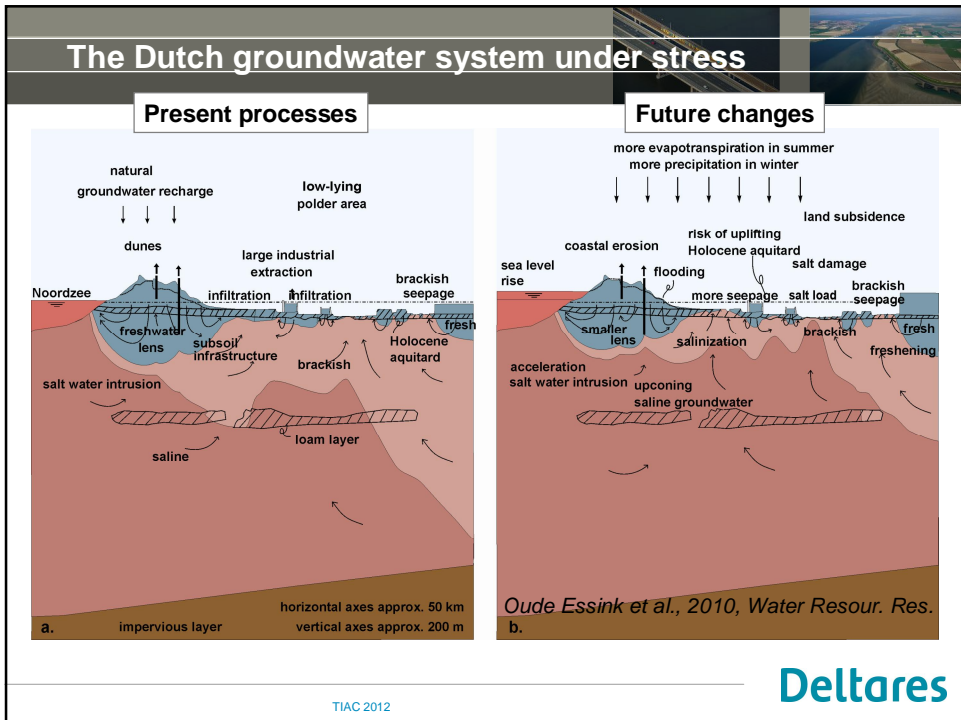
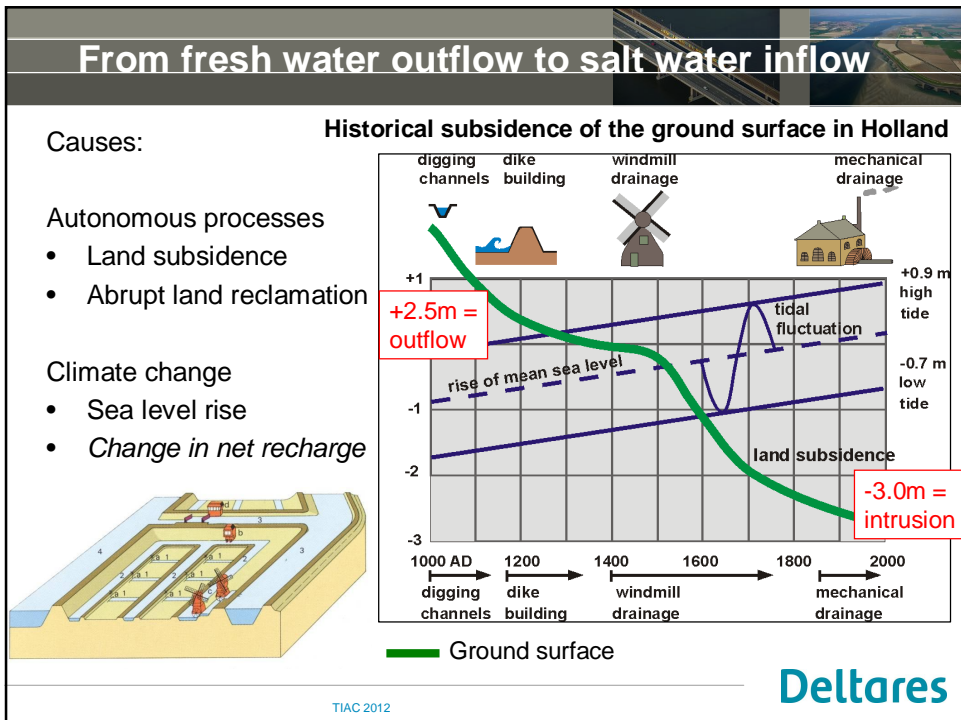
Paises Bajos: Low-lying lands

