



18-20 September 2014, Delft – The Netherlands

Course Groundwater in the coastal zone

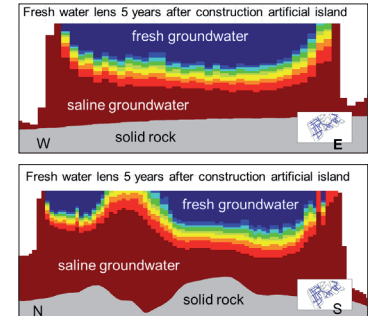
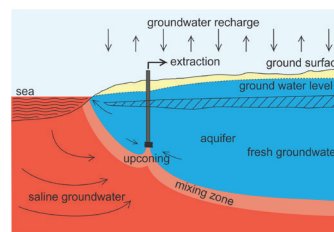
With about 2 billion people living within 60 km from the coastline, fresh-saline groundwater issues are getting more and more attention. Worldwide, the fresh groundwater availability in the coastal zone is under stress, being jeopardized by climate and global changes. In this course we will deal with various aspects of groundwater in the coastal zone: concepts, modelling, monitoring and problems and solutions.

Description:

The course will provide participants with (1) principles and procedures of variable density groundwater flow and coupled solute transport, (2) salinisation of groundwater systems and fresh-saline groundwater flow phenomena in the coastal zone, (3) monitoring techniques for fresh-brackish-saline water systems and (4) modelling experiences through hands-on training in computer workshops. On completion of this course the participants are able to understand, quantify and monitor groundwater flow processes in the coastal zone and to construct some (relatively simple) models on variable density groundwater flow and coupled salt transport. A field visit to the south-western part of the Netherlands will provide participants some field experiences in handling monitoring techniques to understand fresh-saline groundwater systems.

Target group:

A firm hydro(geo)logical background and affection with quantification/modelling techniques is required. Water consultants in hydro(geo)logy, PhD-students, medium to senior experts at water boards, provinces or nature organisations are encouraged to participate.



Time schedule: In total 3 days, 1 day is field visit to Zeeland

Course leaders: dr. ir. Gualbert Oude Essink and dr. Perry de Louw, hydrogeologists at Deltares with many years experience on groundwater issues in the coastal zone

Own laptop required*

Language: English

Where: Deltares in Delft, and field visit Zeeland

When: 18-20 September 2014: week before Deltas in Times of Climate Change II-conference Rotterdam

Participation fee: 850 euro (lunch and excursion included)

Registration via email to: Gualbert.OudeEssink@deltares.nl, Perry.deLouw@deltares.nl

More information: <http://freshsalt.deltares.nl/course>

* in case of difficulties, a laptop can be provided.

Program

Day 1:	Thursday 18 September
Part 1.1	General introduction <ul style="list-style-type: none"> • fresh-saline groundwater on Earth • global groundwater salinization issues
Part 1.2	Theory of variable dependent groundwater flow <ul style="list-style-type: none"> • saline groundwater phenomena (salt water intrusion, upconing under extraction wells, submarine groundwater discharge, saline boils, etc.) • theoretical background on density-dependent groundwater flow and transport in porous media • theory on the sharp interface between fresh and saline groundwater (analytical formulae, freshwater lens, Badon Ghijben-Herzberg principle, Bear-Dagan)
Lunch	
Part 1.3	Saltwater upconing and salt water intrusion <ul style="list-style-type: none"> • upconing under extraction wells: examples, analytical formulae • salt water intrusion in coastal aquifers
Part 1.4	Numerical modelling variable density groundwater flow: theory and practice <ul style="list-style-type: none"> • mathematical background • benchmark problems: Henry, Elder, Hydrocoin, etc. • basics of the SEAWAT modeling code
Day 2:	Friday 19 September
Part 2.1	Monitoring techniques of salinization processes <ul style="list-style-type: none"> • tips and tricks • on geophysical techniques such as TEC-probes, CVES, EM31, AEM
Part 2.2	Local salinization processes <ul style="list-style-type: none"> • salty boils • rainwater lenses (e.g. lenses in areas with saline seepage)
Lunch	
Part 2.3	Regional salinization processes including climate change effects <ul style="list-style-type: none"> • examples from the Netherlands, Indonesia, Singapore, Bangladesh, Australia, etc.
Part 2.4	Numerical modelling variable density groundwater with SEAWAT <ul style="list-style-type: none"> • exercises on some benchmark problems: Henry, Elder, Hydrocoin, etc.
Evening programme (slow food diner included)	
Part 2.5	Kaleidoscope 30min presentations on relevant coastal groundwater topics <ul style="list-style-type: none"> • ASR/MAR solutions fresh water supply in saline environments • surface water - groundwater interaction in coastal lowlands • participative water management • salt damage to crops • global coastal groundwater resources assessments
Day 3:	Saturday 20 September
Part 3.1	Field excursion: field visit in Zeeland <ul style="list-style-type: none"> • demonstration salinization processes, monitoring techniques
Lunch	
Part 3.2	Field work <ul style="list-style-type: none"> • applying field techniques



Deltares

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