SUPPLEMENTARY MATERIAL

Models

LPJmL-DGVM (Lund Potsdam Jena managed Land model)

The process-based dynamic global vegetation and hydrology model LPJmL calculates carbon and the corresponding water fluxes with a daily time step and a spatial resolution of 0.5 x 0.5 (lat/lon) (Sitch et al., 2003; Gerten et al., 2004b; Bondeau et al., 2007; Rost et al., 2008). Potential natural vegetation and the main processes controlling its dynamics are calculated from inputs of climate data (temperature, precipitation and cloud cover), atmospheric CO2, and soil texture. The main processes included in LPJmL are photosynthesis (based on Farquhar et al., 1980 and Collatz et al., 1992), auto- and heterotrophic respiration, establishment, mortality and phenology. These processes lead to the dynamics of carbon stored in the vegetation, litter and soil. Simulated water fluxes include evaporation, soil moisture, snowmelt, runoff, discharge, interception and transpiration. LPJmL calculates the performance of nine plant functional types in each grid cell, each of these representing an assortment of species classified as being functionally similar. However, in the Amazon basin, LPJmL primarily simulates three of these plant functional types, representing tropical evergreen and deciduous forest and C4 grasses. LPJmL has been proved to reproduce observed patterns of biomass production, river discharge; it also includes managed land (Cramer et al., 2001; Sitch et al., 2003; Wagner et al., 2003; Gerten et al., 2004a; Bondeau et al., 2007; Gerten et al., 2008; Rost et al., 2008; Biemans et al., 2009; Poulter et al., 2009; Fader et al., 2010; Thonicke et al., 2010). It has been shown that the observed patterns in water fluxes (including soil moisture, evapotranspiration and runoff) are comparable to stand-alone global hydrological models (Wagner et al., 2003; Gerten et al., 2004a; Gordon et al., 2004; Gerten et al., 2008; Biemans et al., 2009). Several studies on Amazonia have been conducted showing the effect of climate change on NPP (Poulter et al., 2009), on carbon stocks (Gumpenberger et al., 2010), on the risk for forest dieback (Rammig et al., 2010) and also on riverine-related changes such as inundation patterns (Langerwisch et al., 2013).

INLAND-DGVM (INtegrated model of LAND surface processes)

INLAND (Foley et al., 1996; Kucharik et al., 2000) is the land surface module of the Brazilian Earth System Model (BESM), and represents virtually all relevant aspects of the land surface to the climate system. BESM is a world-class global coupled model of the climate system currently being developed within Brazil's Climate Change Program that includes modules of atmospheric and ocean general circulation, the terrestrial and marine biosphere, cryosphere, carbon cycles, and aerosols. INLAND simulates 12 different PFTs competing for available resources within the grid cell and the relative success of each PFT determines its fractional coverage. The model allows trees and herbaceous plants or grasses to experience different light and water availability: while trees in the upper canopy have priority in capturing available light (thus shading the shrubs and grasses in the lower part of the canopy), the herbaceous plants are able to capture soil water first when it infiltrates the ground (Foley et al., 1996). INLAND uses the mechanistic treatment of canopy photosynthesis proposed by Farquhar et al. (1980) and the semi-mechanistic Ball-Berry approach to estimate stomatal conductance (Ball et al., 1987; Collatz et al., 1992), computing gross photosynthesis, maintenance respiration and growth respiration to yield the annual carbon balance for each PFT, and the vegetation dynamics module simulates biomass changes for each PFT on a yearly time step. The model uses specific soil water-stress functions to down-regulate the gross primary productivity of vegetation as soils dry.

ORCHIDEE (ORganising Carbon and Hydrology In Dynamic EcosystEms)