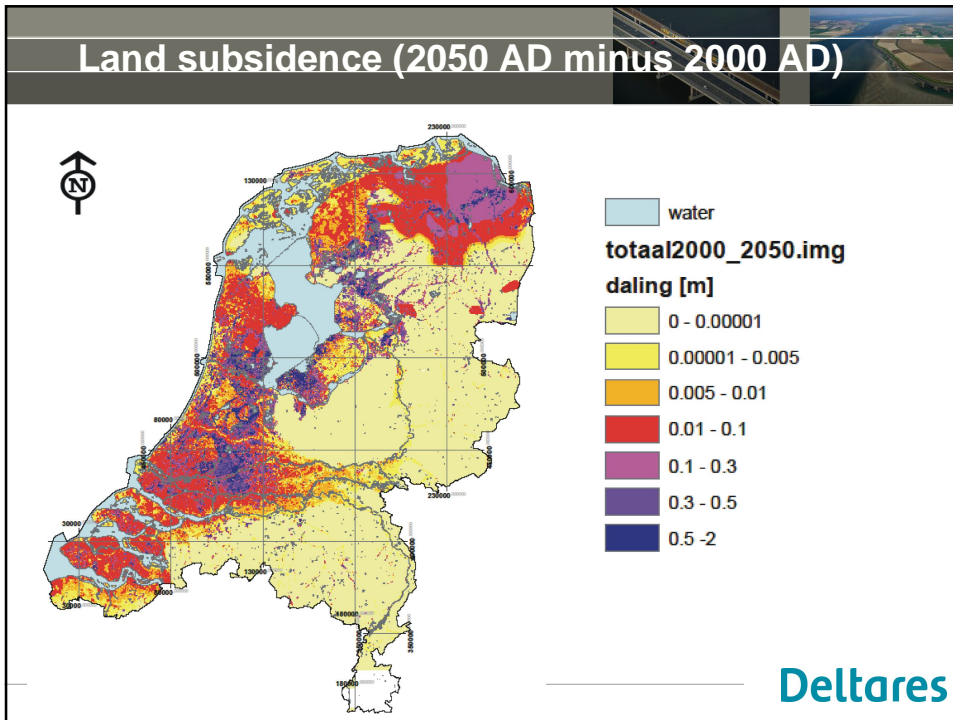
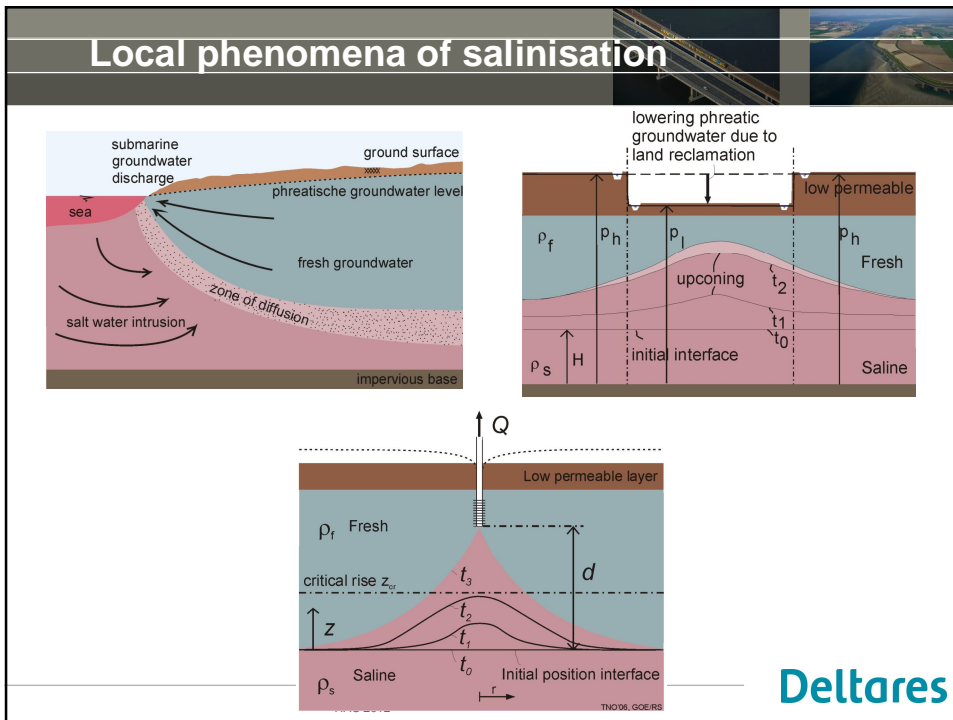
Sea level rise: +2 m

