Home

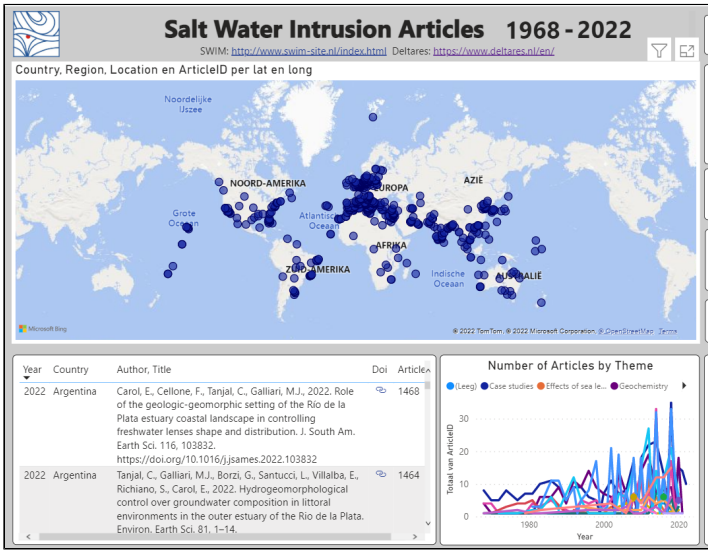
Over zoet-zout grondwater in het kustgebied

http://zoetzout.deltares.nl/

NIEUW

Infographic grondwater verzilting delta's:

Grondwater verzilting database (in het Engels), gebruikmakend van power



Inleiding

Nieuws:

- Project Vietnam: Fresh water availability in the Mekong
- FRESHEM Zeeland (3D kartering zoet-brak-zout grondwater verdeling provincie Zeeland): alle Helikopter Elektromagnetic (HEM) metingen
- Bijna alle Salt Water Intrusion Meeting proceedings van de afgelopen 45 jaar zijn beschikbaar op swim-site.org
- leaflet fresh-saline groundwater Deltares online available

Overzicht

Project en Publicaties

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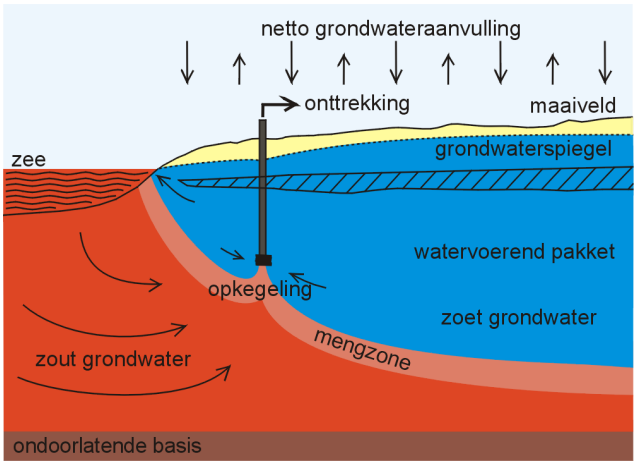
Englishwiki-site

freshsalt.deltares.nl

Inleiding

Wereldwijd is het grondwater in het kustgebied op veel plaatsen brak tot zout. Dit grondwater is waarschijnlijk zeewater dat honderden tot duizenden jaren geleden in de ondergrond is achtergebleven toen de zee zich na transgressies telkens terugtrok. Door ontwatering via drainage van de bodem en waterpeilverlagingen stroomt brak tot zoute grondwater langzaam naar de oppervlakte, leidend tot verzilting.



Verzilting

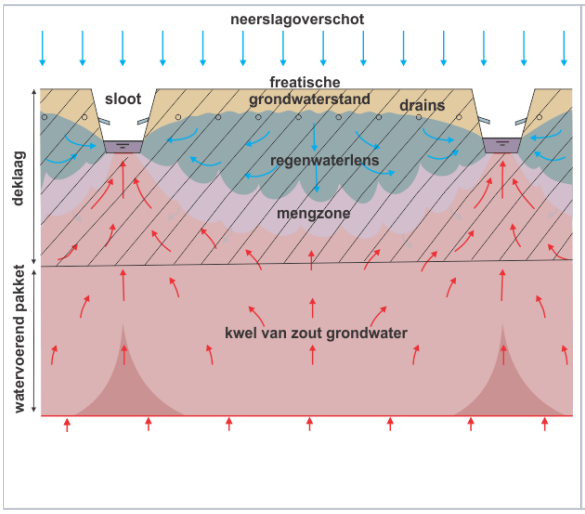
Dit verziltingsproces wordt versneld door zeespiegelstijging, veranderingen in het klimaat (waaronder drogere zomers), de verdergaande bodemdaling en menselijke invloeden als grondwateronttrekkingen. Het zouter worden van het ondiepe grondwater noemen we verzilting, en kan zorgen voor problemen voor de landbouw, de natuur en het waterbeheer. Het zoute grondwater stroomt naar het oppervlaktewater, dat met aangevoerd zoet water moet worden 'zoet gespoeld'. De meeste landbouwgewassen kunnen niet tegen zout water, waardoor er schade optreedt als het zoute grondwater tot in de wortelzone reikt. Wanneer er geen maatregelen worden genomen, zullen deze problemen in de toekomst op verschillende locaties in het kustgebied toenemen.

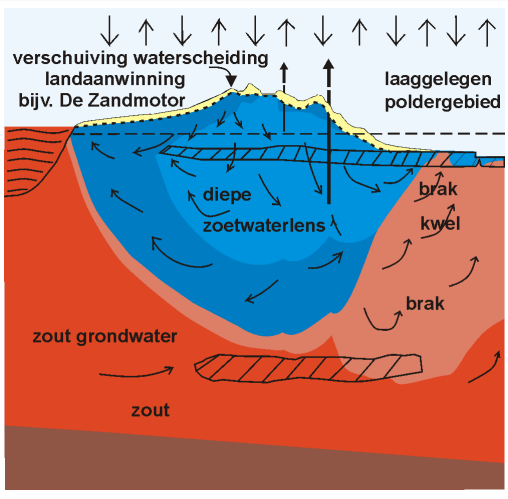
Regionale en lokale processen

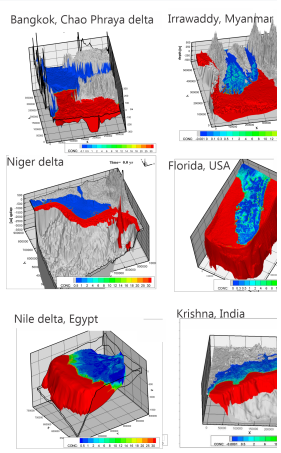
Onderzoek dat bij Deltares wordt uitgevoerd richt zich op zowel de regionale als lokale schaal en is zowel toegepast als meer fundamenteel. Op regionale schaal speelt de langjarige verandering in zoutconcentraties in het grondwatersysteem als gevolg van veranderingen in het klimaat, zeespiegelstijging of voorgenomen herinrichtingsmaatregelen. Belangrijke vraag is ook hoe deze verandering de zoutconcentraties in het oppervlaktewater beïnvloedt. Op lokale schaal kijken we onder andere naar de dynamiek van dunne regenwaterlenzen, die drijven op zout grondwater. Deze regenwaterlenzen maken landbouw mogelijk in gebieden met veel zout in de ondergrond. Onderzoek van Deltares laat zien dat klimaatverandering en zeespiegelstijging het voortbestaan van deze regenwaterlenzen kan bedreigen. Een ander belangrijk onderwerp zijn zoute wellen, kortsluitingen tussen het diepe grondwater en het oppervlaktewater, die in grote mate bijdragen aan de verzilting in laaggelegen gebieden zoals de Nederlandse polders.

Een brede benadering van verziltingsproblematiek

Deltares heeft een mooie combinatie voorhanden om de processen die spelen bij zoet-zout grondwater beter in de vingers te krijgen. Innovatieve monitoringstools en -technieken (Airborne EM, T-EC prikstok, EM-Slimflex, online continue meettechnieken) koppelen we aan onze ruime modelleerervaring met codes als MOCDENS3D en SEAWAT om dichtheidsafhankelijke grondwaterstroming en stoftransport te simuleren. Tegenmaatregelen ter compensatie van de verzilting worden daarbij doorgerekend. Daarnaast zoeken we samen met stakeholders, zoals bedrijfsleven, agrariërs en regionale/lokale overheid naar oplossingen om de zoetwatervoorziening in kustgebieden te garanderen. In een aantal aansprekende projecten brengen we onze expertise over het thema tesamen, van o.a. Interreg IV-B CliWat, de Kennis voor Klimaat projecten Climate Proof Fresh Water Supply en GO-FRESH tot Het Kustlaboratorium en de Waterhouderij. We maken daarbij gebruik van uitgebreide geo-databestanden (van TNO) voor de geologie (REGIS, Geotop), hydrogeologie (DINO) en kwaliteitsmetingen (REGIS zoet-zout).







Productblad

Zoet-zout grondwater in het kustgebied (Engelstalig)

Meer Informatie

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T 088335 7139
gualbert dot oudeessink at deltares dot nl

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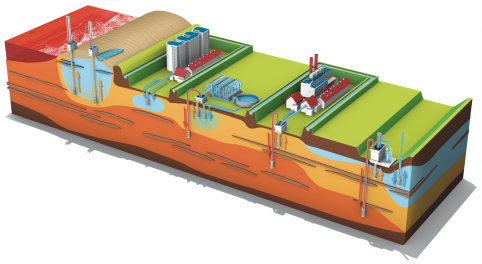
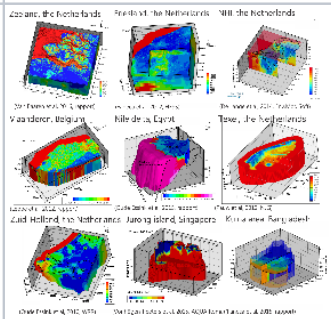
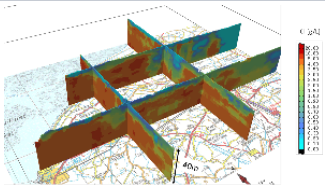


