New Phytologist **Supporting Information**

Article title: **A global analysis of parenchyma tissue fractions in secondary xylem of seed plants**

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The following Supporting Information is available for this article:

Fig. S1 Distribution map of the species for which parenchyma fraction values were compiled.

Fig. S2 Poly-co-linearity matrix for the parameters analysed in relation to wood anatomy, plant organ, geography and climate.

Fig. S3 Comparison of total parenchyma fractions in wood based on our own measurements and literature.

Fig. S4 Comparison of mean annual temperature and mean annual precipitation for species for which both sampling locations and GBIF locations were available.

Fig. S5 The effect of MAT, MAP and altitude on the proportion of axial parenchyma in angiosperms.

Fig. S6 The effect of MAT, MAP and altitude on the proportion of ray parenchyma in angiosperms.

Table S1 The Global Wood Parenchyma Database (see separate file).

Table S2 Summary of statistics for the general additive models (GAM) based on the exact locations dataset.

Table S3 Summary of statistics for the general additive models (GAM) based on the GBIF locations dataset.

Notes S1 Published references from which data were extracted for analyses.

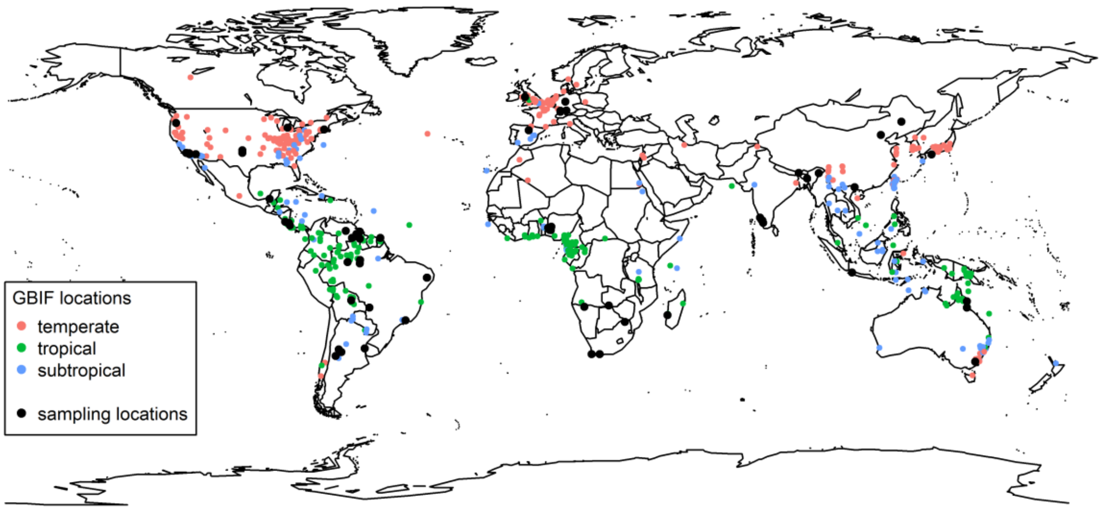

Fig. S1 Distribution map of 612 GBIF locations and 68 exact sampling locations for angiosperm and conifer species for which parenchyma fraction values were compiled in a global xylem parenchyma dataset (see Table S1).