<http://flood.firetree.net>



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Groundwater in the future

We have to cope with...:

- Climate change
- Groundwater extractions
- Development energy use/production (heat-cold)
- Land subsidence
- Development spatial land use
- **Politics, Policy & Watermanagement**

Direct anthropogenic influence on groundwater is more important than climate effect

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Delta Program and National Water Plan

Two main goals for water management of our national government:

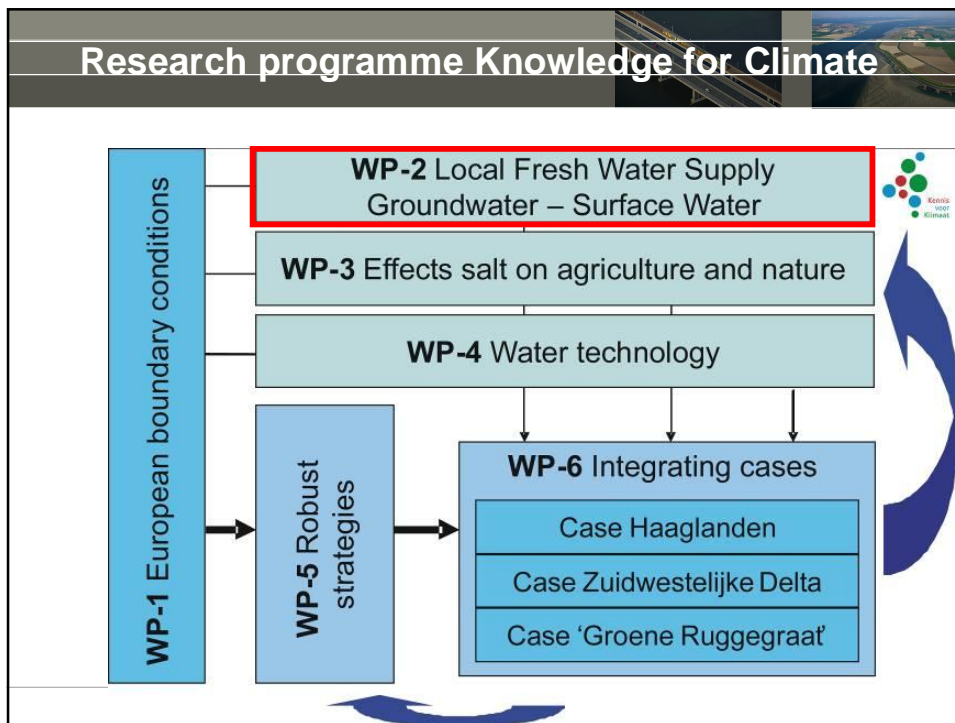
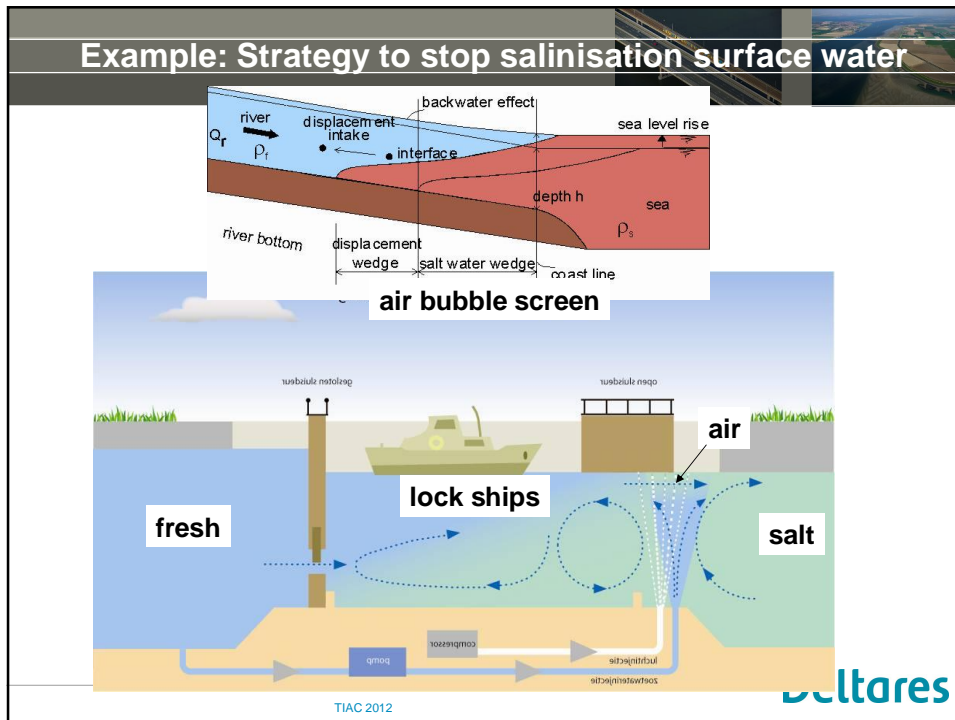
- To protect The Netherlands from flooding
- **To make Fresh Water Supply Climate Change Resilient**