Modelstudies

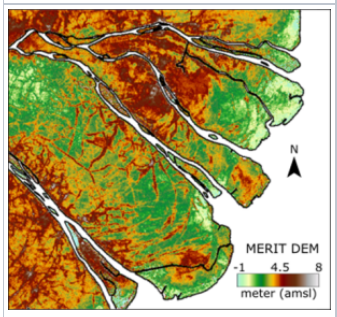
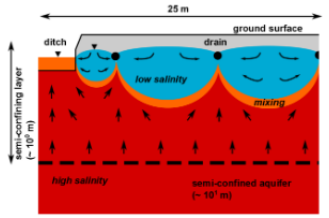
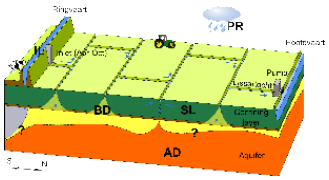
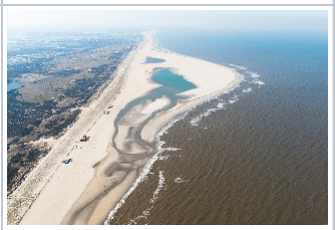
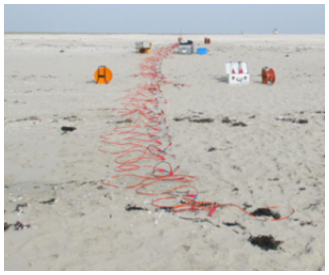
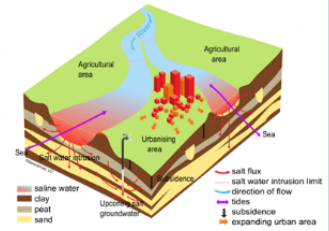
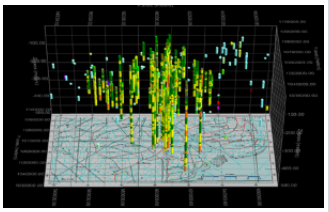


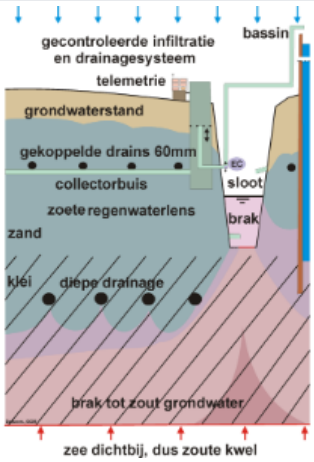
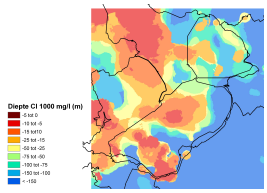
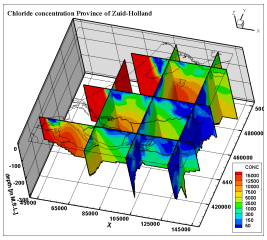
FRESHEM

3D zoet-zout kartering



GO-FRESH

FAME Freshwater availability Mekong Delta	Climate Proof Fresh Water Supply	NatureCoast De Zandmotor	Rise & Fall (UDW) Mekong, Vietnam	Fre Res
	 	 	 	

Promoties Joost Delsman Pieter Pauw Perry de Louw	Slimmer doorspoelen	Zoetwatervoorziening	Regionale Studies
 			 

Publicaties

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PhD theses

1. King, J., 2022. Airborne electromagnetic mapping of coastal groundwater salinity; Quantifying uncertainty and investigating methodological improvements, Utrecht University, Utrecht, 188 pp.
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2. Zamrsky, D., 2021. Current and future state of groundwater in coastal unconsolidated sediment systems worldwide, Utrecht University, Utrecht, 238 pp.
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3. Mabrouk, M.B., 2020. Climate Change and Development Impacts on Groundwater Resources in the Nile Delta Aquifer, Egypt. IHE Delft, 150 pp.

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4. Van Engelen, J., 2020. Fresh groundwater reserves in major deltas: Evolution and current state of deltaic groundwater resources, Utrecht University, Utrecht, 194 pp.
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5. Aydin, B.E., 2020. Model Predictive Control of Water Level and Salinity in Coastal Areas. Delft University of Technology, 103 pp.

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6. Huizer, S. 2019. Fresh groundwater in large beach nourishments; Growth of freshwater resources in coastal areas, Utrecht University, Utrecht, 152 pp.
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7. Delsman, J.R. 2015, Saline groundwater - surface water interaction in coastal lowlands, VU University Amsterdam, Amsterdam, 194 pp.
   download PhD thesis
8. Pauw, P.S. 2015. Field and Model Investigations of Freshwater Lenses in Coastal Aquifers, PhD thesis, Wageningen University, Wageningen, 168 pp.
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9. De Louw, P.G.B. 2013. Saline seepage in deltaic areas. Preferential groundwater discharge through boils and interactions between thin rainwater lenses and upward saline seepage. PhD thesis, Vrije Universiteit Amsterdam, ISBN/EAN 9789461085429.
   download PhD thesis

Artikelen (peer-reviewed)

- Van Engelen, J., Oude Essink, G.H.P., Bierkens, M.F.P., 2022. Sustainability of fresh groundwater resources in fifteen major deltas around the world. Environ. Res. Lett. 113650. https://doi.org/10.1088/1748-9326/aca16c download
- Karaoulis, M., Ritsema, I., Bremmer, C., De Kleine, M., Oude Essink, G.H.P., Ahlrichs, E., 2022. Drone-Borne Electromagnetic (DR-EM) Surveying in The Netherlands: Lab and Field Validation Results. Water (Switzerland) 5335, 1–20. https://doi.org/https://doi.org/10.3390/rs14215335
- Aydin, B.E., Oude Essink, G.H.P., Delsman, J.R., Van de Giesen, N., Abraham, E., 2022. Nonlinear model predictive control of salinity and water level in polder networks: Case study of Lissertocht catchment. Agric. Water Manag. 264, 11. https://doi.org/10.1016/j.agwat.2022.107502 downloac
- Zamrsky, D., Oude Essink, G.H.P., Sutanudjaja, E.H., Van Beek, L.P.H., Bierkens, M.F.P., 2022. Offshore fresh groundwater in coastal unconsolidated sediment systems as a potential fresh water source in the 21st century. Environ. Res. Lett. 17. https://doi.org/10.1088/1748-9326/ac4073 download
- King, J., Mulder, T., Oude Essink, G.H.P., Bierkens, M.F.P., 2022. Joint estimation of groundwater salinity and hydrogeological parameters using variable-density groundwater flow, salt transport modelling and airborne electromagnetic surveys. Adv. Water Resour. 160, 104118. https://doi.org/10.1016/j.advwatres.2021.104118 download
- Thorslund, J., Bierkens, M.F.P., Oude Essink, G.H.P., Sutanudjaja, E.H., Van Vliet, M.T.H., 2021. Common irrigation drivers of freshwater salinisation in river basins worldwide. Nat. Commun. https://doi.org/10.1038/s41467-021-24281-8. download
- Gunnink, J., Pham, H. Van, Oude Essink, G.H.P., Bierkens, M.F.P., 2021. The 3D groundwater salinity distribution and fresh groundwater volumes in the Mekong Delta, Vietnam, inferred from geostatistical analyses. Earth Syst. Sci. Data 13, 3297–3319. https://doi.org/10.5194/essd-13-3297-2021. download
- Verkaik, J., Van Engelen, J., Huizer, S., Bierkens, M.F.P., Lin, H.X., Oude Essink, G.H.P., 2021. Distributed memory parallel computing of three-dimensional variable-density groundwater flow and salt transport. Adv. Water Resour. 154, 103976. https://doi.org/10.1016/j.advwatres.2021.103976. download
- Verkaik, J., Hughes, J.D., Van Walsum, P.E.V., Oude Essink, G.H.P., Lin, H.X., Bierkens, M.F.P., 2021. Distributed memory parallel groundwater modeling for the Netherlands Hydrological Instrument. Environ. Model. Softw. 143, 105092. https://doi.org/10.1016/j.envsoft.2021.105092 downloac
- Willet, J., Wetser, K., Dykstra, J.E., Bianchi, A.B., Oude Essink, G.H.P., Rijnaarts, H.H.M., 2021. WaterROUTE: a model for cost optimization of industrial water supply networks when using water resources with varying salinity. Water Res. 117390. https://doi.org/10.1016/j.watres.2021.117390 download
- Van Engelen, J., Bierkens, M.F.P., Delsman, J.R., Oude Essink, G.H.P., 2021. Factors determining the natural fresh-salt groundwater distribution in deltas. Water Resour. Res. https://doi.org/10.1029/2020WR027290 download
- Karamouz, M., Mahmoodzadeh, D., Oude Essink, G.H.P., 2020. A risk-based groundwater modeling framework in coastal aquifers: a case study on Long Island , New York , USA. Hydrogeology Journal. https://doi.org/https://doi.org/10.1007/s10040-020-02197-9
- Willet, J., King, J., Wetser, K., Dykstra, J.E., Oude Essink, G.H.P., Rijnaarts, H.H.M., 2020. Water supply network model for sustainable industrial resource use a case study of Zeeuws-Vlaanderen in the Netherlands. Water Resour. Ind. 24, 100131. https://doi.org/10.1016/j.wri.2020.100131
- King, J., Oude Essink, G.H.P., Karaolis, M., Bierkens, M.F.P., 2020. A practical quantification of error sources in regional-scale airborne groundwater salinity mapping. Environ. Res. Lett. 1–18. https://iopscience.iop.org/article/10.1088/1748-9326/ab7b23, download
- Zamrsky, D., Karssenberg, M.E., Cohen, K.M., Bierkens, M.F.P., Oude Essink, G.H.P., 2020. Geological heterogeneity of coastal unconsolidated groundwater systems worldwide and its influence on offshore fresh groundwater occurrence. Front. Earth Sci. 7, 1–23. https://doi.org/10.3389/feart.2019.00339
- Haasnoot, M., Kwadijk, J.C.J., Van Alphen, J., Le Bars, D., Van den Hurk, B., Diermanse, F., Der Van Spek, A., Oude Essink, G.H.P., Delsman, J. R., Mens, M. 2019. Adaptation to uncertain sea-level rise; how uncertainty in Antarctic mass-loss impacts the coastal adaptation strategy of the Netherlands. Environ. Res. Lett. https://iopscience.iop.org/article/10.1088/1748-9326/ab666c. direct download
- Van Engelen, J., Verkaik, J., King, J., Nofal, E. R., Bierkens, M. F. P., Oude Essink, G. H. P. 2019: A three-dimensional palaeohydrogeological reconstruction of the groundwater salinity distribution in the Nile Delta Aquifer, Hydrol. Earth Syst. Sci., 23, 5175–5198, https://doi.org/10.5194/hess-23-5175-2019.
- Mabrouk, M., Jonoski, A., Oude Essink, G.H.P., Uhlenbrook, S., 2019. Assessing the fresh-saline groundwater distribution in the Nile Delta Aquifer using a 3D variable-density groundwater flow model. Water (Switzerland) 1–22., 11, 1946 doi:10.3390/w11091946 *download*
- Huizer, S., Luijendijk, A.P., Bierkens, M.F.P., Oude Essink, G.H.P., 2019. Global potential for the growth of fresh groundwater resources with large beach nourishments. Sci. Rep. 1–14. https://doi.org/10.1038/s41598-019-48382-z *download*
- Bakx, W., Doornenbal, P.J., Weesep, R.J., Bense, V.F., Oude Essink, G.H.P., Bierkens, M.F.P. 2019. Determining the Relation between Groundwater Flow Velocities and Measured Temperature Differences Using Active Heating-Distributed Temperature Sensing. *Water, 11*, 1619. https://doi.org/10.3390/w11081619 *download*
- Aydin, B.E., Hagedooren, H., Rutten, M., Delsman, J., Oude Essink, G.H.P., Abraham, E., 2019. A Greedy Heuristic for Optimal Sensor Placement for Estimating Salinity in a Polder. Water (Switzerland) 11, 1–14. https://doi.org/10.3390/w11051101 *download*

