Supplementary material

Figure S1.

Individual VOC compounds detected, classified by chemical groups and their corresponding correlation coefficients for European beech (*Fagus sylvatica*) emissions during a 10 days drought period (Rombach, 2018). Chemical classes named at the axes refer to a set of individual chemical species (79 in total).

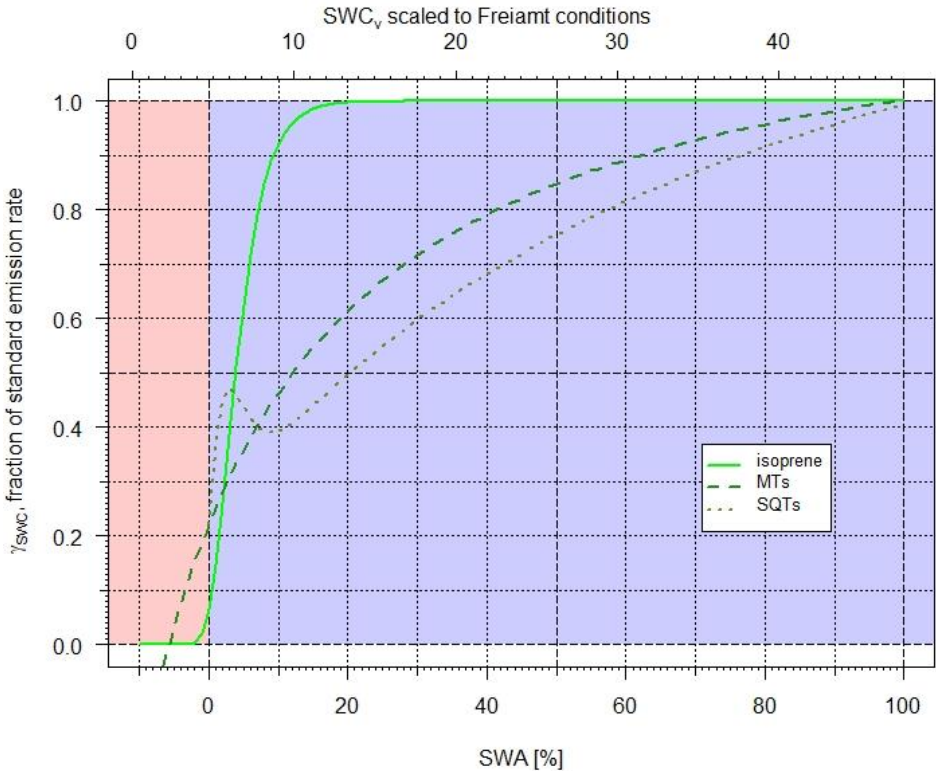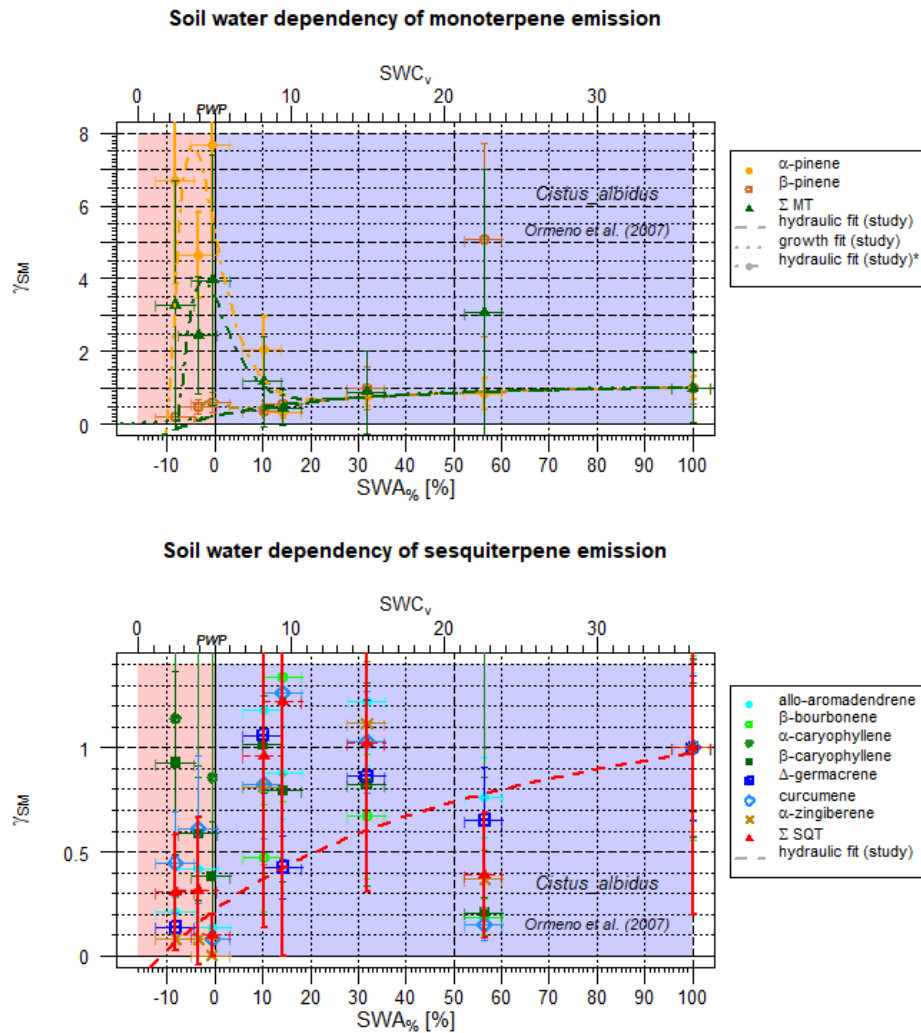Correlation analysis (plant nursery, Freiburg)

