Monitoring boil seepage with fiber-optic Distributed Temperature Sensing

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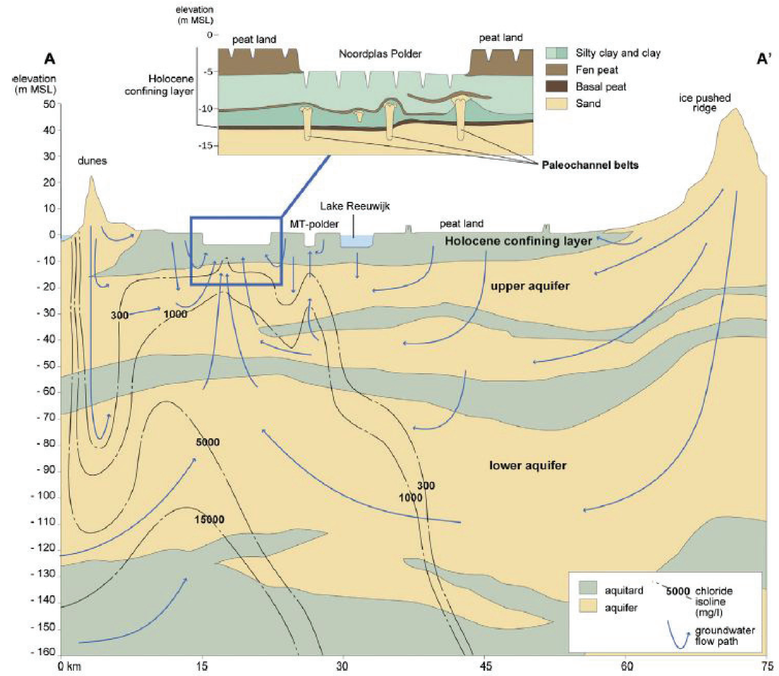
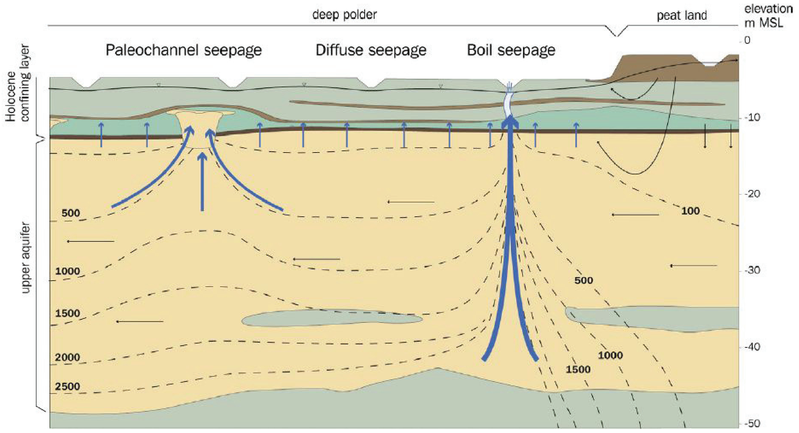
Introduction

Boils are local seepage sources that mainly occur in ditches in deeper polders in deltas.

Problem: boils account for the largest source of salinization, which will be enhanced with future sea level rise and land subsidence.



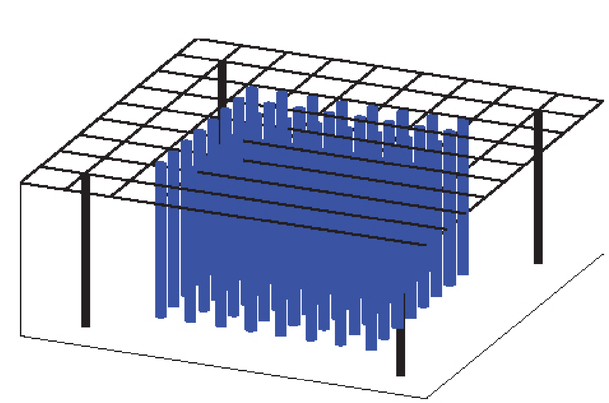


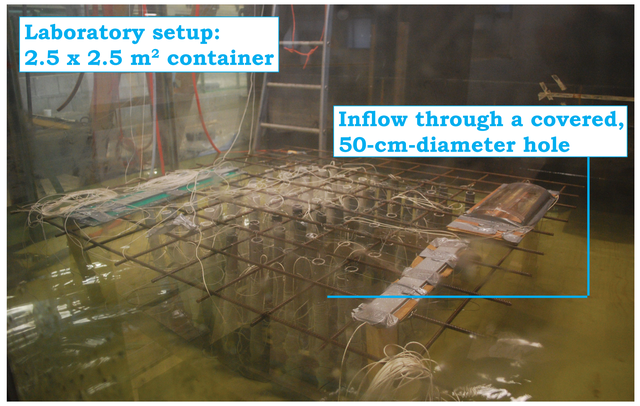
(De Louw et al., J Hydrol, 2010)