- Hung Van Pham, Van Geer, F.C., Bui Tran, V., Dubelaar, W.,Oude Essink, G.H.P. 2019. Paleo-hydrogeological reconstruction of the fresh-saline groundwater distribution in the Vietnamese Mekong Delta since the late Pleistocene. Journal of Hydrology: Regional Studies, *23*(February), 100594. https://doi.org/10.1016/j.ejrh.2019.100594. *download*
- Aydin, B.E., Tian, X., Delsman, J., Oude Essink, G.H.P., Rutten, M., Abraham, E., 2019. Optimal Salinity and Water Level Control of Polder Ditches using Model Predictive Control. Environ. Model. Softw. doi:10.1016/j.envsoft.2018.11.010 *download*
- Mabrouk, M., Jonoski, A., Oude Essink, G.H.P., Uhlenbrook, S., 2018. Impacts of Sea Level Rise and Groundwater Extraction Scenarios on Fresh Groundwater Resources in the Nile Delta Governorates, Egypt. Water 10, 1690. doi:10.3390/w10111690 *download*
- King, J., Oude Essink, G.H.P., Karaolis, M., Siemon, B., Bierkens, M.F.P., 2018. Quantifying inversion algorithms using airborne frequency domain electromagnetic data – applied at the Province of Zeeland, the Netherlands. Water Resour. Res. 2060, 1–22. doi:10.1029/2018WR023165 *download*
- Zamrsky, D., Oude Essink, G.H.P., Bierkens, M.F.P.: 2018. Estimating the thickness of unconsolidated coastal aquifers along the global coastline, Earth Syst. Sci. Data, 10, 1591-1603, https://doi.org/10.5194/essd-10-1591-2018 *download*
- Delsman, J., Van Baaren, E.S., Siemon, B., Dabekaussen, W., Karaoulis, M.C., Pauw, P., Vermaas, T., Bootsma, H., De Louw, P.G.B., Gunnink, J.L., Dubelaar, W., Menkovic, A., Steuer, A., Meyer, U., Revil, A., Oude Essink, G.H.P., 2018. Large-scale, probabilistic salinity mapping using airborne electromagnetics for groundwater management in Zeeland, the Netherlands. Environ. Res. Lett. 13. doi:10.1088/1748-9326/aad19e *download*
- Post, V.E.A., Oude Essink, G.H.P., Szymkiewicz, A., Bakker, M., Houben, G., Custodio, E., Voss, C., 2018, Celebrating 50 years of SWIMs (Salt Water Intrusion Meetings). Hydrogeology, 26:1767–1770. https://doi-org.proxy.library.uu.nl/10.1007/s10040-018-1800-8 *download*
- Van Engelen, J., Oude Essink, G. H. P., Kooi, H., and Bierkens, M. F. P. 2018. On the origins of hypersaline groundwater in the Nile Delta aquifer. Journal of Hydrology, 560, 301-317. https://doi.org/10.1016/j.jhydrol.2018.03.029 *download*
- Huizer, S., Radermacher, M., de Vries, S., Oude Essink, G. H. P., and Bierkens, M. F. P. 2018. Impact of coastal forcing and groundwater recharge on the growth of a fresh groundwater lens in a mega-scale beach nourishment, Hydrol. Earth Syst. Sci., 22, 1065-1080, https://doi.org/10.5194/hess-22-1065-2018.
- Huizer, S., Karaoulis, M.C., Oude Essink, G.H.P., Bierkens, M.F.P., 2017, Monitoring and simulation of salinity changes in response to tide and storm surges in a sandy coastal aquifer system, Water Resources Research, doi: 10.1002/2016WR020339. *download*
- Revil, A., Coperey, A., Shao, Z., Florsch, N., Fabricius, I.L.L., Deng, Y., Delsman, J.R., Pauw, P.S., Karaoulis, M., De Louw, P.G.B., Van Baaren, E.S., Dabekaussen, W., Menkovic, A., Gunnink, J.L. 2017. Complex conductivity of soils. Water Resources Research, 53(8), 7121–7147. https://doi.org/10.1002/2017WR020655 *download*
- Delsman, J.R., De Louw, P.G.B., De Lange, W.J., Oude Essink, G.H.P., 2017, Fast calculation of groundwater exfiltration salinity in a lowland catchment using a lumped celerity / velocity approach, Environmental Modelling and Software, 96, 323–334, doi: 10.1016/j.envsoft.2017.07.004 *download*
- Eeman, S., De Louw, P.G.B., van der Zee, S.E.A.T.M., 2017. Cation exchange in a temporally fluctuating thin freshwater lens on top of saline groundwater. Hydrogeol. J. 25, 223–241. doi:10.1007/s10040-016-1475-y. *download*
- Huizer, S., Oude Essink, G.H.P., Bierkens, M.F.P., 2016, Fresh groundwater resources in a large sand replenishment, Hydrol. Earth Syst. Sci., 20, 3149-3166, doi:10.5194/hess-20-3149-2016. *download*
- Stofberg, S.F., Oude Essink, G.H.P., Pauw, P., De Louw, P.G.B., Leijnse, A., van der Zee, S.E.A.T.M., 2016, Fresh Water Lens Persistence and Root Zone Salinization Hazard Under Temperate Climate, Water Resources Management, doi: 10.1007/s11269-016-1315-9. *download*
- Delsman, J. R., Winters, P., Vandenbohede, A., Oude Essink, G. H.P. and Lebbe, L., 2016, Global sampling to assess the value of diverse observations in conditioning a real-world groundwater flow and transport model. Water Resour. Res. doi:10.1002/2014WR016476.*download*
- Pauw P.S., van der Zee S.E.A.T.M., Leijnse A., Oude Essink G.H.P., 2015, Saltwater Upconing Due to Cyclic Pumping by Horizontal Wells in Freshwater Lenses. *Ground Water, Vol 54 (4), 521-531*. doi: 10.1111/gwat.12382. *download*
- Pauw, P.S., Van Baaren, E.S., Visser, M. De Louw, P.G.B., Oude Essink, G.H.P., 2015, Increasing a freshwater lens below a creek ridge using a controlled artificial recharge and drainage system: a case study in the Netherlands, *Hydrogeology Journal*. doi: 10.1007/s10040-015-1264-z. *download*
- De Louw, P.G.B., Oude Essink, G.H.P., Eeman, S., Van Baaren, E.S., Vermue, E., Delsman, J.R., Pauw, P.S., Siemon, B., Gunnink, J.L., Post, V. E.A., 2015, Dunne regenwaterlenzen in zoute kwelgebieden, *Landschap*, 32, 5-15.*download*
- Zeghici, R.M., Oude Essink, G.H.P., Hartog, N., Sommer, W., 2015, Integrated assessment of variable density–viscosity groundwater flow for a high temperature mono-well aquifer thermal energy storage (HT-ATES) system in a geothermal reservoir. Geothermics, 55, 58–68. doi: 10.1016/j.geothermics.2014.12.006. *download*
- Pauw, P.S., van der Zee, S.E.A.T.M., Leijnse, A., Delsman, J.R., De Louw, P.G.B., de Lange, W.J., Oude Essink, G.H.P. 2015. Low-Resolution Modeling of Dense Drainage Networks in Confining Layers, *Ground water,* 1-11, doi: 10.1111/gwat.12273
- Delsman, J.R., Waterloo, M.J., Groen, M.M.A. Groen, J., Stuyfzand, P.J. 2014 Investigating summer flow paths in a Dutch agricultural field using high frequency direct measurements, *J. Hydrology*, doi: 10.1016/j.jhydrol.2014.10.058
- De Lange, W.J., Prinsen, G.F., Hoogewoud, J.C., Veldhuizen, A., Verkaik, J., Oude Essink, G.H.P., van Walsum, P.E.V., Delsman, J.R., Hunink, J.C., Massop, H.T.L., Kroon, T., 2014. An operational, multi-scale, multi-model system for consensus-based, integrated water management and policy analysis: The Netherlands Hydrological Instrument. *Environmental Modelling & Software* 59, 98–108, doi: 10.1016/j.envsoft.2014.05.009. *download*
- Pauw, P.S., Oude Essink, G.H.P., Leijnse, A., Vandenbohede, A., Groen, J., van der Zee, S.E.A.T.M. 2014. Regional scale impact of tidal forcing on groundwater flow in unconfined coastal aquifers, *J. Hydrology*, 517, 269–283, doi: 10.1016/j.jhydrol.2014.05.042 . download
- Delsman, J.R., Hu-a-ng, K.R.M., Vos, P.C., de Louw, P.G.B., Oude Essink, G.H.P., Stuyfzand, P.J., & Bierkens, M.F.P. 2014. Paleo-modeling of coastal saltwater intrusion during the Holocene: an application to the Netherlands. *Hydrology and Earth System Sciences*, *18*(10), 3891–3905, doi: 10.5194/hess-18-3891-2014. link to paper; link to animation
- Vandenbohede, A., de Louw, P.G.B., Doornenbal, P.J.P.J., 2014. Characterizing preferential groundwater discharge through boils using temperature. Journal of Hydrology 510, 372–384, doi: 10.1016/j.jhydrol.2014.01.006
- De Louw, P.G.B., Eeman, S., Oude Essink, G.H.P., Vermue, E., Post, V.E.A. 2013. Rainwater lens dynamics and mixing between infiltrating rainwater and upward saline groundwater seepage beneath a tile-drained agricultural field. J. Hydrology, 501, 133-145, doi: 10.1016/j.jhydrol.2013.07.026. *link to paper*
- Delsman, J.R., Oude Essink, G.H.P., Beven, K.J., Stuyfzand, P.J. 2013. Uncertainty estimation of end-member mixing using generalized likelihood uncertainty estimation (GLUE), applied in a lowland catchment, *Water Resour. Res.*, 49 , 4792 – 4806, doi: 10.1002/wrcr.20341. *download*
- De Louw, P.G.B., Vandenbohede, A., Werner, A.D., Oude Essink, G.H.P. 2013. Natural saltwater upconing by preferential groundwater discharge through boils. J. Hydrol., 490, 74-87, doi: 10.1016/j.jhydrol.2013.03.025. *download*
- Faneca Sànchez , M., Gunnink , J.L., van Baaren , E.S., Oude Essink , G.H.P., Siemon, B. , Auken, E. , Elderhorst, W. , de Louw, P.G.B. 2012. Modelling climate change effects on a Dutch coastal groundwater system using airborne Electro Magnetic measurements, *Hydrol. Earth Syst. Sci.*, 16, 4499-4516, doi: 10.5194/hess-16-4499-2012. *download*
- Pauw, P.S., Louw, P.G.B., de, Oude Essink, G.H.P. 2012. Groundwater salinization in the Wadden Sea area of the Netherlands; quantifying the effects of climate change, sea level rise and anthropogenic interferences, *Netherlands Journal of Geosciences* 91-3, 373-383, doi: 10.1017/S0016774600000500, *link to NJG*

