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# A model for simulating the deposition of water-lain sediments in dryland environments

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Abstract. A numerical process-imitating model, the Discrete Storm Event Sedimentation Simulator (DSESS), has been developed to represent the climatic and hydraulic conditions of drylands in modelling their geomorphological development and sedimentary facies distributions. The ultimate aim is to provide insights into the lateral variability of permeability in the Triassic Sandstone aquifers of the UK for the study of solute movement. DSESS employs discrete storm-flood automata, released across a cellular landscape, to model sediment transport: erosion, migration and deposition. Sediment classes with different grain sizes can be modelled. Empirical process-based equations are used to quantify the movement of the automata, their erosion potential, sediment-carrying capacity and interaction with the underlying sediments. The approach emphasises the sequence of dryland storm events and associated floods rather than their timing. Flood events are assumed to be discrete in time. Preliminary tests carried out with DSESS using simple systems and idealised initial conditions produce lithological and land surface features characteristic of dryland settings and indicate the potential of the model for large-scale, long-time modelling of sedimentary facies development. Markedly different results are observed across the range of tests carried out in response to the non-linear interactions between the different elements of the landscape and the floodwaters simulated with DSESS. Simulations show that sediment accumulations develop concave upward radial profiles, plano-convex cross-profiles and possess a general lateral grading of sediment with distance from source. The internal grain size architecture shows evidence of both persistent and rapidly changing flow conditions, with both lateral and longitudinal stepping of coarse bodies produced by 'scour and fill' events and random avulsions. Armoured layers form so that near-surface sediments have increased likelihood of preservation. Future developments will include representation of aeolian deposition, mass wasting and hyper-concentrated (debris) flows.

Keywords: avulsion, channel, deposition, drylands, erosion, gravel armouring, modelling, sheet-flood, transport capacity

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