ORCHIDEE (Krinner et al., 2005) is the land component of the IPSL (Institut Pierre Simon Laplace) coupled climate model. It simulates energy and water through the SECHIBA (Schématisation des Echanges Hydriques à l'Interface entre la Biosphère et l'Atmosphère, Ducoudré et al., 1993; de Rosnay and Polcher, 1998) module and CO_2 fluxes and ecosystem carbon cycling through the STOMATE (Saclay Toulouse Orsay Model for the Analysis of Terrestrial Ecosystems, Viovy, 1996) module. When coupled with SECHIBA, STOMATE links the fast hydrological and biophysical processes with the carbon dynamics. STOMATE also contains a dynamic vegetation model, but this module was not activated for this study. In each grid cell, up to 12 plant functional types (PFTs) can be represented simultaneously, in addition to bare soil. LAI dynamics (from carbohydrate allocation) is simulated by STOMATE which models the allocation of assimilates, autotrophic respiration components, foliar development, mortality and litter and soil organic matter decomposition. A factor representing drought stress (McMurtrie et al., 1990) linearly computes the rate of ribulose bisphosphate (RuBP) regeneration and the carboxylation rate. The drought stress and the leaf age of the vegetation directly influence the photosynthetic capacity (Farquhar et al., 1980; Collatz et al., 1992; Verbeeck et al., 2011; de Weirdt et al., 2012) and indirectly the stomatal conductance (Ball et al., 1987). The latter controls the transpiration as a function of water availability in the soil column and a fixed root density profile (de Rosnay and Polcher, 1998). The soil hydrology is represented by an 11-layer scheme which simulates vertical unsaturated flows based on the Richards equation, which allows capillary rise (de Rosnay et al., 2000; Campoy et al., 2013). For numerical integration, the 2-m soil column is divided into 11 discrete layers, with thickness increasing geometrically with depth. Variation in soil texture among grid cells is taken into account by means of three different soil types (coarse, medium and fine textured). Their spatial distribution is diagnosed by interpolating the $1° \times 1°$ Food and Agriculture Organization texture map (FAO, 1978) by Zobler (1986), upscaled to the working resolution of ORCHIDEE by only keeping the dominant texture in each grid cell. The precipitation rate and the soil hydraulic conductivity govern the partitioning between soil infiltration and surface runoff production. The second contribution to total runoff is free gravitational drainage at the bottom of the soil. The routing module (Polcher, 2003; Guimberteau et al., 2012) calculates the daily discharge to the ocean. It is based on linear reservoirs along the drainage networks derived at 0.5° resolution. The routing scheme also includes a floodplain/swamp parameterization (d'Orgeval et al., 2008), recently improved by Guimberteau et al. (2012) for the Amazon basin, by introducing a new floodplain/swamp map. The simulation of the hydrology by the model ORCHIDEE has been widely tested over the Amazon basin and its sub-basins (Guimberteau et al., 2012; Getirana et al., 2014; Guimberteau et al., 2014).

Location	Station Name	Abbreviation	River Name	Abbreviation	Latitude	Longitude	Area (km^2)
MAIN	Óbidos	OBI	Amazonas	AMAZ	-1.95	-55.30	4,680,000
SOUTH	Fazenda Vista Alegre	FVA	Madeira	MAD	-4.68	-60.03	1,293,600
	Guajará-Mirim	GMIR	Mamoré	MAM	-10.99	-65.55	532,800
	Itaituba	ITA	Tapajós	TAP	-4.24	-56.00	461,100
	Altamira	ALT	Xingu	XIN	-3.38	-52.14	469,100
WEST	Tamshiyacu	TAM	Upper Solimões	UPSO	-4.00	-73.16	726,400
	Lábrea	LAB	Purus	PUR	-7.25	-64.80	230,000
	Gavião	GAV	Juruá	JUR	-4.84	-66.85	170,400
NORTH	Caracaraí	CARA	Branco	BRA	+1.83	-61.08	130,600

Table S1. List of the gauging stations for the studied sub-basins. Sources: SO HYBAM (Observation Service of the Geodynamical, hydrological and biogeochemical control of erosion/alteration and material transport in the Amazon, Orinoco and Congo basins, Cochonneau et al., 2006).

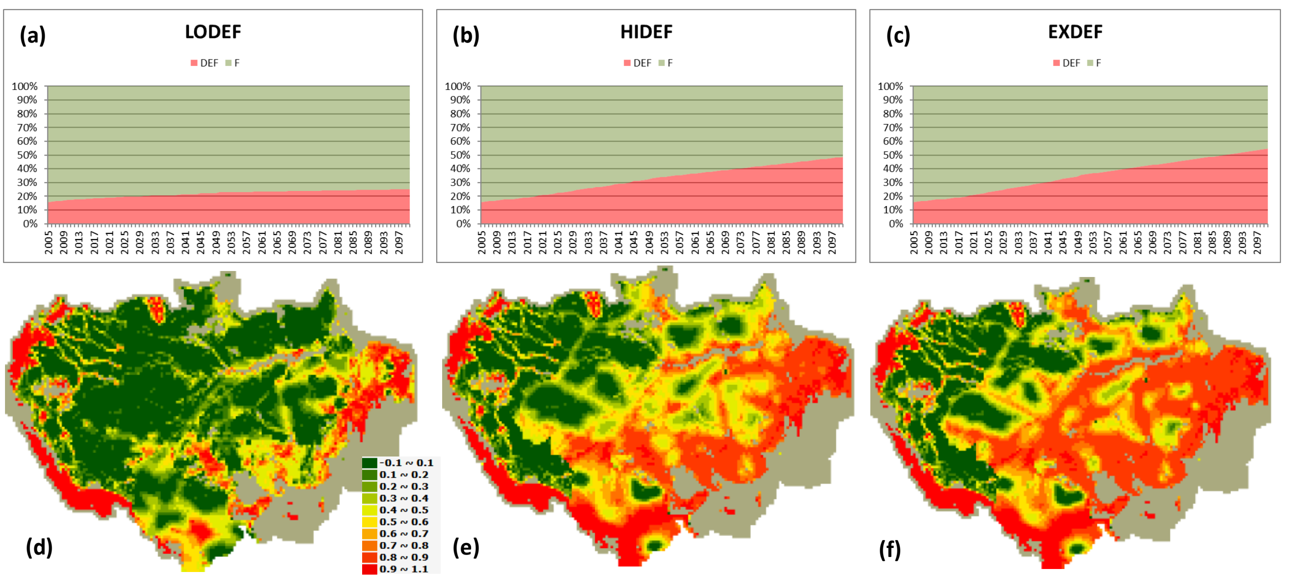

Figure S1. Percentage of deforested area in each 25 x 25 km^2 for the LCC scenarios LODEF (**a** and **d**), HIDEF (**b** and **e**) and EXDEF (**c** and **f**).

