Supplementary information of

Forest fluxes and mortality response to drought: model description (ORCHIDEE-CAN-NHA, r7236) and evaluation at the Caxiuanã drought experiment

Yitong Yao[1*], Emilie Joetzjer[2*], Philippe Ciais[1], Nicolas Viovy[1], Fabio Cresto Aleina[1], Jerome Chave[3], Lawren Sack[4], Megan Bartlett[5], Patrick Meir[6], Rosie Fisher[7], Sebastiaan Luyssaert[8]

[1] Laboratoire des Sciences du Climat et de l'Environnement, LSCE/IPSL, CEA-CNRS-UVSQ, Université Paris-Saclay, Gif-sur-Yvette, 91191, France
[2] Centre National de Recherche Meteorologique, Unite mixte de recherche 3589 Meteo-France/CNRS, 42 Avenue Gaspard Coriolis, Toulouse, 31100, France
[3] Laboratoire Evolution et Diversité Biologique UMR 5174 CNRS, IRD, Université Paul Sabatier, Toulouse, 31062, France
[4] Department of Ecology and Evolutionary Biology, University of California Los Angeles, Los Angeles, California, 90095, USA
[5] Department of Viticulture & Enology, University of California, Davis, California, 95616, USA
[6] Research School of Biology, Australian National University, Canberra, ACT 2601 Australia
[7] CICERO Centre for International Climate and Environmental Research, Oslo, Norway
[8] Faculty of Science, Vrije Universiteit Amsterdam, Netherlands

* These authors contributed equally to this work.

Correspondence to: Yitong Yao (yitong.yao@lsce.ipsl.fr)

Table S1

Figure S1 to S14

Table S1 Tree height and diameter of each cohort (take CTL as example).

# of cohort	tree diameter (m)	tree height (m)
1	0.02	6
2	0.03	8
3	0.18	18
4	0.32	23
5	0.46	27
6	0.60	31
7	0.74	34
8	0.87	37
9	1.01	40
10	1.15	42
11	1.29	44
12	1.43	47
13	1.57	49
14	1.71	51
15	1.86	53
16	2.02	55
17	2.19	57
18	2.38	59
19	2.64	62
20	3.1	67

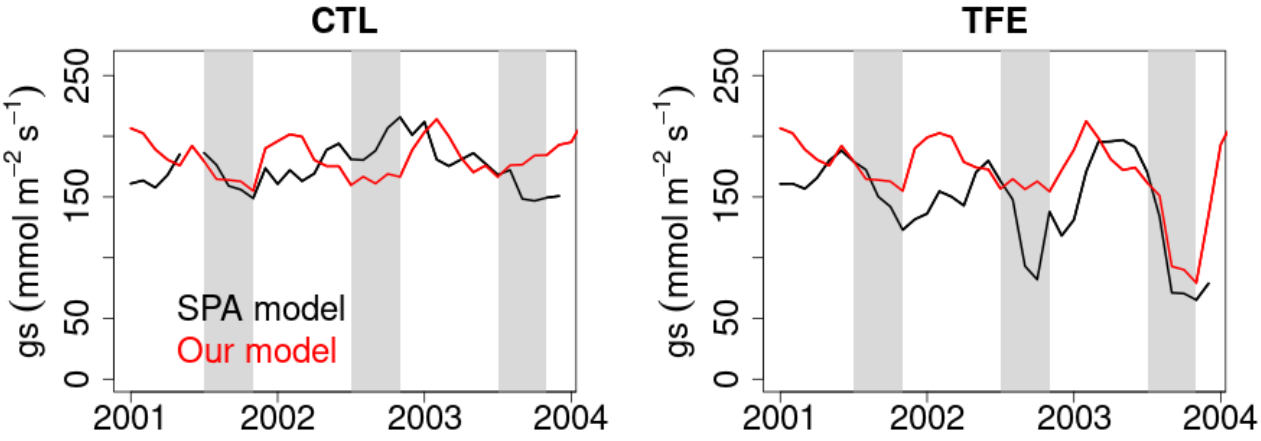

Figure S1 Comparison of our simulated stomatal conductance (gs) with SPA model output in Fisher et al (2007) at Caxiuana site.

