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Interpolating long term TOC concentration in throughfall and stemflow waters

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Concentration of total organic carbon (TOC) was measured during an entire hydrological year in throughfall and stemflow in a mature olive orchard in Southern Spain. The final objective was to evaluate the relevance of these fluxes. For this, we examined the relationship between carbon concentrations under the canopy and rain event characteristics, and extrapolated the results of our study over longer time periods, using multiple regression models fitted to the available data. The explanatory variables considered in constructing models, were chosen among the factors influencing organic carbon concentration so to obtain an estimated regression equation with the larger adjusted R2 value and a lower AICc (Akaike's Information Criterion) with a correction for finite sample size. As TOC concentration distributions in throughfall and stemflow presented right skewed, we modeled the natural logarithms of TOC concentrations.
Based on 39 event/tree combinations, the predicted multiple regression equations for log(TOC) in throughfall and stemflow were respectively:
log([Thr TOC]) = 1.30 + 8.5*10-3(RI) + 0.18(ETc) + 4.88*10-3(ADP) - 8.89*10-3 (R)
[adjusted R2 = 0.71, Sum of Squared Residuals = 1.76];
log([Stem TOC]) = 1.76 + 0.06(ETc) + 3.55*10-3(ADP)+ 1.76*10-3(RI) - 0.47(Stem) - 5.05*10-3 (R)
[adjusted R2 = 0.81, Sum of Squared Residuals = 0.44];
(Thr= throughfall; RI= rainfall interception; ADP= antecedent dry period; R=rainfall; Stem= stemflow)
These two models allowed us to estimate the year to variability of throughfall and stemflow TOC fluxes in the 1982-1990 period in the same olive orchard, exploiting the available data (Lombardo et al., 2017; Castro Tendero, 1998).
The results of this long-term model calculation showed a large variability associated to rainfall, with cumulative TOC fluxes by throughfall ranging from 15.51 to 64.77 g m-2 year-1 and cumulative TOC fluxes by stemflow ranging from 2.92 to 13.98 g m-2 year-1. Thus, these enriched waters serve as primary components of the carbon budget in an agrarian ecosystem and might play a relevant role in counteracting part of the organic carbon losses through runoff and sediment in olive groves (101-432 kg ha^{-1} yr^{-1} ; Gómez et al., 2017).

References

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