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Supplement of

Testing conceptual and physically based soil hydrology schemes against observations for the Amazon Basin

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Supplementary material

Name	Description	Units	Sources
T_{air}	Two-meter air temperature	K	NCEP–NCAR reanalysis / CRU TS3.0
Q_{air}	Two-meter air specific humidity	kg kg ⁻¹	NCEP–NCAR reanalysis
Wind	Ten-meter wind speed	m s ⁻¹	NCEP–NCAR reanalysis
P_{surf}	Surface pressure	Pa	NCEP–NCAR reanalysis
SW_{down}	Surface downward short wave flux	W m ⁻²	NCEP–NCAR reanalysis / NASA Langley SRB V3.0
LW_{down}	Surface downward long wave flux	W m ⁻²	NCEP–NCAR reanalysis / NASA Langley SRB V3.0
P	Precipitation rate	kg m ⁻² s ⁻¹	GPCC

Table 1: List of atmospheric variables in the Princeton forcing data.

	Amazon		Xingu (ALT)		Tapajós (ITA)		Madeira (FVA)		Solimões (SPO)		Negro (SER)	
	$\Delta\alpha$	$\Delta\phi$	$\Delta\alpha$	$\Delta\phi$	$\Delta\alpha$	$\Delta\phi$	$\Delta\alpha$	$\Delta\phi$	$\Delta\alpha$	$\Delta\phi$	$\Delta\alpha$	$\Delta\phi$
2LAY	+25	+15	+154	-6	+87	-9	+75	+3	+29	+0.3	-47	+31
11LAY	+52	+12	+110	-5	+46	-5	+62	+8	+12	+2.5	-77	+24

Table 2: Amplitude ($\Delta\alpha$ in mm) and phase ($\Delta\phi$ in days) differences of TWS between simulations (2LAY and 11LAY) and GRACE, for the Amazon basin and its sub-basins, for the period 2003-2008. The bold values correspond to the lowest bias between 2LAY or 11LAY and GRACE for a given sub-basin.

Sta.	Observed			2LAY						11LAY					
	Q_{mean}	Q_{min}	Q_{max}	Q_{mean}	Q_{min}	Q_{max}	Nash	N-RMSE	D/R _{tot}	Q_{mean}	Q_{min}	Q_{max}	Nash	N-RMSE	D/R _{tot}
OBI	179 060	66 220	260 500	190 282	135 912	253 740	0.43	22.4	0.95	185 859	111 321	262 069	0.58	19.1	0.69
				(6.2)	(105.2)	(-2.6)				(3.8)	(68.1)	(0.6)			
ALT	7 788	707	30 120	15 142	1 881	40 329	-0.63	118.2	0.95	14 273	3 030	46 964	-0.33	107	0.55
				(94.4)	(165.7)	(33.9)				(83.3)	(328)	(55.9)			
ITA	11 826	2 908	27 410	15 489	2 405	43 073	0.06	62.7	0.95	14 974	3 161	48 298	0.23	56.8	0.53
				(31.0)	(-17.3)	(57.1)				(26.6)	(8.7)	(76.2)			
FVA	27 873	2 914	69 530	34 520	11 576	78 081	0.70	36	0.95	32 328	13 436	75 934	0.74	33.7	0.61
				(23.8)	(297.2)	(12.3)				(16.0)	(361.1)	(9.2)			
SPO	46 660	15 280	81 660	40 006	20 236	68 561	0.45	24.6	0.95	38 927	19 562	66 540	0.40	25.7	0.70
				(-14.3)	(32.4)	(-16.0)				(-16.6)	(28.0)	(-18.5)			
SER	16 377	3 603	31 790	18 893	11 182	27 776	0.47	29.2	0.95	18 788	9 716	29 984	0.65	23.9	0.79
				(15.4)	(210.4)	(-12.6)				(14.7)	(169.7)	(-5.7)			

Table 3: Statistical results of observed and simulated discharges (Q_{mean} , Q_{min} , Q_{max} (all in m³.s⁻¹), Nash coefficient and N-RMSE (%) for the studied stations over the period 1980-2008. Values between brackets are relative differences (%) between simulation and observations. See Guimberteau et al. (2012) for more details on the computation of the indicators. The bold values correspond to the best score between 2LAY and 11LAY with observations for a given station. Values of the ratio of drainage (D in kg.m⁻²) and total runoff ($R_{\text{tot}} = R_{\text{surf}} + D$, in kg.m⁻²), simulated by the 2LAY and 11LAY, are also indicated for each sub-basin.

