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Piping in practice: Incorporating natural subsurface variability into backward erosion models

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River embankments form an essential part of the primary flood defence in the Netherlands. Of all failure mechanisms, piping is considered one of the key mechanism for triggering dike destabilization of river dikes in Rhine-Meuse Delta. Within the STW project Piping in practice, we aim to better understand 1) the influence of variability within subsurface characteristics on the piping process, and 2) the natural variability of these subsurface characteristics underneath embankments in the Rhine-Meuse delta.
We employ the lithogenesis of sandy deposits to group variability in subsurface parameters across different scales. Using extensive borehole datasets, we quantified regional trends within and between geological units in order to investigate geological controls on variability these subsurface properties. On a smaller scale, laboratory experiments have shown that larger variation in grain size or layering in porous media have a retarding effect on the progression of small-scale pipes, demonstrating the importance of incorporating these variabilities into the piping assessments. Combining laboratory experiments and field observations, representative sedimentary architectures are implemented into digital piping models at several embedded scales. This will allow us to better describe subsurface variability in terms of model parameters, and improve computation of the piping process.