Assessing the effects of:

- Changing water management (e.g. dike higher water level)
- Droughts
- Land subsidence
- Sea level rise (e.g. precipitation pattern)
- Coming (e.g. emissions and pesticide leaching, etc.)
- Adaptive strategies

Tools: Delta Model and Netherlands Hydrological modeling Instrument

**To implement Delta Program (2015-2050):
~1.4 billion euro per year**



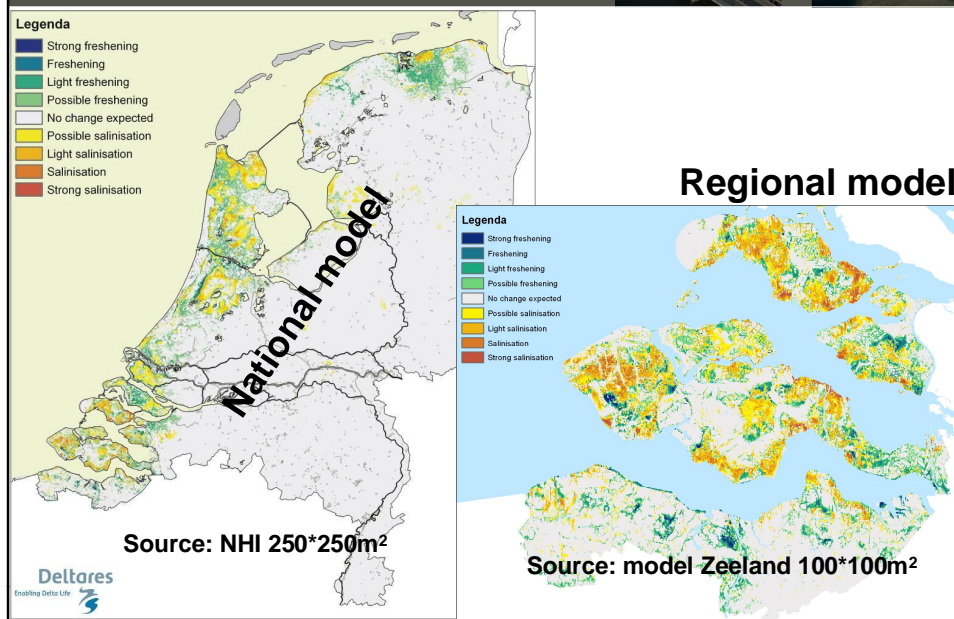
Steps towards a robust fresh water supply