- Harbo, M.S., Pedersen, J. Johnsen., R. and Petersen, K. 2012. (Eds) The CLIWAT handbook: Groundwater in a future climate, www.cliwat.eu. 184 p. *CLIWAT Handbook*
- Oude Essink, G.H.P. and Kooi, H. 2012. Land-subsidence and sea-level rise threaten fresh water resources in the coastal groundwater system of the Rijnland water board, The Netherlands, p. 227-248, Chapter 13 in: Climate Change Effects on Groundwater Resources: A Global Synthesis of Findings and Recommendations, Treidel, H., Martin-Bordes, J.L. and Gurdak, J.J. (Eds), 401 p. *link to Book*
- Louw, P.G.B., de, Eeman, S., Siemon, B., Voortman, B.R., Gunnink, J., van Baaren, E.S., and Oude Essink, G.H.P., 2011, Shallow rainwater lenses in deltaic areas with saline seepage, *Hydrol. Earth Syst. Sci.*, 15, 3659-3678, doi: 10.5194/hess-15-3659-2011. *link to HESS*
- Louw, P.G.B., de, van der Velde, Y., and van der Zee, S.E.A.T.M. 2011. Quantifying water and salt fluxes in a lowland polder catchment dominated by boil seepage: a probabilistic end-member mixing approach, *Hydrol. Earth Syst. Sci.*, 15, 2101-2117, doi: 10.5194/hess-15-2101-2011. *ink to HESS*
- Louw, P.G.B., de, Oude Essink, G.H.P., Stuyfzand, P.J., Zee, van der, S.E.A.T.M. 2010. Upward groundwater flow in boils as the dominant mechanism of salinization in deep polders, The Netherlands, *J. Hydrol.* 394, 494-506, doi: 10.1016/j.jhydrol.2010.10.009. *download*
- Oude Essink, G.H.P., E.S. van Baaren, and P.G.B. de Louw. 2010. Effects of climate change on coastal groundwater systems: A modeling study in the Netherlands, *Water Resour. Res.*, 46, W00F04, doi: 10.1029/2009WR008719. *download*
- Goes, B.J.M., Oude Essink, G.H.P., Vernes, R.W. and Sergi, F. 2009. Estimating the depth of fresh and brackish groundwater in a predominantly saline region using geophysical and hydrological methods, Zeeland, the Netherlands, *Near Surface Geophysics* 401-412, doi: 10.3997/1873-0604.2009048. *download*
- Giambastiani, B.M.S., Antonellini, M., Oude Essink, G.H.P. and Stuurman, R.J. 2007. Saltwater intrusion and water management in the unconfined coastal aquifer of Ravenna (Italy): a numerical model, *J. of Hydrol.* (340), 1-2, 91-104, doi: 10.1016/j.jhydrol.2007.04.001. *download*
- De Louw, P. and Oude Essink, G.H.P. 2006. Salinisation of the Northern coastal area of the Netherlands due to land subsidence and sea level rise. In: Jun Xu, Y. and Singh, V.P. (Eds.): Coastal Environmental and Water Quality, AIH Annual Meeting & International Conference, Challenges in Coastal Hydrology and Water Quality, Baton Rouge, Louisiana, 167-179. *download*
- Langevin, C.D., G.H.P. Oude Essink, Panday, S., Bakker, M., Prommer, H., Swain, E.D., Jones, W., Beach, M. and Barcelo, M. 2003. MODFLOW-Based Tools for Simulation of Variable-Density Groundwater Flow. In: Coastal Aquifer Management-Monitoring, Modeling and Case Studies. A.H.-D. Cheng and D. Ouazar, CRC Press, 30-76. *download draft*
- Bakker, M., Oude Essink, G.H.P. and Langevin, C.D. 2004. The rotating movement of three immiscible fluids, *J. of Hydrol.* (287), 270-278, doi: 10.1016/j.jhydrol.2003.10.007. *download*
- Bouw, L. and Oude Essink, G.H.P. 2003. Development of a freshwater lens in the inverted Broad Fourteens Basin, Netherlands offshore, *J. of Geochemical Exploration* 78-79: 321-325, doi: 10.1016/S0375-6742(03)00113-4. *download*
- Bouw, L. and Oude Essink, G.H.P. 2003. Fluid flow during Late Cretaceous inversion of the northern Broad Fourteens Basin, Netherlands *J. of Geosciences* 82 (1): 55-69. *download*
- Oude Essink, G.H.P. 2001. Salt Water Intrusion in a Three-dimensional Groundwater System in The Netherlands: a Numerical Study, *Transport in Porous Media* 43(1): 137-158, doi: 10.1023/A:1010625913251*download*
- Oude Essink, G.H.P. 2001. Improving fresh groundwater supply - problems and solutions. *Ocean & Coastal Management* 44: 429-449, doi: 10.1016/S0964-5691(01)00057-6 . *download*
- Oude Essink, G.H.P. 2001. Saltwater intrusion in 3D large-scale aquifers: a Dutch case, *Phys. & Chem. of the Earth* 26(4): 337-344, doi: 10.1016/S1464-1909(01)00016-8. *download*
- Oude Essink, G.H.P. 2001. Density dependent groundwater flow at the island of Texel, The Netherlands. Proc. 16th Salt Water Intrusion Meeting, Miedzyzdroje-Wolin Island, Poland: 47-54. *download*
- Klein, R.J.T., R.J. Nicholls, G.H.P. Oude Essink, N. Minura and R.A. Warrick. 1998. Coastal Zones (Chapter 7). Unites Nations Environmental Programme, in UNEP Handbook on Methods for Climate Change Impact Assessments and Adaptation Strategies,. J.F. Feenstra, I. Burton, J.B. Smith and R.S.J. Tol (Eds), CRC Press, 464 p. *download*
- Oude Essink, G.H.P. 1998. MOC3D adapted to simulate 3D density-dependent groundwater flow. In: Proc.MODFLOW'98 Conference, October 4-8, 1998, Golden, Colorado, USA, Vol. I, 291-303. *download*
- Oude Essink, G.H.P. 1996. Impact of sea level rise on groundwater flow regimes. A sensitivity analysis for the Netherlands. Ph.D. thesis, Delft University of Technology. Delft Studies in Integrated Water Management: no. 7 ISBN 90-407-1330-8. 428 p. *download*
- Oude Essink, G.H.P. Boekelman, R.H., 1996. Problems with large-scale modelling of salt water intrusion in 3D, Proc. 14th Salt Water Intrusion Meeting, Malmo, Sweden. *download*
- Jelgersma, S., M. J. Tooley, G.H.P. Oude Essink, R.H. Boekelman, M.C.J. Bosters, W.J. Wolff, K.S. Dijksma, B.J. Ens, L. Bijlsma, R. Hillen, and R. Misdorp. 1993. Sea Level Changes and their Consequences for Hydrology and Water Management, State of the Art Report, UNESCO, IHP-IV Project H-2-2, 135 p.

Rapporten, Artikelen, Boeken, Proceedings, etc.

1. Delsman, J.R., Mulder, T., 2021. Verkenning geohydrologische effecten Voorraadbekken IJsselmeer, Deltares rapport 1120714.
   download
2. Zuurbier, K.G., Van der Schans, M., Paalman, M.A.A., de Putter, P., Te Winkel, T., Velstra, J., Oude Essink, G.H.P. 2015. Technisch-juridische handreiking risicobeoordeling 'Ondergrondse Waterberging', 67 p.
   download
3. Schipper , P.N.M., Janssen , G.M.C.M. , Polman , N.B.P., Linderhof , V.G.M., van Bakel , P.J.T., Massop , H.T.L., Kselik , R.A.L., Oude Essink , G.H.P. en Stuyt , L.C.P.M. 2014. €ureyeopener 2.1: Zoetwatervoorziening Zuidwestelijke Delta en Rijnmond-Drechtsteden, Alterra-rapport 2510, 74 p.
   download
4. Stuyt, L.C.P.M., van Bakel, P.J.T., Delsman, J., Massop, H.T.L., Kselik, R.A.L., Paulissen, M.P.C.P., Oude Essink, G.H.P., Hoogvliet, M. en Schipper, P.N.M., 2012, Zoetwatervoorziening in het Hoogheemraadschap van Rijnland; Onderzoek met hulp van €ureyeopener 1.0, 93 p. Alterra-rapport 2439
   download
5. Sommeijer, M.J.; Pauw, P.S.: Van Baaren, E.S.; Oude Essink, G.H.P. 2013, Zeeland kan voorraden zoet groundwater vergroten. Land+Water.
   download
6. Inventaris wellen te Hoogheemraadschap van Rijnland 2012.
   download
7. Louw, de, P.G.B., Doornenbal, P., Hendriks, D.M.D., 2012. Veldonderzoek naar het dichten van wellen. Deltares-rapport. 1201949-000, 52p.
   download
8. Klein, J., Raat, K., Faneca Sanchez, M., Oude Essink, G., Paalman, M., Vermeulen, R. 2013. Effecten van brijnsystemen ten behoeve van de gietwatervoorziening in het Westland op de gebruiksfuncties van het grondwatersysteem, H2O, 7p.
   download
9. Faneca Sànchez, M., Raat, K.J., Klein, J., Paalman, M., Oude Essink, G. 2012. Effecten van brijninjectie op de grondwaterkwaliteit en functies in het Westland. Deltares rapport 1205897-000-BGS-0007, KWR rapport 2012.096.
   download