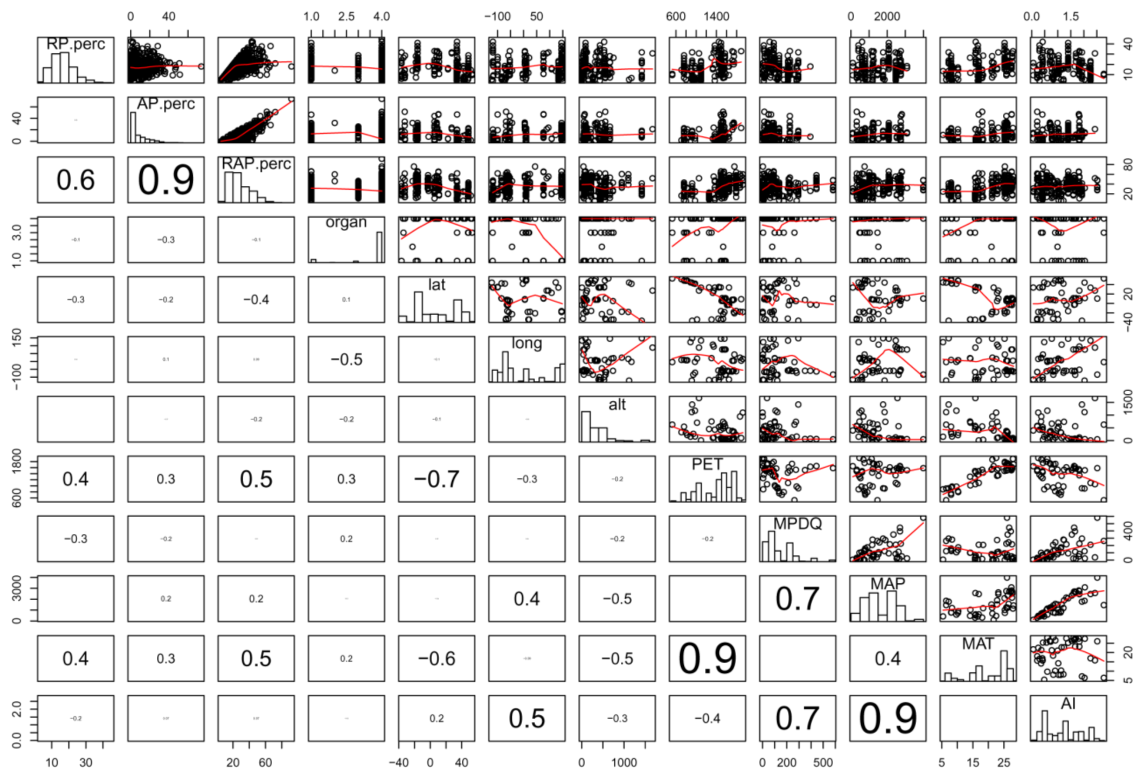

Fig. S2 Poly-co-linearity matrix based on the GBIF dataset for the following parameters: ray parenchyma (RP.perc), axial parenchyma (AP.perc), ray and axial parenchyma (RAP.perc), organ (root, trunk, branch), latitude (lat), longitude (long), altitude (alt), potential evapotranspiration (PET), mean precipitation during the driest quarter (MPDQ), mean annual temperature (MAT), aridity index (AI).