Method

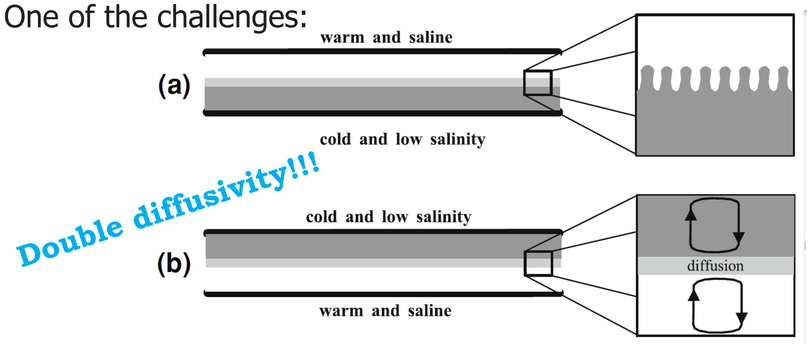
Goal: measure boil seepage without needing to penetrate the soil.

Method: measure the temperature profile above the boil and use this as a model input to infer the seepage discharge.





One of the challenges:

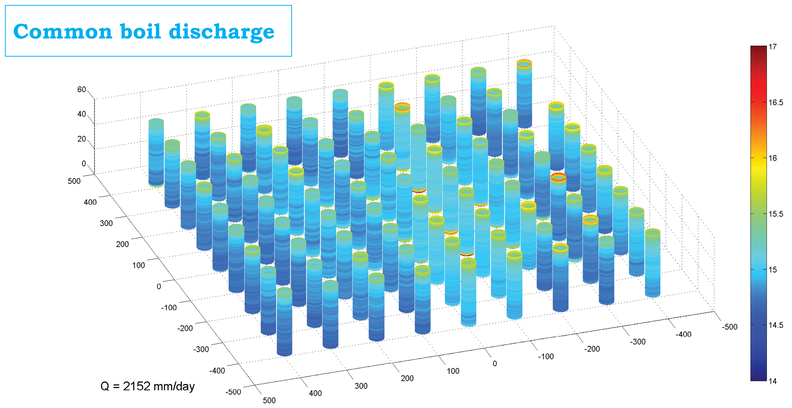


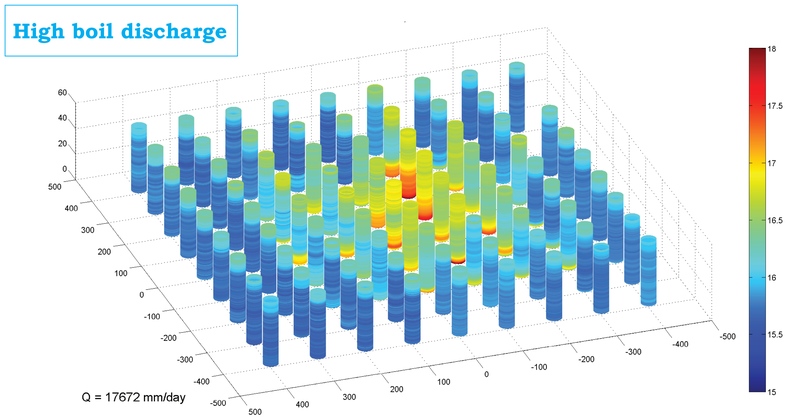
(Berthold and Börner, Environ Geol, 2008)

First results

First laboratory results:

With common boil discharges of ~2 m/day, only the first 5 cm directly above the boil show a significant increase in temperature, whereas higher flows clearly result in a temperature increase over the full depth (see figures below).





Conclusions

- Higher-resolution measurements of the bottom layer are required for measurements of boils with lower discharges.
- With an improved setup, a modeling study should indicate if accurate boil discharges can be inferred from the profiles.
- More laboratory tests are needed to study the influences of salt concentration and temperature on potential layering.

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