



Science
Societies

President's pick: SSSA Research

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Assessing
fungal–mineral
interactions
in soil:
A review of
microscale
methods



Subgrid
parametrizations
mediate the
large-scale
effects of soil
macroporosity
on the water cycle
in the ORCHIDEE
land surface model

Exciting new research is shared every day among the scientific community in our journals. SSSA is the sole publisher of the *Soil Science Society of America Journal* and *Vadose Zone Journal* and co-publisher of the *Journal of Environmental Quality* and *Agricultural & Environmental Letters* with CSSA and ASA.

Each month, I will pick one or two articles among our journals that represent some of the most exciting, creative, and innovative research in our field of soil science. This month, I have chosen the following two articles, one from the *Soil Science Society of America Journal* and one from *Vadose Zone Journal*. Congratulations to the authors and thank you for sharing your excellent work!

Assessing fungal–mineral interactions in soil: A review of microscale methods

Fungi are increasingly recognized as important, though still not fully understood, agents of mineral weathering. Morris et al. review fungal–mineral interactions from the hyphal contact point to their broader implications for soils and the environment. The authors place this work in a long history, with some of the oldest known mycorrhizal fossils dating to more than 400 million years ago. They then examine how fungi may alter minerals through physical contact and penetration, the release of organic acids and other compounds, and the formation of secondary minerals such as oxalates. Fungi also appear to direct growth toward nutrient-rich minerals such as apatite and K-feldspar, a behavior described as mineral biosensing. The evidence for active penetration of intact minerals remains unresolved because hyphae may instead grow through pre-existing cracks. A substantial part of the review compares the tools researchers use to study these interactions, from electron, helium-ion, and atomic-force microscopy to X-ray methods, mass spectrometry, molecular sequencing, and field approaches such as mesh bags. The authors discuss possible applications in

enhanced silicate weathering and carbon-cycle research, as well as materials science, biomining, and the search for biosignatures beyond Earth. Their review makes clear that connecting what happens at the hyphal–mineral interface to larger environmental effects will require more quantitative research across scales.

Journal: *Soil Science Society of America Journal*

Authors: M.L. Morris, D.G. Zaharescu, C.V. Collins, E.E. Nuccio, R.A. Lybrand

Article link: <https://doi.org/10.1002/saj2.70340>

Subgrid parametrizations mediate the large-scale effects of soil macroporosity on the water cycle in the ORCHIDEE land surface model

Soil structure strongly affects water movement at the scale of a soil core or plot, but its effects can be muted in land surface models operating at roughly 100-km grid scales. Kiatka et al. test why this happens in the land surface model, ORCHIDEE, where averaging rainfall across large grid cells and long time steps can smooth out intense events and leave soils less often near saturation, the conditions under which macroporosity has its greatest influence. The team added a physically based representation of plant-linked structural macroporosity, parameterized in relation to observed gross primary productivity, and tested two existing subgrid treatments. These treatments represented the timing of precipitation within a forcing time step and spatial variability in saturated hydraulic conductivity during infiltration. Together, they accounted for about two-thirds of macroporosity's effect on mean global runoff and soil moisture. In grid cells with above-median runoff, macroporosity reduced runoff by an average of 44%. In the more productive half of grid cells, it increased total soil moisture by 8% and plant transpiration by 28% on average. In coupled land-atmosphere simulations, the soil moisture changes were associated with statistically

significant regional cooling of up to 2K. The authors show that soil structure can matter in large-scale water-cycle simulations, but its influence becomes visible when models also represent subgrid variation in soil hydraulic properties or precipitation.

Journal: *Vadose Zone Journal*

Authors: F. Kialka, V. Bastrikov, O. Flores, K. Naudts, S. Luyssaert, B. Guenet

Article link: <https://doi.org/10.1002/vzj2.70136>

Soil Science Society of America Journal

Vadose Zone Journal

President's Picks

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