Scientists call for infiltration to be better incorporated into land surface models

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Soil structure is one of many factors that affects infiltration of water. Credit: J. Sebastián Silva O.

Soil scientists can't possibly be everywhere at once to study every bit of soil across the planet. Plus, soils are constantly changing.

Conditions like weather and land use have a major impact on soil over time. So, to understand everything about soil, we would need to be continuously studying soil around the world. Since this isn't possible, soil

scientists are turning to math to predict what happens at the soil's surface.

Soil models—just like economic models—are helpful to predict trends and make suggestions. An example might be the impact of climate change on water processes in the soil. Models help fill in the gaps of measured data.

Since soil is a complex environment, a soil model consists of many pieces that represent different processes. One important aspect of soil models—how water interacts with soil at the land surface—was recently discussed by a group of almost 30 scientists. Their work was recently published in *Vadose Zone Journal*.

Water infiltration at the land surface is a crucial area of study. Infiltration refers to what fraction of the water is getting absorbed by the soil. Being able to predict if precipitation will run over the soil surface or soak in is crucial in land management decisions. If affects aspects of land management like erosion control. It is also important in making sure we have a safe and clean water supply. Land surface models can help scientists predict and simulate the water and energy cycles from the soil's surface into the atmosphere.

Each piece of a land surface model is important. The study team found that information about infiltration warrants more attention in land surface models.

Slower infiltration can lead to increased soil erosion. Credit: Martha Pings

In order to be truly useful, land surface models need to include loads of information. This includes soil structure, soil moisture and temperature, precipitation, terrain, plants, and more. Scientists use the information to calculate the Earth's climate or see how land use changes may affect it.

Harry Vereecken, Forschungszentrum Jülich in Germany, was the lead author of this effort. "The review found important gaps in the current treatment of infiltration processes in land surface models," says Vereecken. "Current models don't account for the effect of structural properties on soil water dynamics. Also, we saw the lack of a consistent framework to upscale infiltration processes from different scales and the large diversity in approaches to describing them."

The group is calling on scientists to work together and lend their skills to better include this information in land surface models. This is so the

models better reflect the reality of what's happening at the Earth's surface.

Their review was a way to compile scientific research from over a long period of time and give suggestions about where soil scientists should focus their efforts next. In looking over lots of research, they found there's no consistent way to predict infiltration. They also found that some aspects of soil that affect infiltration are often ignored.

"The climate and Earth sciences community typically operate at a larger scale than the soil science community," Vereecken explains. "Soil scientists have mostly worked at smaller scales, such as plot to field scale to study processes and often did not include atmospheric processes in their studies. We wanted to write about the importance of these communities coming together. This is the first review ever that addressed the handling of infiltration processes in these models."

He adds that they hope their work provides a common understanding about how infiltration processes are dealt with in land surface models. While it can be difficult to quantify these complex processes and combine them into larger models, it's important in studying the state of the planet. Both groups need each other. Without soil scientists working on a smaller scale, others won't have data for their models.

"Because soil exerts a key control on climate-related processes, it can add relevance to the research we are doing as soil scientists," Vereecken says. "We hope this can serve as a kind of reference paper for other scientists and connect those that work on different aspects of land surface models."

More information: Harry Vereecken et al, Infiltration from the Pedon to Global Grid Scales: An Overview and Outlook for Land Surface Modeling, *Vadose Zone Journal* (2019). DOI: 10.2136/vzj2018.10.0191