10. Harbo, M.S., Pedersen, J. Johnsen., R. and Petersen, K. 2012. (Eds) The CLIWAT handbook: Groundwater in a future climate, www.cliwat.eu. 184 p.
CLIWAT Handbook
11. Baaren, van, E.S.; De Louw, P.G.M. and Oude Essink, G.H.P., 2010, Salinisation and freshening of phreatic groundwaters in Zeeland, The Netherlands: a modeling study, Proceedings of the 21th Salt Water Intrusion Meeting, Azores, Portugal, 303-306.
download
12. Oude Essink, G., Delsman, J., Borren, W., Stuurman, R., Verkaik, J. 2010. Veranderingen in het grondwatersysteem van het Markermeergebied; Rapportage DC project Wetlands in het IJsselmeergebied. Deltares rapport 1202830-000, 118 p.
download
13. Oude Essink, G.H.P., De Louw, P.G.B., Stevens, S., de Veen, B., de, Prevo, C., Marconi, V. en Goes, B. 2009. Voorkomen van dynamiek van regenwaterlenzen in de Provincie Zeeland - Resultaten van een verkennende en provinciedekkende meetcampagne, 2007-U-R0925/A, 132p.
download
14. Onze Delta, onze toekomst, 2009, Deltares, (eds), hoofdstuk 3: Staat en Toekomst van de Delta (Haas, H. Goede, E. Groot, S., Michielsen, C., Oude Essink, G. Vries, de, I., Wijsman, J.).
download
15. Oude Essink, G.H.P. and Baaren, E., van. 2009. Verzilting van het Nederlandse Grondwatersysteem, Deltares 2009-U-R91001, 24 p.
download
16. Oude Essink, G.H.P., De Louw, P.G.B., Baaren, E., van & Vliet, M. van, et al. 2008, Zoet-zout studie Provincie Flevoland, Deltares-rapport 2008-U-R0546/A, 160 p.
download
17. Hoogvliet, M., Oude Essink, G.H.P., et al, 2008 Koploper Klimaat Werkpakket Watervoorziening, 2008-U-R0434/A, 59p.
download
18. Stuurman, R., Baggelaar, P., Berendrecht, W., Buma, J., De Louw, P.G.B., Oude Essink, G.H.P., 2008, Toekomst van de Nederlandse grondwatervoorraad in relatie tot klimaatverandering, TNO rapport, i.o.v VROM, 2008-U-R0074/B, 85 p.
download
19. Vries, A., de, Vries I., de, Veraart J.A., Zwolsman G.J., Oude Essink, G.H.P., Baaren, E.S. van; Creusen, R. Buijtenhek, H.S. 2009. Vraag en aanbod van zoetwater in de Zuidwestelijk Delta, een verkenning. 79 p.
download samenvatting
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20. Oude Essink, G.H.P., Baaren, E., van & Vliet, M. van, 2008, Verkennende studie klimaatverandering en verzilting grondwater in Zuid-Holland, Deltares-rapport 2008-U-R0322/A, 60 p.
download
21. Hoogvliet, M., et al., 2007, Inventarisatie van effecten van klimaatverandering op fysiek systeem Hoogheemraadschap van Delfland, TNO rapport 2007-U-R01023/A, in opdracht van Hoogheemraadschap van Delfland, 117 p.
download
22. Kwadijk, J., Vuren, van, S. Verhoeven, G., Oude Essink, G., Snepvangers, J. en Calle, E. 2007, Gevolgen van grote zeespiegelstijging op de Nederlandse zoetwaterhuishouding, i.o.v. Milieu en Natuurplan Bureau, Deltares-rapport, Q4394, 73 p.
download
23. De Louw, P., Oude Essink, G.H.P. en Maljaars, P. 2007: Achtergrondstudie kwelreductietechnieken, TNO rapport 2007-U-R0357/B, 82 p., april 2007.
download
24. Oude Essink, G.H.P. and De Louw, P.G.B. 2006. Kwalitatieve beschouwing over de invloed van zoute kwel op de landbouw bij peilwijziging op het Lauwersmeer, TNO rapport 2006-U-R0152/A, 17 p.
download
25. De Louw, P. and Oude Essink, G.H.P. 2006. Salinisation of the Northern coastal area of the Netherlands due to land subsidence and sea level rise. In: Jun Xu, Y. and Singh, V.P. (Eds.): Coastal Environmental and Water Quality, AIH Annual Meeting & International Conference, Challenges in Coastal Hydrology and Water Quality, Baton Rouge, Louisiana, 167-179.
download
26. Bader, E., Post V.E.A., Oude Essink, G.H.P. 2006, Verziltings- en verzoetingsprocessen in Nederland, met speciale aandacht voor de Wieringermeerpolder, Bachelorafsluiting Aardwetenschappen TNO Bouw en Ondergrond, p. 61.
download
27. Oude Essink, G.H.P., Van der Linden, W. 2005, Impact of the 26-12-04 Tsunami on groundwater systems and groundwater based water supplies, TNO report 2006-U-R-172/A, 19 p., Utrecht, The Netherlands.
download
28. Oude Essink, G.H.P., Houtman, H. and Goes B.J.M. 2005. Chloride-concentratie onderkant deklaag in Nederland, NITG 05-056-A, 17 p., Utrecht, TNO Bouw en Ondergrond.
download
29. Oude Essink, G.H.P., Post, V.E.A., Kuijper, M.J.M., Minnema, B., 2004, Land subsidence and sea level rise threaten the coastal aquifer of Zuid-Holland, the Netherlands, Proceedings of the 18th Salt Water Intrusion Meeting, Cartagena, Spain, 617-624.
download
30. Minnema, B., Kuijper, B., & Oude Essink, G.H.P. 2004. Bepaling van de toekomstige verzilting van het grondwater in Zuid-Holland, *NITG 04-189-B*, 86 p., Utrecht, TNO Bouw en Ondergrond.
download
31. Oude Essink, G.H.P., 2003. Salt water intrusion in a groundwater system at the Basilicata Region, South Italy, Proc. Italian CRYSTECHSALIN Meeting, Bari/Scanzano, 65-74.
download
32. Oude Essink, G.H.P., 2002. Salinisation of the Wieringermeerpolder, The Netherlands, Proc. 17th Salt Water Intrusion Meeting, Delft, The Netherlands, 12p.
download
33. Oude Essink, G.H.P., 2002. Modelling for geochemists: Everything you always wanted to know about modelling, but were afraid to ask!, Proc. 17th Salt Water Intrusion Meeting, Delft, The Netherlands, 13-25.
download
34. Oude Essink, G.H.P., 2001. Density-dependent groundwater flow; Salt water intrusion and Heat Transport. Lecture notes IHE, 136 p.
download
35. Oude Essink, G.H.P. 2001. Density dependent groundwater flow at the island of Texel, The Netherlands. Proc. 16th Salt Water Intrusion Meeting, Miedzyzdroje-Wolin Island, Poland: 47-54.
download

36. Oude Essink, G.H.P. 2000. Zoutwaterintrusie in het grondwatersysteem van de Kop van Noord-Holland: een toepassing van de drie-dimensionale computer code MOCDENS3D, Stromingen 6(3): 9-21.
download
37. Klein, R.J.T., R.J. Nicholls, G.H.P. Oude Essink, N. Minura and R.A. Warrick. 1998. Coastal Zones (Chapter 7). Unites Nations Environmental Programme, in UNEP Handbook on Methods for Climate Change Impact Assessments and Adaptation Strategies,. J.F. Feenstra, I. Burton, J.B. Smith and R.S.J. Tol (Eds), CRC Press, 464 p.
download
38. Oude Essink, G.H.P., 1999. Simulating 3D density dependent groundwater flow: the adapted MOC3D, Proc. 15th Salt Water Intrusion Meeting, Ghent, Belgium, 1998, 69-79.
download
39. Oude Essink, G.H.P. 1998. MOC3D adapted to simulate 3D density-dependent groundwater flow. In: Proc.MODFLOW'98 Conference, October 4-8, 1998, Golden, Colorado, USA, Vol. I, 291-303.
download
40. Oude Essink, G.H.P. (1998) Simuleren van 3D dichtheidsafhankelijke grondwaterstroming: MOCDENS3D; in: Stromingen 4(1): pag 5-23.
download
41. Jelgersma, S., M. J. Tooley, G.H.P. Oude Essink, R.H. Boekelman, M.C.J. Bosters, W.J. Wolff, K.S. Dijksma, B.J. Ens, L. Bijlsma, R. Hillen, and R. Misdorp. 1993. Sea Level Changes and their Consequences for Hydrology and Water Management, State of the Art Report, UNESCO, IHP-IV Project H-2-2, 135 p.
42. Oude Essink, G.H.P. Boekelman, R.H., 1996. Problems with large-scale modelling of salt water intrusion in 3D, Proc. 14th Salt Water Intrusion Meeting, Malmo, Sweden.
download
43. Oude Essink, G.H.P., Paap, H.A., Boekelman, R.H., 1993. Influence of sea level rise on a groundwater flow system in Noord-Holland, the Netherlands, Proc. 12th Salt Water Intrusion Meeting, Barcelona, Spain, 1992, 57-79.
download
44. Oude Essink, G.H.P., 1993. A sensitivity analysis of the adapted groundwater model MOC, Proc. 12th Salt Water Intrusion Meeting, Barcelona, Spain, 1992, 371-389.
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Abstracts en Posters

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   Authors: Joost Delmans, Gualbert Oude Essink Poster
3. Analysis of Submarine Groundwater Discharge to Manila Bay: Density Dependent Hydrogeological Modeling of the South-eastern coastal zone of Bataan, Philippines, SWIM 21 2010
   Authors: Aileen Mirasol-Robert, Gualbert Oude Essink, Hans H. Dürr Abstract
4. Netherlands Hydrological modelling Instrument for fresh and saline groundwater in the Dutch coastal zone, SWIM 21 2010
   Authors: Jarno Verkaik, Esther van Baaren, Joost Delsman and Gualbert Oude Essink Poster Abstract
5. Salinisation and freshening of phreatic groundwaters in Zeeland, The Netherlands: a modeling study, SWIM 21 2010
   Authors: Esther van Baaren, Perry De Louw, Gualbert Oude Essink Poster Abstract
6. CLIWAT: a transnational project about climate change and coastal groundwater in the North Sea Region, SWIM 21 2010
   Authors: Gualbert Oude Essink, Perry De Louw, and many others! Poster Abstract
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   Authors: Esther van Baaren and Gualbert Oude Essink Poster Abstract

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- Slim Water Management, case Rijnland
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  The Challenges of Saline Groundwater
  Zoetwater zelfvoorzienendheid, Deltaproof
  GO-FRESH: Ondergrondse waterbergingsproeven Proeftuin Zuidwestelijke Delta
  Kansrijke oplossingen voor een robuuste zoetwatervoorziening(uitleg GO-FRESH 3 proeven, 4m20s)
  Kreekrug Infiltratie Proef in bedrijf (2m39s)
  De effectiviteit van het doorspoelen van polders in Nederland
  De bronnen van verzilting, en de lange geschiedenis die eraan voorafgaat, case NL
  Nederland, een Landschap gevormd door Mens en Natuur

