



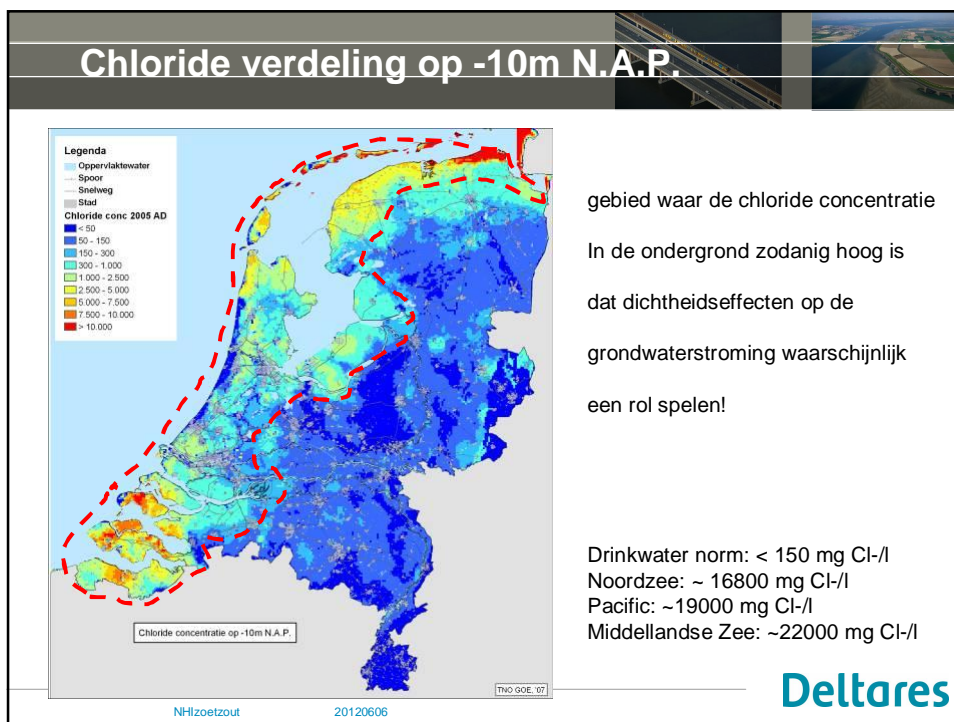

NHI zoetzout

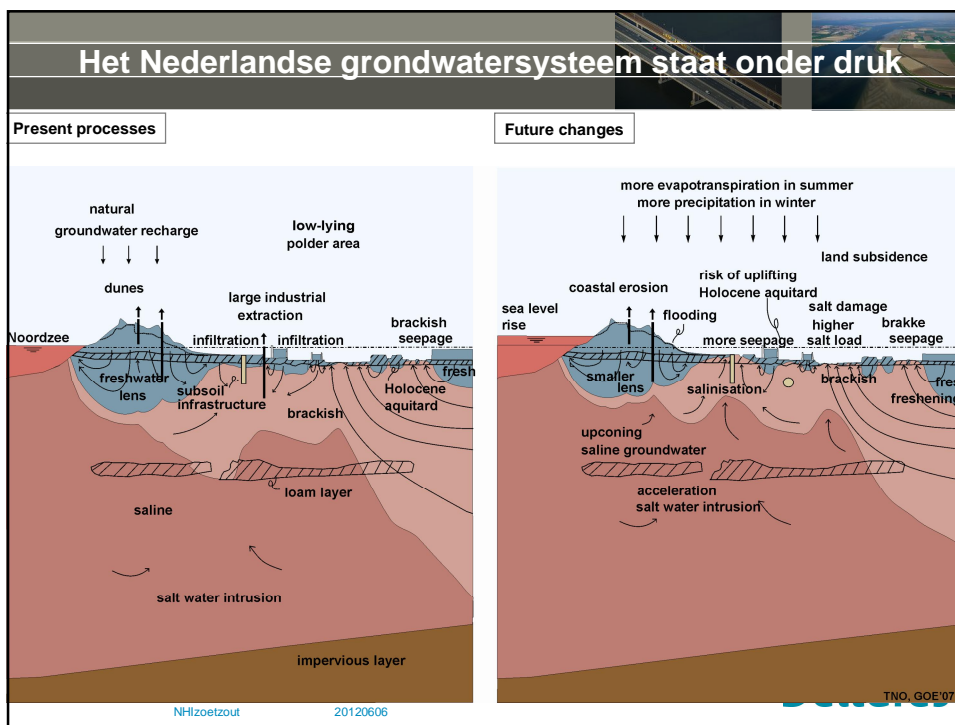
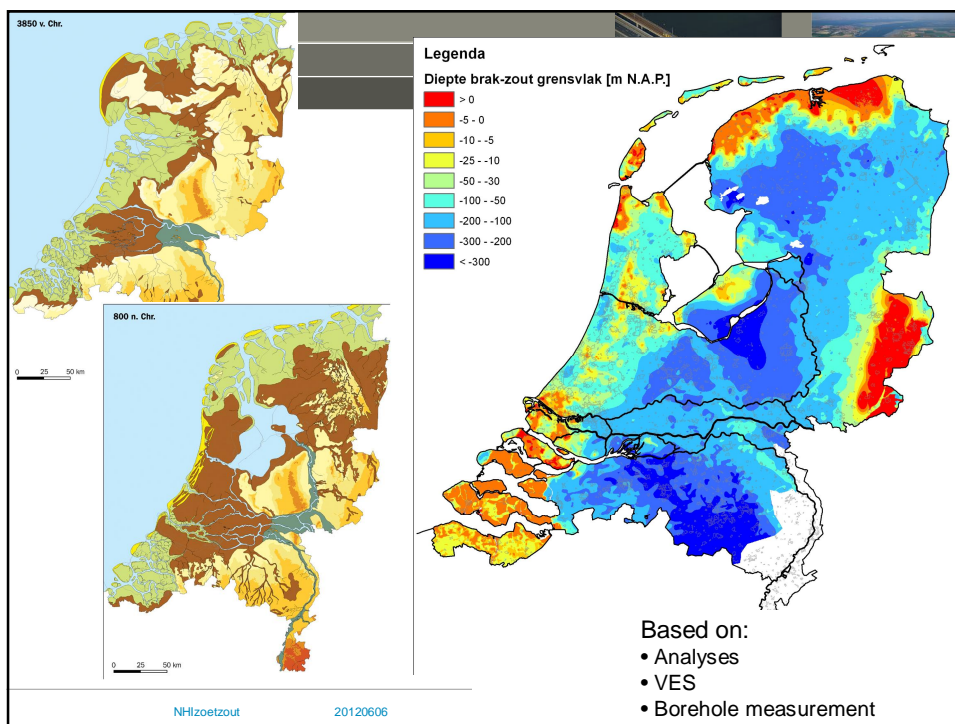




