Supplement of Biogeosciences, 18, 739–753, 2021
https://doi.org/10.5194/bg-18-739-2021-supplement

Biogeosciences Open Access EGU

Supplement of

L-band vegetation optical depth as an indicator of plant water potential in a temperate deciduous forest stand

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Allocation of water between vegetation components

The exact amount of water in each of the leaves, branches, and stems of the oak trees is not known, and is modulated by both the differing water content values of these different components, as well as plant allometry (e.g. biomass of leaves relative to branches relative to trunk). We used data from the TRY database (Kattge et al., 2011), the Biomass and Allometry Database (BAAD) (Falster et al., 2015), and individual studies of oak species to estimate several of these quantities, as detailed in the table below:

Quantity	**Definition**	**Value**	**Source**
LM:SM	dry leaf mass per total dry stem and branch mass	0.022	BAAD (average of 9 adult *Quercus rubra*)
BM:SM	dry branch mass per total dry stem and branch mass	0.17	BAAD (average from 12 temperate oak species)
LDMC	leaf dry matter content, or leaf dry mass per total leaf mass	0.31	TRY (average of 315 *Quercus rubra* values)
BDMC	branch dry matter content, or branch dry mass per total branch mass	0.51	(Palacio et al., 2008) (1 to 2-year-old branches, average from *Q. ilex* and *Q. faginea*)
SDMC	stem dry matter content, or stem dry mass per total stem mass	0.51	Assumed equal to BDMC

These quantities were combined to calculate the average units of leaf water content (2.2 units), branch water content (7.4), and stem water content (36) per unit of dry leaf mass, respectively These numbers also determine the relative fractions of the total aboveground water content in the leaves, branches, and stems, respectively - approximately 5% of an oak tree's water is expected to be in its leaves, 16% in its branches, and 79% in its trunk.

Thus approximately 21% of the total tree water is in the leaves and branches.

