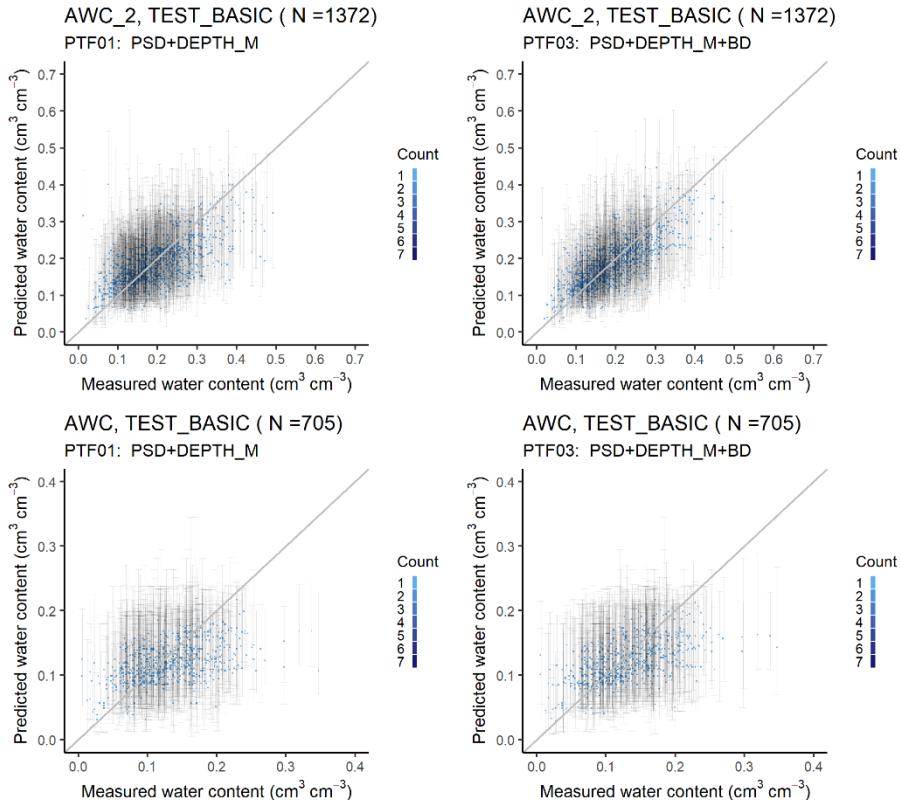


# Updated European hydraulic pedotransfer functions with communicated uncertainties in the predicted variables (euptfv2)

5      **Brigitta Szabó et al.**\* Correspondence: [toth.brigitta@agrar.mta.hu](mailto:toth.brigitta@agrar.mta.hu) (B.Sz.)10    **Figure S1.** The scatter plot of the measured versus predicted plant available water content values of the worst and best performing PTF with 90% prediction interval on test datasets. AWC\_2: plant available water content based on filed capacity at -100 cm matric potential head (PTF01 vs. PTF03); AWC: plant available water content based on filed capacity at -330 cm matric potential head (PTF01 vs. PTF03); PSD: particle size distribution (sand, 50–2000 µm; silt, 2–50 µm; clay, <2 µm (mass %)); DEPTH\_M: mean soil depth (cm); BD: bulk density (g cm<sup>-3</sup>).

**Table S1.** Performance of pedotransfer functions (PTF) by input combination on training and test datasets to predict the plant available water content of the soil (AWC\_2) belonging to the -100 cm matric potential head. N: number of samples, RMSE: root mean square error ( $\text{cm}^3 \text{cm}^{-3}$ ), and R<sup>2</sup>: determination coefficient, TEST\_BASIC: samples with measured PSD, DEPTH, OC and BD; TEST\_CHEM+: samples with measured PSD, DEPTH, OC, BD, CACO<sub>3</sub>, PH\_H<sub>2</sub>O and CEC. Recommended PTFs are highlighted in bold.

Name of PTF in euptfv2	Predictor variables <sup>1</sup>	Training set			Test set			Sign. difference <sup>2</sup>		
		N	RMSE	R <sup>2</sup>	N	RMSE	R <sup>2</sup>	TEST <sup>+</sup> BASIC set	TEST <sup>-</sup> CHEM + set	Recommended PTF
								TEST <sup>-</sup> BASIC set	TEST <sup>-</sup> CHEM + set	Recommended PTF
PTF01	<b>PSD+DEPTH</b>	3528	0.062	0.446	1372	0.060	0.432	a	ab	PTF01
PTF02	<b>PSD+DEPTH+OC</b>	3208	0.055	0.540	1372	0.054	0.544	b	abcd	PTF02
PTF03	<b>PSD+DEPTH+BD</b>	3472	0.054	0.581	1372	0.053	0.552	b	abcd	PTF03
PTF04	PSD+DEPTH+CACO <sub>3</sub>	1548	0.050	0.326	274	0.055	0.219	-	abcd	PTF01
PTF05	PSD+DEPTH+PH_H <sub>2</sub> O	1849	0.058	0.463	274	0.055	0.216	-	a	PTF01
PTF06	PSD+DEPTH+CEC	1550	0.059	0.512	274	0.060	0.050	-	abcd	PTF01
PTF07	PSD+DEPTH+OC+BD	3197	0.051	0.609	1372	0.051	0.588	b	abcd	PTF03
PTF08	PSD+DEPTH+OC+CACO <sub>3</sub>	1464	0.048	0.353	274	0.053	0.257	-	abcd	PTF02
PTF09	PSD+DEPTH+OC+PH_H <sub>2</sub> O	1615	0.055	0.490	274	0.053	0.270	-	abc	PTF02
PTF10	PSD+DEPTH+OC+CEC	1358	0.054	0.563	274	0.053	0.278	-	abcd	PTF02
PTF11	PSD+DEPTH+BD+CACO <sub>3</sub>	1545	0.044	0.470	274	0.048	0.396	-	d	PTF03
PTF12	PSD+DEPTH+BD+PH_H <sub>2</sub> O	1796	0.052	0.565	274	0.048	0.406	-	abcd	PTF03
PTF13	PSD+DEPTH+BD+CEC	1498	0.053	0.598	274	0.048	0.398	-	abcd	PTF03
PTF14	PSD+DEPTH+CACO <sub>3</sub> +PH_H <sub>2</sub> O	1195	0.051	0.341	274	0.052	0.284	-	abcd	PTF01
PTF15	PSD+DEPTH+CACO <sub>3</sub> +CEC	726	0.050	0.286	274	0.052	0.303	-	abcd	PTF01
PTF16	PSD+DEPTH+PH_H <sub>2</sub> O+CEC	1255	0.058	0.539	274	0.051	0.331	-	abcd	PTF01
PTF17	PSD+DEPTH+OC+BD+CACO <sub>3</sub>	1464	0.044	0.465	274	0.048	0.390	-	bcd	PTF03
PTF18	PSD+DEPTH+OC+BD+PH_H <sub>2</sub> O	1607	0.051	0.556	274	0.048	0.407	-	abcd	PTF03
PTF19	PSD+DEPTH+OC+BD+CEC	1349	0.052	0.593	274	0.046	0.441	-	abcd	PTF03
PTF20	PSD+DEPTH+OC+CACO <sub>3</sub> +PH_H <sub>2</sub> O	1130	0.050	0.367	274	0.051	0.309	-	abcd	PTF02
PTF21	PSD+DEPTH+OC+CACO <sub>3</sub> +CEC	683	0.049	0.305	274	0.050	0.359	-	abcd	PTF02
PTF22	PSD+DEPTH+OC+PH_H <sub>2</sub> O+CEC	1067	0.054	0.561	274	0.049	0.367	-	abcd	PTF02
PTF23	PSD+DEPTH+BD+CACO <sub>3</sub> +PH_H <sub>2</sub> O	1192	0.046	0.471	274	0.049	0.375	-	bed	PTF03
PTF24	PSD+DEPTH+BD+CACO <sub>3</sub> +CEC	725	0.045	0.420	274	0.046	0.444	-	d	PTF03
PTF25	PSD+DEPTH+BD+PH_H <sub>2</sub> O+CEC	1204	0.052	0.621	274	0.046	0.456	-	abcd	PTF03
PTF26	PSD+DEPTH+CACO <sub>3</sub> +PH_H <sub>2</sub> O+CEC	684	0.049	0.318	274	0.048	0.388	-	abcd	PTF01
PTF27	PSD+DEPTH+OC+BD+CACO <sub>3</sub> +PH_H <sub>2</sub> O	1130	0.045	0.475	274	0.049	0.367	-	abcd	PTF03
PTF28	PSD+DEPTH+OC+BD+CACO <sub>3</sub> +CEC	683	0.045	0.408	274	0.045	0.466	-	bcd	PTF03
PTF29	PSD+DEPTH+OC+BD+PH_H <sub>2</sub> O+CEC	1059	0.052	0.603	274	0.045	0.473	-	bcd	PTF03
PTF30	PSD+DEPTH+OC+CACO <sub>3</sub> +PH_H <sub>2</sub> O+CEC	641	0.049	0.330	274	0.048	0.393	-	abcd	PTF02
PTF31	PSD+DEPTH+BD+CACO <sub>3</sub> +PH_H <sub>2</sub> O+CEC	683	0.044	0.450	274	0.045	0.480	-	cd	PTF03
PTF32	PSD+DEPTH+OC+BD+CACO <sub>3</sub> +PH_H <sub>2</sub> O+CEC	641	0.045	0.425	274	0.045	0.471	-	cd	PTF03

<sup>1</sup>PSD: particle size distribution (sand, 50–2000  $\mu\text{m}$ ; silt, 2–50  $\mu\text{m}$ ; clay, <2  $\mu\text{m}$  (mass %)); DEPTH: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H<sub>2</sub>O: pH in water (-); CEC: cation exchange capacity ( $\text{cmol (+) kg}^{-1}$ ).