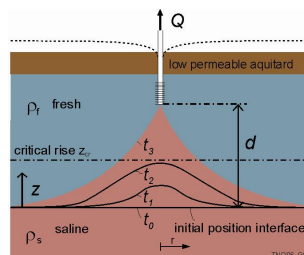
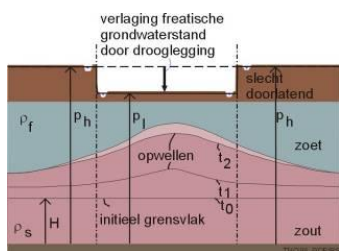
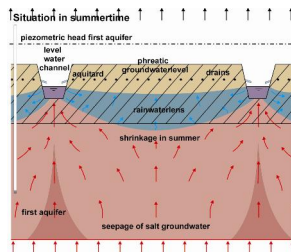
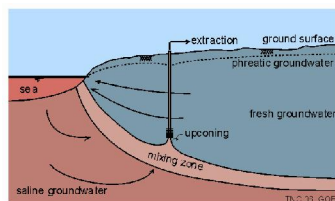

Gualbert Oude Essink
zoetzout.deltares.nl

1. Inleiding
2. Activiteiten tot nu toe
3. Plan van aanpak 2013-





Lokale zoet-zout processen hebben invloed op de landelijke zoet-zout modellering

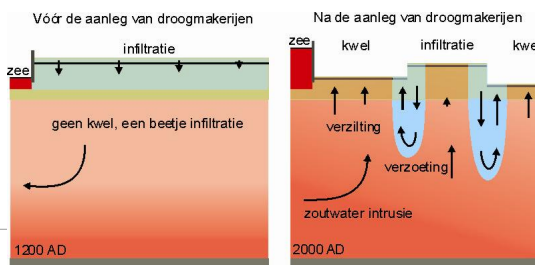
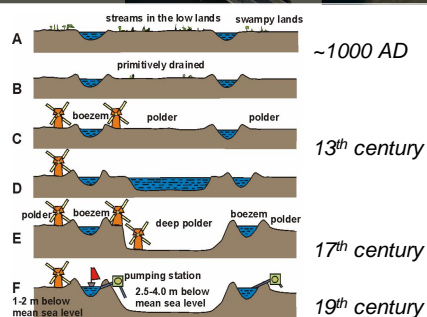
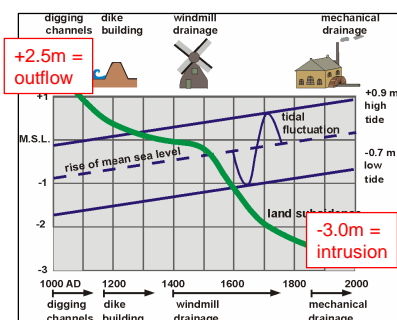


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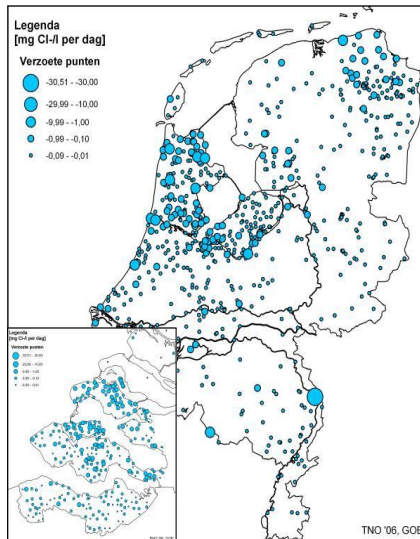
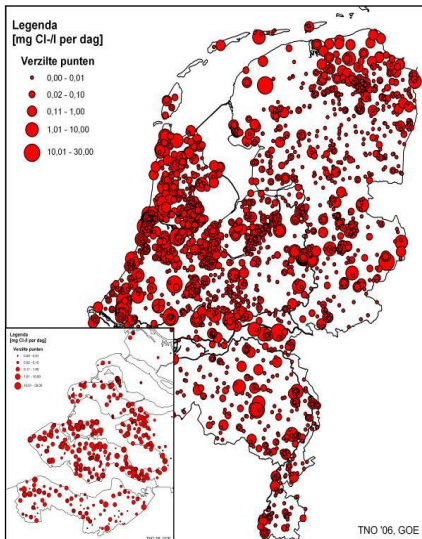
From fresh water outflow to salt water inflow

Historical subsidence of the ground surface in Holland



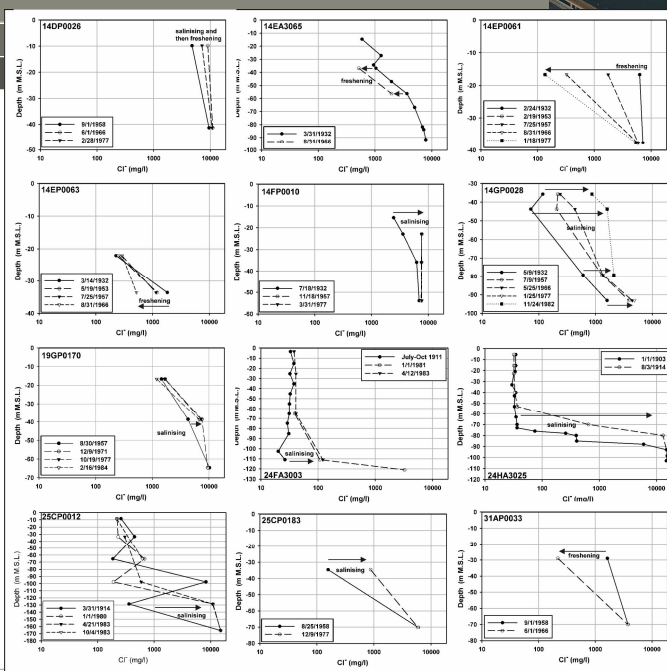
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Verzilting en verzoeting!