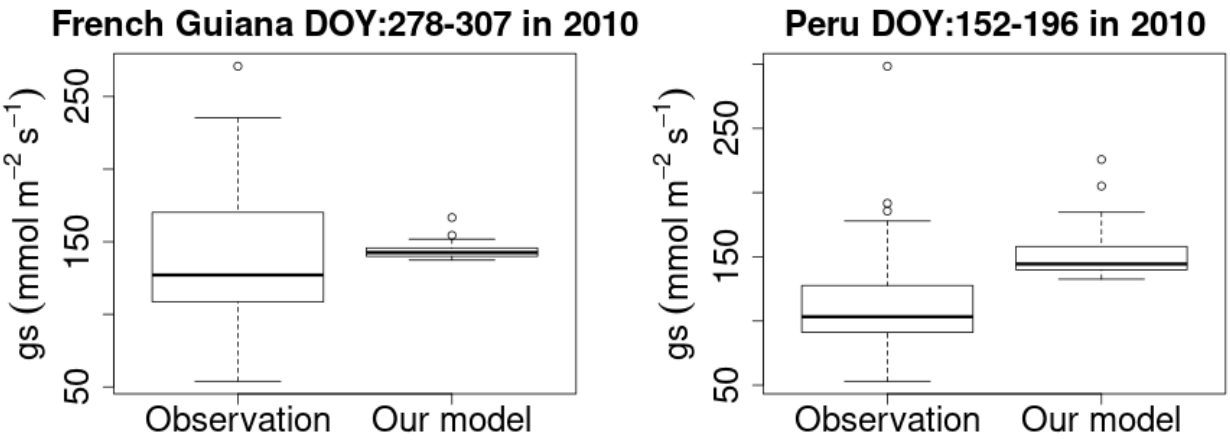

Figure S2 Comparison of our simulated stomatal conductance (gs) at (a) French Guiana and (b) Peru site. The gs observation data at French Guiana and Peru site are from Lin et al (2015).

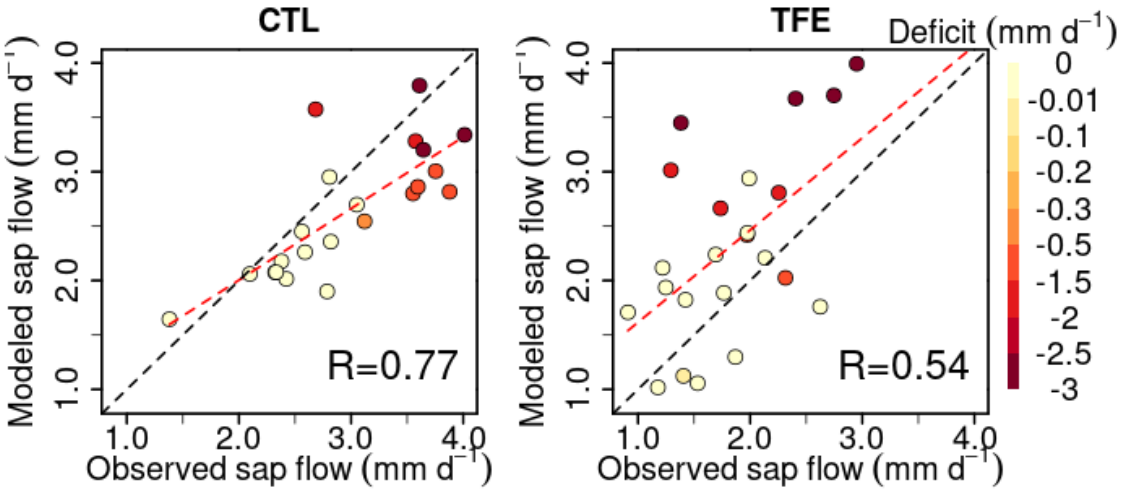

Figure S3 Similar to Figure 3 but for ORCHIDEE-CAN-RS.

