



## **Stochastic theory of soil erosion: the novel approach to modelling and experimentation**

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The third-generation stochastic soil erosion model (STOSEM) was developed. It is based on the description of erosion, transport and deposition of soil aggregates by the equation of mass continuity, where all terms are regarded as local temporal/spatial mean values of corresponding stochastic variables - soil aggregate masses and velocities, soil and flow characteristics. This gives the opportunity to estimate mean erosion and deposition rate explicitly from the probability density functions (PDFs) of flow velocity, soil aggregate size, soil cohesion and other basic controlling factors. The main advantage of stochastic approach is the possibility to determine the relationship between the rate of erosion/deposition and controlling factors inside the model theoretically, by a solution of the governing deterministic equations with stochastic components. Variability of the PDFs of controlling factors through time and space due to the changes in flow regimen and/or soil composition produces differences in the structure of relationship between the mean erosion/deposition rate and controlling factors, as well as in resulting mean rate of erosion. Erosion rate increases with flow velocity more rapidly for soil with higher cohesion and larger aggregates. This theory also shows great difference in type of soil erosion for relatively high and relatively low flow velocities, and explains rather high errors in calculating of low erosion rate even with detailed models. The theory is far from application due to the lack of specific experimental data for validation. The main application of STOSEM at the current state is the numerical experimentation with broad variation of input stochastic characteristics of erosion factors. These calculations can help in designing soil erosion field and laboratory experiments and in the analysis and explanation of the variability in the results obtained, which leads to the better understanding of soil erosion/deposition mechanics.