

Date: February 26

Time: 12:00 NOON

Location: Olin 305

Speaker: Dr. Henk Kooi
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Title: "Beyond the coastline: Variable-density flow and transport modeling applied to offshore groundwater"

Abstract

Over the last decades, flow and transport in variable-salinity groundwater has been studied extensively within the context of salt-water intrusion. This work was always concerned with hydrogeological conditions and processes in aquifer systems on land. However, a number of key conditions and processes relevant to fresh groundwater do occur in the offshore:

- (1) Submarine groundwater discharge (SGD). Outflow of fresh groundwater from the continent into estuaries and seas, driven by elevated topographic heads onshore.
- (2) Offshore fresh and brackish paleowaters. Fossil groundwater bodies which formed during periods of low sea level and that became entrapped during Holocene sea-level rise.

We address both these issues in regional studies - notably in Suriname and the North Sea - and through process modeling of the development of offshore groundwater salinity patterns and flow fields using the variable-density groundwater flow code METROPOL. In the talk, results and insights obtained thus far will be presented. Special attention will be paid to the modeling of salinization by free convection. This phenomenon is particularly important in the offshore where inverse density stratification is the rule rather than the exception. First it is shown that model behaviour is consistent with existing theory on free convection for simple and idealized conditions (homogeneous, isotropic, no mechanical dispersion). Then model results for more complicated boundary- and initial conditions are presented that provide a better representation of field situations. Finally, a number of fundamental questions are discussed that need to be resolved before many real-world problems that involve free convection in high-permeability, heterogeneous aquifers at $Ra >$ can be addressed.