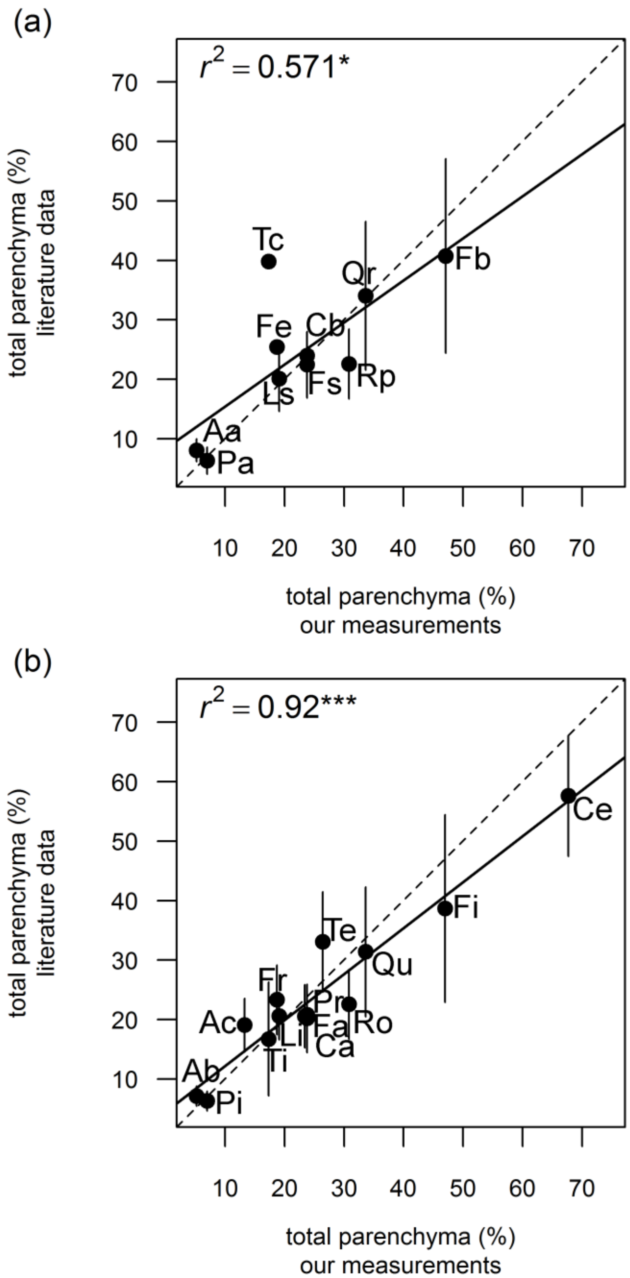

Fig. S3 Comparison of total parenchyma fractions in wood based on our own measurements and data from literature for 10 species (a) and 14 genera (b). The following species were included in Fig. S3(a), with the number of specimens obtained from literature between brackets: Aa, *Abies alba* (3); Cb, *Carpinus betulus* (1); Fs, *Fagus sylvatica* (5); Fb, *Ficus benjamina* (2); Fe, *Fraxinus excelsior* (2); Ls, *Liquidambar styraciflua* (3); Pa, *Picea abies* (4); Qr, *Quercus robur* (3); Rp, *Robinia pseudoacacia* (5); Tc, *Tilia cordata* (1). The genera included in Fig. S3(b) (with reference to the number of species/specimens from literature) are: Ab, *Abies* (6/9); Ac, *Acer* (14/19); Ca, *Carpinus* (8/8); Cei, *Ceiba* (2/5); Fa, *Fagus* (4/8); Fi, *Ficus* (29/31); Fr, *Fraxinus* (7/12); Li, *Liquidambar* (3/5); *Picea* (5/8); Pr, *Prunus* (9/9); Qu, *Quercus* (39/60); Ro, *Robinia* (1/5); Te, *Terminalia* (9/12); Ti, *Tilia* (9/9). The regression (solid) line and the 1:1 (dashed) line are shown. ***, $P \leq 0.001$; *, $P \leq 0.05$.

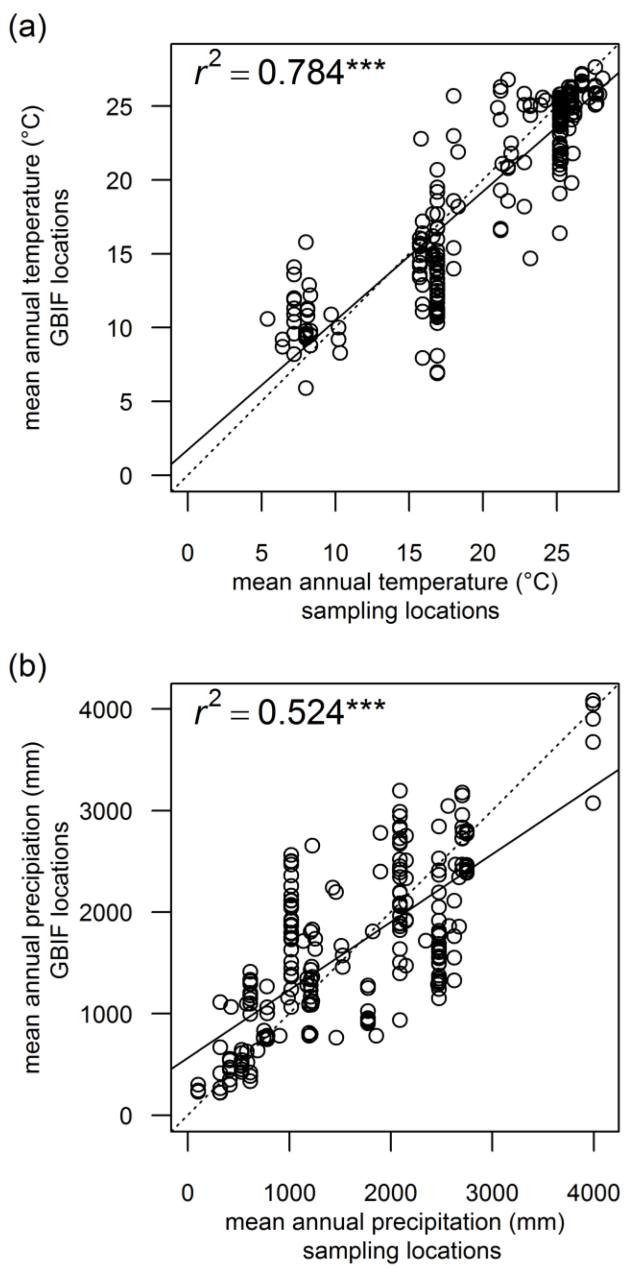

Fig. S4 Comparison of mean annual temperature (a) and mean annual precipitation (b) values for 244 species from the global xylem parenchyma dataset for which both sampling locations and GBIF locations were available. The regression (solid) line and the 1:1 (dashed) line are shown. ***, $P \leq 0.001$.