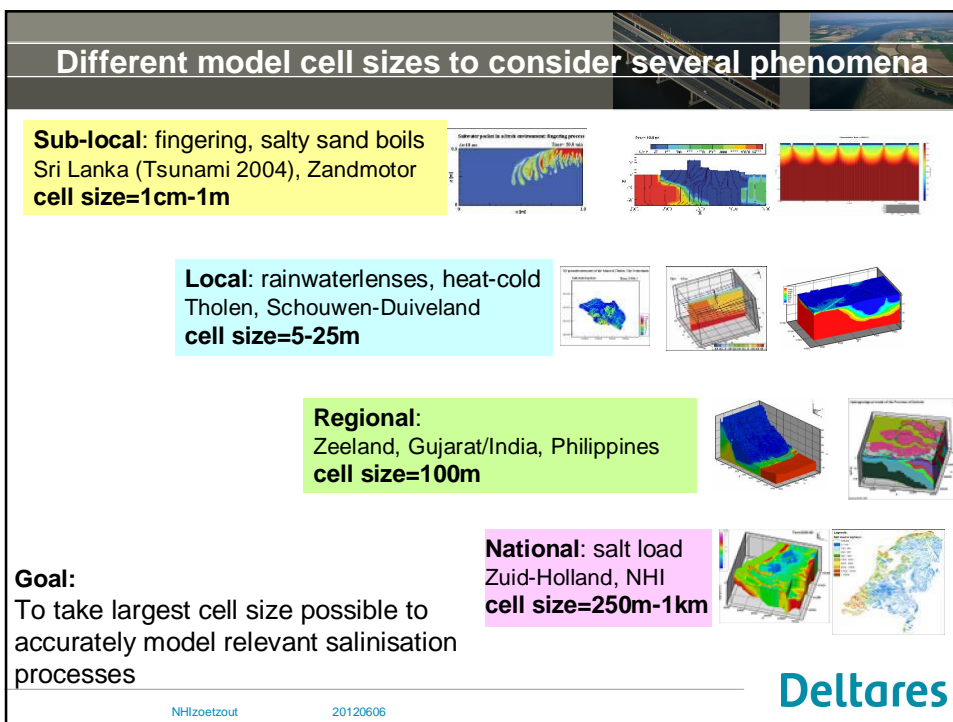
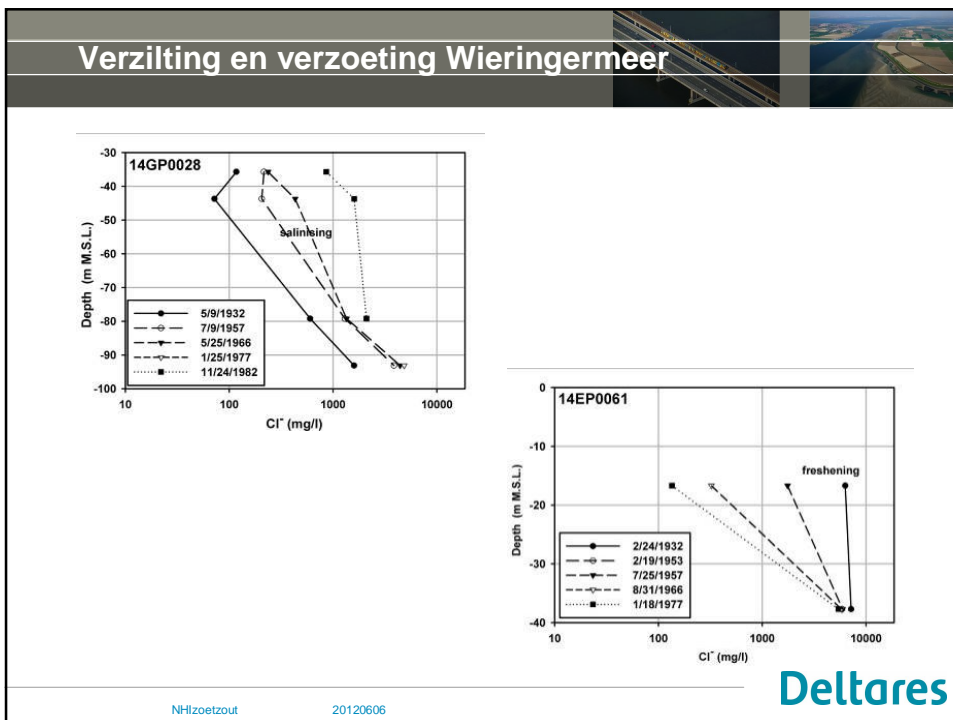
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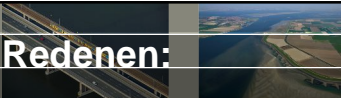


Activiteiten tot nu toe

1. 2009: Modelopzet NHI zoet-zout
 - geologie: versie 2.0
 - code MOCDENS3D (~SEAWAT)
2. 2009: eerste schatting initiële zoetzout verdeling
3. 2010: doorekenen KNMI06 klimaatscenarios
4. 2011: implementatie zoute wellen
5. 2012: start implementatie regionale modellen
6. 2012: verschil met en zonder zoet-zout

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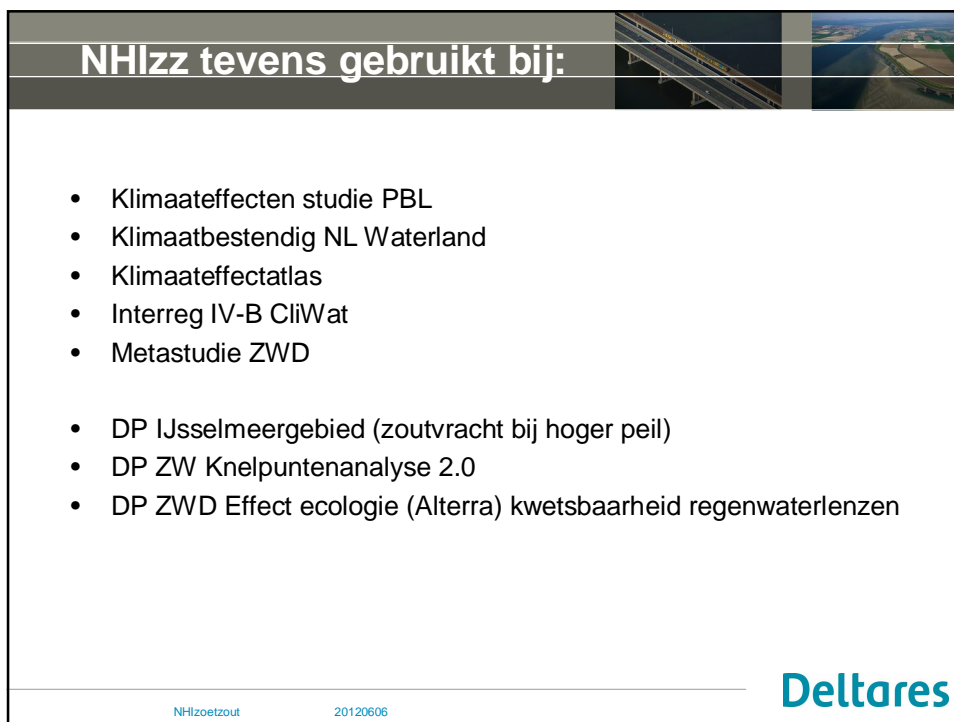
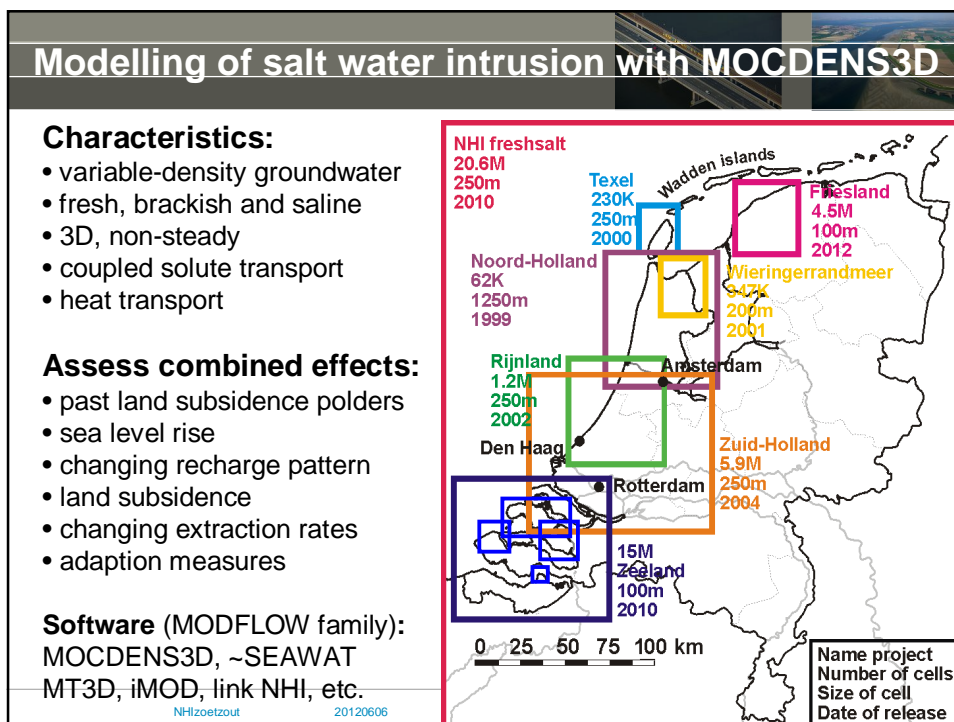
2009: Waarom MOCDENS3D? Redenen:

- Proven technology for large-scale domains
- Alternatives such as SEAWAT or SWI were not proven technology!
- Can cope with large-scale domains and long simulation times (100yrs) within reasonable computation times
- Can consider:
 - instable salt-fresh inversion
 - hydrodynamic dispersion (for long-term simulations)
 - salt loads to surface water system
- Fully consistent with modelling approach NHI-kwaliteit
- 13 years of experience in modelling salt water intrusion with MOCDENS3D
- Published 3D cases in numerous peer-reviewed journals, e.g.
 - Netherlands Journal of Geosciences, 2012
 - Hydrogeology, 2006, 2007
 - Hydrol. Earth Syst. Sci. Discuss, 2011, 2012
 - Water Resour. Res. 2010
 - J. of Hydrol. 2007
 - Transport in Porous Media, 2001

check a.o. publications on zoetzout.deltares.nl

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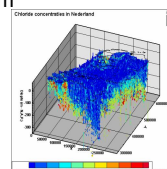
NHI zoet-zout

Using the national subsoil parametrisation

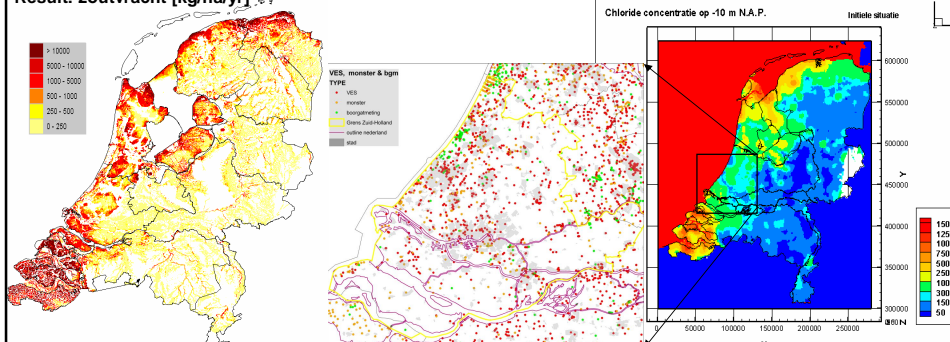
- 6 layers based on REGIS and NHI
- 31 model layers with varying thicknesses: 2*5m; 10*2m; 8*5m en 11*20m
- cellsize 250x250m

Using the national 3D salt concentration in groundwater

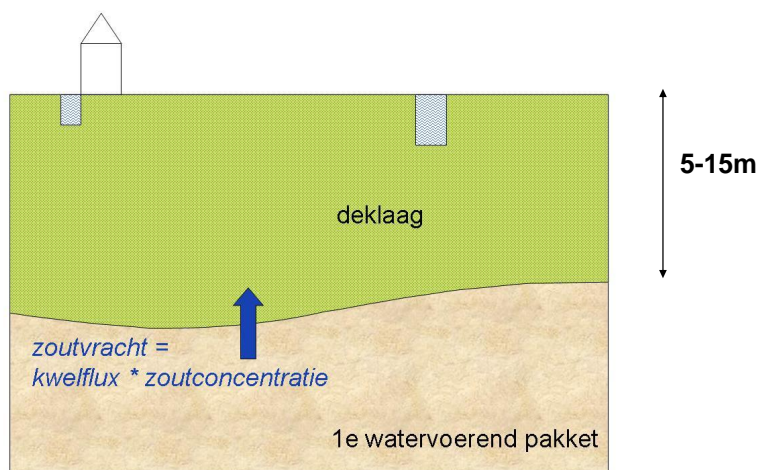
Fresh-saline REGIS: ~65000 measuring points (analyses, VES, Borehole)

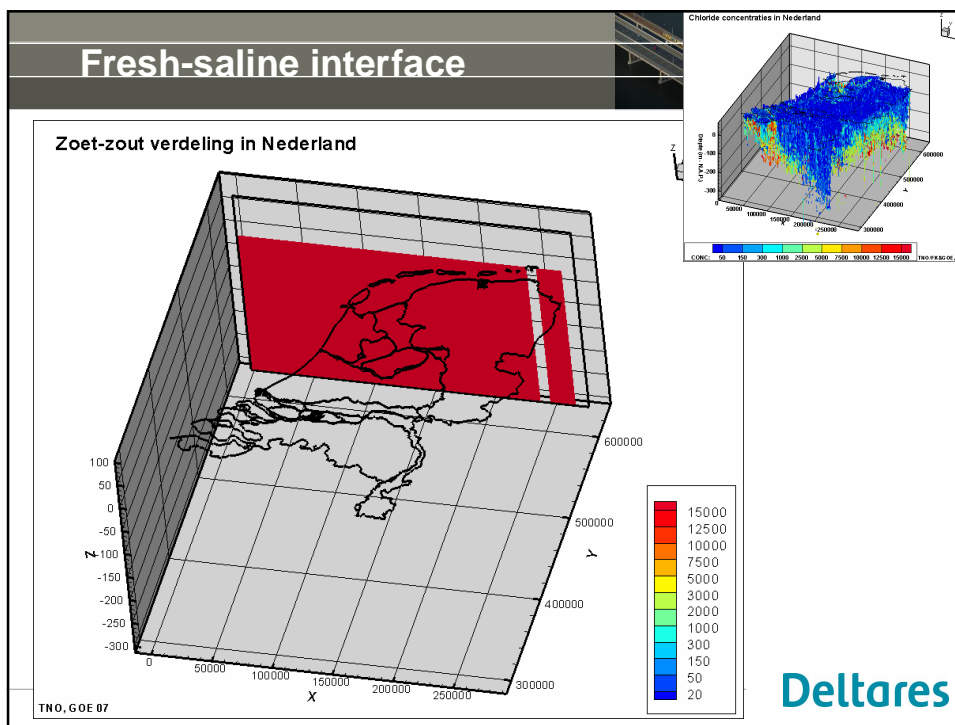
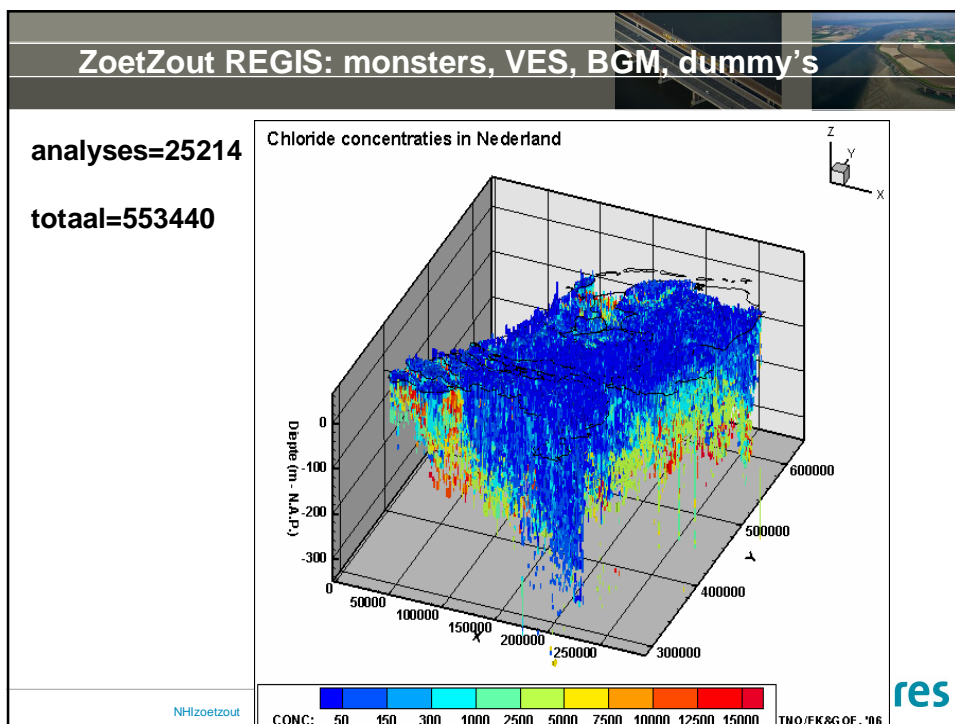


