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Modeling boil seepage discharge from DTS data

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The exploitation and drainage of fresh water in coastal lowland areas often cause seepage from the saline groundwater layer. The seepage occurs both diffusely, i.e., spread over the surface, and via preferential paths, commonly divided into Paleochannels and boil seepage through small high-conductive vents. Boil seepage mainly occurs in polder ditches where the pressure gradient often is larger compared to the adjoining land. Their large corresponding salt fluxes make boils of specific interest (De Louw et al., 2010).

Many methods to measure seepage discharge into streams require penetrating the soil, which is very undesirable for measuring boils, for their paths are very sensitive to changes in resistance. Our aim is to measure boil seepage from the surface water. This way, the equipment is easy to install and leaves the bed undisturbed.

Our study uses fiber-optic Distributed Temperature Sensing (DTS) data of the temperature profile above a boil as a model input to infer the boil discharge. Studies using temperature data to measure groundwater-surface water interactions are numerous, but most of them measure temperature in the streambed or assume the groundwater inflow to mix instantaneously with the surface water, e.g., Westhoff et al. (2007). Since the surface water systems of our interest are close to stagnant for most of the time and strong density gradients occur, we choose to use DTS data as an input to a density flow model. The model comprises the local surface water above the boil and allows deducing the vertical groundwater flux from the boil.

References

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