1. better understand the present water system
2. assess impact of future climate and anthropogenic stresses to groundwater
3. communicate and cooperate with (local) stakeholders, like farmers, water boards and provinces
4. come up with and implement feasible, robust and flexible strategies for future water management
 - start with showcases
 - upscale to larger regions

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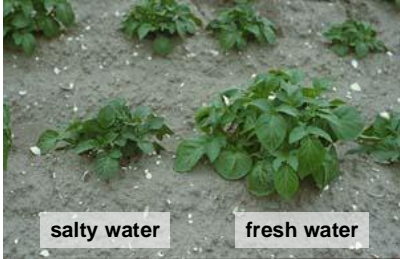
Salinisation and freshening of groundwater system




Local model: fresh water supply under stress







salty water




fresh water



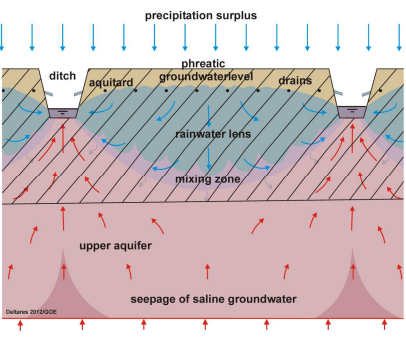
Schouwen-Duiveland

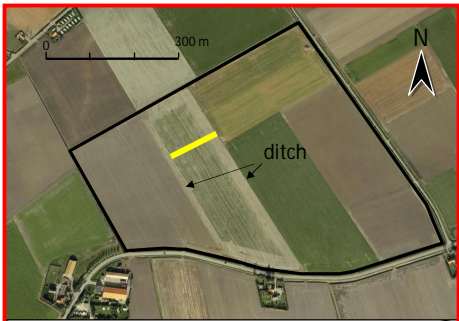
**Local model:
3D
salt-fresh
10*10m2 cells**




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Local model: fresh water supply under stress