Figure S2.

Relative effect of available soil moisture on emission rates of isoprene, MT and SQT at standard conditions otherwise (T=30°C). The local peak of SQT emission rates is based on Rosmarinus officialis (Ormeno et al., 2007) and Cistus ladanifer (Haberstroh et al., 2018) emission rates and depends on individual species behaviour.

Figure S3.

Relative effect of available soil moisture on emission rates of MT and SQT at standard conditions otherwise (T=30°C) for *Cistus albidus*. (top) Effect on monoterpene emissions (Ormeno et al., 2007) with different fit options explained in the study; (bottom) effect on sesquiterpene emission rates (Ormeno et al., 2007). The corresponding fitted curves are listed below the figure. Please note, that in case of sesquiterpenes scattering and uncertainty ranges are so large that no distinct pattern is apparent which might be fitted to an assumption other than the hydraulic fit.

Fits (MT):

$\gamma_{SM}(\Sigma MT, growth\ fit) = \exp(-\exp(0.0441 \cdot \exp(1) \cdot (-5.0 - SWA_\%) + 1))$

$\gamma_{SM}(\Sigma MT, hydr.\ fit) = 0.22 + 0.78 \cdot SWA_\% \cdot 1.333/(45 + SWA_\%)$

$\gamma_{SM}(\Sigma MT, hydr.\ fit^*) = 0.22 + 0.78 \cdot SWA_\% \cdot 1.333/(45 + SWA_\%) + 0.5*(SWA_\% + 4)^{1.6} \cdot \exp(-0.6 \cdot (SWA_\% + 4))$

$\gamma_{SM}(\alpha\text{-pinene}, hydr.\ fit^*) = 0.22 + 0.78 \cdot SWA_\% \cdot 1.333/(45 + SWA_\%) + 2.6*(SWA_\% + 10)^{1.6} \cdot \exp(-0.3 \cdot (SWA_\% + 10))$

$\gamma_{SM}(\beta\text{-pinene}, hydr.\ fit^*) = 0.22 + 0.78 \cdot SWA_\% \cdot 1.333/(45 + SWA_\%) + 1.3*(SWA_\% + 8)^{1.6} \cdot \exp(-0.3 \cdot (SWA_\% + 8))$

Fits (SQT):

$\gamma_{SM}(\Sigma SQT, hydr.\ fit) = 0.22 + 0.78 \cdot SWA_\% \cdot 1.6/(81 + SWA_\%)$

Figure S4.

Relative effect of available soil moisture on emission rates of MT and SQT at standard conditions otherwise (T=30°C) for *Pinus halepensis*. (top) Effect on monoterpene emissions (Ormeno et al., 2007) with different fit options explained in the study. Please note that $\gamma_{SM}(\beta\text{-myrcene})$ values are beyond 17 and were discarded form that plot to make others visible; (bottom) effect on sesquiterpene emission rates (Ormeno et al., 2007). Please note, that in case of individual (except β-pinene) and total monoterpenes scattering and uncertainty ranges are so large that no distinct pattern is apparent, which cannot be fitted to an assumption other than no change (=1). Values of β-pinene may tentatively indicate a γ_{SM} value maximum around 30% $SWA_\%$, but all values except the one at 100% $SWA_\%$ are insignificantly different!

