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Title

Extracting 3D grain size trends across synthetic analogues of prograding deltas created in Delft3D GeoTool

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Abstract

Geological models are generated by interpretation and interpolation of sparse data. To limit uncertainty, relevant analogues are used to extrapolate knowledge of previously studied, well understood systems. However, these analogues only provide a snapshot of deposition. During delta progradation, sediment will not only be deposited, but is also reworked resulting in unique preserved sediment distribution patterns for each delta. We show how process-based models can be used to study the evolution of deltaic sediment distribution in four dimensions. Grain-size distribution trends are extracted from preserved deposits in synthetic analogues of prograding deltas.

Process-based models also allow us to go beyond the extraction of trends. It allows the detailed study of the deposition and preservation of sediment in a prograding delta environment. The reservoir potential of deltaic systems is to a large extent dependent on the distribution and composition of its sandy mouth bar and channel deposits. The active channel network acts as a distributed sediment source across the delta where coarser sediment is transported within the active channel network as bedload which can be deposited as part of channel accretion or mouth bar deposits. Finer sediments are also transported along the active channel network, but can leave the channels more readily and be deposited on the flood plain, delta front or prodelta. An automated method was developed to classify the resultant deposits into architectural elements. We compare the sediment property trends of the sand-rich mouth bar and channel deposits which typically exhibit good reservoir characteristics.

The scripts used in this comparative analysis will also be made available in the new open-source Delft3D GeoTool, which allows the simple simulation and analysis of different deltaic systems by the global community of geoscientists. In future, this method can be used to generate custom synthetic analogues to better constrain geological models.