Modeling Bulk Soil Deformation using Rheological Properties and Micro Scale Pore Closure. (S01-berli155852-Oral)

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Abstract:

We address compaction of wet soils of relatively high bulk density such as agricultural subsoils. Bulk soil compaction under steady stress was modeled as shrinkage of isolated spherical pores embedded in a homogeneous viscoplastic matrix. The microscale model describing the extent and rate of deformation of isolated pores was used to derive soil stress-strain behaviour at different water contents (hence different soil rheological properties). The model was applied to experimental data from confined uniaxial compression tests of a silt loam soil from Ruckfeld, Switzerland. Qualitative agreement between measurements and model predictions show the potential of the model to provide predictive capabilities based on first principles and independent rheological measurements. The model can be extended to derivation of bulk moduli, and to prediction of soil compaction behavior under transient loading (e.g. passage of farm implements) where loading rate and soil viscoelastic properties become important.

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