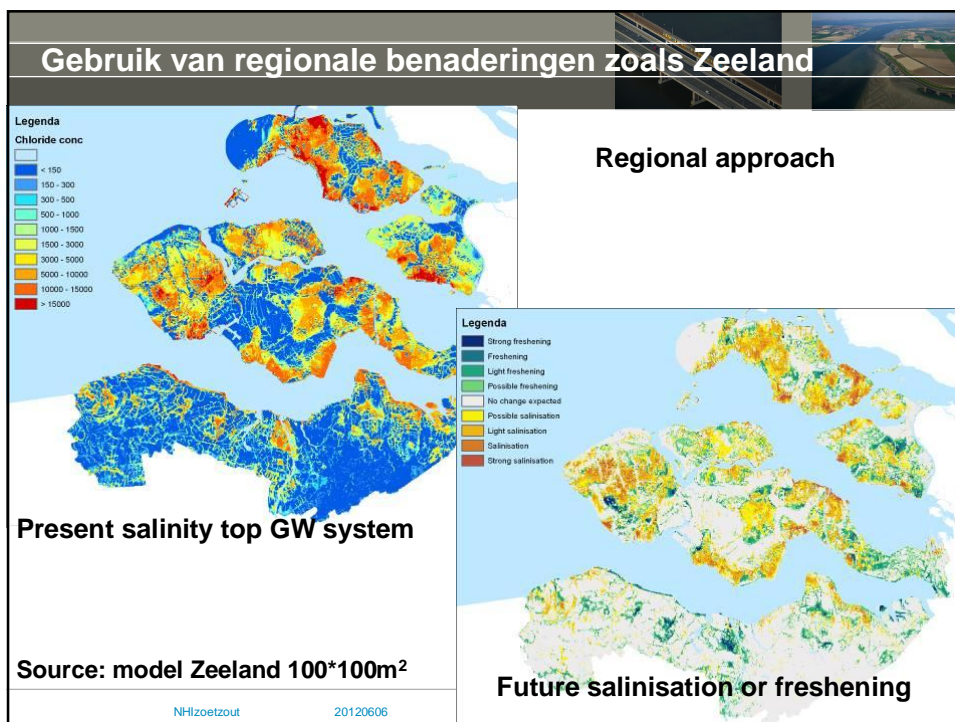
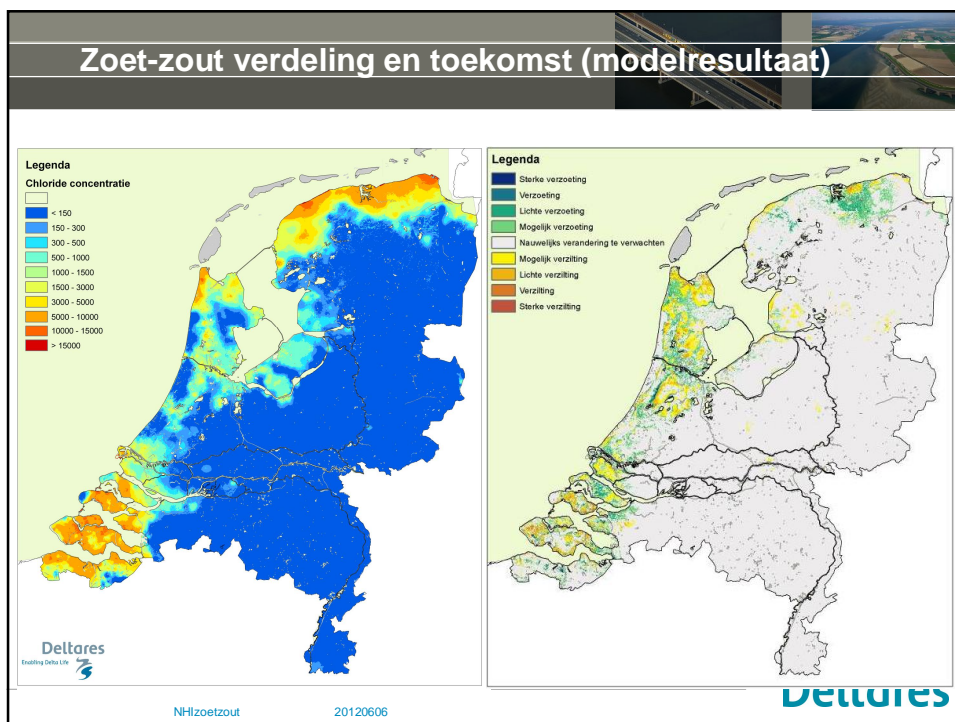
Result: zoutvracht [kg/ha/yr]