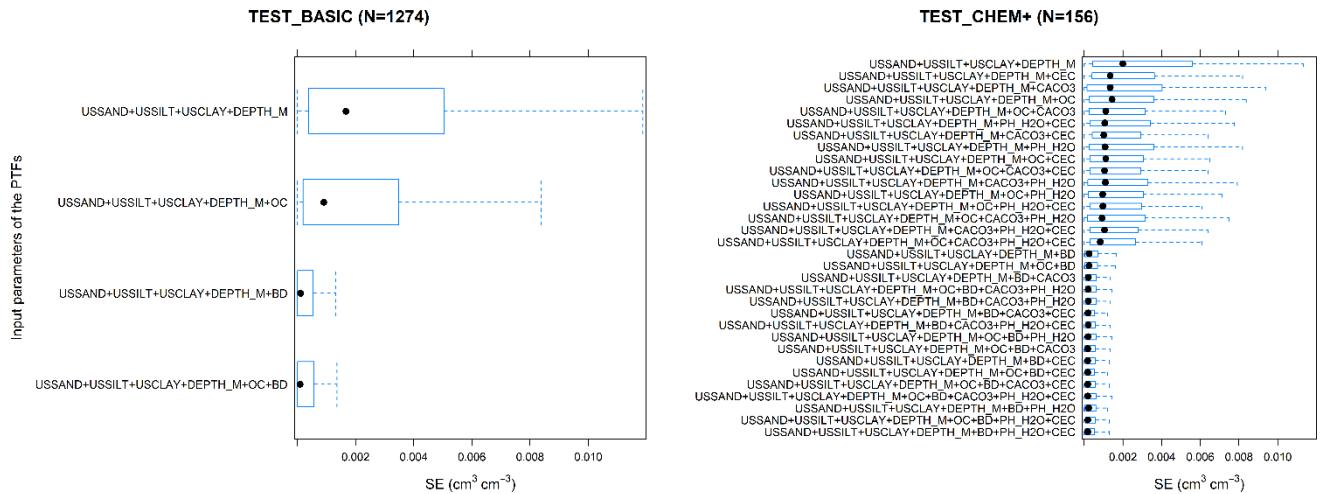
<sup>2</sup>Different letters indicate significant differences at the 0.05 level between the accuracy of the methods based on the squared error; for example performance indicated with the letter c is significantly better than the one noted with letters b and a.

**Table S2.** Performance of pedotransfer functions (PTF) by input combination on training and test datasets to predict the plant available water content of the soil (AWC) belonging to the -330 cm matric potential head. N: number of samples, RMSE: root mean square error ( $\text{cm}^3 \text{cm}^{-3}$ ), and R<sup>2</sup>: determination coefficient, TEST\_BASIC: samples with measured PSD, DEPTH, OC and BD; TEST\_CHEM+: samples with measured PSD, DEPTH, OC, BD, CACO<sub>3</sub>, PH\_H<sub>2</sub>O and CEC. Recommended PTFs are highlighted in bold.

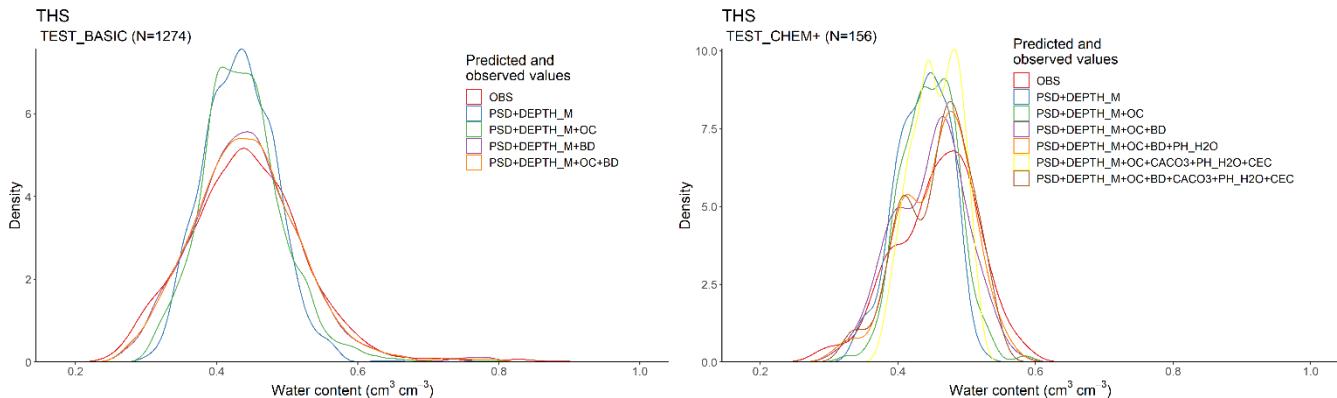
Name of PTF in euptfv2	Predictor variables <sup>1</sup>	Training set			Test set			Sign. difference <sup>2</sup>		
		N	RMSE	R <sup>2</sup>	N	RMSE	R <sup>2</sup>	TEST <sup>+</sup> BASIC set	TEST <sup>-</sup> CHEM + set	Recommended PTF
<b>PTF01</b>	<b>PSD+DEPTH</b>	1863	0.042	0.312	705	0.048	0.196	a	a	PTF01
PTF02	PSD+DEPTH+OC	1650	0.041	0.337	705	0.045	0.288	ab	a	PTF01
<b>PTF03</b>	<b>PSD+DEPTH+BD</b>	1849	0.040	0.374	705	0.045	0.285	ab	a	PTF01
PTF04	PSD+DEPTH+CACO <sub>3</sub>	1531	0.040	0.366	279	0.050	0.199	-	a	PTF01
PTF05	PSD+DEPTH+PH_H <sub>2</sub> O	1245	0.042	0.344	279	0.048	0.238	-	a	PTF01
PTF06	PSD+DEPTH+CEC	1092	0.041	0.356	279	0.053	0.078	-	a	PTF01
PTF07	PSD+DEPTH+OC+BD	1645	0.040	0.381	705	0.043	0.337	b	a	PTF03
PTF08	PSD+DEPTH+OC+CACO <sub>3</sub>	1336	0.041	0.345	279	0.049	0.219	-	a	PTF01
PTF09	PSD+DEPTH+OC+PH_H <sub>2</sub> O	1074	0.042	0.345	279	0.048	0.242	-	a	PTF01
PTF10	PSD+DEPTH+OC+CEC	998	0.039	0.413	279	0.051	0.147	-	a	PTF01
PTF11	PSD+DEPTH+BD+CACO <sub>3</sub>	1522	0.038	0.428	279	0.048	0.258	-	a	PTF01
PTF12	PSD+DEPTH+BD+PH_H <sub>2</sub> O	1236	0.039	0.429	279	0.047	0.287	-	a	PTF01
PTF13	PSD+DEPTH+BD+CEC	1088	0.038	0.429	279	0.049	0.231	-	a	PTF01
PTF14	PSD+DEPTH+CACO <sub>3</sub> +PH_H <sub>2</sub> O	1230	0.041	0.376	279	0.047	0.263	-	a	PTF01
PTF15	PSD+DEPTH+CACO <sub>3</sub> +CEC	791	0.041	0.366	279	0.049	0.214	-	a	PTF01
PTF16	PSD+DEPTH+PH_H <sub>2</sub> O+CEC	739	0.042	0.321	279	0.048	0.237	-	a	PTF01
PTF17	PSD+DEPTH+OC+BD+CACO <sub>3</sub>	1334	0.039	0.399	279	0.048	0.262	-	a	PTF03
PTF18	PSD+DEPTH+OC+BD+PH_H <sub>2</sub> O	1072	0.040	0.393	279	0.047	0.293	-	a	PTF03
PTF19	PSD+DEPTH+OC+BD+CEC	995	0.038	0.432	279	0.049	0.223	-	a	PTF03
PTF20	PSD+DEPTH+OC+CACO <sub>3</sub> +PH_H <sub>2</sub> O	1059	0.042	0.362	279	0.047	0.289	-	a	PTF01
PTF21	PSD+DEPTH+OC+CACO <sub>3</sub> +CEC	707	0.041	0.358	279	0.049	0.229	-	a	PTF01
PTF22	PSD+DEPTH+OC+PH_H <sub>2</sub> O+CEC	660	0.041	0.339	279	0.048	0.253	-	a	PTF01
PTF23	PSD+DEPTH+BD+CACO <sub>3</sub> +PH_H <sub>2</sub> O	1221	0.039	0.442	279	0.047	0.267	-	a	PTF01
PTF24	PSD+DEPTH+BD+CACO <sub>3</sub> +CEC	788	0.039	0.405	279	0.047	0.269	-	a	PTF01
PTF25	PSD+DEPTH+BD+PH_H <sub>2</sub> O+CEC	736	0.039	0.402	279	0.046	0.307	-	a	PTF01
PTF26	PSD+DEPTH+CACO <sub>3</sub> +PH_H <sub>2</sub> O+CEC	732	0.040	0.405	279	0.048	0.254	-	a	PTF01
PTF27	PSD+DEPTH+OC+BD+CACO <sub>3</sub> +PH_H <sub>2</sub> O	1057	0.040	0.415	279	0.046	0.312	-	a	PTF03
PTF28	PSD+DEPTH+OC+BD+CACO <sub>3</sub> +CEC	705	0.040	0.383	279	0.047	0.277	-	a	PTF03
PTF29	PSD+DEPTH+OC+BD+PH_H <sub>2</sub> O+CEC	658	0.040	0.385	279	0.046	0.315	-	a	PTF03
PTF30	PSD+DEPTH+OC+CACO <sub>3</sub> +PH_H <sub>2</sub> O+CEC	653	0.040	0.395	279	0.047	0.274	-	a	PTF01
PTF31	PSD+DEPTH+BD+CACO <sub>3</sub> +PH_H <sub>2</sub> O+CEC	729	0.039	0.431	279	0.047	0.290	-	a	PTF01
PTF32	PSD+DEPTH+OC+BD+CACO <sub>3</sub> +PH_H <sub>2</sub> O+CEC	651	0.039	0.403	279	0.046	0.307	-	a	PTF03