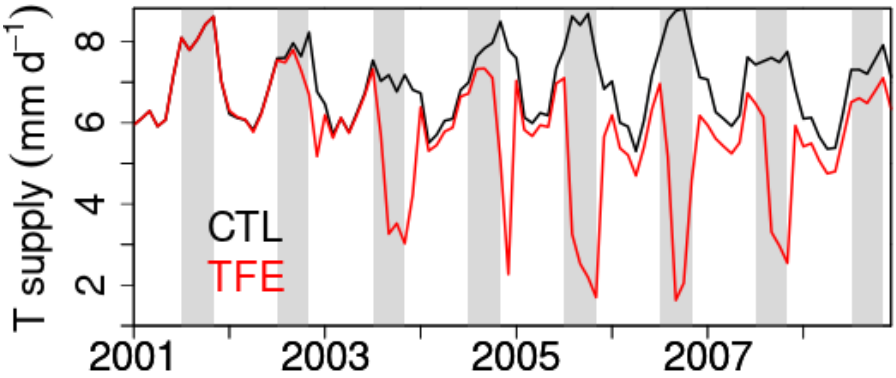

Figure S4 Transpiration supply simulated by ORCHIDEE-CAN-NHA during 2001-2008. In Caxiuanã site, dry season is deemed from July to November.

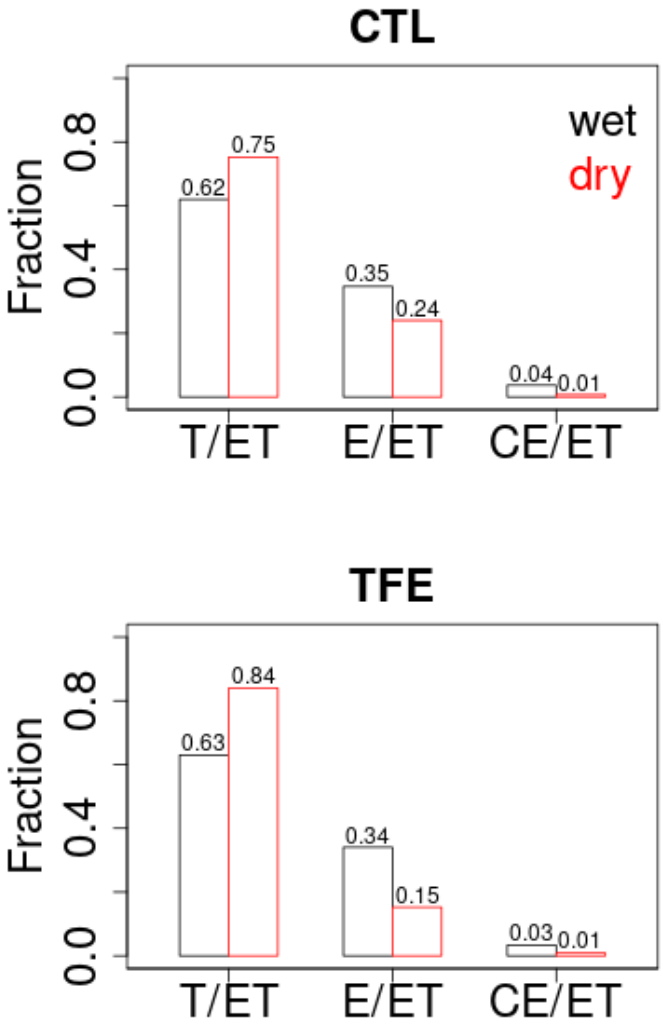

Figure S5 Simulated T/ET, E/ET and CE/ET during 2001 to 2008 under CTL and TFE from ORCHIDEE-CAN-NHA. T, transpiration. ET, evapotranspiration. CE, intercepted canopy water or dew re-evaporation. In Caxiuanã site, dry season is deemed from July to November.