Fits (MT):

$\gamma_{SM}(\Sigma MT, \text{growth fit}) = \exp(-\exp(0.0441 \cdot \exp(1) \cdot (-5.0 - SWA_\%) + 1))$
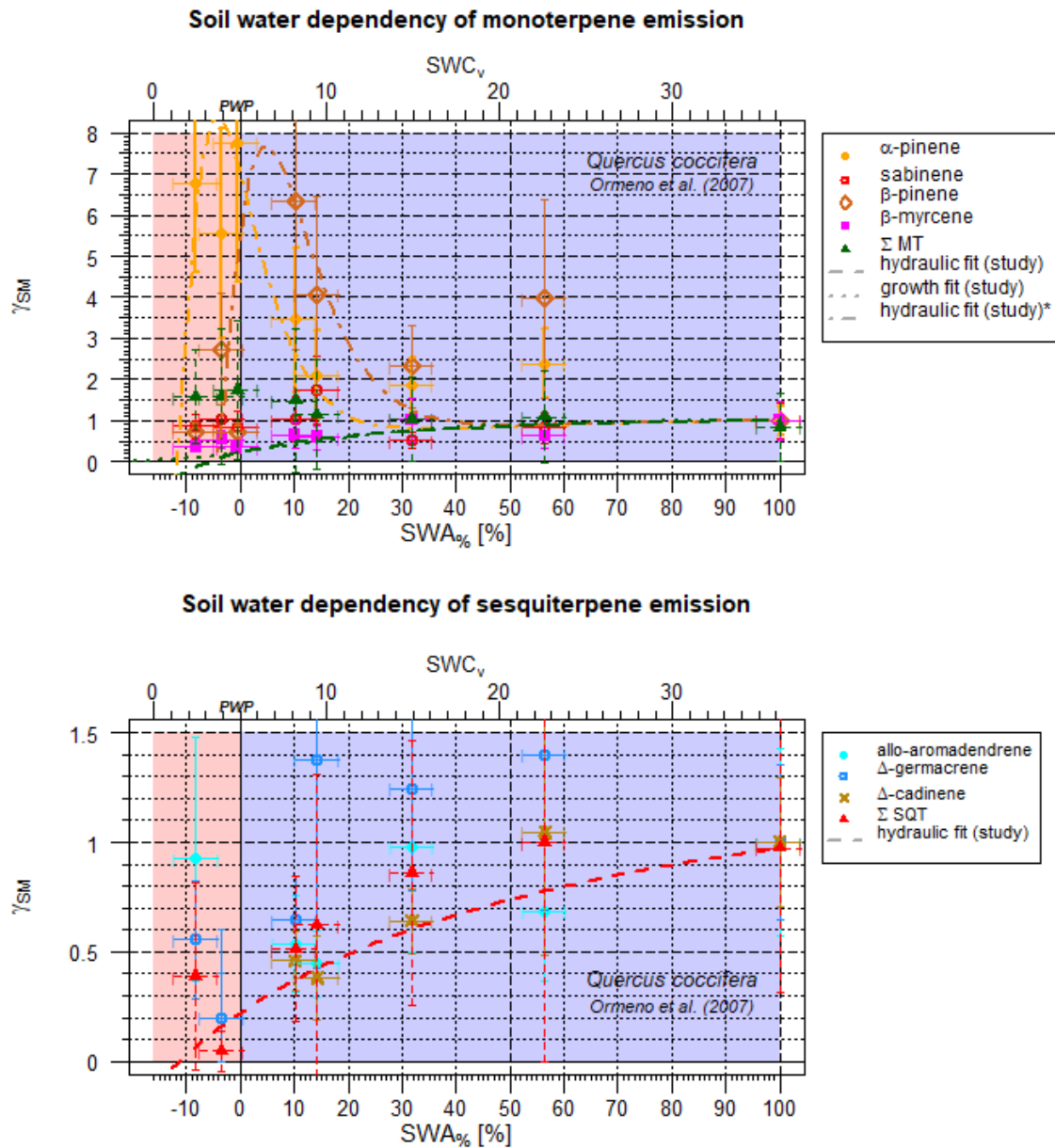
$\gamma_{SM}(\Sigma MT, \text{hydr. fit}) = 0.22 + 0.78 \cdot SWA_\% \cdot 1.333/(45 + SWA_\%)$

Fits (SQT):

$\gamma_{SM}(\Sigma SQT, \text{hydr. fit}) = 0.22 + 0.78 \cdot SWA_\% \cdot 1.6/(81 + SWA_\%)$

Figure S5.

Relative effect of available soil moisture on emission rates of MT and SQT at standard conditions otherwise (T=30°C) for *Quercus coccifera*. (top) Effect on monoterpene emissions (Ormeno et al., 2007) with different fit options explained in the study; (bottom) effect on sesquiterpene emission rates (Ormeno et al., 2007). Please note, that in case of total sesquiterpenes scattering and uncertainty ranges are so large that no distinct pattern is apparent which might be fitted to an assumption other than the hydraulic fit.