<sup>1</sup>PSD: particle size distribution (sand, 50–2000  $\mu\text{m}$ ; silt, 2–50  $\mu\text{m}$ ; clay, <2  $\mu\text{m}$  (mass %)); DEPTH: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H<sub>2</sub>O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).

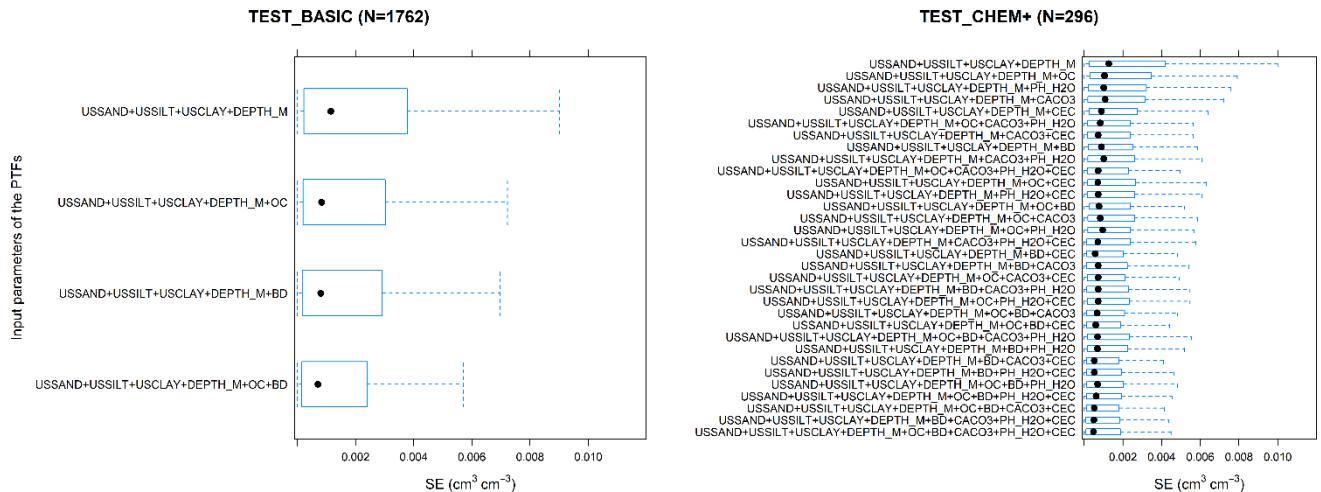
<sup>2</sup>Different letters indicate significant differences at the 0.05 level between the accuracy of the methods based on the squared error; for example performance indicated with the letter c is significantly better than the one noted with letters b and a.



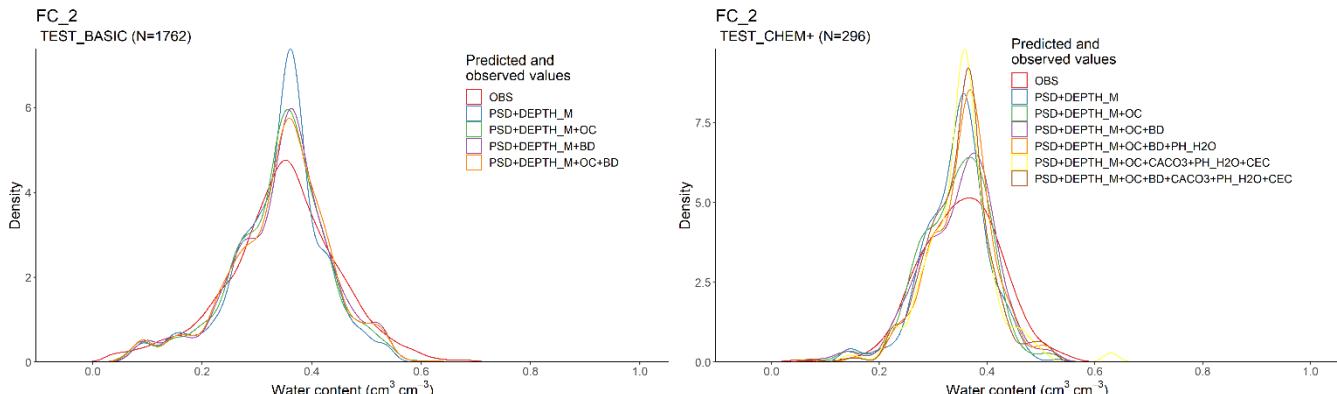
**Figure S2.** Squared error (SE) of the pedotransfer functions derived to predict water content at saturation (THS) computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).



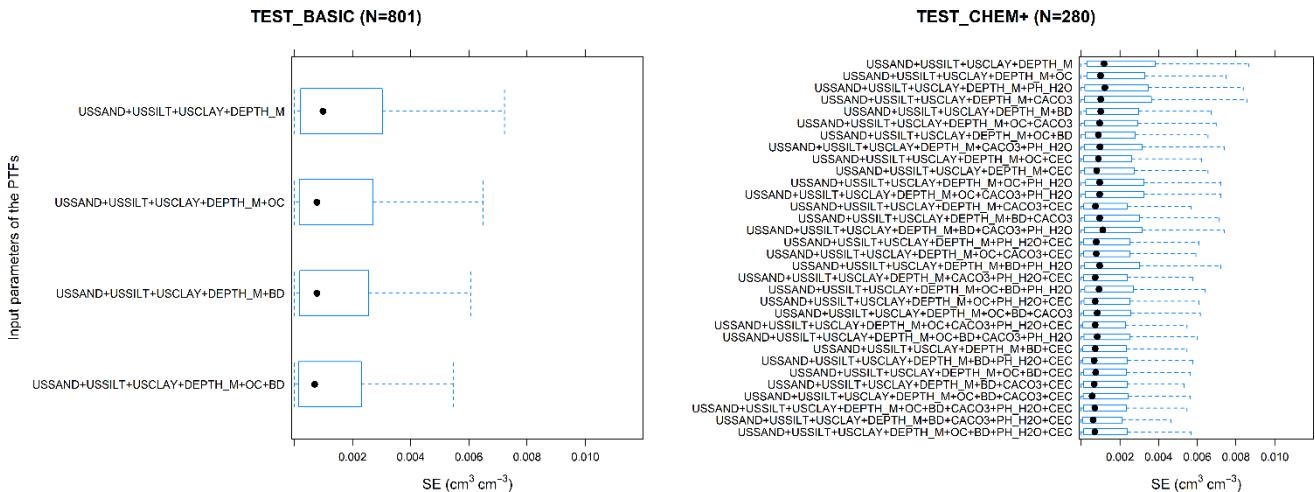
**Figure S3.** Density plot of observed (OBS) and predicted median (USSAND+USSLIT+USCLAY+DEPTH\_M+\*) water content at saturation (THS) for selected pedotransfer functions, computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).



