Supplement of

Uncertainty in root zone storage capacity estimates and its implications for hydrological modelling

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Contents:

S1: Hydrological model structure and equations

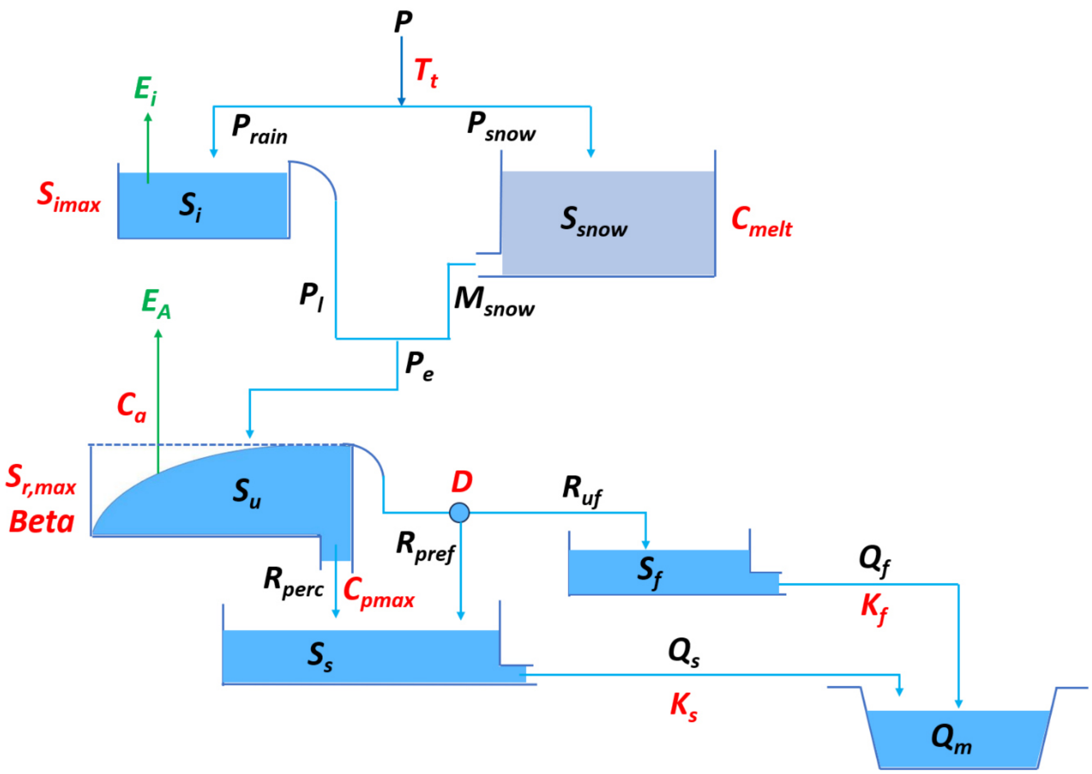

Figure S1: Hydrological model structure used in this study. Blue boxes represent the hydrologically active storage reservoirs. Blue arrows indicate liquid water fluxes, whereas green arrows represent vapours fluxes. Model parameters are shown in red adjacent to the corresponding model component. All symbols are defined in Table S1 and Table S2.

Table S1: Definitions of the symbols used for representing different hydrological model components and fluxes

Storages (mm)	
S_{snow}	Snow storage
S_i	Interception storage
S_u	Root zone storage
S_s	Slow reservoir storage
S_f	Fast reservoir storage
Fluxes (mm d^{-1})	
P	Precipitation
P_{snow}	Precipitation as snow
P_{rain}	Precipitation as snow
P_l	Liquid precipitation
M_{snow}	Snow melt
P_e	Effective precipitation
E_i	Interception evaporation
E_a	Evaporation from the root zone storage
R_{perc}	Percolation runoff
R_{pref}	Preferential runoff
R_{uf}	Recharge to the fast reservoir
Q_f	Fast reservoir runoff
Q_s	Slow reservoir runoff
Q_m	Modelled streamflow