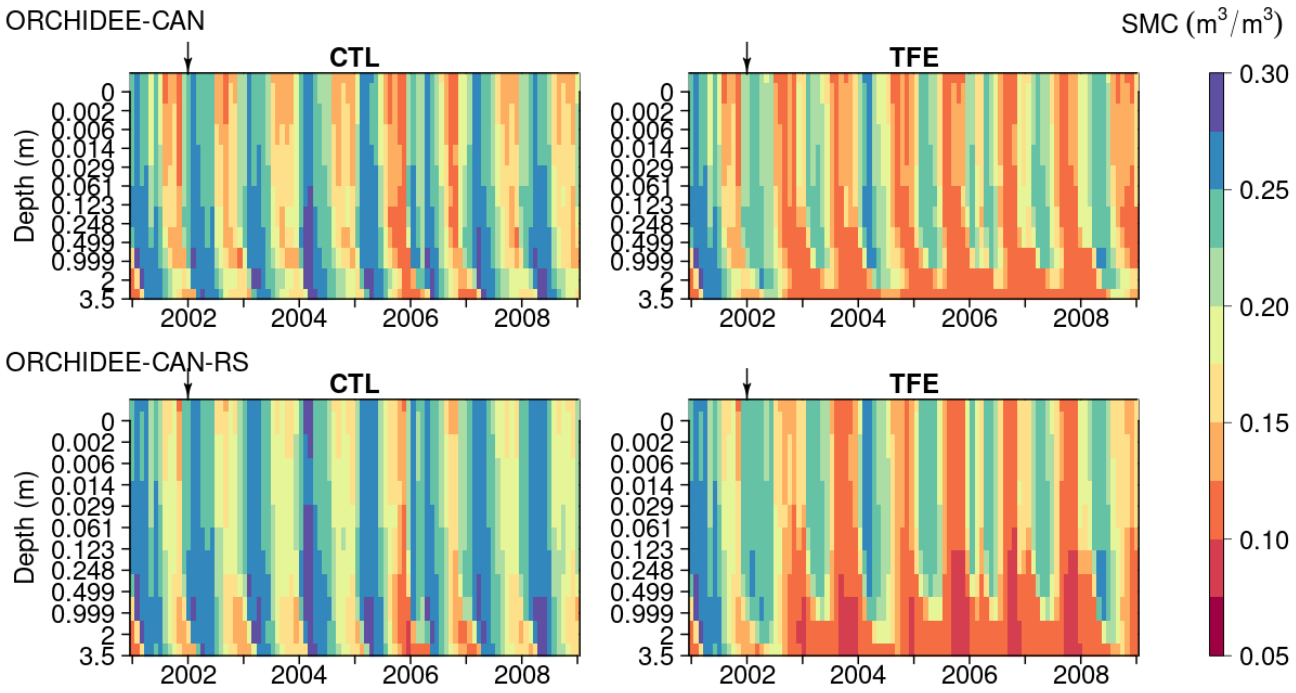

Figure S6 Similar to Figure 6 but for ORCHIDEE-CAN and ORCHIDEE-CAN-RS.

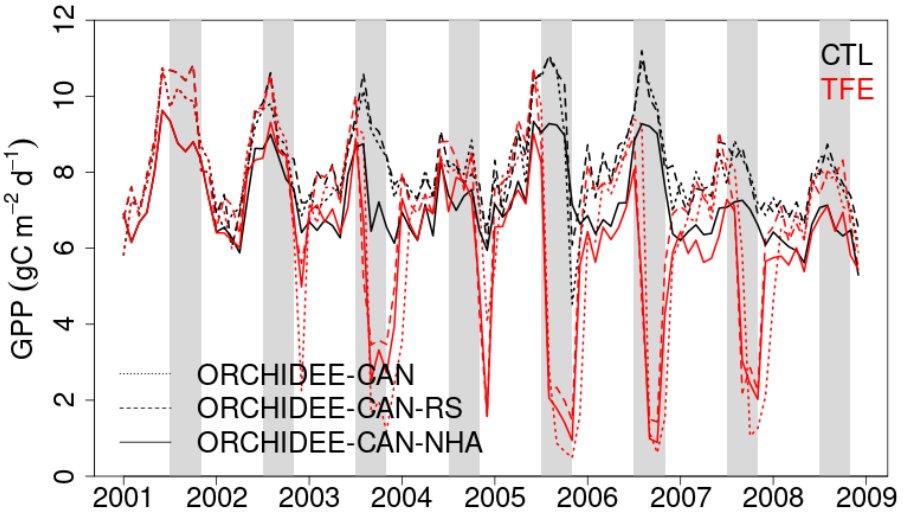

Figure S7 Simulation of GPP dynamics during 2001 to 2008.