Soil water dependency of monoterpene emission

Soil water dependency of sesquiterpene emission

Fits (MT):

$\gamma_{SM}(\Sigma MT,\ growth\ fit) = exp(-exp(0.0441 \cdot exp(1) \cdot (-5.0 - SWA_\%) + 1))$

$\gamma_{SM}(\Sigma MT,\ hydr.\ fit) = 0.22 + 0.78 \cdot SWA_\% \cdot 1.333/(45 + SWA_\%)$

$\gamma_{SM}(\alpha-pinene,\ hydr.\ fit^*) = 1.6 \cdot (SWA_\% + 12)^{1.6} \cdot exp(-0.21 \cdot (SWA_\% + 12)) + 0.22 + 0.78 \cdot SWA_\% \cdot 1.333/(45 + SWA_\%)$
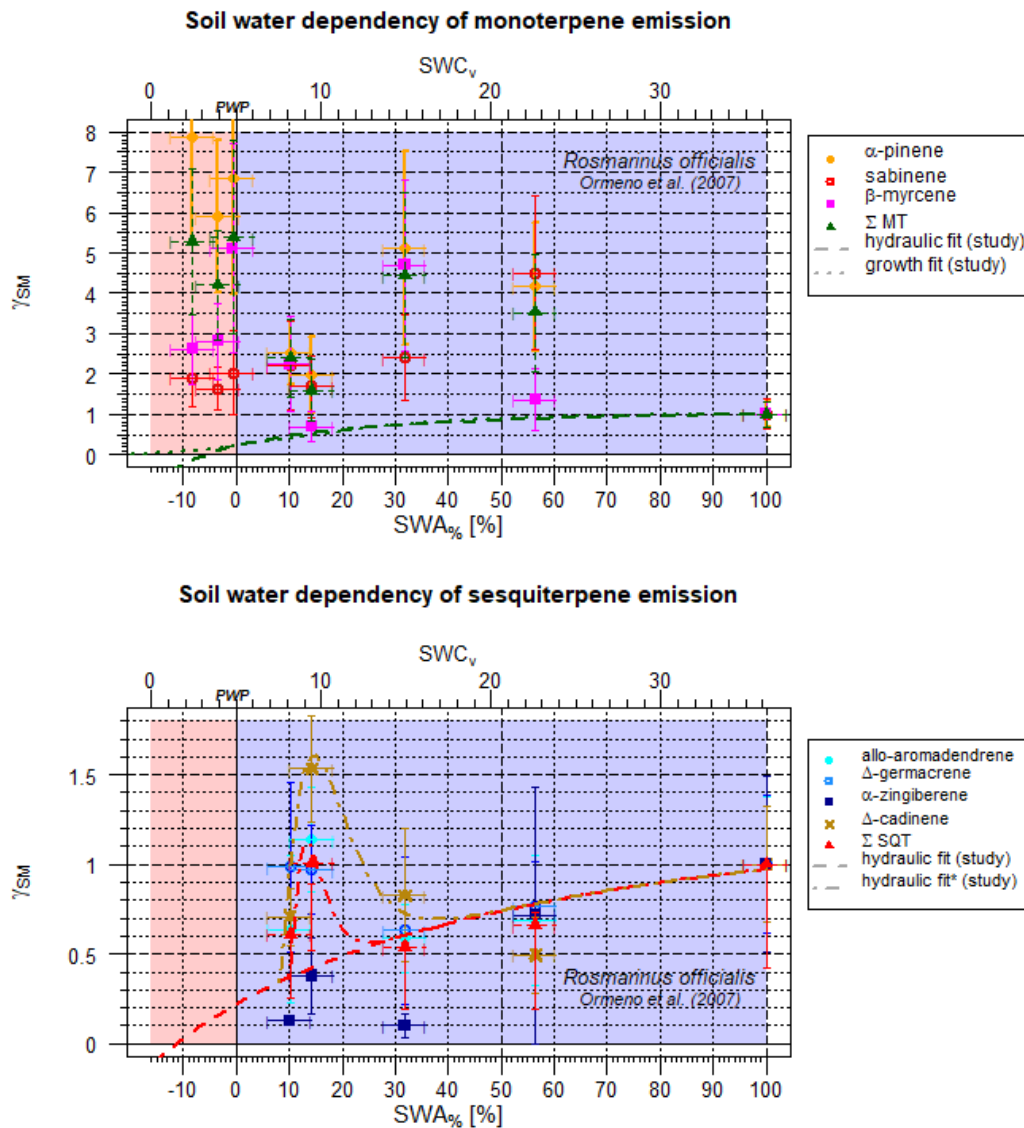
$\gamma_{SM}(\beta-pinene,\ hydr.\ fit^*) = 1.1 \cdot (SWA_\% + 4.3)^{1.6} \cdot exp(-0.18 \cdot (SWA_\% + 4.3)) + 0.22 + 0.78 \cdot SWA_\% \cdot 1.333/(45 + SWA_\%)$

Fits (SQT):

$\gamma_{SM}(\Sigma SQT,\ hydr.\ fit) = 0.22 + 0.78 \cdot SWA_\% \cdot 1.6/(81 + SWA_\%)$

Figure S6.