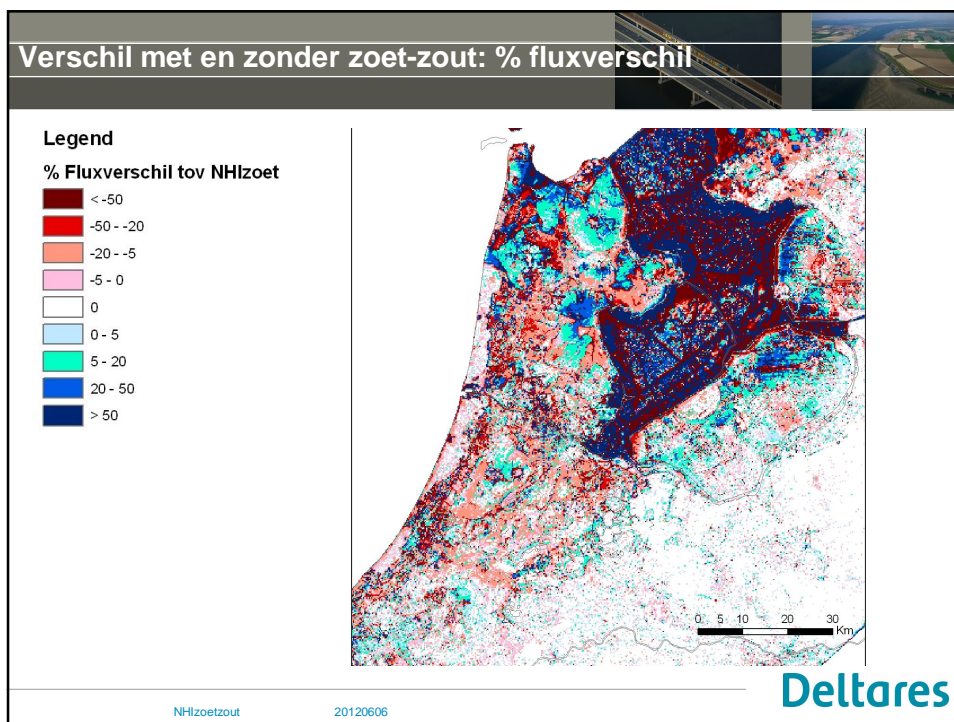
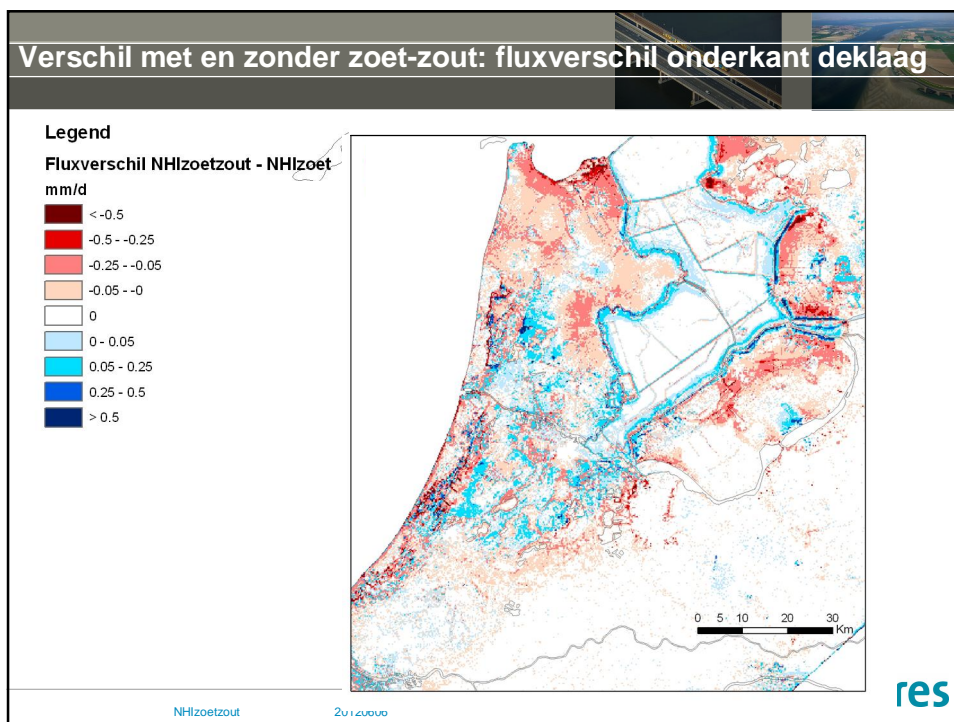


Huidige bepaling zoutvracht naar OW











We hebben ook kaarten voor alleen kwel en alleen infiltratie...





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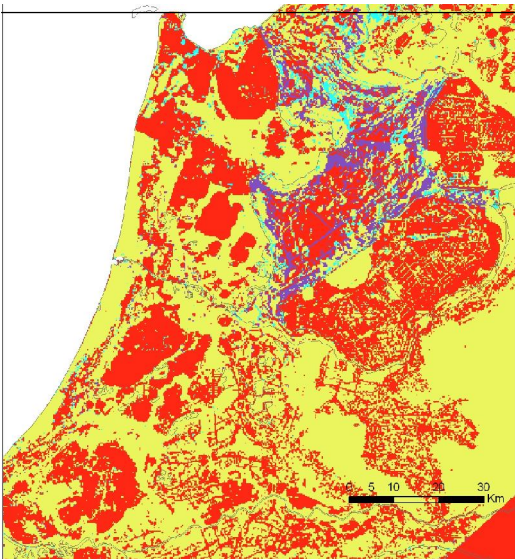
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Verschil met en zonder zoet-zout: verspringen kwel<->infiltratie

Legend

Hinge zones

-  -2 NHlzz kwel en NHlzoet infi
-  -1 NHlzz en NHlzoet infiltratie
-  0 NHlzz en NHlzoet kwel
-  1 NHlzz infiltratie en NHlzoet



NHlzoetzout 20120606

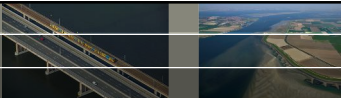
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Plan van Aanpak


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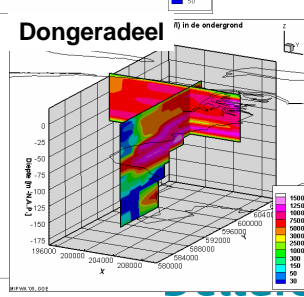
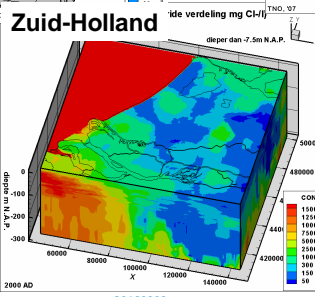
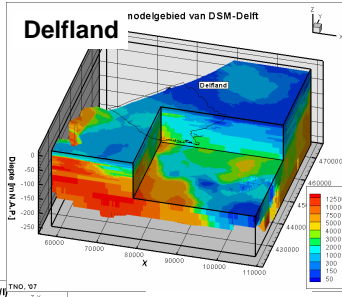
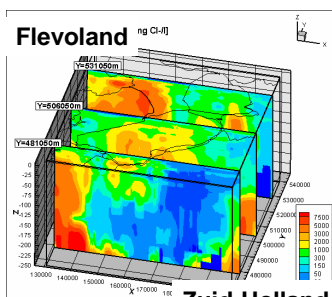
Plan van Aanpak

- NHI zoetzout integreren in NHI versie 3.1
- Verbeteren initiele zoet-zout verdeling
 - Check huidige verdeling
 - Gebruikmaken van regionale kennis zoet-zout
 - Implementatie deelmodellen ZL, PZH, FL, FR
- SEAWAT v4:
 - NHI versie 3.0/3.1
 - MOCDENS3D schematisatie a la SEAWAT
 - Parallisatie code a la NHI kwaliteit
- Samenwerking met NHI Kwaliteit



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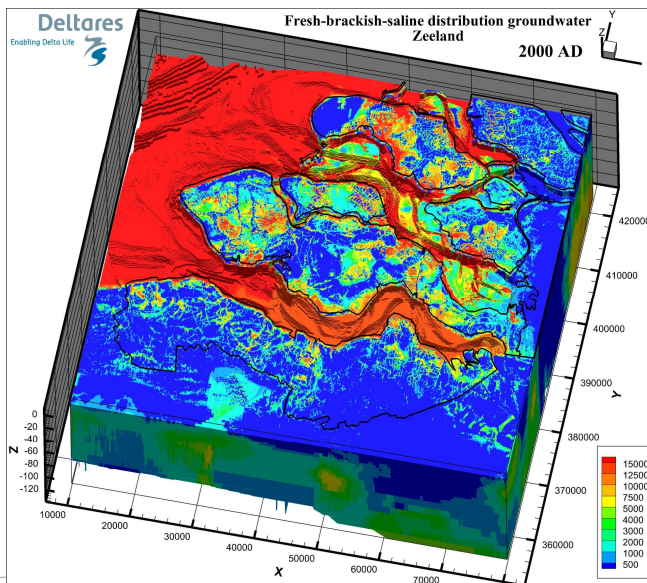
Enkele regionale studies