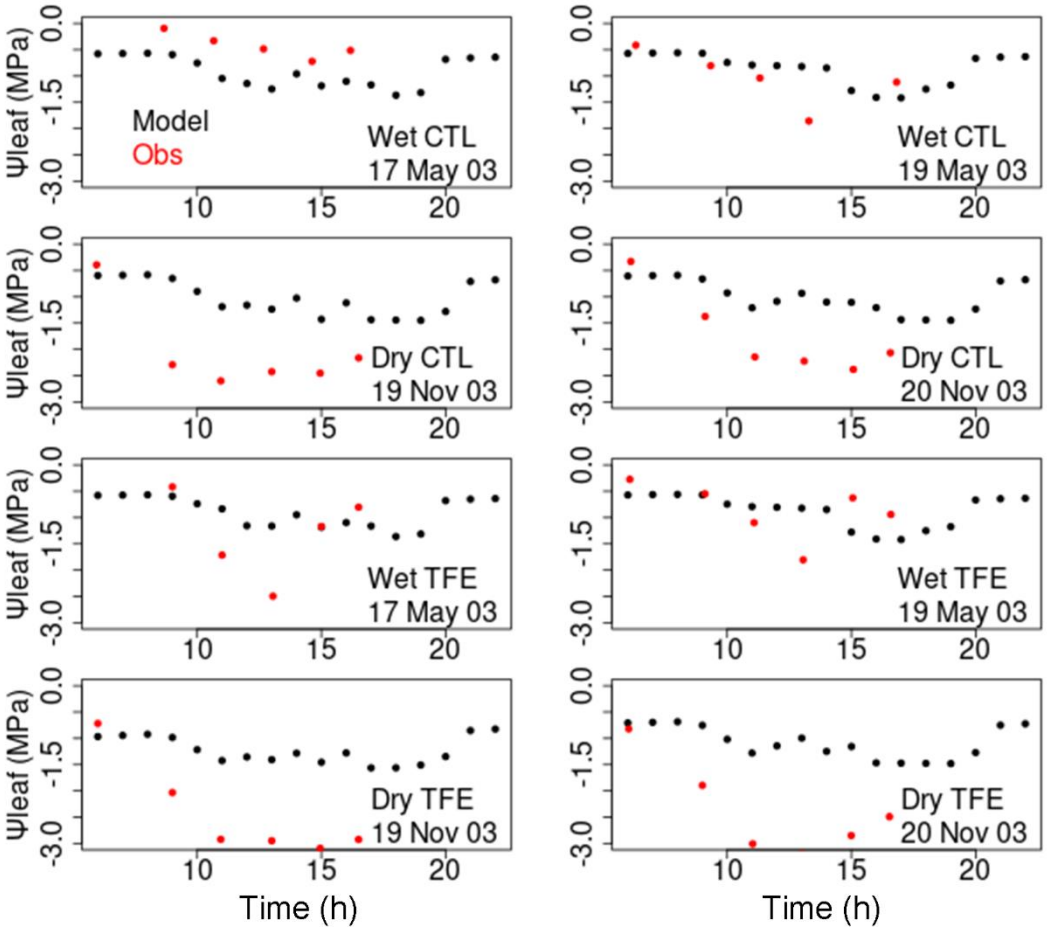

Figure S8 Modeled (black dots) and measured (red dots) leaf water potential in the control (CTL) and throughfall exclusion (TFE) for wet and dry seasons. Measured leaf water potential comes from Fisher et al (2006).