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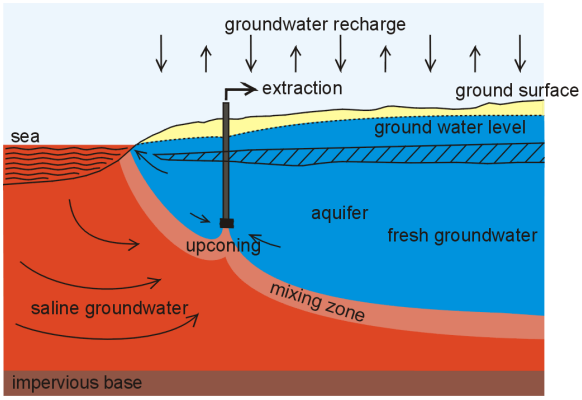
Lecture Notes Density Dependent Groundwater Flow: Salt water intrusion in coastal aquifers

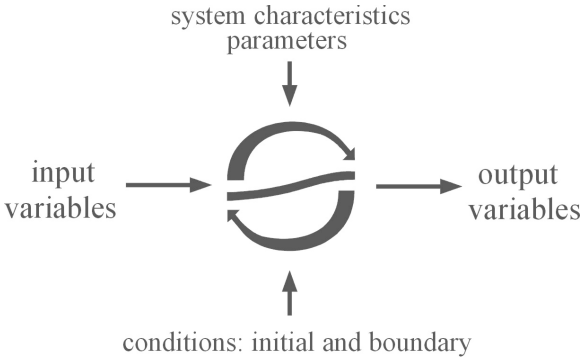
Auteur: Gualbert Oude Essink
Dictaat: Density Dependent Groundwater Flow

1 Introduction
2 Characteristics of a density dependen groundwater system
3 Freshwater head
4 The concept of a fresh-saline interface
5 Control of salt water intrusion
6 Numerical modelling
7 Salt water intrusion in the Netherlands
8 Heat transport in porous media: introduction

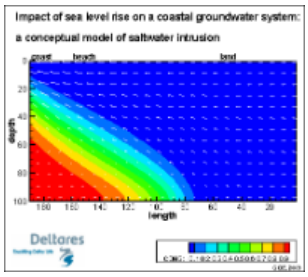
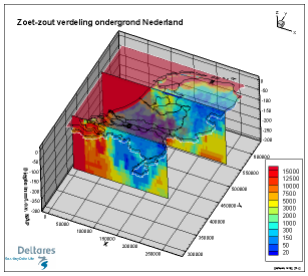
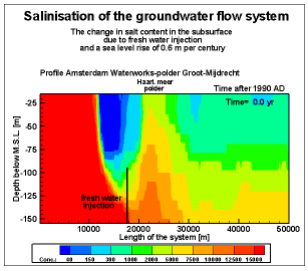
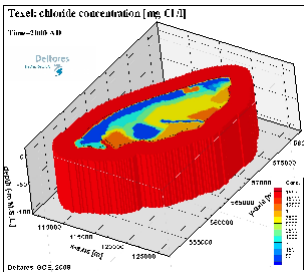
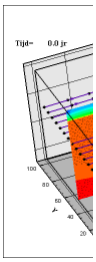


Lecture Notes Groundwater Modelling

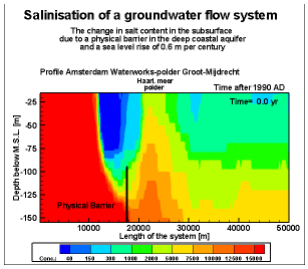
Auteur: Gualbert Oude Essink
Dictaat: Groundwater Modelling
PART I Modelling Protocol
1 Introduction
2 Classication of mathematical models
3 Methodology of modelling
4 Data gathering
PART II Groundwater Modelling
5 Introduction
6 Mathematical description of hydrogeologic processes
7 Solution techniques
8 Numerical aspects of groundwater models
9 Some selected groundwater codes



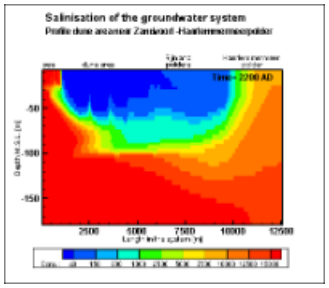
Animations: examples of salinisation processes

Henry's profile with sea level rise	3D zoet-zout verdeling ondergrond NL	Fresh water injection to combat salinisation	3D zoet-zout verdeling ondergrond Texel	Regional g captured b
				
Henry's profile with sea level rise	3D zoet-zout verdeling ondergrond NL	Fresh water injection to combat salinisation	3D zoet-zout verdeling ondergrond Texel	Regional gro captured by

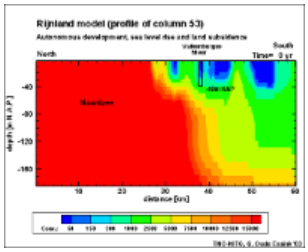
Physical barrier in the coastal zone	Dutch profile: extraction, upconing and low inland levels	Profile over 3D model: effect sea level rise on salinisation	Movement of the island De Griend (NL): creation of a freshwater lens	Evolu lens



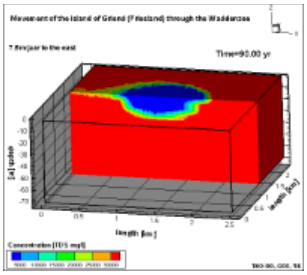
Physical barrier in the coastal zone



Dutch profile extraction, upconing and low inland levels



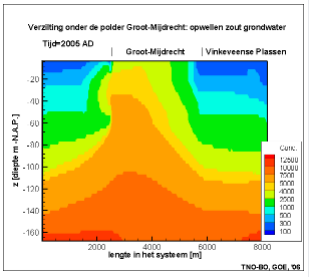
Profile over 3D model: effect sea level rise on salinisation



Movement of the island De Griend (NL): creation of a freshwater lens

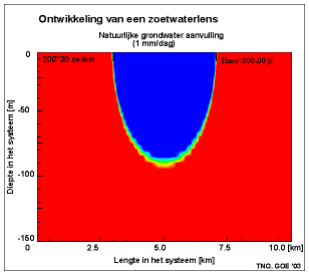
Evoluti lens

Upconing saline groundwater under a low-lying area



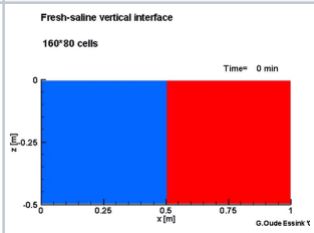
Upconing saline groundwater under a low-lying area

Ontwikkeling van een zoetwaterlens

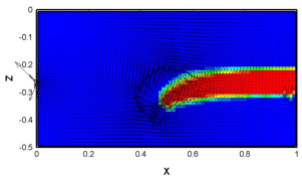


Ontwikkeling van een zoetwaterlens

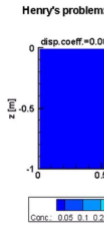
Interface



Saltwater pocket



Henry



Nieuws

Overzicht Inleiding Projecten Publicaties Download Nieuws Contact Stage

2018

- **25th Salt Water Intrusion Meeting: Gdansk, Polen, 17-22 Juni 2018,** website
  Presentations:
  - Delsman, J.R., Van Baaren, E.S., Siemon, B., Dabekaussen, W., Steuer, A., Gunnink, J.L., Karaoulis, M.C., Pauw, P.S., Vermaas, T., Bootsma, H., De Louw, P.G.B., Oude Essink, G.H.P. 2018. Large-scale, probabilistic airborne salinity mapping for groundwater management in Zeeland, The Netherlands
  - De Louw, P.G.B., Bootsma, H., Kooi, H., Kramer, M., Erkens, G. 2018. Land subsidence by peat oxidation leads to enhanced salinization through boils in Dutch polders
  - Zamrsky, D., Oude Essink, G.H.P., Bierkens, M.F.P. 2018. Estimating characteristic times of regional groundwater systems along the global coastline with regard to past sea level fluctuations and sediment accumulation patterns
  - Van Engelen, J., Bierkens, M.F.P., Oude Essink, G.H.P. 2018. 3D Paleohydrogeological modelling of the Nile Delta
  - King, J., Oude Essink, G.H.P., Karaoulis, M.C., Siemon, B., Bierkens, M.F.P. 2018. A Quantitative Review of D Airborne Electromagnetic Inversion Methods: A Focus on Fresh-Saline Groundwater Mapping
  - Huizer, S., Radermacher, M., De Vries, S., Oude Essink, G.H.P., Bierkens, M.F.P. 2018. Impact of coastal forcing and groundwater recharge on the growth of a fresh groundwater lens in a mega-scale beach nourishment
  - Oude Essink, G.H.P., Mulder, T., Van Engelen, J., Zamrsky, D., Pham Van, H., Weerasekera, W., Meggiorin, M. 2018. Building up D salinity models for estimating fresh groundwater resources in major deltas under global and climate stresses
  - Vandevelde, D. Van Baaren, E.S., Delsman, J.R., Karaoulis, M.C., Oude Essink, G.H.P. De Louw, P.G.B., Vermaas, T., Pauw, P.S., De Kleine, M., Thofte, S., Teilmann, R., Walraevens, K., Van Camp, M., Huits, D., Dabekaussen, W., Gunnink, J.L., Vandenbohede, A. 2018. Groundwater salinity mapping of the Belgian coastal zone to improve local freshwater storage availability

  Posters
  - Oude Essink, G.H.P., Van Baaren, E.S., Galvis Rodriguez, S., Zuurbier, K., Raat, K., Kooiman, J.W., Boonekamp, T. 2018. Potential map for large-scale implementation of subsurface water solutions: COASTAR
  - Verkaik, J., Huizer, S., Van Engelen, J., Ram, R., Vuik, K., Oude Essink, G.H.P. 2018. Parallel Computing with SEAWAT

- America, I., De Louw, P.G.B., Bier, G., Van der Zee, S. 2018. Influence of tides, bathymetry, lithology and regional flows on the salinization process in nature area the Rammegors

2017

- **Zoet-zout kartering Provincie Zeeland online beschikbaar: FRESHEM**
- **Rapportage Zeeland model digitaal beschikbaar: Regionaal 3D model voor zoet-zout grondwater in de Provincie Zeeland. link naar wiki-pagina**
- **2017 23-28 April: European Geosciences Union, General Assembly**
  - Zamrsky, D., Bierkens, M. and G.H.P. Oude Essink, 2017. On aquifer thicknesses and geological complexity affecting fresh/salt groundwater distribution.
  - Van Engelen, J., Oude Essink, G.H.P., Kooi, H., Bierkens, M.F.P. 2017. On the origins of hypersaline groundwater in the Nile Delta Aquifer.
  - Boran, B.E., Rutten, M., Oude Essink, G.H.P., Delsman, J.R., Abraham, E. 2017 Smart salinity management in low-lying deltaic areas: a model predictive control scheme applied to a test case.
  - Siemon, B., Van Baaren, E., Dabekaussen, W., Delsman, J.R., Gunnink, J., Karaoulis, M., De Louw, P., Oude Essink, G., Pauw, P., Steuer, A., Vermaas, T., Meyer, U. 2017. FRESHEM - Fresh-saline groundwater distribution in Zeeland (NL) derived from airborne EM.
- **Gezocht: Gent Universiteit Belgie: Docent-TT Hydrogeologie**

