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## Lectures Density dependent groundwater flow, IHE, Delft, 17-18-22-24 June 2020

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## Exercises

### Vertical interface:

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### Freshwater lens:

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### Henry's problem:

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### Elder's problem:

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**Download:** [word documents Henry, Elder, Vertical Interface, Freshwater Lens](#)

## Additional material

**Download:** [info on numerical dispersion and oscillation: Chapter 8, p. 119-132](#)

**Download:** [animation Elder](#)

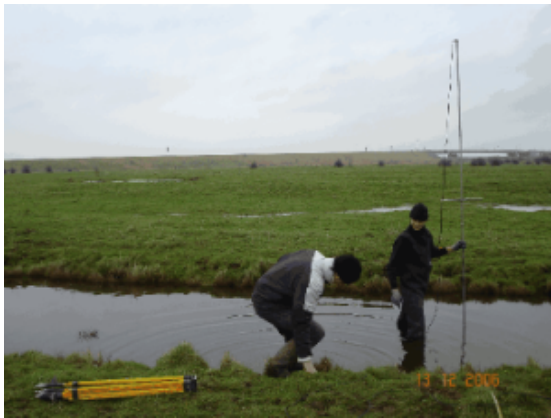
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# Movies

- [Slim Water Management, case Rijnland](#)
- [Innovatie in Perkpolder, peilbuizen beschermen grondwater tegen verzilting](#)
- [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](#)



**Course Hazards and risk assessment GEO4-4425, Utrecht University, 20 March 2020**

**Topic: Vulnerability of groundwater systems to flooding events**

- Download: [Powerpoint presentation: pdf format](#)
- Download: [Effect saline flooding event on groundwater: pdf document](#)
- Download: [saltfresh\\_flooding: PMWIN files, Exercise 1](#)
- Download: [saltfresh\\_flooding: PMWIN files, Exercise 5](#)

**Regional Workshop on Saltwater Intrusion Modeling & Implications of Sea Level Rise, July 23-24, 2014**

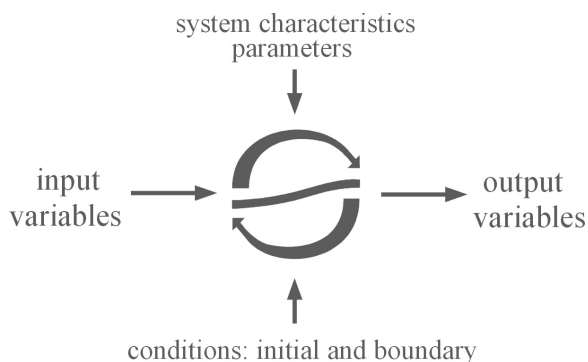
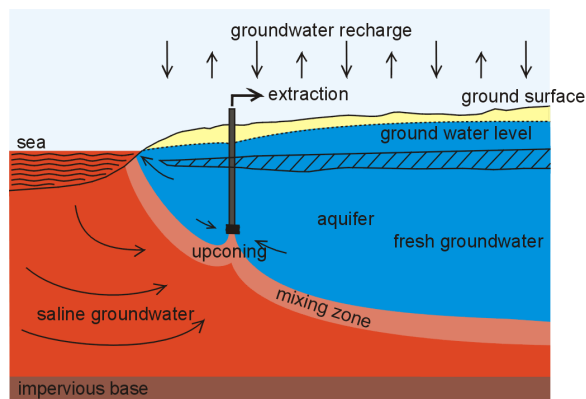
**Lecture Notes Density Dependent Groundwater Flow: Salt water intrusion in coastal aquifers**

**Auteur:** Gualbert Oude Essink  
**Dictaat:** [Density Dependent Groundwater Flow](#)

- 1 Introduction
- 2 Characteristics of a density dependent 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 Classification 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**

<a href="#">Henry's profile with sea level rise</a>	<a href="#">3D zoet-zout verdeling ondergrond NL</a>	<a href="#">Fresh water injection to combat salinisation</a>	<a href="#">3D zoet-zout verdeling ondergrond Texel</a>	<a href="#">Region partly c</a>
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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 captured

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

<p>Upconing saline groundwater under a low-lying area</p>	<p>Ontwikking van een zoetwaterlens</p>	<p>3D salinity groundwater distribution of the Nile Delta, Egypt</p>
Upconing saline groundwater under a low-lying area	Development lens	Nile delta

## CRYTECHSALIN

Download: [Proceedings Meeting 21-24 September 2002, Scanzano, Italy](#)

Homage Prof. Custodio:

article: [Salinisation of groundwater resources in the Dutch Deltaic Area: modelling, monitoring, Climate Change and Solutions](#)