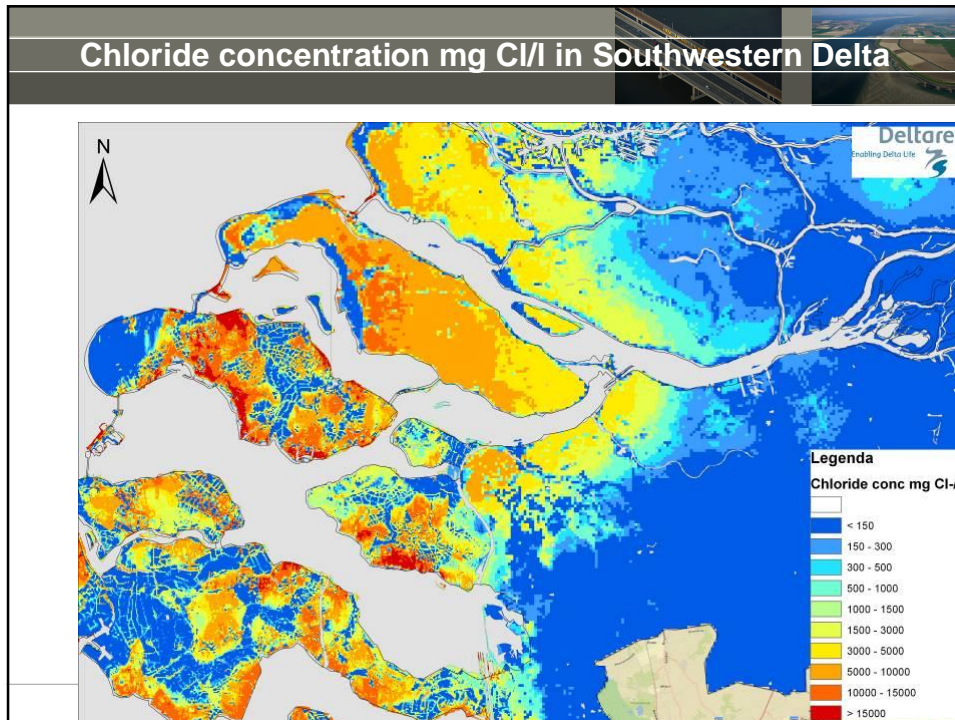
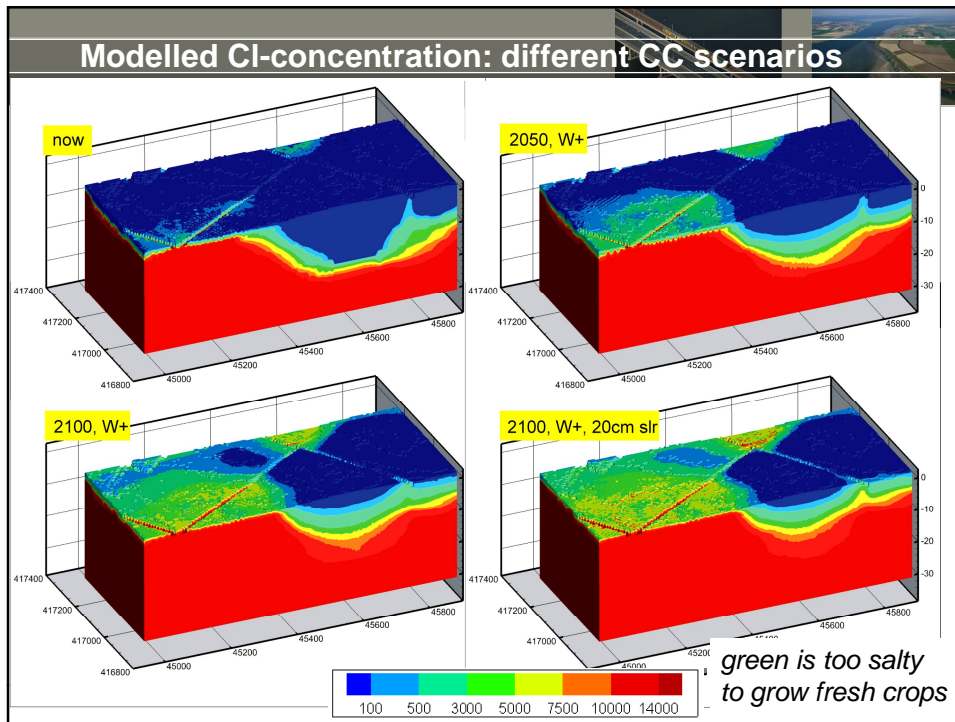
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**Local model:
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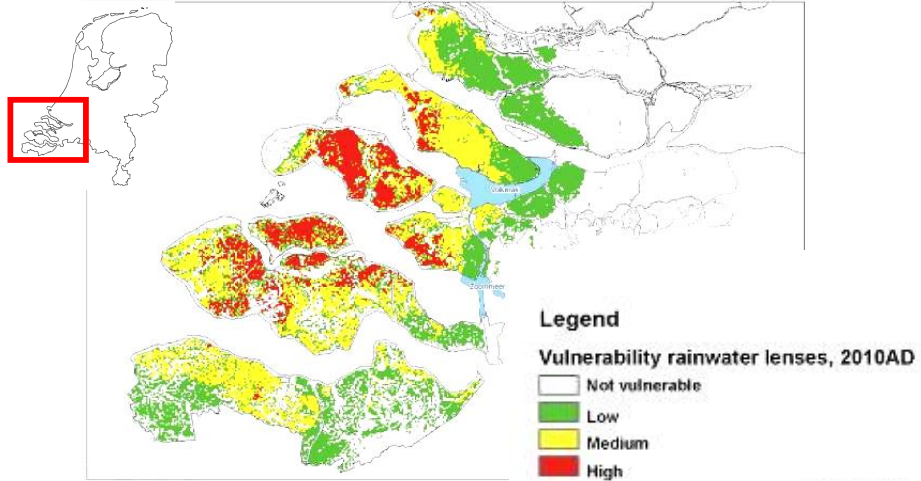


De Louw et al., *Hydrol. Earth Syst. Sci. Discuss.*, 8, 7657-7707, 2011.

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Large areas with vulnerable rainwater lenses



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Sense of Urgency farmers: agriculture and climate change



Mr. Van den Hoek:
 "Spring starts earlier: sowing earlier means increased production!"

"Land subsidence is a threat: my house is sinking and the roots of the crops are losing space"



Mr. Rentmeester:
 "Climate change is uncertain, hence not relevant for the management of my farm."

