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Comparison of Kolmogorov model and experimental data

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Kolmogorov (1951) proved that it is possible to calculate the distribution of layer thickness after infinite repetition of erosion and deposition, from PDF about occurrence of layer thickness for each event. Endo (2010) proved that it is possible to solve the inverse problem under some assumption. Both models for forward and inverse problems assume the continuity of PDF (probability density function) of the magnitude of deposition or erosion where erosion is defined as negative deposition. However it is not obvious that the assumption is always correct in any sedimentary processes or environments. Here we test the model using flume-experimental data conducted at SAFL in University of Minnesota that obtained topographic data during the experimental run and the sedimentary structure of the resultant deposit. By analyzing the topographic data it is found that the PDF of increments and decrements of the surface elevation can be regarded as continuous. After solving the inverse problem from the bed thickness distribution of the deposit, we can calculate the PDF of increments during arbitrary numbers of events. By comparison between calculation and the topographic data from the experiment, it is found that (1) the PDF of increments and decrements of the surface elevation within 8 hours well agrees with the model, but (2) the PDF for 16 hours does not agree with the model and instead the probability of occurrence of increment with the calculated average value (expectation) was quite larger than expected by the model. The result implies the dependence between an event and past ones (history-dependence) for a relatively longer term. To develop the model in the future, the history-dependence should be considered.

Keywords: Probabilistic model, Sedimentation model, Bed thickness distribution