2016

- 2016 4-8 July, 24th Salt Water Intrusion Meeting: Cairns, Australia
- 2016 10-13 May, 4th Int. Climate Change and Adaptation Conference, Rotterdam, The Netherlands

In het Nieuws:

20151214, Volkskrant: kwelvoorziening Perkpolder

20150917, Trouw: Zilte grond vraagt om zilte groente

20150822, Nieuwe Oogst: Helivluchten Zeeland hervat

20140527, Volkskrant: Landbouw op zout water

20140428, Trouw: Zuinig op het zoete water

20140331, De Akker: Zorgen om zoute kwel; Toenemende verzilting vereist bewustere omgang met zoet water

20140407, Financieel Dagblad: Zuinig op Zoet Water

20140205, PZC: Hoe Bloemkool nog jaren kan groeien

20140125, Nieuwe Oogst: Zoute Kwel Onder De Duim Houden

20140120, Nederlands-Franse samenwerking binnen project GO-FRESH

20140129, Reformatorisch Dagblad: Boeren in Zilte Polders

20140111, Nieuwe Oogst: Sloten met zoute wellen tijdelijk isoleren

20131220, Cobouw: Achtergrond nr. 229: Verzilting diepe polders loopt vooral via wellen

20131205, Nieuwe Oogst: De rol van zoute wellen bij verzilting onderzocht

20131130, Nieuwe Oogst: Sparen als je sparen kunt

20131121, Minister overweegt financiële steun GO-FRESH project

20130924, De Boerderij: Zeeuwse telers sparen zoet water

20130906, Groenten en Fruit Actueel bericht; Jan de Rijk: Hele jaar door water sparen zonder bassin

20120404, BN de Stem Zeeuws-Vlaanderen: Een zoektocht naar zoet water

2012, Visie Deltares Magazine: Aanpak verzilting is maatwerk

20110516, Boerderij: Behoud zoetwaterlens is sleutel bij onontkoombare verzilting

Algemeen

Salt Water Intrusion Meetings

Saltnet

2015

- 2015 13-18 September, 42nd IAH AQUA2015, Hydrogeology, Back to the Future!, Rome, Italy, session S7.8: Groundwater quality issues in coastal aquifers: Improving our understanding through measurements and modelling
- 2015 28 June - 3 July: IAHR, Delft, The Netherlands, Deltas of the Future
- 2015 17 juni, middag symposium 'Zoetwaterbeheer en de rol van wetenschappelijk onderzoek'
- 2015, 9-12 June: AquaConSoil, Copenhagen, Denmark: Sustainable Use and Management of Soil, Sediment and Water Resources
- 2015 12-17 April, EGU, Wenen, Oostenrijk, HS8.2.9 Freshwater-saltwater interactions in coastal and inland aquifers
- 2015 23-26 March, Deutschen Geophysikalischen Gesellschaft, Hannover, Duitsland: o.a. Hydrogeofysica en grondwatersystemen

2014

- 2014 AGU Fall Meeting, 15-19 December 2014, San Francisco, USA
  Abstract submission by Sebastian Huizer: Modeling Changing Morphology and Density Dependent Groundwater Flow in a Dynamic Environment: case study

- International Conference Deltas in Times of Climate Change II, 24-26 September 2014
  ->Download the Flyer (check *Fresh Water Management*)

- IAEG XII Congress, Torino September 15-19, 2014 Engineering Geology for Society and Territory, 1.4 - Climate change: impacts on natural resources and hazards

- 23rd Salt Water Intrusion Meeting, Husum, Germany, 16-20 June 2014
  Presentatie: Esther van Baaren, Bouke Ottow, Marco Arts, Pieter Pauw, Gualbert Oude Essink, Sharing precious water volumes in the Water Farm
  Presentatie: Marta Faneca, Gualbert Oude Essink, Gijs Janssen, Roelof Stuurman, Yangxiao Zhou, SWIBANGLA, Managing Salt Water Impacts in Bangladesh
  Presentatie: Pieter Pauw, Controlled level drainage to expand freshwater lenses below creek ridges
  Presentatie: Sebastian Huizer, Can a large sand suppletion lead to a substantial increase in fresh water resources?: The Sand Motor Project
  Presentatie: Gualbert Oude Essink, Daniel Zamrsky, Marta Faneca, Global Quick Scan of the Vulnerability of Groundwater systems to Tsunamis (and other flooding events)
  Poster: Esther van Baaren, Perry de Louw, Gualbert Oude Essink, Regional variable-density groundwater flow model: a Dutch case in the southwestern delta

- EGU, Vienna, Austria, 27 April - 2 May 2014

- FRIEND-Water2014, Vietnam, Hanoi, 24-28 February 2014: 7th Global FRIEND-Water Conference Hydrology in a Changing World: Environmental and Human Dimensions

2013

- 2013 AGU Fall Meeting, 9-13 December 2013, San Francisco, US
  Session invitation: H062: "Open-Source Programming, Scripting, and Tools for the Hydrological Sciences", invited speaker Jarno Verkaik
- Deltares Software Dagen, 10 juni 2013 Symposium 'Ontwikkelingen in de Hydrologie', Ontwikkelingen Zoet-Zout Grondwater (Gualbert Oude Essink)
- MODFLOW and More 2013: Translating Science into Practice, 2-5 June 2013, Colorado School of Mines in Golden, Colorado, US
- Kennisproeverij Deltares, 24 April 2013
- AquaConSoil, Barcelona, 16-19 April 2013, 12th International UFZ-Deltares Conference on Groundwater-Soil-Systems and Water Resource Management
- EGU, Vienna, Austria, 07-12 April 2013: Freshwater-saltwater interactions and density-driven flow

2012

- Studie Brijnlozingsproblematiek Haaglanden afgerond, december 2012

- AGU, San Francisco, 3-7 December 2012: H016: Measurement, Modeling and Management of Coastal Aquifers

- Symposium BodemBreed 2012, 27-28 november 2012

- 22nd Salt Water Intrusion Meeting, Buzios, Brazil, June 17-21, 2012
  Presentation: Esther van Baaren, The Water Farm: self-sufficient in water
  Presentation: Gualbert Oude Essink, Local Climate Proof Fresh Groundwater Supply: adaptation water management strategy with national impact?
  Presentation: Gualbert Oude Essink, Geophysics Applied to Coastal Aquifer Studies
  Presentation: Gualbert Oude Essink, How to determine a reliable 3D fresh-brackish-saline distribution in data-rich coastal groundwater systems
  Presentation: Joost Delsman, Salt load to an agricultural catchment: 'seepage flux times concentration', or is there more to it than that? Insights from a multi-scale tracer study
  Presentation: Esther van Baaren, Climate Proof Areas: Innovative solutions for improving the freshwater availability
  Poster: Pieter Pauw, Large scale drainage measures to increase freshwater supply from sandy creek deposits
  Poster: Gualbert Oude Essink, Airborne Geophysics: a powerful tool to start up fresh groundwater management in the coastal zone
  Presentation: Esther van Baaren, The Coastal Laboratory: salt and fresh water supply. More info?: Esther dot vanBaaren at deltares dot nl

- Tweedaagse bijeenkomst over zoet en zout water, 31 mei-1 juni 2012, georganiseerd door Kennis voor Klimaat, RWS Waterdienst en STOWA
  Poster: Pieter Pauw, Vergroten van de zoetwatervoorraad onder kreekruggen in de Zuidwestelijke Delta
  Poster: Gualbert Oude Essink, Airborne Geophysics: a powerful tool to start up fresh groundwater management in the coastal zone

- IV Int. Conf. on Technology Seawater Intrusion in Coastal Aquifer, Alicante, Spain, April 24-26 2012
  Presentation: Marta Faneca, Effect of geological uncertainties on the salinisation of surface water systems in deltaic areas
  Presentation: Gualbert Oude Essink, Local Climate Proof Fresh Groundwater Supply: adaptation water management strategy with national

impact?
In april 2012 ontving Deltares tijdens het TIAC2012-congres de ‘Carlos Ruiz Celaá Award’. De award is toegekend voor een zoetwaterproject dat Deltares tijdens het congres presenteerde. over het omgaan met verzilting in kustgebieden.

- inzending Deltares-IMARES De KREEK teRUG Delta Water Award, Vlissingen, The Netherlands, April 18, 2012

2011

World Delta Summit, The Pulse of Deltas and the Fate of our Civilization, Jakareta Indonesia, 21-24 November 2011

2010

International Centre for Advanced Mediterranean Agronomic Studies CIHEAM course, 22-27 March 2010, Zaragoza, Spain, teaching Quantitative methods

21st Salt Water Intrusion Meeting 21-25 June 2010, Azores, Portugal

Deltas in Times of Climate Change 29 September- 1 October, Rotterdam, the Netherlands
Presentatie: Oude Essink GHP, Van Baaren ES, De Louw PGB, 2010, Effects climate change on coastal groundwater systems, focus on the Rhine Delta, Proceedings Deltas in Times of Climate Change, Rotterdam, The Netherlands, Sept-Oct. 2010

Blog stream

Create a blog post to share news and announcements with your team and company.

Contact

Overzicht Inleiding Projecten Publicaties Download Nieuws Contact Stage

De volgende personen werken aan de op deze pagina genoemde onderwerpen:

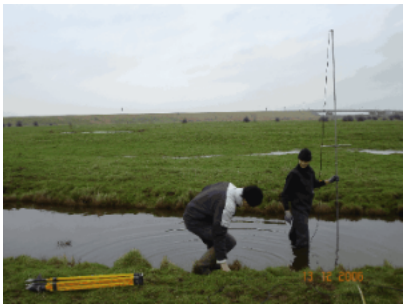
Gu Oude Essink	Perry de Louw	Esther van Baaren	Marta Faneca Sanchez	Jarno Verkaik	Joost Delsman	**Gijs Janss**
Gualbert dot OudeEssink at Deltares dot nl	Perry dot deLouw at Deltares dot nl	Esther dot vanBaaren at Deltares dot nl	Marta dot Faneca at Deltares dot nl	Jarno dot Verkaik at Deltares dot nl	Joost dot Delsman at Deltares dot nl	Gijs dot Jar Deltares do

Stage

Overzicht Inleiding Projecten Publicaties Download Stage Contact

Al een flink aantal jaren dragen studenten bij aan Deltares projecten op het gebied van zoet-zout grondwater in het kustgebied. Soms leidt dit mooie resultaten, peer-reviewed artikel waardig! Alles bij elkaar: we zijn een groot voorstander van het begeleiden van studenten, voor een stage- of afstudeeropdrachten. De laatste jaren hebben we studenten gehad van verschillende pluimage: universiteiten (WUR, UU, VU), hogescholen (Zeeland, Larensteijn) en instituten als IHE. Ook buitenlandse (PhD-)studenten waren welkom (Universiteiten van Gent, Firenze, Bologna, Roma (La Sapienza), Aken, Teheran, etc.).