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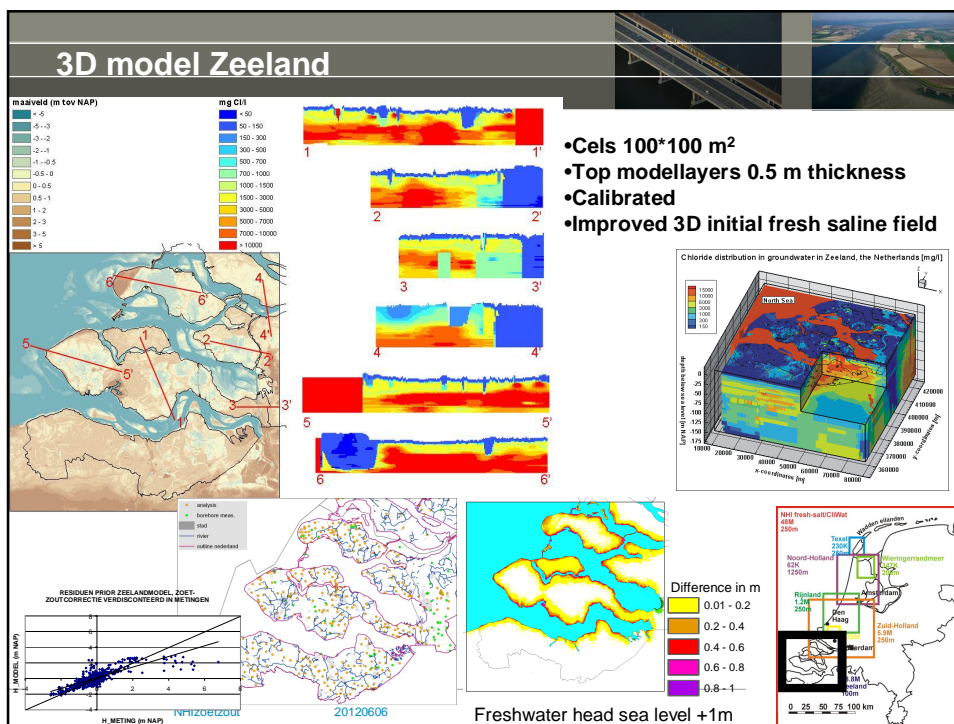


Fresh-brackish-saline distribution groundwater Zeeland 2000 AD



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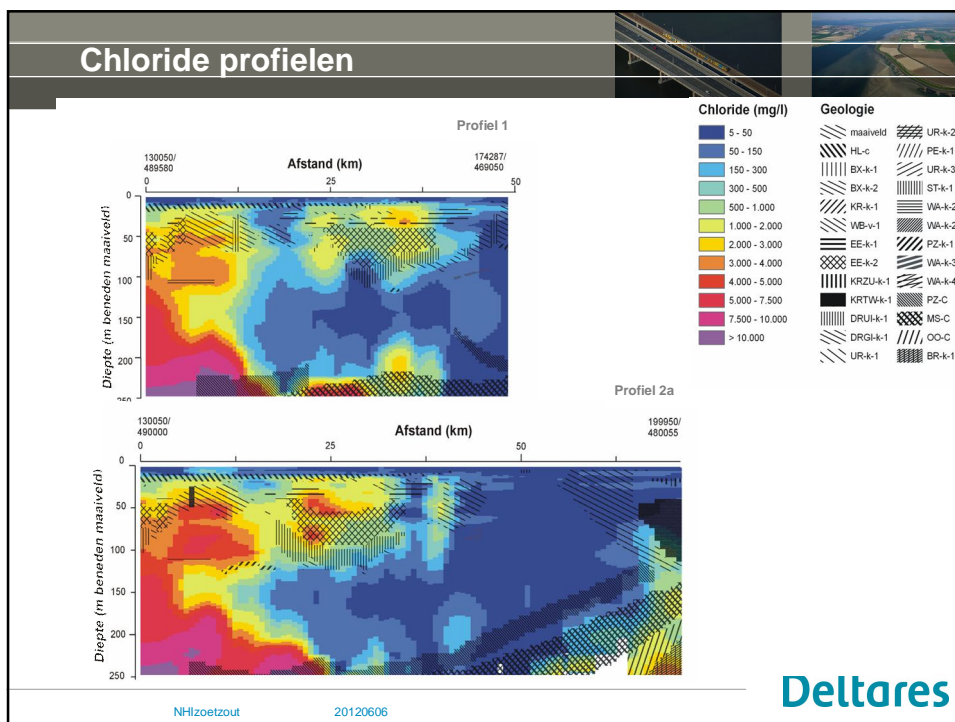
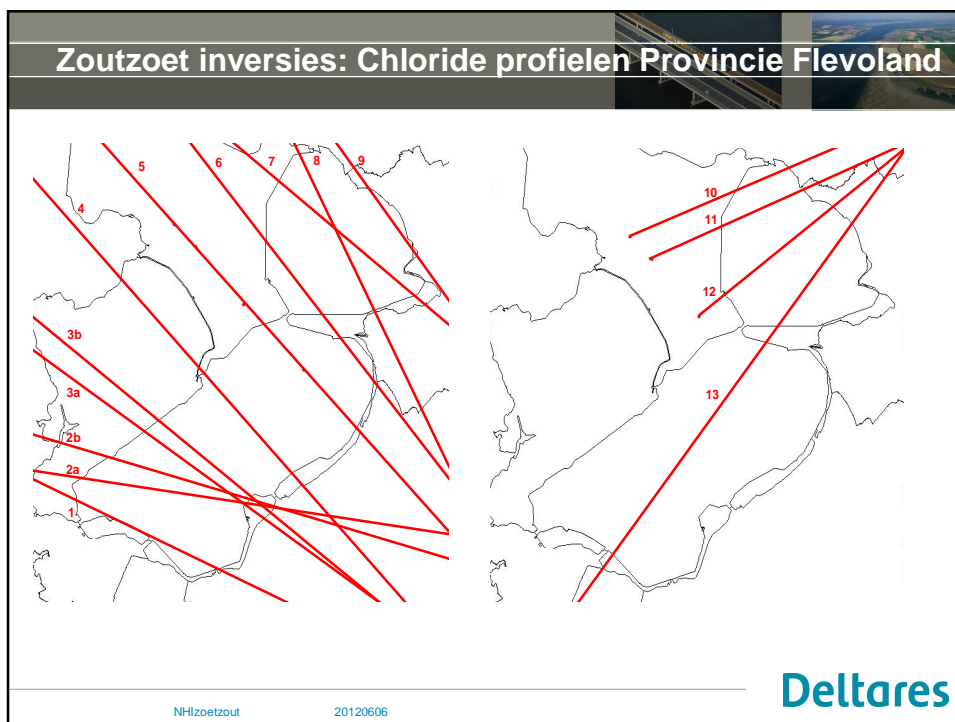