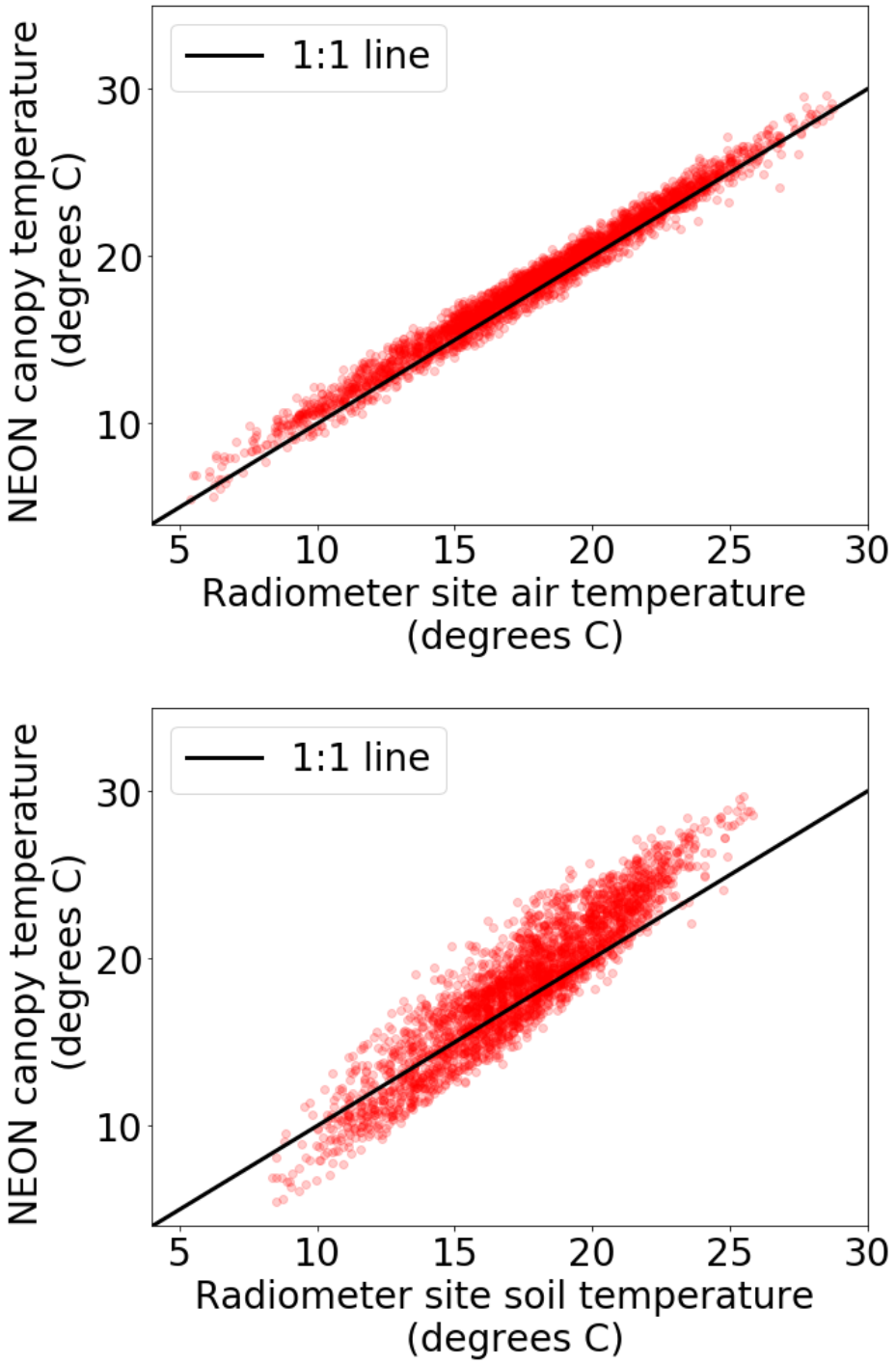

Figure S1. Scatter plots comparing the soil and air temperature at the radiometer site with infrared canopy temperatures from the nearby NEON site, over June through September 2019

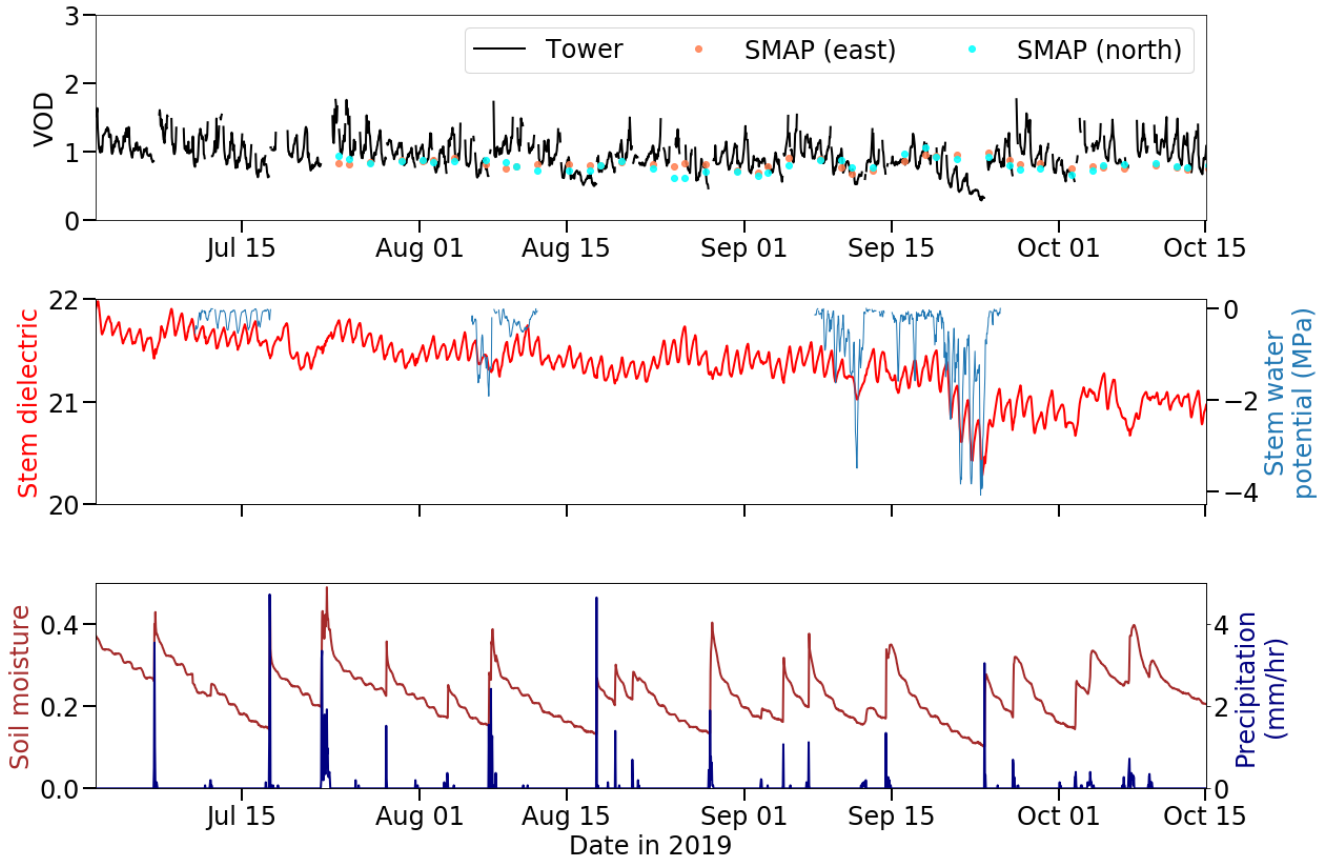

Figure S2. Time series of VOD, stem xylem dielectric constant at 70 MHz, stem xylem water potential, soil moisture, and precipitation at Harvard Forest.