	Amazon	Xingu(ALT)	Tapajós (ITA)	Madeira (FVA)	Solimões (SPO)	Negro (SER)
2LAY	0.90 (0.76)	0.98 (0.68)	0.97 (0.46)	0.98 (0.70)	0.86 (0.59)	0.73 (0.60)
11LAY	0.95 (0.83)	0.98 (0.61)	0.97 (0.47)	0.95 (0.64)	0.91 (0.69)	0.77 (0.61)

Table 4: Monthly correlation of TWS anomalies, between simulations (2LAY and 11LAY) and GRACE, over the Amazon basin and its sub-basins, for the period 2003-2008. Values between brackets indicate correlation of deseasonalized TWS anomalies. The bold values correspond to the highest correlation between 2LAY or 11LAY with GRACE for a given sub-basin.

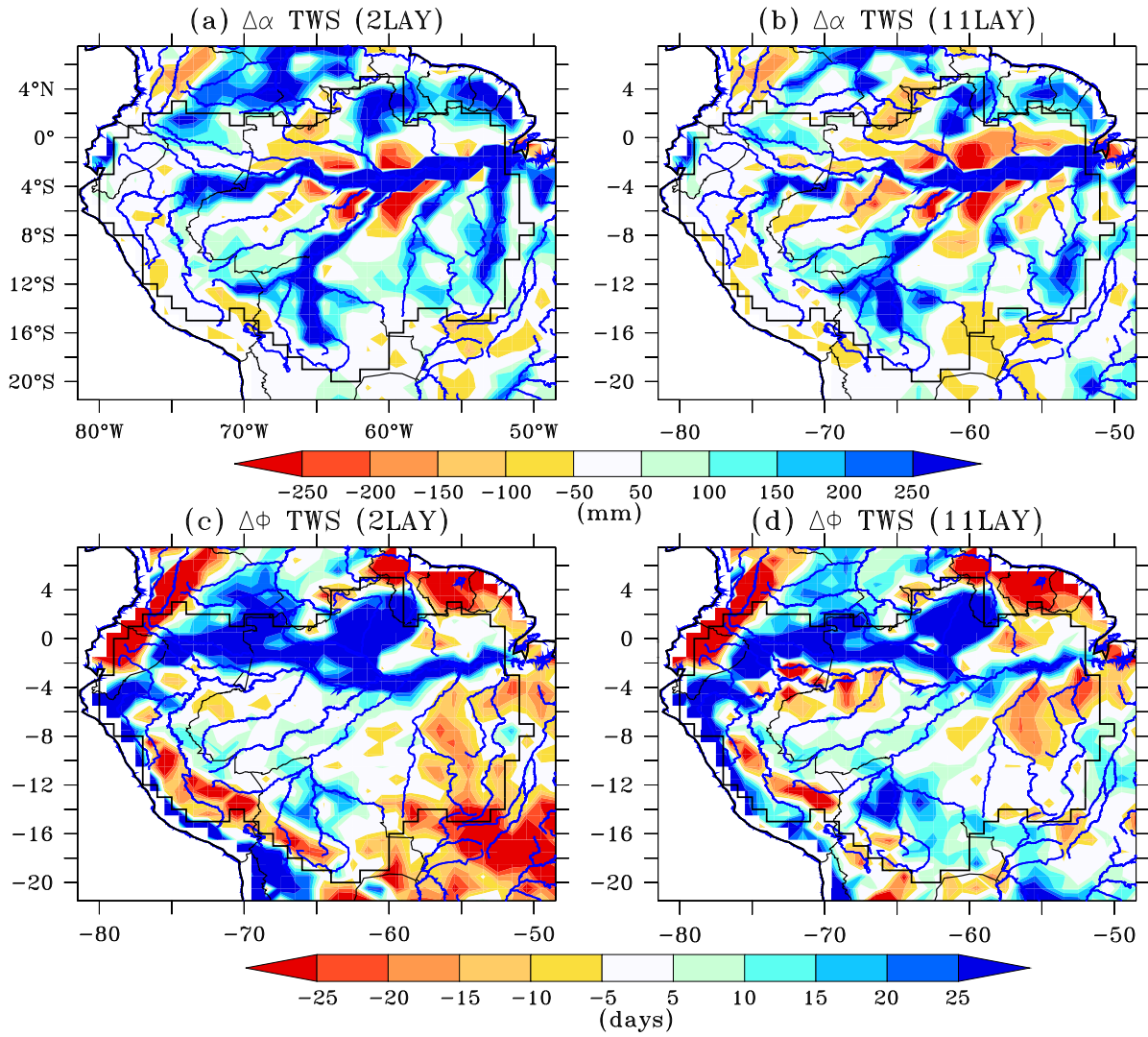


Figure 1: Differences in (a, b) amplitude ($\Delta\alpha$ in mm) and (c, d) phase ($\Delta\phi$ in days) of TWS between simulations (2LAY and 11LAY) and GRACE, averaged over the period 2003-2008.

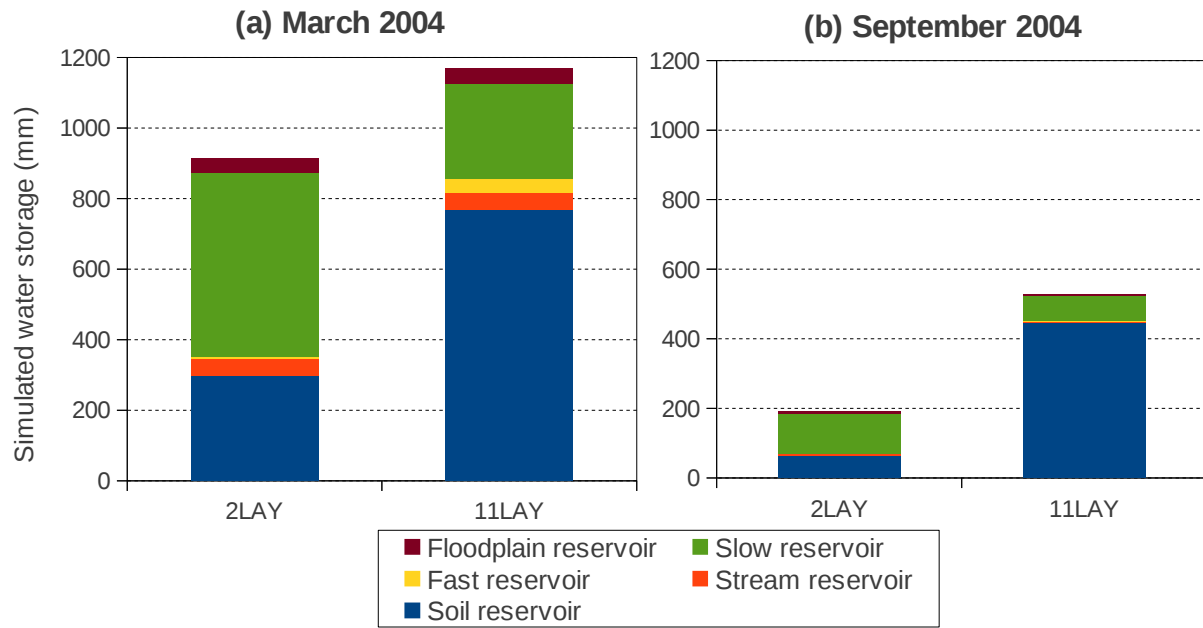


Figure 2: Monthly water storage distribution in the different reservoirs of ORCHIDEE (mm) between 2LAY and 11LAY, averaged over the Xingu sub-basin, during two contrasting months of 2004: **(a)** March (after the wet season) and **(b)** September (after the dry season).