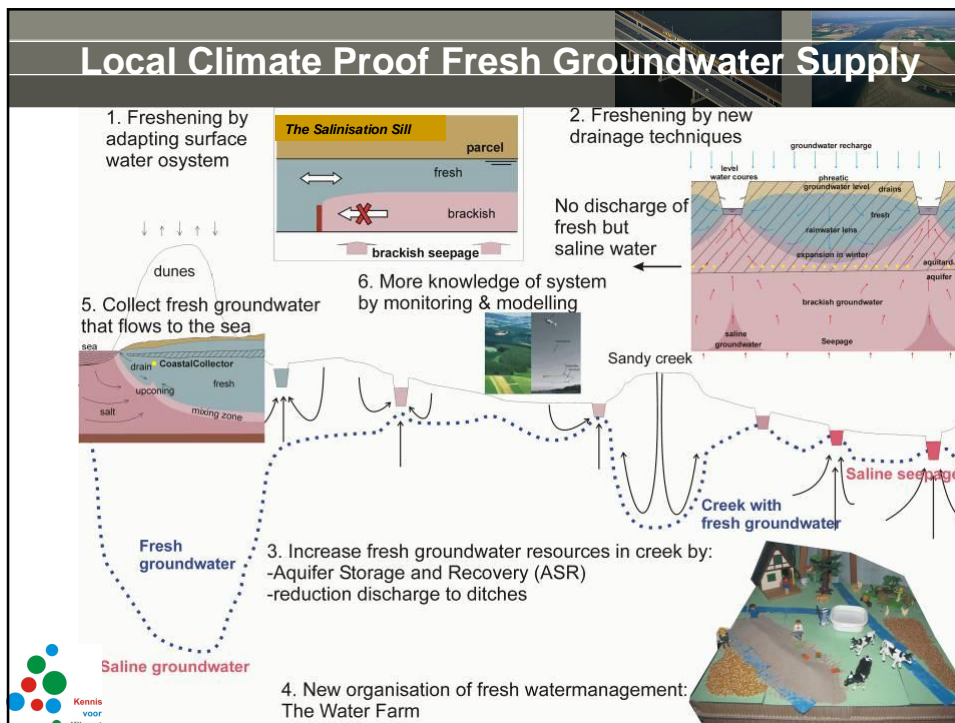
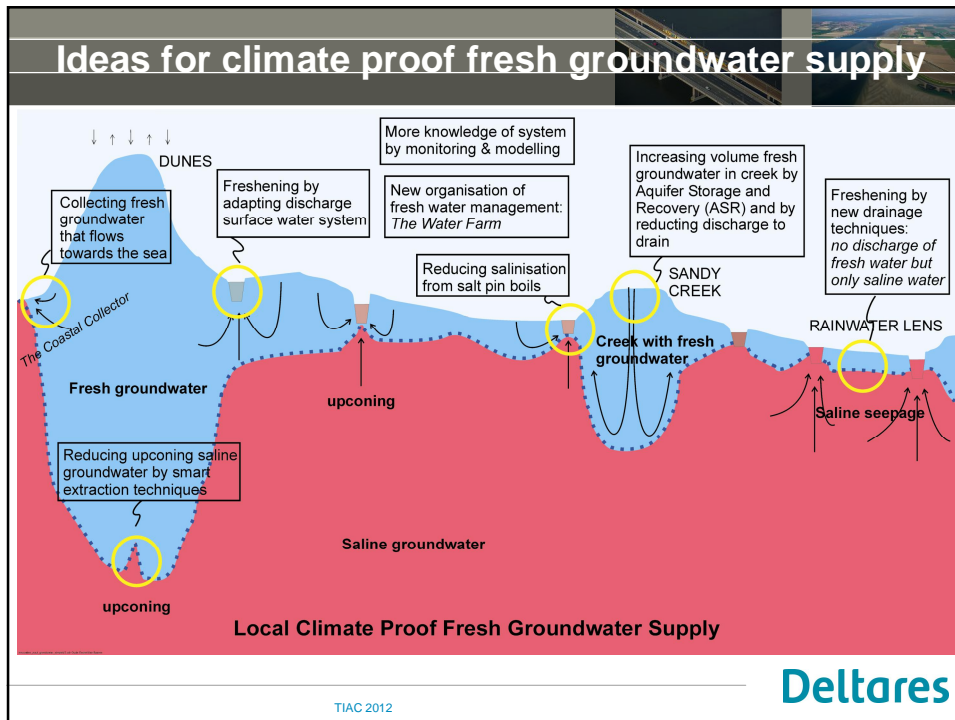
Mr. Van der Velde:
 "In recent years more noticeable extremes: wetter, colder and drier."