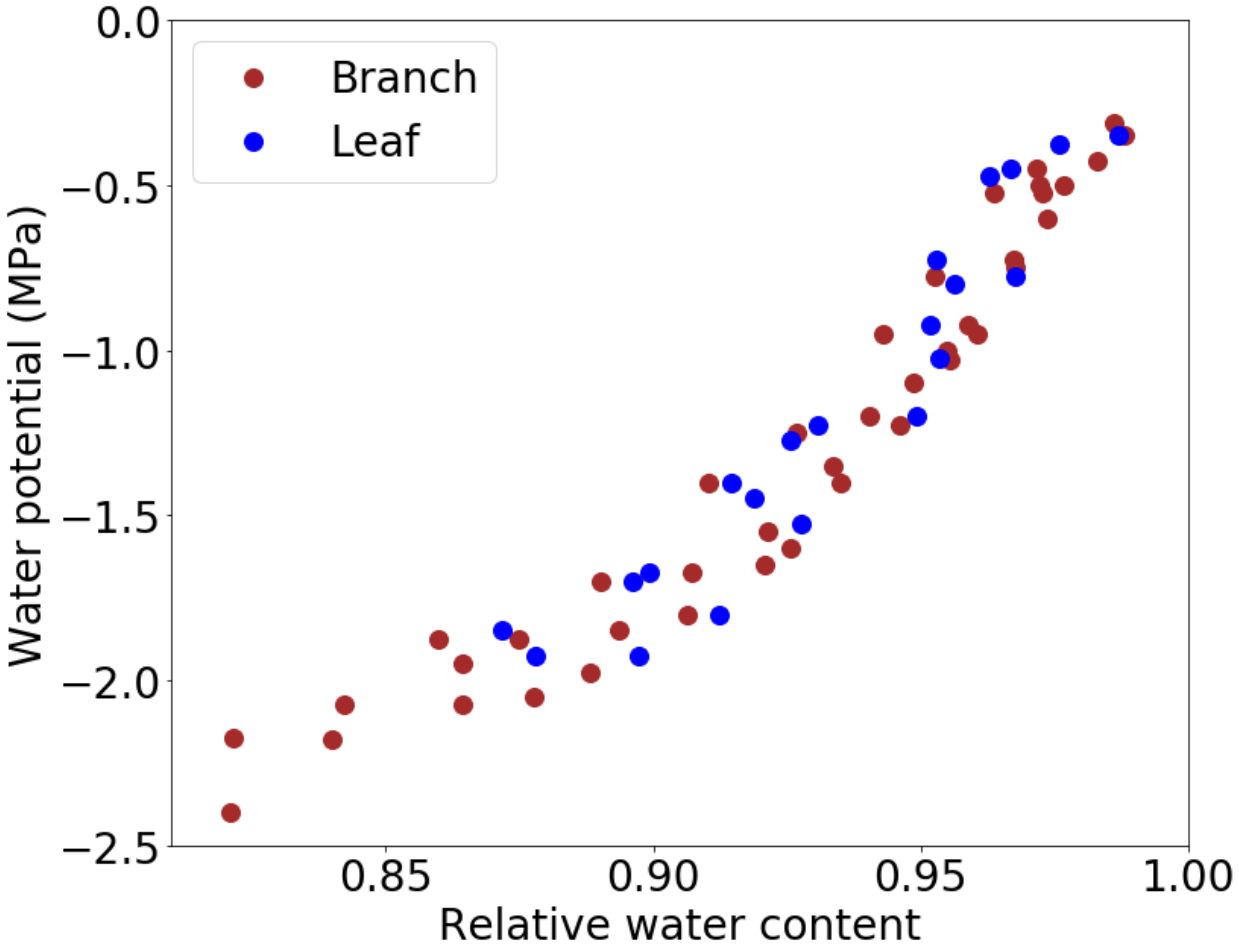

Figure S3. Pressure-volume curve from 3 leaves and 3 small branches collected from Harvard Forest site.

Stem water potential and stem dielectric

Period	R	ρ
All	0.65	0.47
July	0.53	0.58
Aug	0.40	0.28
Sept	0.66	0.51

Stem dielectric and VOD

Period	R	ρ
All	0.68	0.60
July	0.31	0.36
Aug	0.33	0.41
Sept	0.74	0.69

Stem water potential and VOD

Period	R	ρ
All	0.65	0.54
July	0.32	0.31
Aug	0.66	0.53
Sept	0.71	0.64

Table S1. Pearson correlations (R) and Spearman rank correlations (ρ) for the three pairs of variables shown as scatter plots in Figure 7, for all data and individually for each of the three periods that the stem psychrometers were installed (corresponding to three months).

Supplemental References

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