We hebben een flink aantal onderwerpen op de plank klaar liggen, van numeriek modelleren tot en met water systeem analyse en monitoring, of een combi. Neem contact met ons, of met de desbetreffende studenten. Tot hoors!



Enkele onderwerpen:

- Groundwater salinization near the IJmuiden Sea Lock
- Simulating the effect of different scenarios on climate change/sea-level rise and anthropogenic stresses on fresh groundwater in the Mekong delta, using the existing 3D model
- On the water - food nexus in the Nile delta: communicating, understanding and monitoring groundwater availability, collaboration with the universities Kafr El Sheikh and Sadat City; also a visit to Egypt is planned.
- Comparison of 2D and 3D groundwater flow and salinity model estimations in deltaic regions
- Assessing the economic and technic feasibility of offshore groundwater pumping, based on the article *Zamrsky, D., Oude Essink, G.H.P., Sutanudjaja, E.H., Van Beek, L.P.H., Bierkens, M.F.P., 2022. Offshore fresh groundwater in coastal unconsolidated sediment systems as a potential fresh water source in the 21st century. Environ. Res. Lett. 17, 1–22. https://doi.org/https://doi.org/10.1088/1748-9326/ac4073*
- Assessing the effect of model parameters (e.g. solute solvers, grid convergence) on variable-density groundwater and salt transport benchmark cases using iMOD-SEAWAT and/or MODFLOW6
- Fresh groundwater resources management at a farmers level in the province of Zeeland, The Netherlands: setting up robust web-based clipping tools; a modelling study
- Assessing submarine groundwater discharge along coastal stretches: a global analysis
- Setting up a 3D variable-density groundwater flow model simulating salt water intrusion in a deltaic area: possible cases: the Bengal, Indus, Po, Yangtze, Pearl river deltas

info: gualbert dot oudeessink at deltares dot nl

Afstudeeronderwerpen sinds 2005:

2021

- Thijs Hendrikx, Utrecht University, Numerical computation of hurricane-induced saltwater intrusion on fresh groundwater availability in peninsular Florida under different climate scenarios

2020

- Obeid, A.A.A., Sensitivity analysis of variable-density groundwater models.
- Josh Shankel, Utrecht University, Exploration of shallow sandy ridge systems for aquifer storage and recovery solutions in the Vietnamese Mekong Delta
- Wouter Goofers, Utrecht University, Paleo-hydrogeographic reconstruction of the groundwater salinity in the Ayeyarwady Delta, Myanmar, using a 3D variable-density groundwater model

2019

- Eva Schoonderwoerd, Utrecht University, Modelling density-dependent flow with the use of MODFLOW 6, The effect of spatial and temporal discretization
- Lennart Brokx, Utrecht University, Projecting the Effects of Saltwater Intrusion on the Fresh Groundwater Resources of Southeastern Louisiana and the New Orleans Area , USA , based on 3D Variable-Density Groundwater Modelling

2018

- Lars Geitenbeek, Utrecht University, Saline groundwater extraction as a measure to increase the freshwater availability; A case study for the western parts of the Netherlands
- Hendrikx, N., Utrecht University, Identifying the most important factors that determine fresh groundwater availability in deltaic areas
- Hugo Hagendoorn, Delft University of Technology, Measuring and modelling to optimise a salinity monitoring network for use in the optimal control of flushing: Case study: Lissertocht catchment

- Colin Mainz, University of Aachen, Germany, Variable-density groundwater flow and coupled salt transport models of the Chao Phraya Delta, Thailand
- Tobias Mulder, Utrecht University, Constructing 3D variable-density groundwater flow models for six deltas using global data sets

2017

- Wayangi Lakshani Weerasekera, IHE-Delft, 3D Variable-density Groundwater Modelling of the Red River Delta, Vietnam

2016

- Lubna Badi, Utrecht University, BSc, Securing freshwater supply with measures to diminish the effect of sea-level rise by climate change (Literature review on state-of-art SWI research and a case study on SIDS in the Pacific)
- Björn Bolhuis, Utrecht University, Developing an automated open source system for coastal multi-hazard assessment and management of water resources in a changing climate (Based on the Coastal Hazard Wheel system)

2015

- Steven Ros, Utrecht University, The Nile Delta, Egypt: creating a fresh-salt water model
- Marjolein Vogels, Utrecht University, Modelling the central coastal groundwater system of Bangladesh

2014

- Jan Snel, Wageningen UR, Oplossingen ten behoeve van zoetwatervoorziening voor de landbouw op Schouwen-Duiveland
- Mieke Hulshof, Wageningen UR, Spatial scales in salinity modeling, case Waterdunen, Zeeland (Folkert Hellinga Award 2014)
- Daniel Zamrsky, Wageningen UR, Coastal vulnerability to tsunami impacts and modelling SWI in aquifers situated in the most vulnerable areas
- Carlos Rosado de Palacio, Utrecht University, Water system analysis and numerical modelling of a coastal aquifer in western Mexico: a case study

2013

- Marjan Sommeijer, WUR, Identifying suitable locations for infiltration of fresh water in creek ridges
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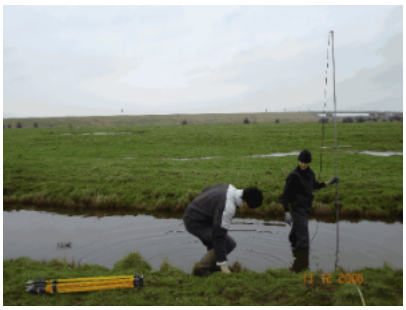
- Beatrice Giambastiani, Uni of Bolgona, Italy, Saltwater intrusion and water management in the unconfined coastal aquifer of Ravenna (Italy): a numerical model J. Hydrol. 340, 1-2, 91-104, 2007.

Overzicht

Al een flink aantal jaren dragen studenten bij aan Deltares projecten op het gebied van zoet-zout grondwater in het kustgebied. Soms leidt dit mooie resultaten, peer-reviewed artikel waardig! Alles bij elkaar: we zijn een groot voorstander van het begeleiden van studenten, voor een stage- of afstudeeropdrachten. De laatste jaren hebben we studenten gehad van verschillende pluimage: universiteiten (WUR, UU, VU), hogescholen (Zeeland, Larensteijn) en instituten als IHE. Ook buitenlandse (PhD-)studenten waren welkom (Universiteiten van Gent, Firenze, Bologna, Roma (La Sapienza), Aken, Teheran, etc.).

We hebben een flink aantal onderwerpen op de plank klaar liggen, van numeriek modelleren tot en met water systeem analyse en monitoring, of een combi. Neem contact met ons, of met de desbetreffende studenten. Tot hoors!



Enkele onderwerpen:

- Freshwater management techniques as a bridge between water demand and supply in the Mekong Delta, Vietnam (including fieldwork provinces Ben Tre or Tra Vinh)
- Analysis of upconing of saline groundwater under deltaic areas (numerical study)
- Effect of model parameters (e,g. solute solvers, grid convergence) on variable-density groundwater and salt transport benchmark cases (e.g. Henry, Hydrocoin, upconing; numerical analysis using iMOD-SEAWAT)
- Fresh groundwater resources management at a farmers level in the province of Zeeland, The Netherlands: setting up robust web-based clipping tools; a modelling study
- Assessing submarine groundwater discharge along coastal stretches: a global analysis
- Setting up a 3D variable-density groundwater flow model simulating salt water intrusion in a deltaic area: possible cases: the Bengal, Indus, Po, Yangtze, Pearl river deltas

info: gualbert dot oudeessink at deltares dot nl

Afstudeeronderwerpen sinds 2005:

2020

- Josh Shankel, Utrecht University, Exploration of shallow sandy ridge systems for aquifer storage and recovery solutions in the Vietnamese Mekong Delta
- Wouter Goofers, Utrecht University, Paleo-hydrogeographic reconstruction of the groundwater salinity in the Ayeyarwady Delta, Myanmar, using a 3D variable-density groundwater model

2019

- Lennart Brokx, Utrecht University, Projecting the Effects of Saltwater Intrusion on the Fresh Groundwater Resources of Southeastern Louisiana and the New Orleans Area , USA , based on 3D Variable-Density Groundwater Modelling

2018

- Lars Geitenbeek, Utrecht University, Saline groundwater extraction as a measure to increase the freshwater availability; A case study for the western parts of the Netherlands
- Hendrikx, N., Utrecht University, Identifying the most important factors that determine fresh groundwater availability in deltaic areas
- Hugo Hagendoorn, Delft University of Technology, Measuring and modelling to optimise a salinity monitoring network for use in the optimal control of flushing: Case study: Lissertocht catchment
- Colin Mainz, University of Aachen, Germany, Variable-density groundwater flow and coupled salt transport models of the Chao Phraya Delta, Thailand

- Tobias Mulder, Utrecht University, Constructing 3D variable-density groundwater flow models for six deltas using global data sets

2017

- Wayangi Lakshani Weerasekera, IHE-Delft, 3D Variable-density Groundwater Modelling of the Red River Delta, Vietnam

2016

- Lubna Badi, Utrecht University, BSc, Securing freshwater supply with measures to diminish the effect of sea-level rise by climate change (Literature review on state-of-art SWI research and a case study on SIDS in the Pacific)
- Björn Bolhuis, Utrecht University, Developing an automated open source system for coastal multi-hazard assessment and management of water resources in a changing climate (Based on the Coastal Hazard Wheel system)

2015

- Steven Ros, Utrecht University, The Nile Delta, Egypt: creating a fresh-salt water model
- Marjolein Vogels, Utrecht University, Modelling the central coastal groundwater system of Bangladesh

2014

- Jan Snel, Wageningen UR, Oplossingen ten behoeve van zoetwatervoorziening voor de landbouw op Schouwen-Duiveland
- Mieke Hulshof, Wageningen UR, Spatial scales in salinity modeling, case Waterdunen, Zeeland (Folkert Hellinga Award 2014)
- Daniel Zamrsky, Wageningen UR, Coastal vulnerability to tsunami impacts and modelling SWI in aquifers situated in the most vulnerable areas
- Carlos Rosado de Palacio, Utrecht University, Water system analysis and numerical modelling of a coastal aquifer in western Mexico: a case study

2013

- Marjan Sommeijer, WUR, Identifying suitable locations for infiltration of fresh water in creek ridges
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