



## **Generating Hydrogeological Virtual Realities Following Sedimentological Principles**

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There are many tools for generating heterogeneous subsurface models for hydrogeological research. Often, these tools do not account for geological depositional concepts, or are unable to simulate the heterogeneity of bedding structures that can control the orientation of the full hydraulic-conductivity tensor.

We have developed a modelling framework that can be used to simulate sedimentary deposits and the associated spatial heterogeneity of hydraulic parameters in three dimensions. The Hydrogeological Virtual Reality (HyVR) package is an open tool for simulating hydraulic parameter fields. A hierarchical modelling framework is utilised to allow for multiple scales of heterogeneity. Features are simulated using an object-based modelling approach, which can be more efficient and less parameter-intensive than process-based approaches. The simulation outputs include hydraulic conductivity, porosity, and the bedding orientation parameters dip and azimuth. These last two parameters can be used to simulate full hydraulic-conductivity tensors. The simulation outputs are compatible with other flow-and-transport simulation tools to facilitate the use of HyVR in hydrogeological modelling.

HyVR has been developed in Python and is openly available (<https://github.com/driftingtides/hyvr/>) to allow researchers to develop their own conceptual models. As such, it forms an open codebase ready for extension and development by the hydrogeological community.