

Two mathematical approaches to delta evolution

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For many morphodynamic problems, the Exner equation can be applied in two different ways. In the first approach, a transport law is prescribed, from which the morphology freely evolves. In the simplest case, if the transport rate is assumed proportional to slope, the long profile becomes governed by a diffusion equation. In the second approach, the morphology is constrained, and it is the transport rate that must accommodate the constrained surface evolution. In the simplest case, avalanching at the angle of repose, the constant slope morphology becomes governed by the eikonal equation. Using either approach or a combination of both, it will be shown that various interesting solutions can be derived to problems of delta evolution. These include the infill of finite reservoirs by hyperpycnal inflows, and the progradation of three-dimensional Gilbert deltas. Laboratory and field examples from Taiwan will be used to compare predicted and observed behaviors.

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