Poster #107

Influence of Topography on Soil Respiration in the Susquehanna-Shale Hills Critical Zone Observatory

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Variation in soil temperature and moisture across hillslope topographic positions may exert strong controls on soil respiration (SR). We monitored the spatial and temporal dynamics of soil temperature, moisture and respiration for a growing season (171 days, May 14 to October 31, 2015) across a forested watershed in central Pennsylvania at the Susquehanna-Shale Hills Critical Zone Observatory. In addition to 8 automated chambers with hourly recorded data (LiCor-8100 system), we monitored 50 plots at 4 locations in each plot over the 8-ha catchment for soil respiration from 10:00 to 15:00 weekly. Cumulative season-long SR averaged 855 ± 27 g C m^{-2}, and ranged from 484 to 1449 g C m^{-2} across the landscape. The valley floor exhibited higher soil moisture and lower temperature at a 5 cm depth than soil at the ridge top and mid-slope locations, but cumulative SR did not differ significantly with hillslope location. Mid-slope swale positions tended to have higher cumulative SR than other locations by about 100 g C m^{-2}. (P =0.196). In most locations across the catchment, the seasonal pattern of SR was largely explained ($r2$ = 60% - 90%) by a combination of soil temperature and moisture. Although topography had a relatively subtle effect on cumulative season-long SR, we did observe significant shifts in the relationship of SR with temperature depending on hillslope position. The seasonal temperature sensitivity (Q_{10}) of SR was higher in the valley floor and mid-slope swale locations (Q_{10} = 2.69 and 2.70, respectively) compared to the ridge top and mid-slope planar positions (Q_{10} = 1.91 and 2.15, respectively) for both weekly and hourly SR (P < 0.01). Our results suggest that landscape topography may modify the seasonal dynamics of SR by altering the responsiveness of SR to shifts in temperature.