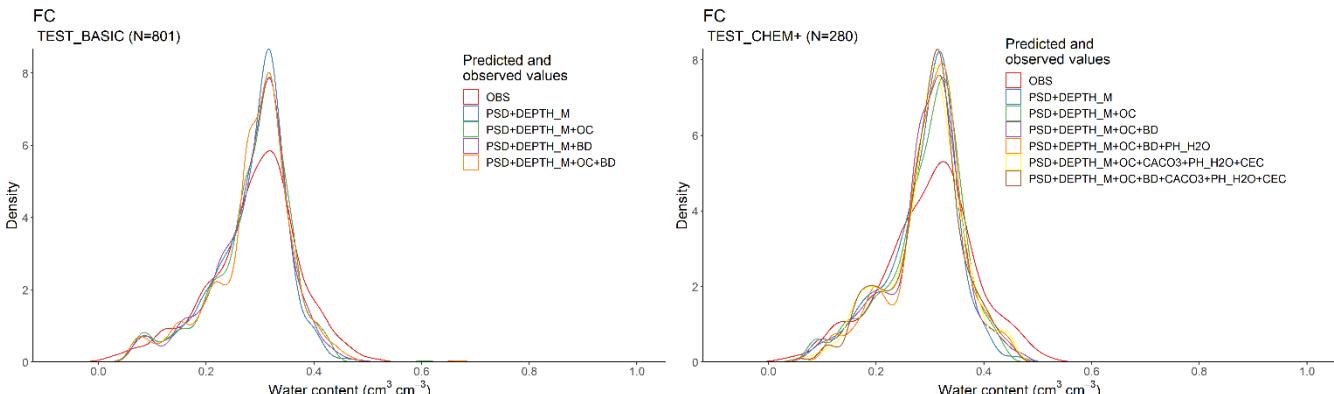
**Figure S4.** Squared error (SE) of the pedotransfer functions derived to predict water content at -100 cm matric potential head (FC\_2) computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).



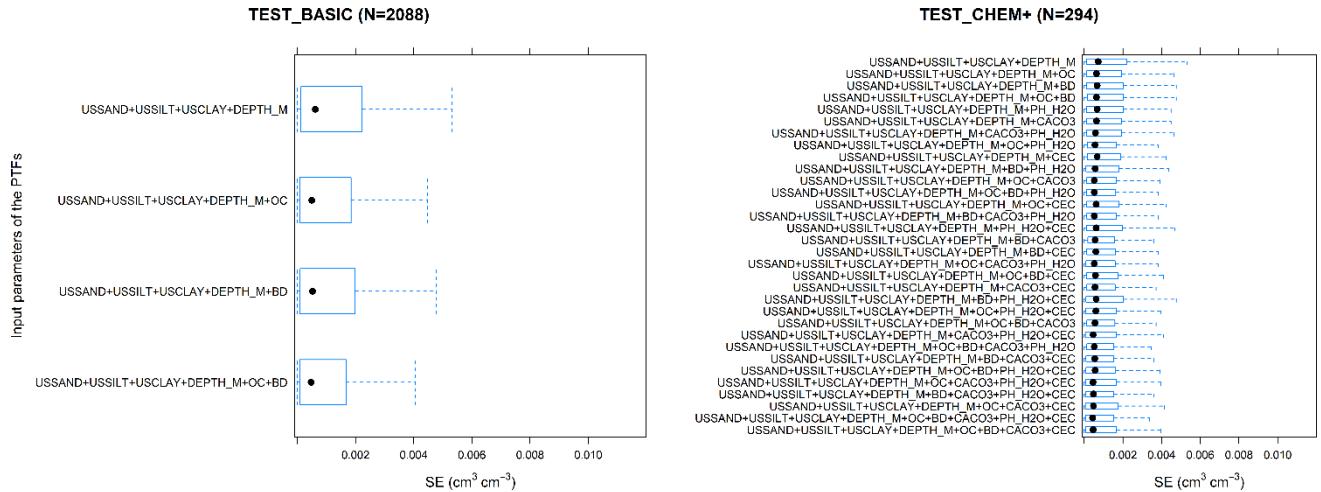
**Figure S5.** Density plot of observed (OBS) and predicted median (USSAND+USSLIT+USCLAY+DEPTH\_M+\*) water content at -100 cm matric potential head (FC\_2) for selected pedotransfer functions, computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).



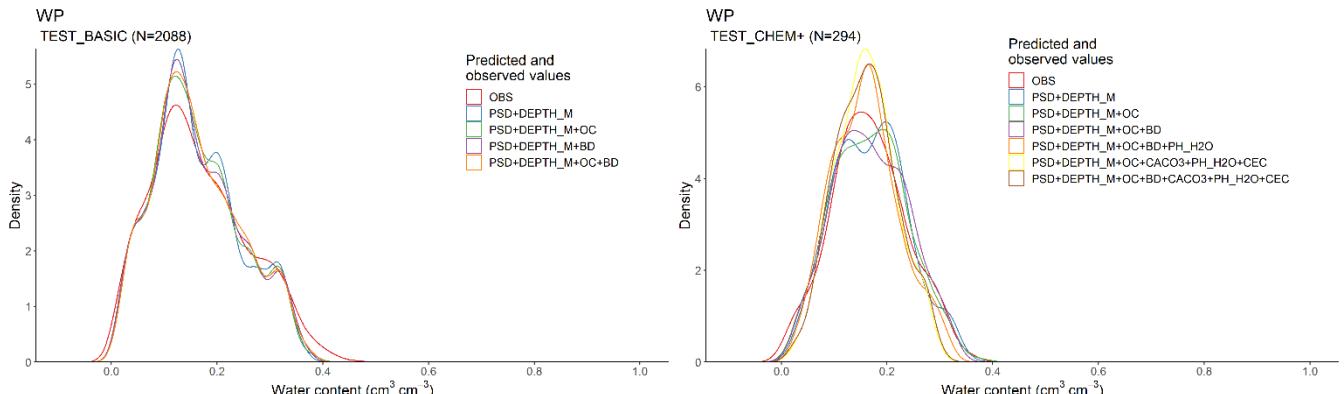
**Figure S6.** Squared error (SE) of the pedotransfer functions derived to predict water content at -330 cm matric potential head (FC) computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H<sub>2</sub>O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).



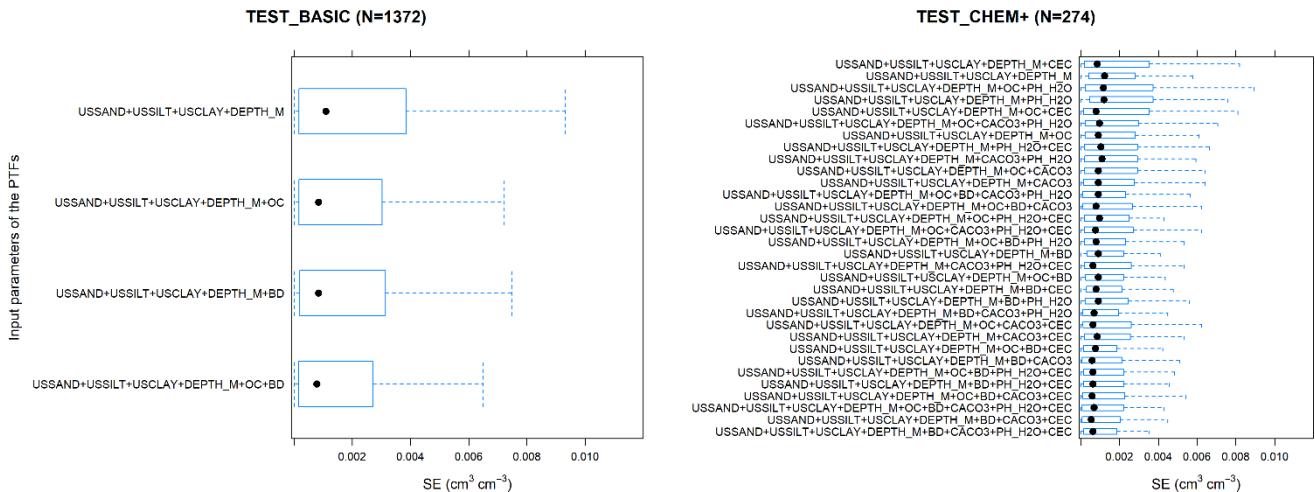
**Figure S7.** Density plot of observed (OBS) and predicted median (USSAND+USSLIT+USCLAY+DEPTH\_M+\*) water content at -330 cm matric potential head (FC) for selected pedotransfer functions, computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H<sub>2</sub>O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).