Relative effect of available soil moisture on emission rates of MT and SQT at standard conditions otherwise (T=30°C) for *Pinus halepensis*. (top) Effect on monoterpene emissions (Ormeno et al., 2007) with different fit options explained in the study. Please note that $\gamma_{SM}(\beta\text{-myrcene})$ values are beyond 17 and were discarded form that plot to make others visible; (bottom) effect on sesquiterpene emission rates (Ormeno et al., 2007). Please note, that in case of individual (except β-pinene) and total monoterpenes scattering and uncertainty ranges are so large that no distinct pattern is apparent, which cannot be fitted to an assumption other than no change (=1). Values of β-pinene may tentatively indicate a γ_{SM} value maximum around 30% $SWA_\%$, but all values except the one at 100% $SWA_\%$ are insignificantly different!

Fits (MT):

$\gamma_{SM}(\Sigma MT,\ growth\ fit)$ = exp(-exp(0.0441·exp(1)·(-5.0-$SWA_\%$)+1))

$\gamma_{SM}(\Sigma MT,\ hydr.\ fit)$ = 0.22+0.78·$SWA_\%$·1.333/(45+$SWA_\%$)

Fits (SQT):

$\gamma_{SM}(\Sigma SQT,\ hydr.\ fit)$ = 0.22+0.78·$SWA_\%$·1.6/(81+$SWA_\%$)

$\gamma_{SM}(\Sigma SQT,\ hydr.\ fit*)$ = 0.3·($SWA_\%$+10)$^{1.6}$·exp(-0.5·($SWA_\%$+10))+0.22+0.78·$SWA_\%$·1.6/(81+$SWA_\%$)

$\gamma_{SM}(\Delta\text{-cadinene},\ hydr.\ fit*)$ = 1.6·($SWA_\%$+8)$^{1.6}$·exp(-0.21·($SWA_\%$+8))+0.22+0.78·$SWA_\%$·1.6/(81+$SWA_\%$)

Figure S7.

Relative effect of available soil moisture on emission rates of MT and SQT at standard conditions otherwise (T=30°C) for *Cistus albidus*. (top) Effect on MT emissions (Haberstroh et al., 2018). Please note that γ_{SM} (MT) values are derived by assuming the standard emission rates for MT species using the value at $SWA_\%$ of 6.3% multiplied with a factor of 2.5; (bottom) effect on SQT emission rates (Haberstroh et al., 2018). Please note, that γ_{SM} (SQT) values are derived by assuming the standard emission rates for SQT species using the value at $SWA_\%$ of 6.3% multiplied with a factor of 1.25!
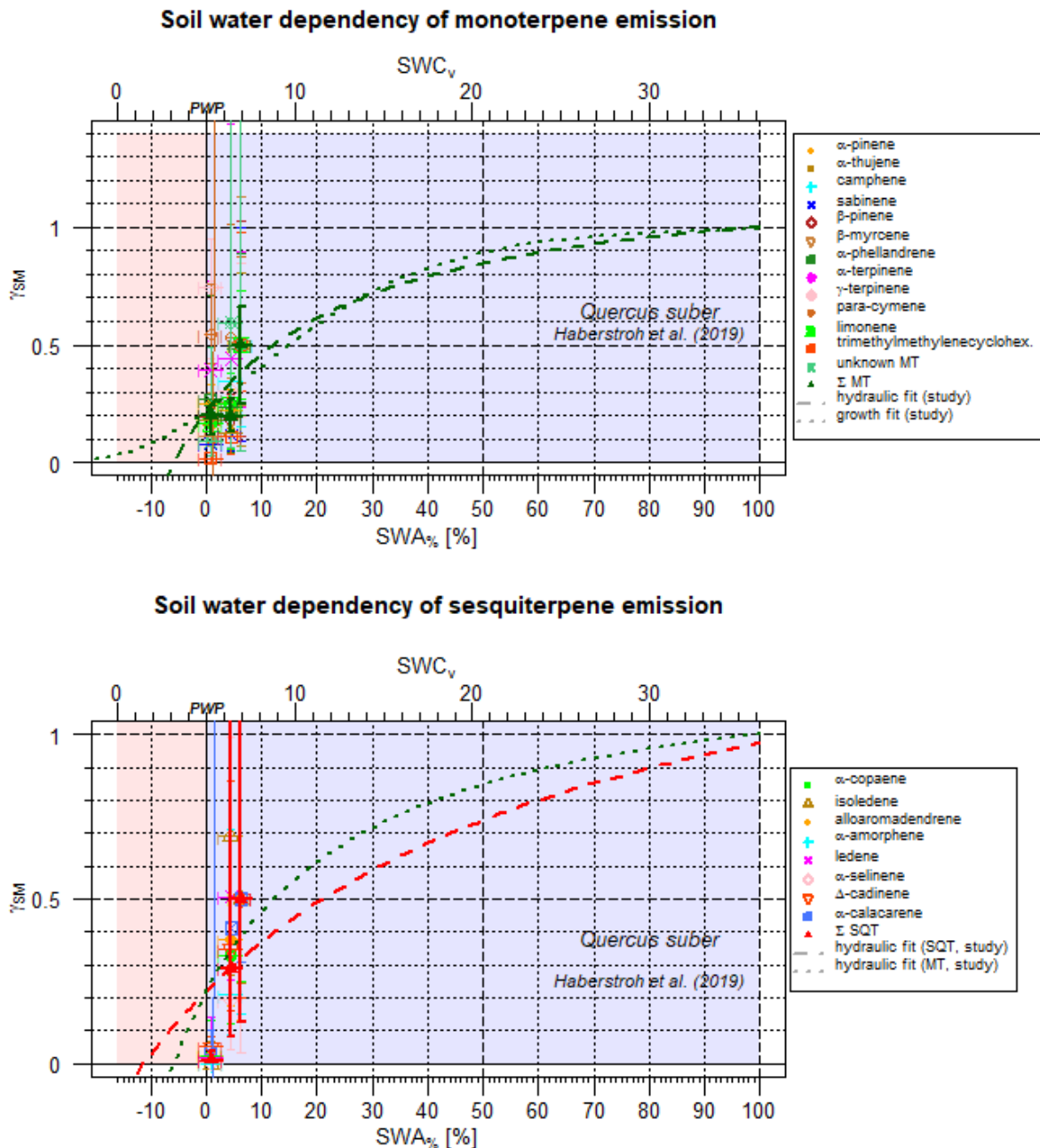
Figure S8.