Table S2: Definitions of the parameters used in hydrological model

Symbol	Unit	Definition	Prior range
T_t	ºC	Threshold temperature	(-2–2)
C_{melt}	mmº C d^{-1}	Melt factor	1–4
S_{imax}	mm	Interception storage capacity	0.1–4
C_a	[-]	Evapotranspiration coefficient	0.1–0.7
$S_{r,max}$	mm	Root zone storage capacity	Varies as explained in manuscript Fig. 2a
$Beta$	[-]	Shape parameter	0.1–2.5
D	[-]	Splitter to fast and slow response reservoirs	0–1
C_{pmax}	mm d^{-1}	Percolation capacity	0.1–3
K_f	d^{-1}	Fast reservoir Recession coefficient	0.1–1
K_s	d^{-1}	Fast reservoir Recession coefficient	0.001–0.2

Table S3: Equations used in hydrological model to simulate different fluxes. Parameters are shown in bold

Storage	Water balance	Equations
Snow Storage	$\frac{dS_{snow}}{dt} = P_{snow} - M_{snow}$	If $T(t) > \boldsymbol{T_t}$: $P_{rain}(t) = P(t)$ $P_{snow}(t) = 0$ $M_{snow}(t) = \text{Min}(S_{snow}(t-1) \text{ or } MF(T(t) - \boldsymbol{T_t}))$ $S_{snow} = S_{snow}(t-1) - M_{snow}(t)$ If $T(t) \leq \boldsymbol{T_t}$: $P_{rain}(t) = 0$ $P_{snow}(t) = P(t)$ $M_{snow}(t) = 0$ $S_{snow} = S_{snow}(t-1) + P_{snow}(t)$
Interception storage	$\frac{dS_i}{dt} = P_{rain} - P_l - E_i$	$P_l(t) = 0$ if $P_{rain}(t) + S_i(t-1) \leq \boldsymbol{S_{imax}}$ $P_l(t) = P_{rain}(t) + S_i(t-1) - \boldsymbol{S_{imax}}$ if $P_{rain}(t) + S_i(t-1) > \boldsymbol{S_{imax}}$ $S_{i,}(t)^* = S_i(t-1) + P_{rain}(t) - P_l(t)$ $E_{i,}(t) = E_P(t)$ if $E_P(t) < S_{i,}(t)^*$ $E_{i,}(t) = S_{i,}(t)^*$ if $E_P(t) \geq S_{i,}(t)^*$
Root zone storage	$\frac{dS_U}{dt} = P_e - R_{perc} - R_{uf} - E_a$	$S_U' = (1 + \boldsymbol{Beta})\boldsymbol{S_{r,max}}(1 - (1 - \frac{S_u}{\boldsymbol{S_{r,max}}})^{(\frac{1}{1+\boldsymbol{Beta}})})$ $R_f = P_e - \boldsymbol{S_{r,max}} + S_u + \boldsymbol{S_{r,max}}\left(1 - \frac{P_e + S_u'}{(1 + \boldsymbol{Beta})\boldsymbol{S_{r,max}}}\right)^{(1+\boldsymbol{Beta})}$ $R_{perc} = min(\boldsymbol{C_{pmax}}\left(\frac{S_u}{\boldsymbol{S_{r,max}}}\right), S_u)$ $E_a = min((E_p - E_i)min(\frac{S_u}{\boldsymbol{S_{r,max}}\,\boldsymbol{C_a}}, 1), S_u)$
Fast reservoir	$\frac{dS_f}{dt} = R_f - Q_f$	$R_{pref} = (1 - \boldsymbol{D})R_f$ $R_{fu} = \boldsymbol{D}R_f$ $Q_f = \min(\boldsymbol{K_f}(S_f + R_{fu}), S_f)$
Slow reservoir	$\frac{dS_s}{dt} = R_{perc} + R_{pref} - Q_s$	$Q_s = \min(\boldsymbol{K_s}S_s, S_s)$