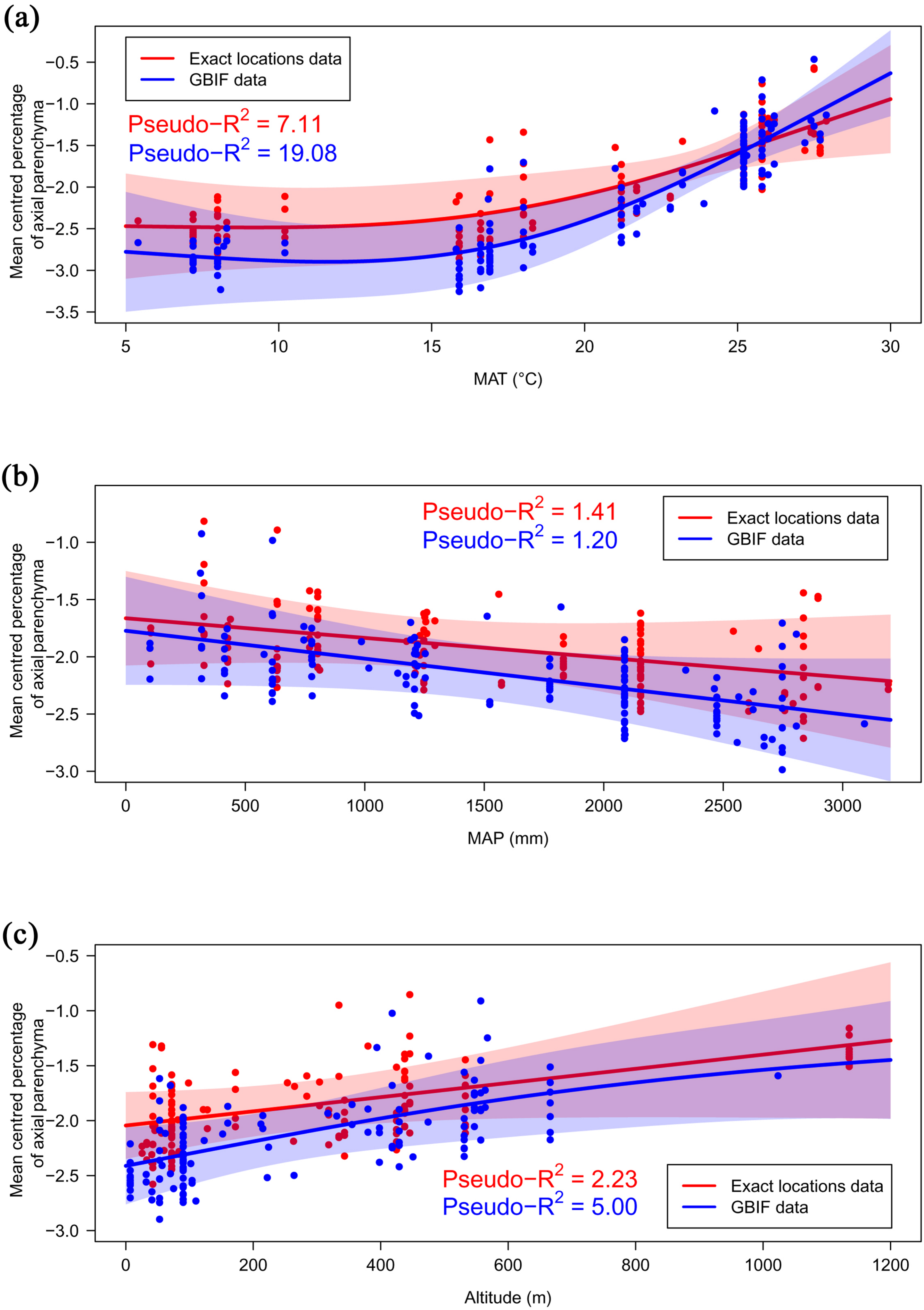
(a)
Exact locations data
GBIF data
Pseudo−R^2 = 7.11
Pseudo−R^2 = 19.08
Mean centred percentage of axial parenchyma
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
−3.5
5
10
15
20
25
30
MAT (°C)
(b)
Pseudo−R^2 = 1.41
Pseudo−R^2 = 1.20
Exact locations data
GBIF data
Mean centred percentage of axial parenchyma
−1.0
−1.5
−2.0
−2.5
−3.0
0
500
1000
1500
2000
2500
3000
MAP (mm)
(c)
Pseudo−R^2 = 2.23
Pseudo−R^2 = 5.00
Exact locations data
GBIF data
Mean centred percentage of axial parenchyma
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0
0
200
400
600
800
1000
1200
Altitude (m)