Relative effect of available soil moisture on emission rates of MT and SQT at standard conditions otherwise (T=30°C) for *Quercus suber*. (top) Effect on MT emissions (Haberstroh et al., 2018). Please note that γ_{SM} values are derived by assuming the standard emission rates for MT species using the value at SWA$_\%$ of 6.3% multiplied with a factor of 2; (bottom) effect on SQT emission rates (Haberstroh et al., 2018). Please note, that γ_{SM} (SQT) values are derived by assuming the standard emission rates for SQT species using the value at SWA$_\%$ of 6.3% multiplied with a factor of 2!

FOR ALL FIGURES WITH FITS OF INDIVIDUAL SPECIES: THE NUMBER OF DATAPOINTS IS FAIRLY LOW AND UNCERTAINTIES MAY BE SUBSTANTIAL! SOMETIMES EACH PARAMETER CORRESPONDS TO A SINGLE VALUE! THUS NO RANGES ARE PROVIDED.

Table S1.

Reaction rate constants for selected VOCs with OH and O_3 at T = 25°C provided in cm^3 molecule^{-1} s^{-1}. The corresponding references or the SAR reference chosen is named on the right. Note, "-" declares the rate constant is either <2e-19 cm^3 molecule^{-1} s^{-1} i.e. negligible at ambient conditions or not expected. 'NA' refers to not available and 'SAR' to structure activity relationship methods. Bold marked values have been used for calculation, experimental values are preferred towards calculated ones.