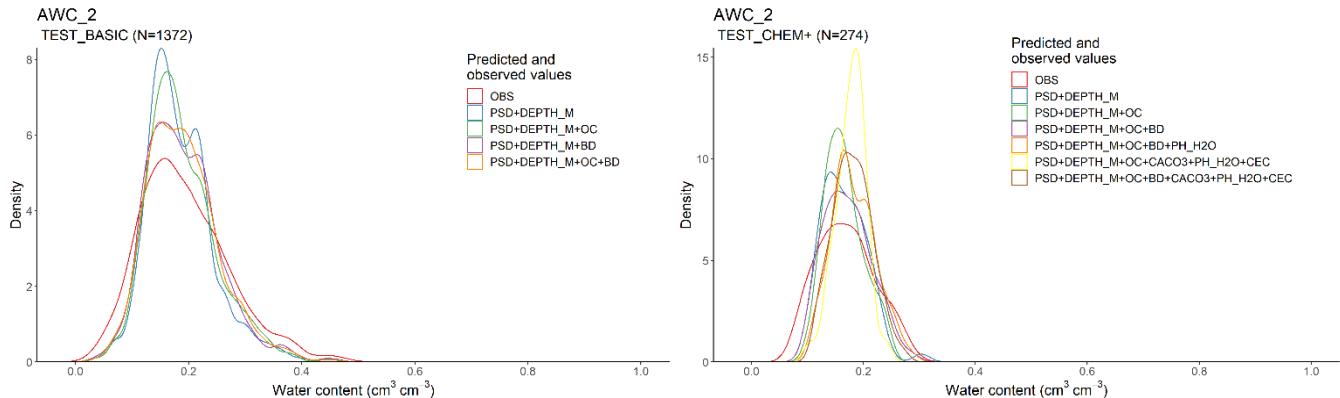
**Figure S8.** Squared error (SE) of the pedotransfer functions derived to predict water content at wilting point (WP) computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).



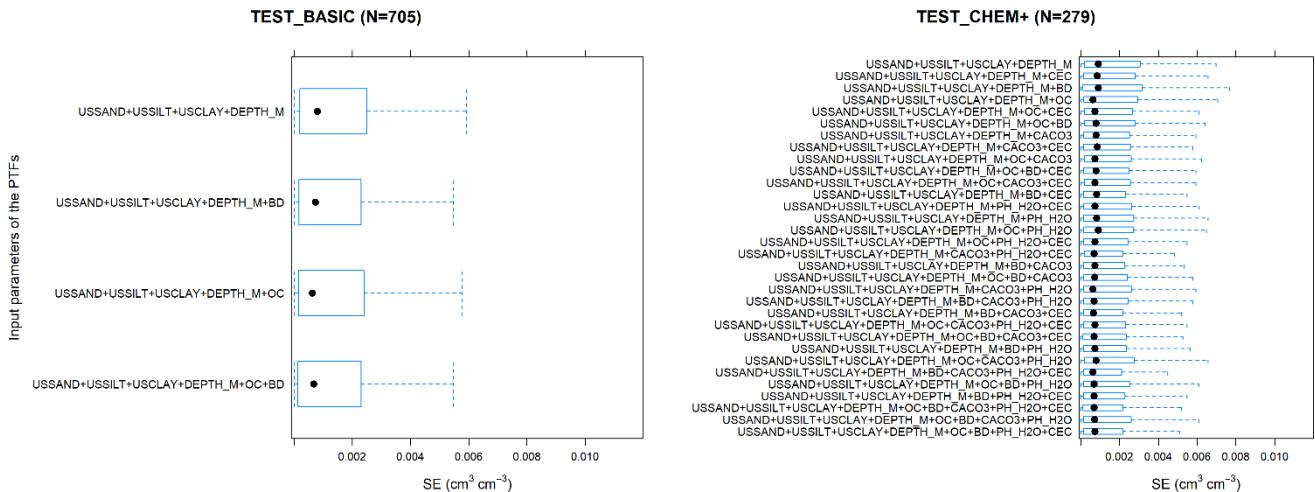
**Figure S9.** Density plot of observed (OBS) and predicted median (USSAND+USSLIT+USCLAY+DEPTH\_M+\*) water content at wilting point (WP) for selected pedotransfer functions, computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).



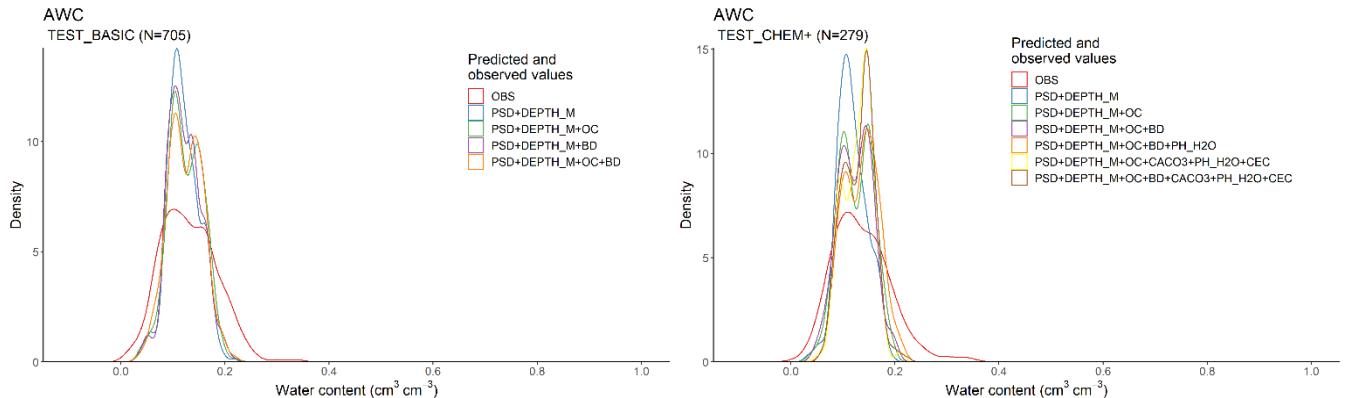
**Figure S10.** Squared error (SE) of the pedotransfer functions derived to predict plant available water content (AWC\_2) considering field capacity at -100 matric potential head (FC\_2), computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H<sub>2</sub>O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).



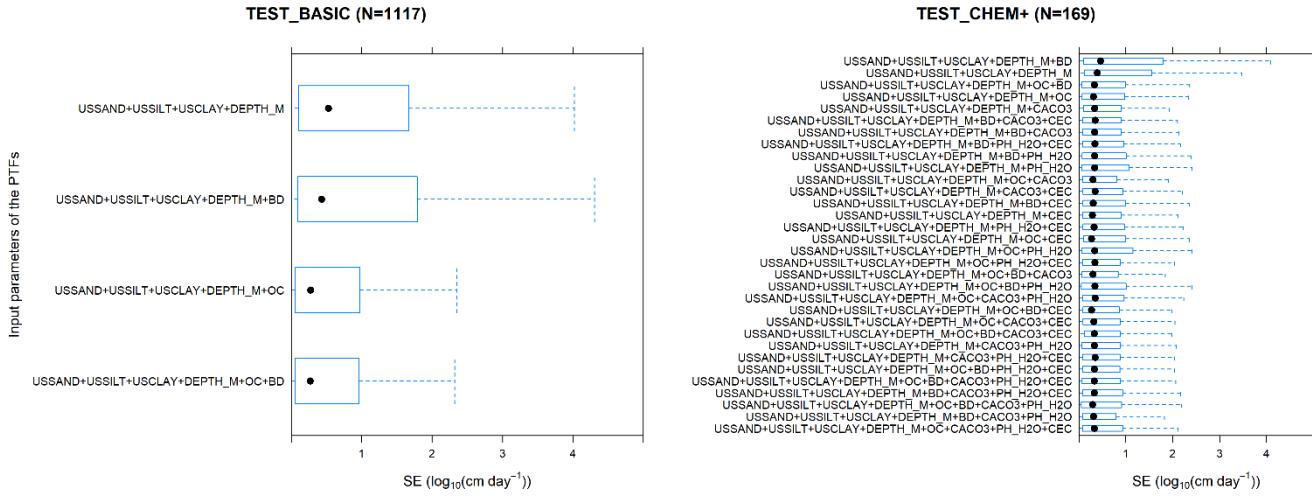
**Figure S11.** Density plot of observed (OBS) and predicted median (USSAND+USSLIT+USCLAY+DEPTH\_M+\*) plant available water content (AWC\_2) considering field capacity at -100 matric potential head (FC\_2) for selected pedotransfer functions, computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H<sub>2</sub>O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).