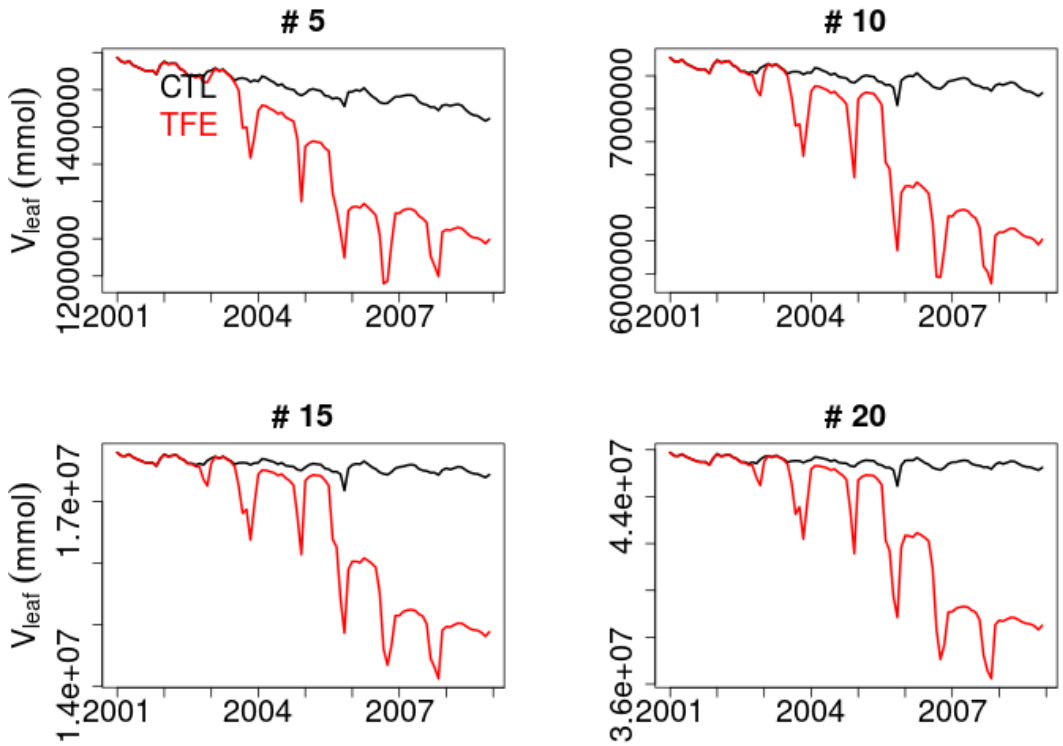

Figure S9 Change in leaf water storage during 2001-2008. Cohorts of #5, #10, #15, and #20 are taken as example here.

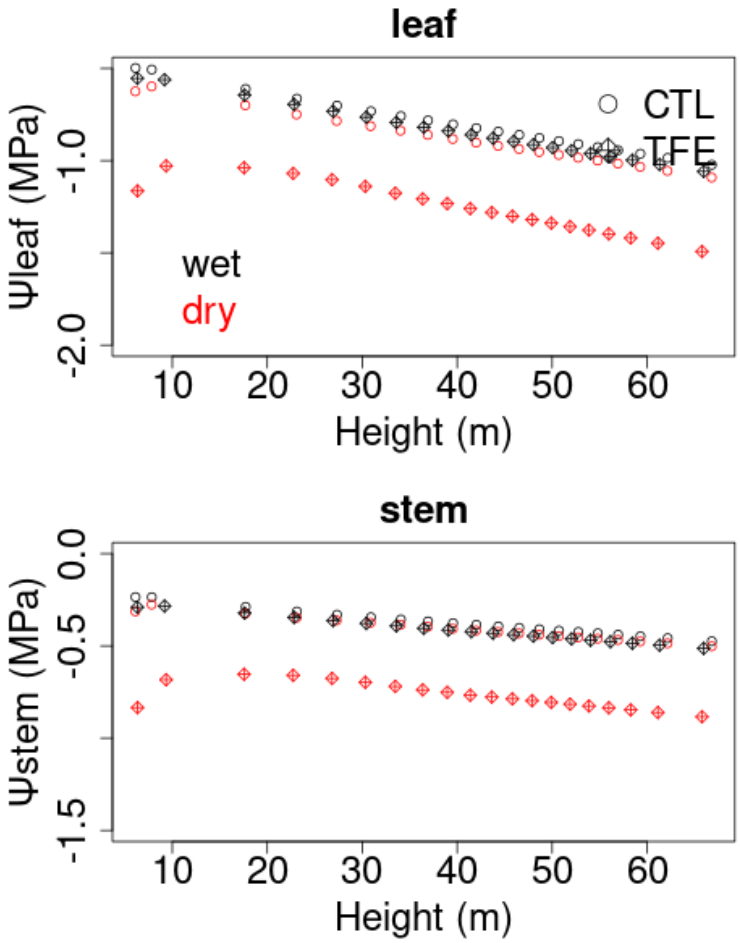

Figure S10 Relationship between Ψ_{leaf}, Ψ_{stem} and tree height.