- Cels $100 \times 100 \text{ m}^2$
- Top modellayers 0.5 m thickness
- Calibrated
- Improved 3D initial fresh saline field

SEAWATV4

- geïntegreerd in MODFLOW USGS lijn
- past in lijn NHI-kwaliteit (SEAWAT is MT3DMS plus dichtheid)
- parallellisatie in de toekomst
- advectie en hydrodynamische dispersie
- inclusief zoet-zout inversies



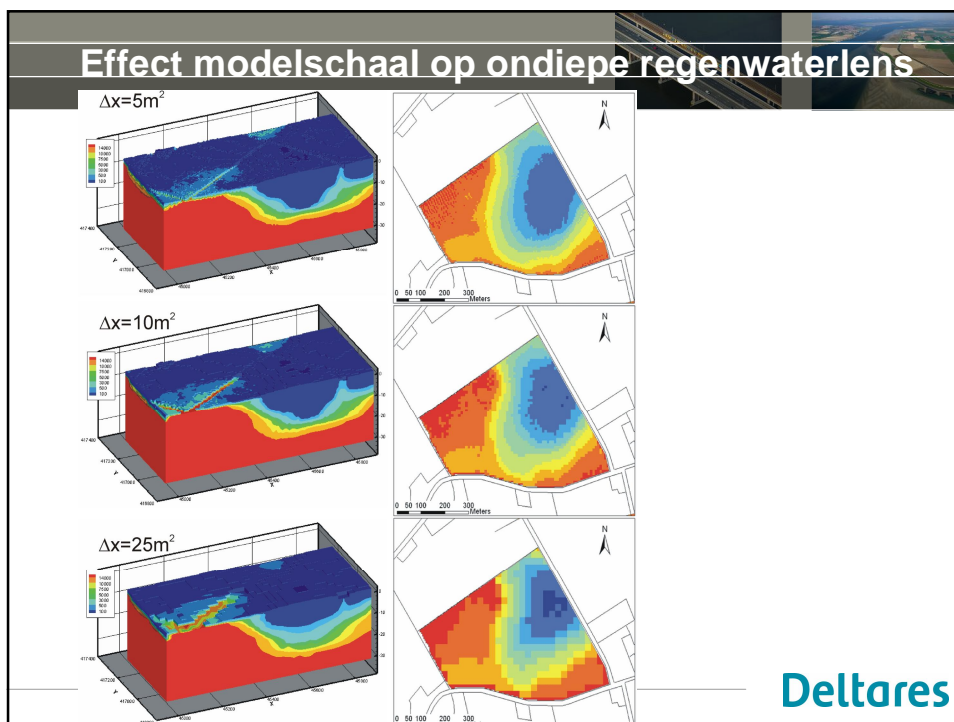


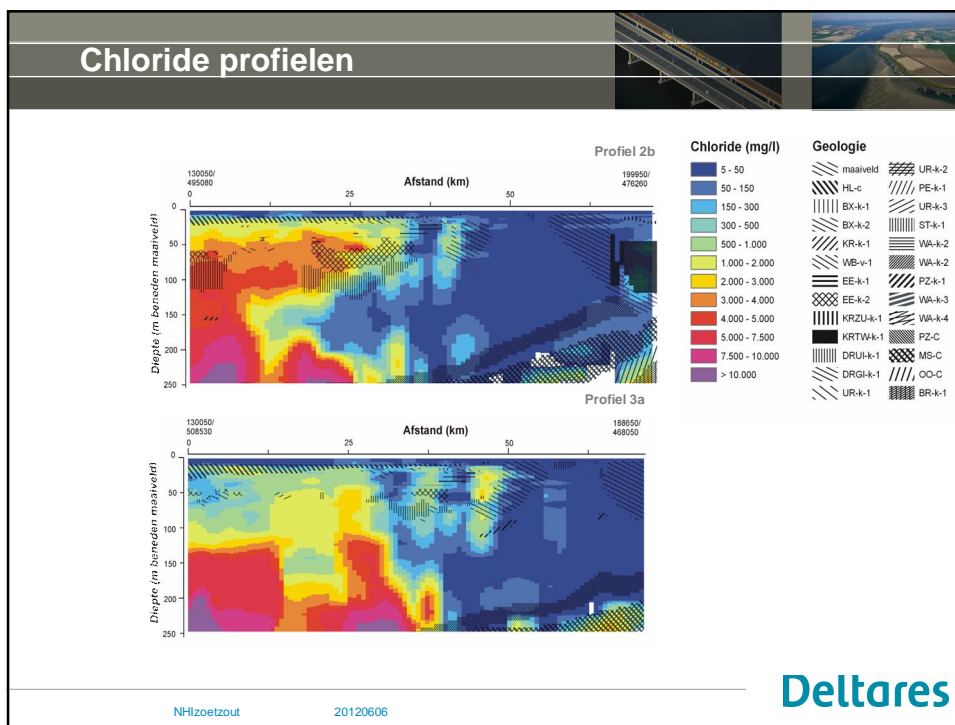
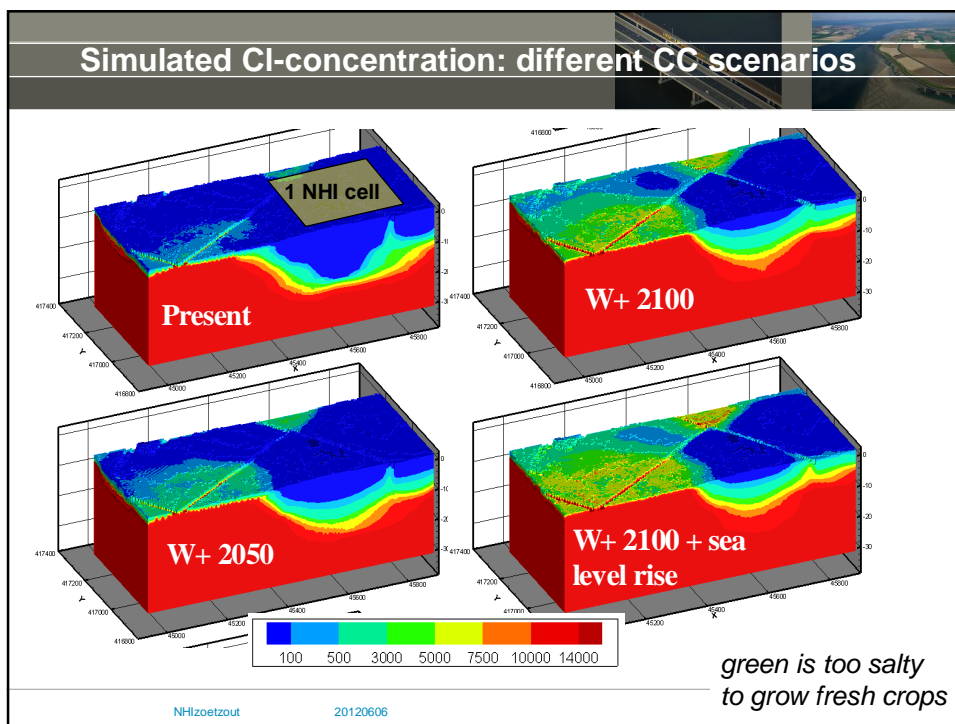
Thank you for your attention!

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