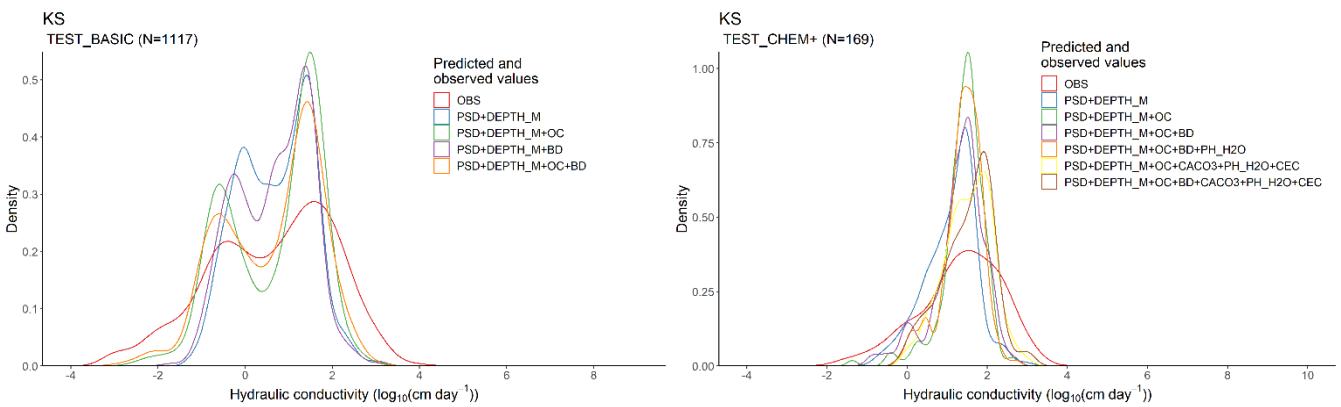
**Figure S12.** Squared error (SE) of the pedotransfer functions derived to predict plant available water content (AWC) considering field capacity at -330 matric potential head (FC), computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO3: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity ( $\text{cmol (+) kg}^{-1}$ ).



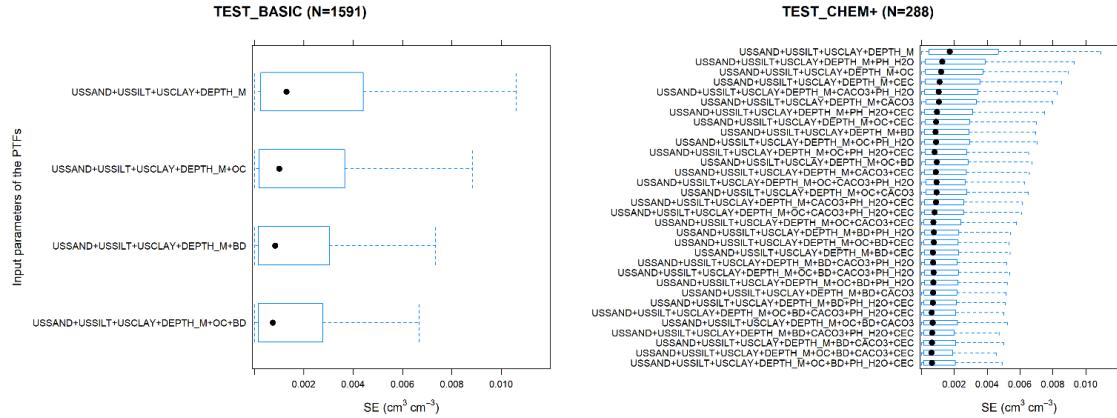
**Figure S13.** Density plot of observed (OBS) and predicted median (USSAND+USSLIT+USCLAY+DEPTH\_M+\*) plant available water content (AWC) considering field capacity at -330 matric potential head (FC) for selected pedotransfer functions, computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO3: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity ( $\text{cmol (+) kg}^{-1}$ ).



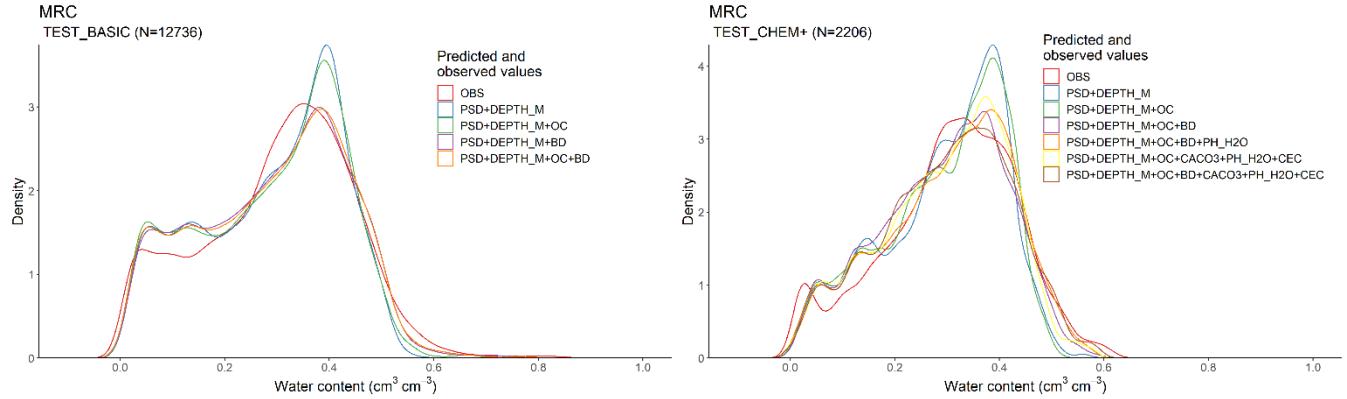
**Figure S14.** Squared error (SE) of the pedotransfer functions derived to predict saturated hydraulic conductivity (KS), computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSILT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity ( $\text{cmol (+) kg}^{-1}$ ).



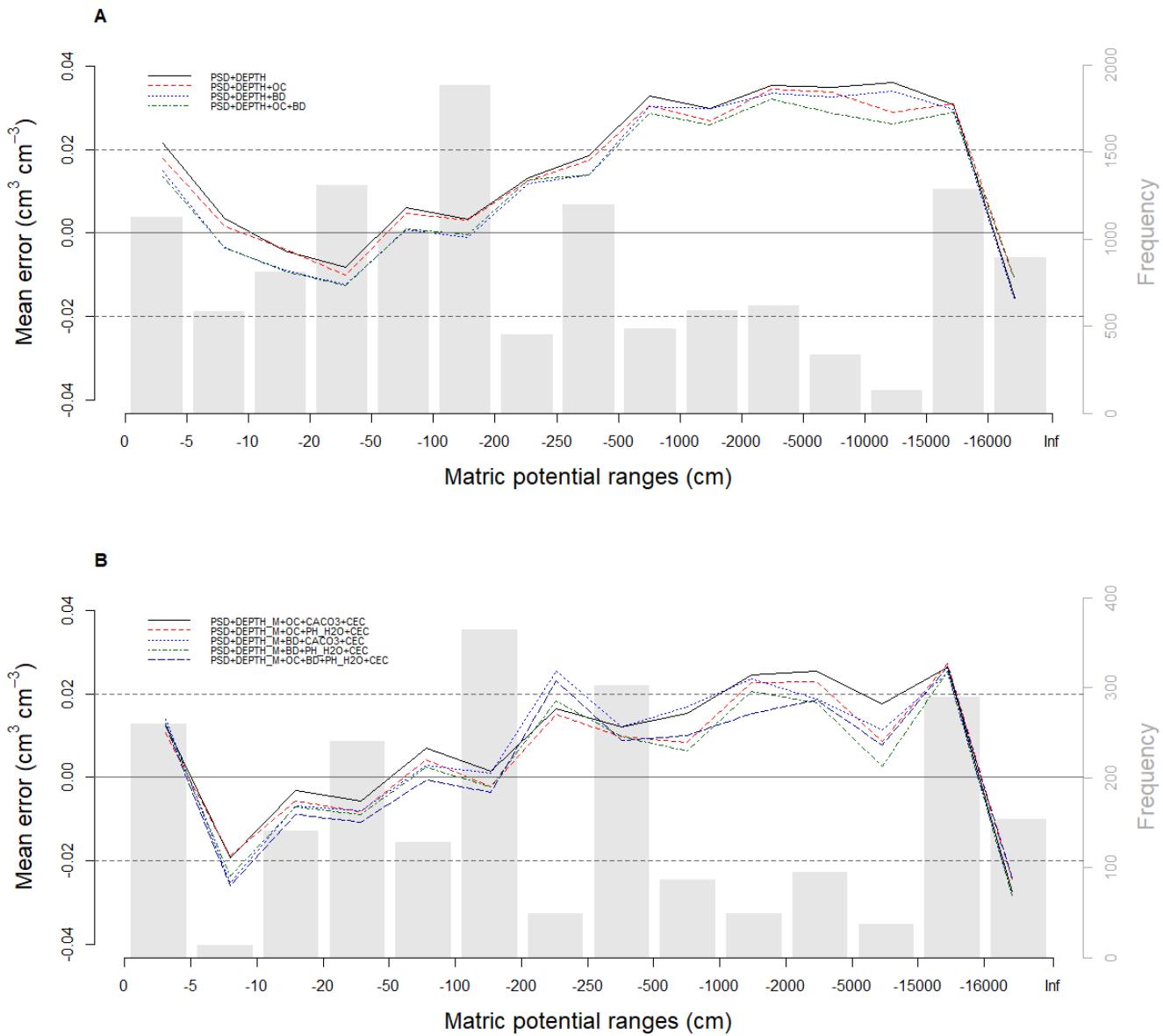
**Figure S15.** Density plot of observed (OBS) and predicted median (USSAND+USSILT+USCLAY+DEPTH\_M+\*) saturated hydraulic conductivity (KS) for selected pedotransfer functions, computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSILT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity ( $\text{cmol (+) kg}^{-1}$ ).



