



Measurement of soil moisture with cosmic-ray neutrons in deciduous forests

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In deciduous forests the calibration of cosmic-ray soil moisture sensors is difficult since the amount of water stored inside and on vegetation (leaves, branches, stems) varies seasonally. A one-time calibration conducted during summer can therefore introduce errors to the method that are especially pronounced in the winter season. We performed calibration in a deciduous forest at the TERENO observatory in north-eastern Germany at different times throughout the year to capture the changing influence of water in the vegetation on the calibration results. Additionally, we calibrated the cosmic-ray neutron sensor with soil samples from different soil depths (0-10 cm, 0-20 cm, 0-30 cm). We compared the resulting soil moisture time series with time series of FDR-based soil moisture point measurements at different depths. This allows us to estimate the error introduced by the influence of organic layers at the soil surface (litter, decomposed organic material) which can vary temporally. The same sensor setup was also used to look at time-lags between the cosmic-ray soil moisture signal and measurements of precipitation, intercepted water and soil moisture point measurements at different depths. Recorded time lags between point measurements and cosmic-ray soil moisture results can potentially help in tracking precipitation on its way through the canopy, the organic layer and into the soils.