Science Societies

New Model to Predict Soil–Gas Diffusivity

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Lead author M.M.T. Lakshani, a postgraduate student at the University of Peradeniya, Sri Lanka, conducts soil–gas diffusion experiments. Photo courtesy of Chamindu Deepagoda.

Both the migration of gas in soils and its emission to the atmosphere play a role in numerous climate and environmental processes. Gas migrates in soils predominantly through diffusion, which can be numerically characterized by the soil–gas diffusion coefficient, Dp. Measuring Dp using instruments is challenging. But predictive models, based on easy-to-measure soil properties such as air-filled porosity and total porosity, can estimate both Dp and soil–gas diffusivity, or Dp/Do (Do denotes the gas diffusion coefficient in free air). Although numerous models for Dp/Do exist in the literature, scientists need models that better account for controlling soil variables, such as moisture and density.

As reported recently in Vadose Zone Journal, scientists have developed an air-saturation-dependent exponential soil–gas diffusivity model, dubbed the ASEX model, which performed well when statistically compared with widely used predictive models for both repacked and undisturbed soils. The ASEX model features an adaptable model parameter ( ) that can be calibrated using measured Dp/Do data. The scientists further provided reasonable estimates of for repacked and undisturbed soils in the absence of measured data.

The ASEX model is an important step toward upgrading the modeling capability for Dp/Do, with further development needed.

Adapted from Lakshani, M.M.T., Chamindu Deepagoda, T.K.K., Hamamoto, S., Elberling, B., Fu, W., Yang, T., ... & Chanakya, H. (2022). A new exponential model for predicting soil gas diffusivity with varying degree of saturation. *Vadose Zone Journal*, 22,e20236. https://doi.org/10.1002/vzj2.20236