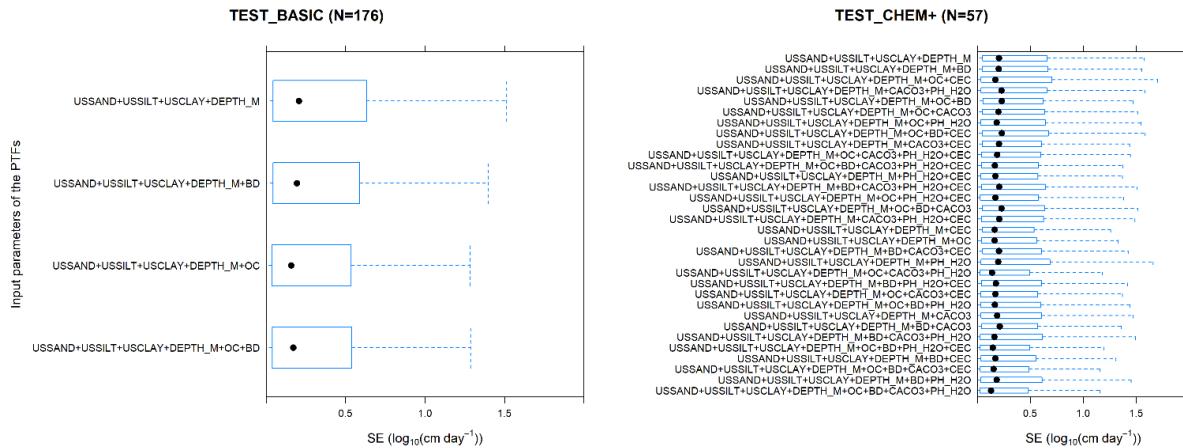
**Figure S16.** Squared error (SE) of the pedotransfer functions derived to predict parameters of the van Genuchten model for the description of the moisture retention curve (MRC), computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity ( $\text{cmol (+) kg}^{-1}$ ).



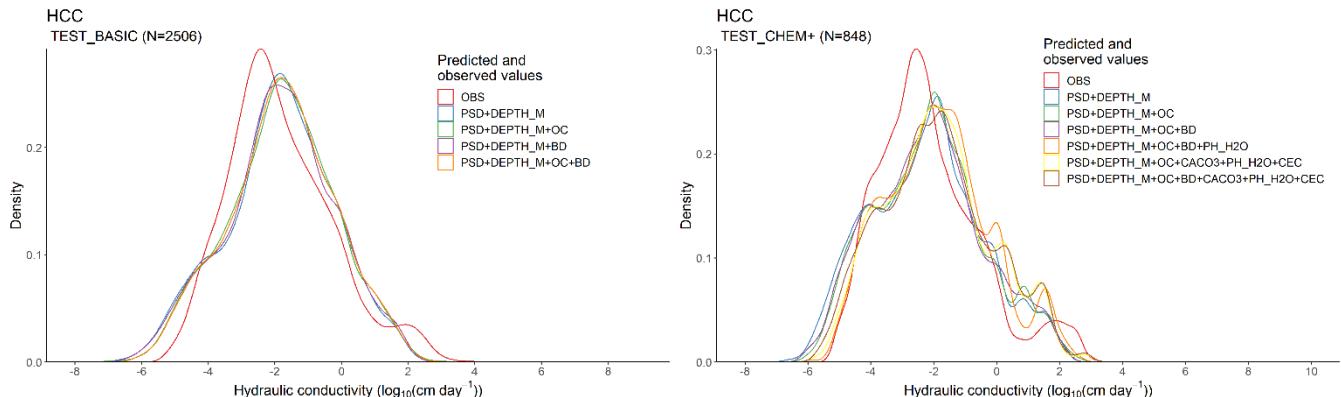
**Figure S17.** Density plot of observed (OBS) and predicted median (USSAND+USSLIT+USCLAY+DEPTH\_M+\*) water retention values (MRC) computed based on the parameters of the van Genuchten model, computed on TEST\_BASIC and TEST\_CHEM+ set. Predicted values of those PTFs are shown which use the most often available predictor variables. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity ( $\text{cmol (+) kg}^{-1}$ ).



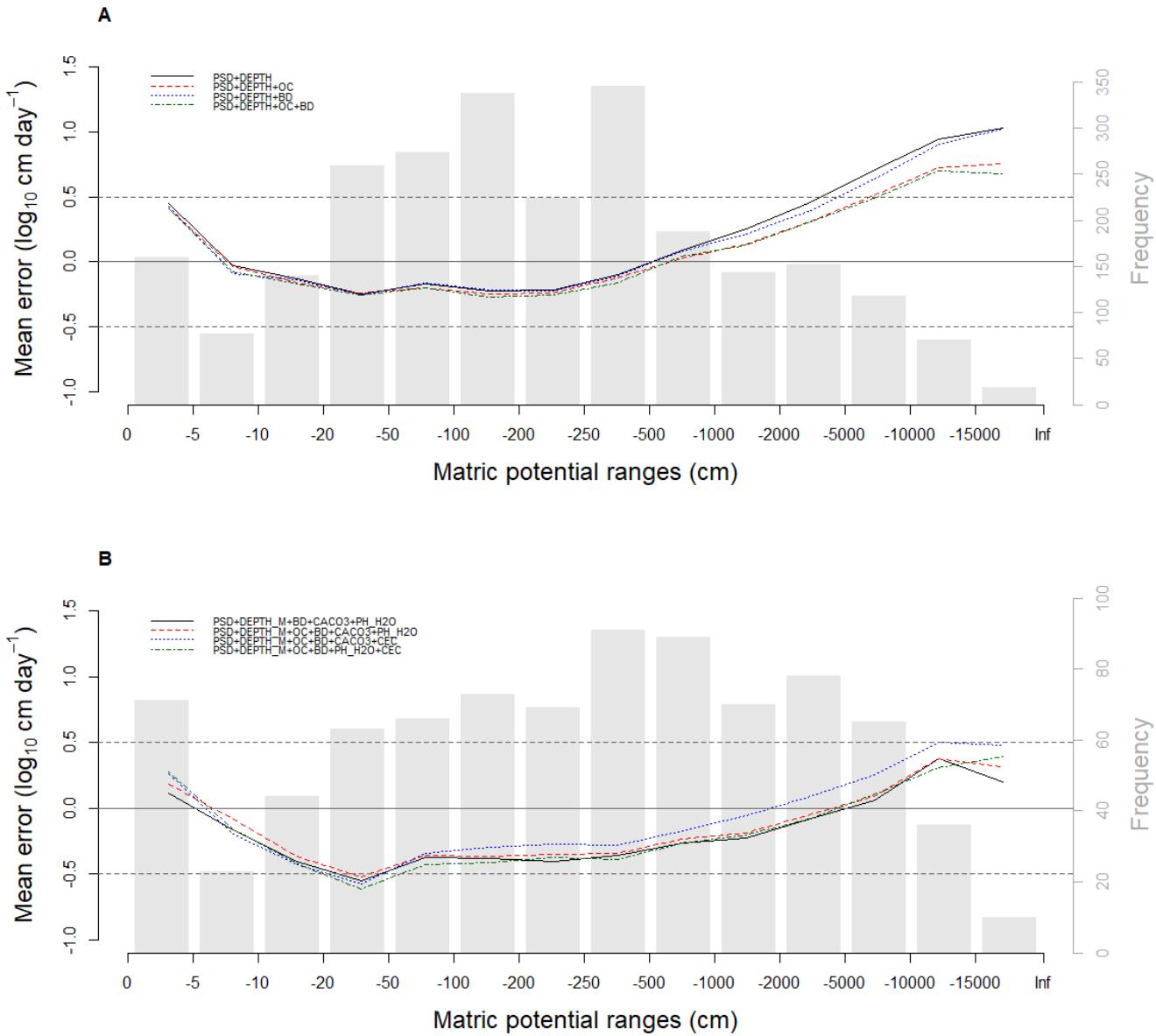
**Figure S18.** Mean error of the pedotransfer functions derived to predict parameters of the van Genuchten model for the description of the moisture retention curve, computed on TEST\_BASIC ( $N = 1591$ ) (A) and TEST\_CHEM+ ( $N = 288$ ) (B) sets by matric potential head values.