"We have little experience with measures against drought."



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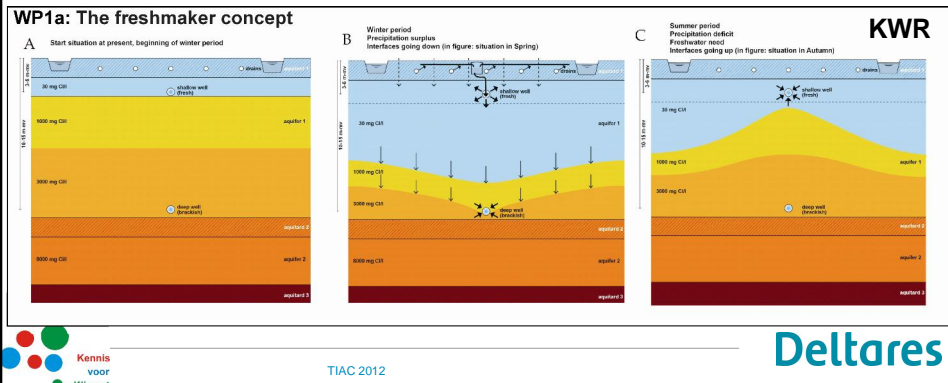


Knowledge for Climate project: 2012-2013

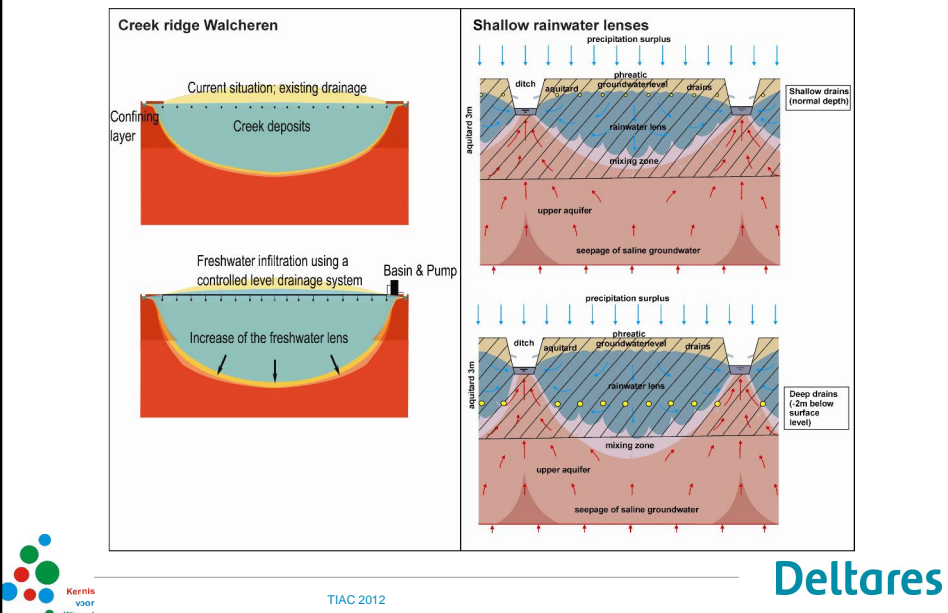
Towards implementation of promising measures for local freshwater supply and salinity control in the Southwestern Delta, The Netherlands

- Storing water in creek ridges through infiltration and recovery (KWR, Deltares)
- Optimizing freshwater volumes in shallow rainwaterlenses (Deltares, Acacia Alterra)

'Local solutions with regional impacts'



Local Climate Proof Fresh Groundwater Supply



Conclusions

- Fresh Water Supply in the Netherlands under stress
- Important national issue
- Universities, knowledge institute, government and companies work together to come to solutions
- Groundwater solutions can be an adaptation water management strategy with national impact