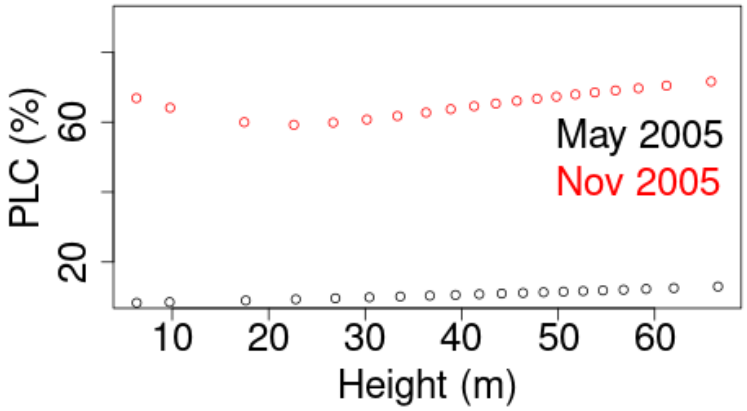

Figure S11 Relationship between percentage loss of conductance (PLC) and tree height.

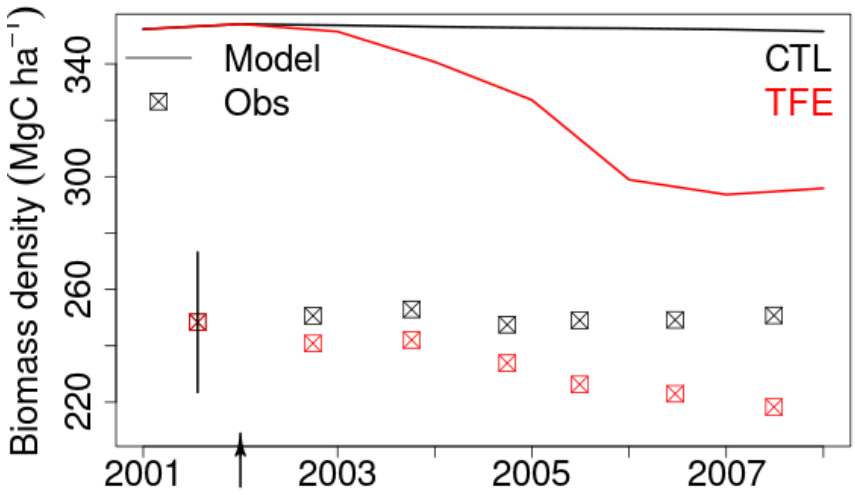

Figure S12 Absolute values of change in biomass simulated by ORCHIDEE-CAN-NHA after mortality being triggered. Since there is a noticeable difference of biomass in 2001 between CTL and TFE observation, we made a shift on CTL biomass to let it to be consistent with TFE in the beginning of experiments (the amount of shift = 25 MgC ha^{-1}).

