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Contribution ID: **791**

Type: **Oral Presentation**

Intermediate-scale testing of a spatially distributed sensing technology for monitoring gas emission from soils as applied to climate change

Friday, 4 June 2021 14:15 (15 minutes)

The current understanding of the effects of soil management on carbon cycling and emissions of major greenhouse gases (e.g., H_2O, CO_2, CH_4, N_2O) is limited by the dearth of available sensing technologies that can make spatially distributed soil gas concentration measurements at the field and landscape-scales. It is important that these gas concentration data be furthermore be closely linked to high fidelity multi-scale soil structure and soil water content characterizations as these soil factors control the generation and transport of greenhouse gases. A combined laboratory and field study is in progress to develop and deploy a spatially distributed gas sensing technology with an embedded fiber-optics component for use in agricultural and the natural environments. This integrated sensing system will be tested under various soil, vegetation, and climatic conditions in a controlled laboratory setting using a specialized coupled micrometeorological wind tunnel and soil testbed facility at the ERDC synthetic environment for near-surface sensing and experimentation (SENSE). Prior to wind tunnel testing and subsequent field installation, a set of experiments were conducted in a three-dimensional intermediate-scale laboratory soil testbed. These experiments, performed under well specified and controlled boundary conditions, were designed to investigate the effects of soil heterogeneity on the spatial dynamics of soil moisture and subsequent gas migration pathway development. The soil testbed was packed with a heterogeneous configuration consisting of five uniform silica sands with the effective sieve numbers #70, #20/30, #16, #12/30, and #8. Spatial and temporal variations of soil moisture were monitored in situ with embedded soil moisture sensors. Gas concentrations were also measured within the soil profile and at the soil surface using a traversing fast-flame ionization detector. Methane was released from a set of ports located at the bottom of the soil test-bed to simulate a distributed natural/anthropogenic release. Various soil moisture dynamics scenarios expected in the field were simulated by fluctuating the water table and applying artificial precipitation using a rainmaker located above the soil testbed. The experimental data were used to validate a two-phase flow and gas migration model and demonstrate the importance of monitoring the soil moisture dynamics to properly/accurately interpreting gas concentration measurements within the soil profile and at the land-atmospheric interface.

Time Block Preference

Time Block B (14:00-17:00 CET)

References

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Student Poster Award

Primary authors: ILIE, Ana (Colorado School of Mines); ILLANGASEKARE, Tissa; SOGA, Kenichi (University of California at Berkeley); WHALLEY, Richard (Rothamsted Research); TRAUTZ, Andrew (Colorado School of Mines); CIHAN, Abdullah (Lawrence Berkeley National Laboratory)

Presenter: ILLANGASEKARE, Tissa

Session Classification: MS25

Track Classification: (MS25) Subsurface Water Flow and Contaminant Transport Processes –Special Session in Honor of Harry Vereecken