Fig. S5 The effect of MAT (a), MAP (b), and altitude (c) on the proportion of axial parenchyma (AP) in angiosperm wood based on a general additive model (GAM) with a binomial distribution for the exact location dataset (red) and the GBIF derived climate data (blue). Each climate variable was limited to three partitions. The solid line represents the fitted smoother; 95% confidence intervals are shown in colour. Each dot represents a specimen for which the sampling location was reported in literature, or climate data were obtained from the WorldClim database. Pseudo-R^2 measures the approximate deviance explained by each explanatory variable.

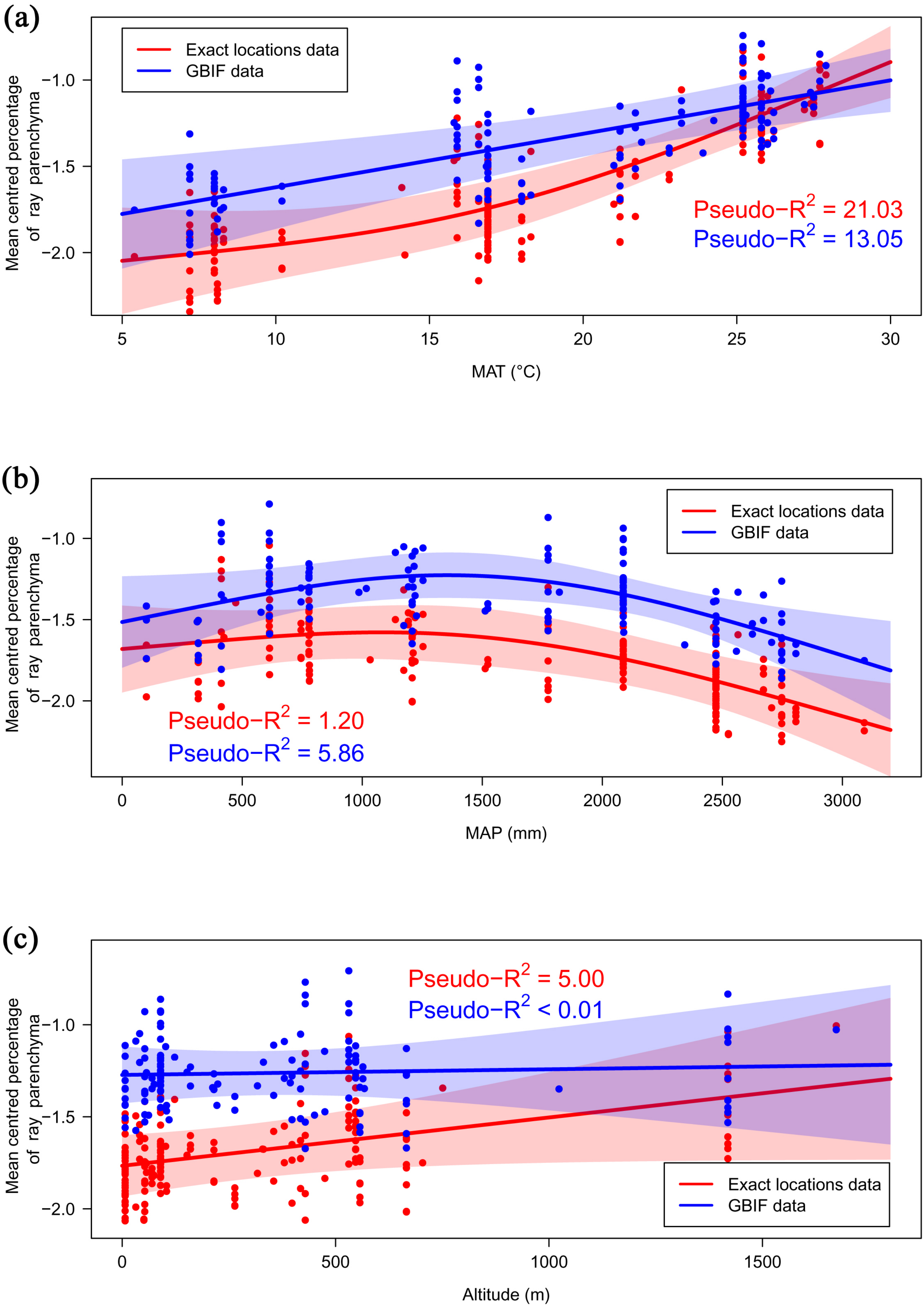
(a)
Exact locations data
GBIF data
Pseudo−R2 = 21.03
Pseudo−R2 = 13.05
Mean centred percentage of ray parenchyma
−1.0
−1.5
−2.0
5
10
15
20
25
30
MAT (°C)
(b)
Exact locations data
GBIF data
Pseudo−R2 = 1.20
Pseudo−R2 = 5.86
Mean centred percentage of ray parenchyma
−1.0
−1.5
−2.0
0
500
1000
1500
2000
2500
3000
MAP (mm)
(c)
Pseudo−R2 = 5.00
Pseudo−R2 < 0.01
Exact locations data
GBIF data
Mean centred percentage of ray parenchyma
−1.0
−1.5
−2.0
0
500
1000
1500
Altitude (m)