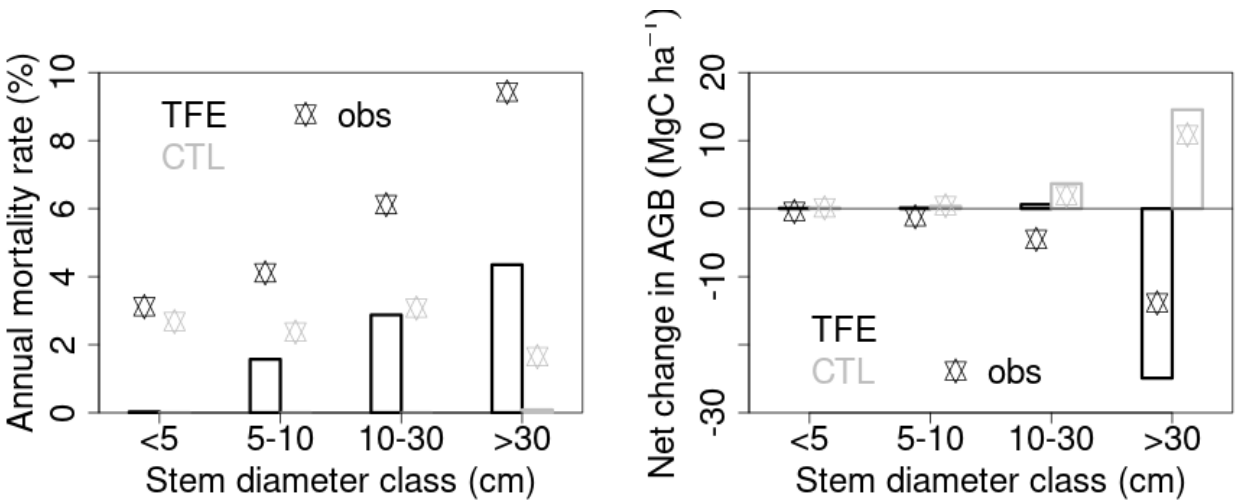

Figure S13 Comparison of (a) annual mortality rates in different diameter size classes and (b) net change in aboveground biomass (AGB) between our model simulation and observation at Tapajos site from 1999 to 2003. CTL: control. TFE: throughfall exclusion experiment. At Tapajos site, TFE only happened in wet season from 2000 to 2003. The net change in AGB accounts for the period from 1999 to 2003.

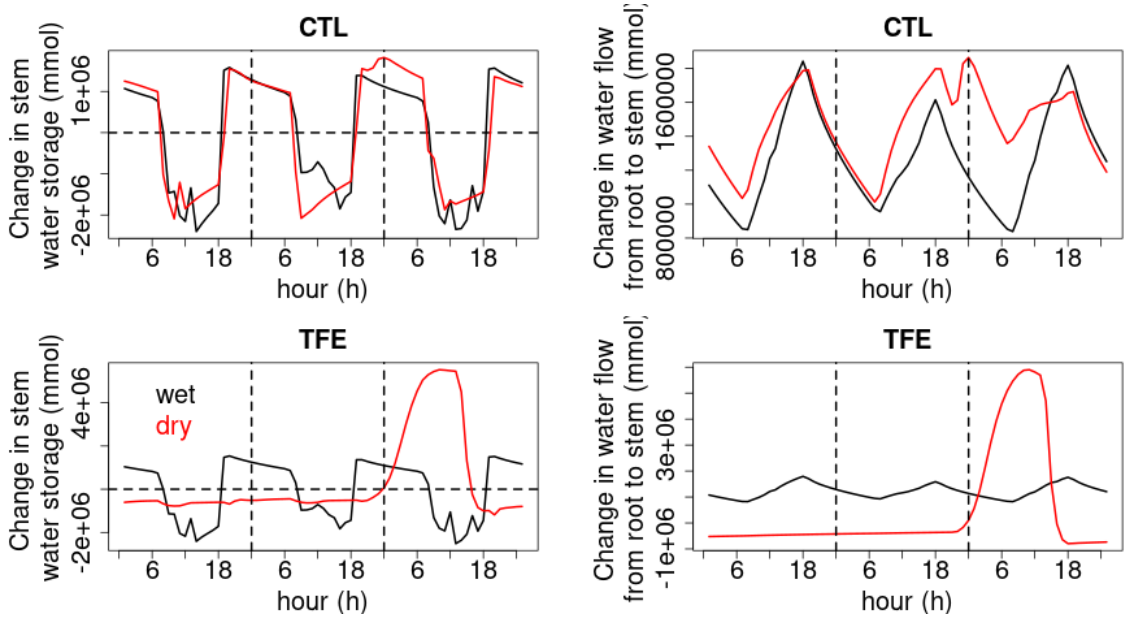

Figure S14 Diurnal cycles of stem water flux and storage change. Here, 'wet' denotes the first three days in May (1-3 May) in 2005, and 'dry' denotes the first three days in November (1-3 Nov) in 2005. Cohort #10 is used here as an example. Positive change in stem water storage means water charge to stem and vice versa.