**Figure S19.** Squared error (SE) of the pedotransfer functions derived to predict parameters of the Mualem-van Genuchten model for the description of the hydraulic conductivity curve (HCC), computed on TEST\_BASIC and TEST\_CHEM+ set. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ ); CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).  
5  
5  
5



10 **Figure S20.** Density plot of observed (OBS) and predicted median (USSAND+USSLIT+USCLAY+DEPTH\_M+\*) hydraulic conductivity values (HCC) computed based on the parameters of the Mualem-van Genuchten model, computed on TEST\_BASIC and TEST\_CHEM+ set. Predicted values of those PTFs are shown which use the most often available predictor variables. USSAND: sand (50–2000  $\mu\text{m}$ ) content (mass %); USSLIT: silt (2–50  $\mu\text{m}$ ) content (mass %), USCLAY: clay (<2  $\mu\text{m}$ ) content (mass %); DEPTH\_M: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density ( $\text{g cm}^{-3}$ );  
15 CACO<sub>3</sub>: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity (cmol (+)  $\text{kg}^{-1}$ ).  
15



**Figure S21.** Mean error of the pedotransfer functions derived to predict parameters of the Mualem-van Genuchten model for the description of the hydraulic conductivity curve, computed on TEST\_BASIC ( $N = 176$ ) (A) and TEST\_CHEM+ ( $N = 57$ )  
5 sets by matric potential head values.

**Table S3.** List of recommended pedotransfer functions (PTFs) by predicted soil hydraulic property and available predictor variables.

Predictor variables <sup>1</sup>	Recommended PTFs <sup>2</sup>								
	THS	FC_2	FC	WP	AWC_	AWC	KS	VG	MVG
PSD+DEPTH_M	PTF01	PTF01	PTF01	PTF01	PTF01	PTF01	PTF01	PTF01	PTF01
PSD+DEPTH_M+OC	PTF02	PTF02	PTF02	PTF02	PTF02	PTF01	PTF02	PTF02	PTF02
PSD+DEPTH_M+BD	PTF03	PTF03	PTF01	PTF01	PTF03	PTF01	PTF01	PTF03	PTF01
PSD+DEPTH_M+CACO3	PTF04	PTF01	PTF01	PTF01	PTF01	PTF01	PTF01	PTF04	PTF04
PSD+DEPTH_M+PH_H2O	PTF05	PTF01	PTF01	PTF01	PTF01	PTF01	PTF01	PTF05	PTF05
PSD+DEPTH_M+CEC	PTF01	PTF01	PTF06	PTF01	PTF01	PTF01	PTF01	PTF06	PTF06
PSD+DEPTH_M+OC+BD	PTF03	PTF03	PTF02	PTF02	PTF03	PTF03	PTF02	PTF07	PTF02
PSD+DEPTH_M+OC+CACO3	PTF02	PTF02	PTF02	PTF02	PTF02	PTF01	PTF02	PTF08	PTF02
PSD+DEPTH_M+OC+PH_H2O	PTF02	PTF02	PTF02	PTF02	PTF02	PTF01	PTF02	PTF09	PTF02
PSD+DEPTH_M+OC+CEC	PTF02	PTF06	PTF02	PTF02	PTF02	PTF01	PTF02	PTF10	PTF02
PSD+DEPTH_M+BD+CACO3	PTF03	PTF03	PTF03	PTF01	PTF03	PTF01	PTF01	PTF11	PTF04
PSD+DEPTH_M+BD+PH_H2O	PTF03	PTF03	PTF03	PTF01	PTF03	PTF01	PTF05	PTF12	PTF12
PSD+DEPTH_M+BD+CEC	PTF03	PTF13	PTF06	PTF01	PTF03	PTF01	PTF01	PTF13	PTF13
PSD+DEPTH_M+CACO3+PH_H2O	PTF05	PTF05	PTF04	PTF01	PTF01	PTF01	PTF05	PTF14	PTF04
PSD+DEPTH_M+CACO3+CEC	PTF04	PTF04	PTF04	PTF01	PTF01	PTF01	PTF01	PTF15	PTF04
PSD+DEPTH_M+PH_H2O+CEC	PTF05	PTF05	PTF06	PTF01	PTF01	PTF01	PTF01	PTF16	PTF06
PSD+DEPTH_M+OC+BD+CACO3	PTF03	PTF07	PTF02	PTF07	PTF03	PTF03	PTF02	PTF11	PTF02
PSD+DEPTH_M+OC+BD+PH_H2O	PTF03	PTF07	PTF02	PTF07	PTF03	PTF03	PTF02	PTF12	PTF02
PSD+DEPTH_M+OC+BD+CEC	PTF03	PTF13	PTF07	PTF07	PTF03	PTF03	PTF02	PTF13	PTF02
PSD+DEPTH_M+OC+CACO3+PH_H2O	PTF02	PTF02	PTF02	PTF02	PTF02	PTF01	PTF02	PTF09	PTF20
PSD+DEPTH_M+OC+CACO3+CEC	PTF02	PTF08	PTF04	PTF08	PTF02	PTF01	PTF02	PTF21	PTF21
PSD+DEPTH_M+OC+PH_H2O+CEC	PTF02	PTF09	PTF09	PTF02	PTF02	PTF01	PTF02	PTF22	PTF02
PSD+DEPTH_M+BD+CACO3+PH_H2O	PTF03	PTF03	PTF03	PTF01	PTF03	PTF01	PTF05	PTF11	PTF23
PSD+DEPTH_M+BD+CACO3+CEC	PTF03	PTF11	PTF11	PTF01	PTF03	PTF01	PTF01	PTF24	PTF04
PSD+DEPTH_M+BD+PH_H2O+CEC	PTF03	PTF12	PTF11	PTF01	PTF03	PTF01	PTF05	PTF25	PTF12
PSD+DEPTH_M+CACO3+PH_H2O+CEC	PTF05	PTF05	PTF14	PTF05	PTF01	PTF01	PTF05	PTF15	PTF04
PSD+DEPTH_M+OC+BD+CACO3+PH_H2O	PTF03	PTF07	PTF02	PTF07	PTF03	PTF03	PTF02	PTF11	PTF27
PSD+DEPTH_M+OC+BD+CACO3+CEC	PTF03	PTF11	PTF07	PTF17	PTF03	PTF03	PTF02	PTF24	PTF28
PSD+DEPTH_M+OC+BD+PH_H2O+CEC	PTF03	PTF12	PTF07	PTF07	PTF03	PTF03	PTF02	PTF29	PTF29
PSD+DEPTH_M+OC+CACO3+PH_H2O+CEC	PTF02	PTF09	PTF08	PTF02	PTF02	PTF01	PTF02	PTF21	PTF20
PSD+DEPTH_M+BD+CACO3+PH_H2O+CEC	PTF03	PTF11	PTF06	PTF05	PTF03	PTF01	PTF05	PTF24	PTF12
PSD+DEPTH_M+OC+BD+CACO3+PH_H2O+CEC	PTF03	PTF18	PTF07	PTF09	PTF03	PTF03	PTF02	PTF29	PTF27

<sup>1</sup>PSD: particle size distribution (sand, 50–2000 µm; silt, 2–50 µm; clay, <2 µm (mass %)); DEPTH: mean soil depth (cm); OC: organic carbon content (mass %); BD: bulk density (g cm<sup>-3</sup>); CACO3: calcium carbonate content (mass %); PH\_H2O: pH in water (-); CEC: cation exchange capacity (cmol (+) kg<sup>-1</sup>). <sup>2</sup>THS: saturated water content (pF 0); FC\_2: water content at -100 cm matric potential head (pF 2.0); FC: water content at -330 cm matric potential head (pF 2.5); AWC\_2: plant available water content based on FC\_2; AWC: plant available water content based on FC; WP: water content at wilting point (pF 4.2); KS: saturated hydraulic conductivity; VG: parameters of the van Genuchten model; MVG: parameters of the Mualem – van Genuchten model; TEST\_BASIC: samples with measured PSD, DEPTH, OC and BD; TEST\_CHEM+: samples with measured PSD, DEPTH, OC, BD, CACO3, PH\_H2O and CEC.