Fig. S6 The effect of MAT (a), MAP (b), and altitude (c) on the proportion of ray parenchyma (RP) in angiosperm wood based on a general additive model with a binomial distribution for the exact location dataset (red) and the GBIF derived climate data (blue). Each climate variable was limited to three partitions. The solid line represents the fitted smoother; 95% confidence intervals are shown in colour. Each dot represents a specimen for which the sampling location was reported in literature, or climate data were obtained from the WorldClim database. Pseudo-R^2 measures the approximate deviance explained by each explanatory variable.

Table S1 The Global Wood Parenchyma Database, including 961 records, but excluding Zheng & Martínez-Cabrera (2013). Data were extracted from 55 sources and include species name, plant organ, growth form, and xylem tissue fractions (%) of ray parenchyma, axial parenchyma, and total parenchyma. Specimens were grouped according to three major climatic zones, which follow Köppen (1936).

See separate Excel file.

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Table S2 Summary of statistics for the general additive models (GAM) fitted with a binomial distribution for the exact locations dataset. The response variables were RAP, AP and RP. Each explanatory variable was fitted with a smoother with a maximum of three effective degrees of freedom (e.d.f). *P*-values are approximate (Wood, 2006). Pseudo-R^2 measures the approximate deviance explained by each explanatory variable.

Response variable	Explanatory variable	e.d.f	*F*-value	*P*-value	Pseudo-R^2
RAP	MAT	1.945	37.210	< 0.001	21.05%
(n = 270)	MAP	1.000	5.219	0.023	1.6%
	Altitude	1.000	12.933	< 0.001	3.6%
AP	MAT	1.728	5.108	0.008	7.11%
(n = 137)	MAP	1.000	1.471	0.227	1.41%
	Altitude	1.000	2.946	0.088	2.23%
RP	MAT	1.000	21.954	< 0.001	21.03%
(n = 182)	MAP	1.876	4.964	0.008	1.2%
	Altitude	1.000	3.584	0.060	5.4%

Reference

Wood SN. 2006. *Generalized additive models: an introduction with R.* London, UK: Chapman and Hall.

Table S3 Summary of statistics for the general additive models (GAM) fitted with a binomial distribution for the GBIF locations dataset. The response variables were RAP, AP and RP. Each explanatory variable was fitted with a smoother with a maximum of three effective degrees of freedom (e.d.f). *P*-values are approximate (Wood, 2006). Pseudo-R^2 measures the approximate deviance explained by each explanatory variable.

Response variable	**Explanatory variable**	**e.d.f**	***F*-value**	***P*-value**	**Pseudo-R^2**
RAP	MAT	1.950	48.234	<0.001	31.65%
(*n* = 221)	MAP	1.000	8.848	0.003	2.8%
	Altitude	1.000	10.433	0.001	3.1%
AP	MAT	1.922	14.615	<0.001	19.05%
(*n* = 142)	MAP	1.000	2.955	0.088	1.2%
	Altitude	1.426	14.615	<0.001	5%
RP	MAT	1.000	12.988	<0.001	13.05%
(*n* = 142)	MAP	1.876	3.842	0.024	5.86%
	Altitude	1.000	0.044	0.834	<0.01%

Reference

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Notes S1 Published references from which data were extracted for analyses.

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