name	k_{OH} [cm^3 s^{-1}]	k_{O3} [cm^3 s^{-1}]	*reference or method*
3-hexen-1-ol	(1.14±0.14)e-10 **(1.08±0.22)e-10**	(6.4±1.7)e-17	Gibilisco et al., 2015 Atkinson et al., 1995
2-nonenal	(4.35±0.30)e-11	(2.5±0.2)e-18	Gao et al., 2009; Gaona Colman et al., 2015
n-heptanal	(2.96±0.23)e-11	-	Albaladejo et al., 2002
benzaldehyde	(1.26±0.25)e-11	-	IUPAC, 2009
sabinene	1.17e-10	8.6e-17	Atkinson, 1994
2-methyl-2-hepten-6-one	(9±6)e-11	(4.0±0.5)e-16	SAR (Neeb, 2000); Ozonolysis approx. using 2-methyl-2-butene (Greene and Atkinson, 1992)
1,2,4-trimethyl benzene	(5.5±0.8)e-11 **(3.4±0.3)e-11**	- -	as mesitylene (Alarcon et al., 2015) Hansen et al., 1975
n-octanal	(3.1±0.3)e-11 3.2e-11 **3.8e-11**	- - -	SAR (Neeb, 2000) EPI Suite, 2017 **Karl et al., 2000**
para-cymene	**(1.51±0.4)e-11** (1.6±0.1)e-11	- -	Corchnoy et al., 1990 Alarcon et al., 2013
limonene	1.17e-10	(2.0±0.5)e-16	Shu & Atkinson, 1994; Atkinson, 1994
benzyl alcohol	(2.9±0.4)e-11	-	Bernard et al., 2013
iso-pinocampheol	(0.97±0.16)e-11 **1.43e-11** 1.77e-11	- - -	SAR (Neeb, 2000) **SAR (Kwok & Atkinson, 1995)** EPI Suite, 2017
1-methyl-4-(1-methylethenyl) benzene	(9.2±0.9)e-11 **5.56e-11**	NA **1.4e-16**	SAR (Neeb, 2000) EPI Suite, 2017
nonanal	**(3.6±0.7)e-11** 4.5e-11	- -	**Bowman et al., 2015** Karl et al., 2000
benzene ethanol	(9.0±0.9)e-11 (1.948±0.2)e-12	- -	SAR (Neeb, 2000) EPI Suite, 2017

trans-pinocarveol	(2.8±0.3)e-11	NA	SAR (Neeb, 2000)
		1.50e-17	EPI Suite, 2017
1-nonanol	(1.9±0.2)e-11	-	SAR (Neeb, 2000)
4-terpineol	(1.9±0.5)e-10	(3.0±0.2)e-16	Wells, 2005
naphthalene	2.2e-11	-	Atkinson et al., 1989
para-cymenol,	5.1e-10	-	Kwok and Atkinson, 1995
2-(4-methylphenyl)	**(4.9±0.2)e-10**	-	SAR (Neeb, 2000)
propan-2-ol	7.4e-12	-	EPI Suite, 2017
methyl-salicylate	(7.4±0.4)e-10	-	SAR (Neeb, 2000)
α-terpineol	(1.9±0.5)e-10	(3.0±0.2)e-16	Wells, 2005
2-(2-hydroxypropoxy) 1-propanol	**(3.1±0.6)e-12**	-	SAR (Neeb, 2000)
	3.5e-11	-	EPI Suite, 2017
3.3'-oxybis 2-butanol	(7.3±1.3)e-12	-	SAR (Neeb, 2000)
2-decenal	(5.3±0.5)e-11	NA	SAR (Neeb, 2000)
	(4.6±0.5)e-11	(1.3±0.6)e-18	EPI Suite, 2017
1-heptadecanol	(5.4±0.5)e-12	-	SAR (Neeb, 2000)
2-undecanal	(2.7±0.3)e-12	-	SAR (Neeb, 2000)
undecanal	(3.6±0.5)e-12	-	SAR (Neeb, 2000)
2-methyl naphthalene	(5.2±0.4)e-11	-	Atkinson & Aschmann, 1986
cis-3-hexenyltiglate	**(3.3±0.2)e-10**	NA	SAR (Neeb, 2000)
	1.0e-10	**(2.4±0.4)e-16**	EPI Suite, 2017
dodecanal	(6.0±0.6)e-12	-	SAR (Neeb, 2000)
junipene	(4.7±1.7)e-11	<5e-19	as longifolene
isolongifolene	(1.0±0.1)e-10	2.6e-17	Atkinson, 1997, Richters et al., 2015
tetradecane	(1.8±0.2)e-11	-	Atkinson, 1997
cyclosativen	(3.6±0.4)e-12	-	SAR (Neeb, 2000)
longifolene	(4.7±1.7)e-11	<5e-19	Atkinson, 1994
6,10-dimethyl-5,9-undecadien-2-one	(3.3±0.5)e-10	NA	SAR (Neeb, 2000)
	1.8e-10	**8.6e-16**	EPI Suite, 2017
2,6-bis (1,1-dimethyl-ethyl)-2,5-cyclohexadiene-1,4-dione	(4.0±0.4)e-10	NA	SAR (Neeb, 2000)
	2.2e-12	3.5e-18	EPI Suite, 2017
1-dodecanol	**(4.1±0.3)e-12**	-	SAR (Neeb, 2000)
	1.8e-11	-	EPI Suite, 2017

