**WHY IS THIS COURSE IMPORTANT?**

Groundwater in coastal zones is a precious resource that supports the livelihoods of hundreds of millions of people worldwide. The growing demand for freshwater increases the risk of seawater intrusion. Climate change and sea level rise both affect groundwater reserves as well. Groundwater models of flow and solute transport are important tools to understand the coastal aquifer systems and make predictions about future developments. The course objective is to impart knowledge and skills that will enable the participants to characterize and model coastal groundwater systems.

**WHO SHOULD ATTEND?**

This course is aimed at practitioners and researchers that want to improve their quantitative skills for the study of coastal aquifers. Basic knowledge of groundwater hydrology and, to a lesser extent, seawater intrusion will be assumed. The course will make use of Python, a scripting language that has become a firmly established tool in science and engineering. Some familiarity with the language will be required (self-guided tutorials available on request before the start of the course).

**WHO IS PRESENTING?**

The course will be presented by world-renowned experts in the field of coastal groundwater research and modelling.

Presenters include Christian Langevin (USGS), Mark Bakker (TU Delft), and Frans Schaars (Artesia Water)

**WHAT WILL THE COURSE COVER?**

* Theory of variable-density flow and solute transport
* Sharp-interface analytical solutions
* FloPy, a Python tool for the MODFLOW code family
* MODFLOW SWI package
* SEAWAT

**SWIM 2018 Pre-Conference Short Course:**

**Modeling Groundwater Flow in Coastal Zones**



**COURSE DETAILS**

**Thurs 14 June-Sat 16 June 2018**

**Gdańsk, Poland, Mercure Gdańsk Stare Miasto hotel**

**This includes course notes, classroom teaching, tutorials, morning and afternoon refreshments and lunches.**

**Attendees are to arrange their own travel and accommodation and laptop for the course.**

**COURSE FEE**

**1300 PLN**

**CONTACT US**

**swim2018poland@gmail.com**

**REGISTER AT**

**swim2018.syskonf.pl**

**Program Modeling Groundwater Flow in Coastal Zones**

**Gdańsk, Poland, Mercure Gdańsk Stare Miasto hotel**

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| **Day 1 Thursday 14th June 2018** | | | |
| **TIME** |  | THEME/TOPIC | **PRESENTERS** |
| **0830** |  | **Coffee & Registration** | **Mark Bakker (TU Delft), Frans Schaars (Artesia Water), and Christian Langevin (USGS)** |
| **Day theme** | | **Sharp-interface analytical solutions in Python** |  |
| **0845** | **1** | **Welcome and general introduction**   * Course overview * Tools and methods * Laptop installation and testing: Python, SEAWAT, SWI, and FLOPY example scripts. |  |
| **0915** | **2** | **Exercise A. Density, pressure, and head**   * Calculations of density, density slope, pressure, head, and freshwater head |  |
| **0945** | **3** | **Explanation and discussion of Exercise A** |  |
| **1030** | | Morning Tea |  |
| **1100** | 4 | Introduction to programming analytical solutions in Python   * Example script: Badon Ghijben-Herzberg principle |  |
| **1130** | 5 | Exercise B   * Single layer confined interface flow * Sensitivity analysis: which parameters are important? |  |
| **1230** | | **Lunch** |  |
| **1300** | 6 | **Explanation and discussion exercise B.** |  |
| **1415** | 7 | Increasing complexity: steady state solutions   * Unconfined flow * With wells |  |
| **1500** | | **Afternoon Tea** |  |
| **1530** | 8 | Exercise C   * Sea level rise   Critical pumping rate |  |
| **1615** | 9 | **Explanation and discussion exercise C.** |  |
| **1700** |  | **Discussion and close** |  |
| **17:15** | | **End of Day 1** |  |

**Program Modeling Groundwater Flow in Coastal Zones**

**Gdańsk, Poland, Mercure Gdańsk Stare Miasto hotel**

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| **Day 2 Friday 15th June 2018** | | | |
| **TIME** |  | THEME/TOPIC | **PRESENTERS** |
| **0830** |  | **Coffee & Registration** | **Frans Schaars (Artesia Water), Mark Bakker (TU Delft), and Christian Langevin (USGS)** |
| **Day theme** | | **Transient sharp-interface SWI package** |  |
| **0845** | **1** | **Refresher** |  |
| **0900** | **2** | **Introduction**   * MODFLOW SWI theory * FLOPY Example: 2D development of a fresh water lens |  |
| **0945** | **3** | Exercise C: 2D development of a fresh water lens   * Comparison with steady state solution * Sensitivity analysis for SWI parameters |  |
| **1030** | | Morning Tea |  |
| **1100** | 4 | Explanation and discussion exercise C. |  |
| **1130** | 5 | Exercise D: building a FLOPY MODFLOW-SWI model from scratch |  |
| **1230** | | **Lunch** |  |
| **1300** | 6 | Explanation and discussion exercise D. |  |
| **1345** | 7 | Exercise E: transient impact on interface position   * Sea level rise * Recharge decrease * Sea water intrusion overshoot |  |
| **1500** | | **Afternoon Tea** |  |
| **1530** | 8 | Explanation and discussion exercise E. |  |
| **1600** | 9 | Examples of MODFLOW SWI case studies   * Terschelling * …. |  |
| **1700** |  | **Discussion and close** |  |
| **17:15** | | **End of Day 2** |  |

**Program Modeling Groundwater Flow in Coastal Zones**

**Gdańsk, Poland, Mercure Gdańsk Stare Miasto hotel**

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| **Day 3 Saturday 16th June 2018** | | | |
| **TIME** |  | THEME/TOPIC | **PRESENTERS** |
| **0830** |  | **Coffee & Registration** | **Christian Langevin (USGS), Frans Schaars (Artesia Water), and Mark Bakker (TU Delft)** |
| **Day theme** | | **Transient - SEAWAT** |  |
| **0845** | **1** | **Refresher** |  |
| **0900** | **2** | **Introduction**   * MODFLOW and MT3D overview * SEAWAT concepts |  |
| **1015** | **3** | Overview of the Henry Problem |  |
| **1030** | | Morning Tea |  |
| **1100** | **4** | **Exercise A: Simulation of the Henry Problem** |  |
| **1215** | **5** | **Explanation and discussion of Exercise A** |  |
| **1230** | | **Lunch** |  |
| **1300** | **6** | Exercise B:   * Design, run, and calibrate a 2D cross-section model |  |
| **1445** | **7** | Explanation and discussion exercise B. |  |
| **1500** | | **Afternoon Tea** |  |
| **1530** | **8** | Exercise C: Design and Run a 3D saltwater intrusion model   * Determining the effects of a proposed wellfield |  |
| **1645** | **9** | **Special topics in saltwater intrusion modeling** |  |
| **1700** |  | **Discussion and close** |  |
| **17:15** | | **End of Day 3** |  |