α-bergamotene	(4.5±0.5)e-10 **1.8e-10**	NA **8.6e-16**	SAR (Neeb, 2000), ring eff. not incl. EPI Suite, 2017
pentadecane	2.1e-11	-	Atkinson, 1997
α-farnesene	(2.19±0.11)e-10	(5.9±3.4)e-16	Kim et al., 2011; Kourtchev et al., 2011
tridecanal	(6.0±0.6)e-12	-	SAR (Neeb, 2000)
1,2,3,4-tetrahydro-1.6-dimethyl-4-(1-methylethyl)-naphthalene	(9.0±0.9)e-11	-	SAR (Neeb, 2000)
1-butylhexyl benzene	(9.0±0.9)e-11	-	SAR (Neeb, 2000)
cadina-1(10),6,8-triene	**(9.0±0.9)e-11** 2.8e-11	- -	SAR (Neeb, 2000) EPI Suite, 2017
1,6-dioxacyclo-dodecane-7,12-dione	(3.0±0.2)e-12	-	SAR (Neeb, 2000)
3-ethyl-tridecane	(2.0±0.5)e-11	-	Approximated by similar alkanes (Atkinson, 1997)
cis-3-hexenyl benzoate	**(4.2±0.2)e-10** 6.1e-11	NA **(1.3±0.5)e-16**	SAR (Neeb, 2000); EPI Suite, 2017
hexadecane	2.3e-11	-	Atkinson, 1997
santalol	(3.8±0.3)e-11	-	SAR (Neeb, 2000)
1-butylheptyl benzene	(9.0±0.9)e-11	-	SAR (Neeb, 2000)
4-methyl hexadecane	(3.0±0.3)e-11	-	SAR (Neeb, 2000)
dotriacontane	(3.0±0.3)e-11	-	SAR (Neeb, 2000)
hexadecahydro-pyrene	(5.7±0.4)e-12	-	SAR (Neeb, 2000)
5.6-bis(2.2-dimethylpro-pylidene)-decane	(1.9±0.2)e-10	-	SAR (Neeb, 2000)
2,3-dihydro-1,1,3-trimethyl-3-phenyl 1H indene	**(7.8±1.9)e-11** 1.1e-11	- -	SAR (Neeb, 2000) EPI Suite, 2017
octadecane	(2.3±1.1)e-11 2.2e-11 **(2.6±0.3)e-11**	- - -	SAR (Neeb, 2000) EPI Suite, 2017 app. by sim. alkanes (Atkinson, 1997)
isopropyl myristate	(5.5±0.4)e-12	-	SAR (Neeb, 2000)
6,10,14-trimethyl 2-pentadecanone	(4.4±0.3)e-12	-	SAR (Neeb, 2000)

oxacycloheptadecan-2-one	(5.0±0.2)e-12	-	SAR (Neeb, 2000)
1-octanol	(2.5±0.3)e-12	-	SAR (Neeb, 2000)
trimethyl (2-methyl-1-propenylidene) cyclopropane	**(1.1±0.1)e-10** **1.1e-10**	NA **4.1e-17**	SAR (Neeb, 2000) EPI Suite, 2017
2-nonenal	(5.9±0.6)e-11 **(4.4±0.3)e-11** (4.4±0.1)e-11	NA NA (1.3±0.5)e-18	SAR (Neeb, 2000) **Gao et al., 2009** **EPI Suite, 2017**
3-cyclohexen-1-ol 4-methyl-1-(1-methylethyl), terpinen-4-ol	**(1.0±0.1)e-10** **1.0e-10**	NA **4.3e-16**	SAR (Neeb, 2000) EPI Suite, 2017
trans-chrysanthenyl acetate	**(2.8±0.3)e-11** 9.2e-11	NA **4.3e-16**	SAR (Neeb, 2000) EPI Suite, 2017
dodecyl oxirane	(5.5±0.3)e-12	-	SAR (Neeb, 2000)
hexatriacontane	(1.00±0.05)e-11	-	SAR (Neeb, 2000)
2-dodecanone	(3.0±0.2)e-12	-	SAR (Neeb, 2000)
1,8-dimethyl naphthalene	(8.4±0.6)e-11	-	SAR (Neeb, 2000)
3-methyl tetradecane	(2.1±0.2)e-11	-	Approx. by using Atkinson, 1997
10-methyl eicosane	(3.6±0.5)e-11	-	Approx. by using Atkinson, 1997
2-methyl pentadecane	(2.3±0.3)e-11	-	Approx. by using Atkinson, 1997
3-methyl pentadecane	(2.3±0.3)e-11	-	Approx. by using Atkinson, 1997
3-methyl heptadecane	(2.8±0.3)e-11	-	Approx. by using Atkinson, 1997
1,1'-oxybis octane	(9.5±0.6)e-12	-	SAR (Neeb, 2000)
n-eicosane	(3.4±0.4)e-11	-	Approx. by using Atkinson, 1997
heneicosane	(3.6±0.5)e-11	-	Approx. by using Atkinson, 1997
trans-β-ocimene	(2.5±0.2)e-10 NA	NA (3.7±0.9)e-16	Atkinson et al., 1986; Gaona-Colman et al., 2016

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