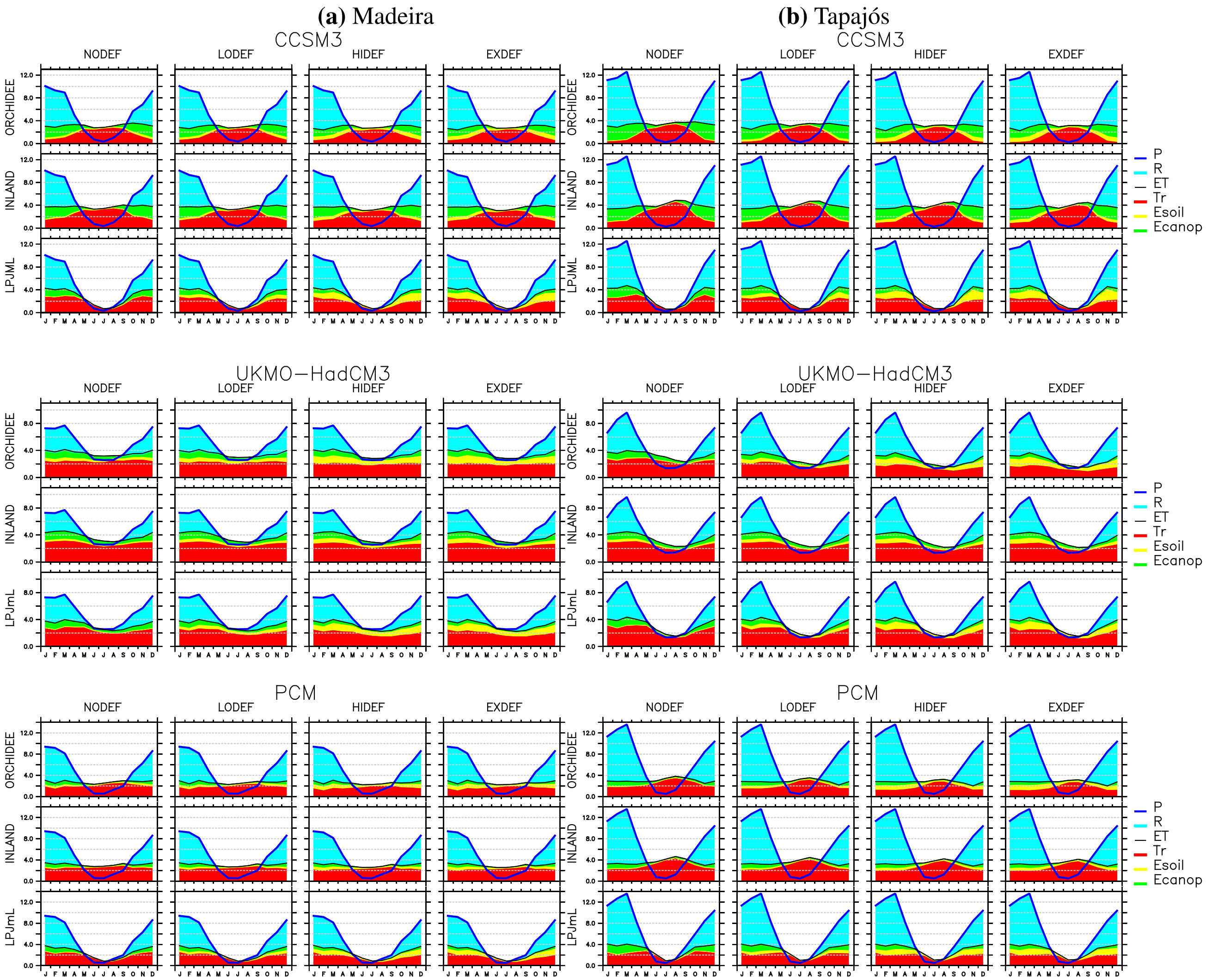

Figure S2. For each GCM-forcing, monthly mean seasonalities of the water budget components (including the ET components) (mm d^{-1}) from the three LSMs (lines) and for each NODEF and LCC scenarios (columns) over **(a)** the Madeira and **(b)** the Tapajós catchments. The variables of the water budget are: precipitation (P), runoff (R) and evapotranspiration (ET). The variables of the ET components are: transpiration (Tr), soil evaporation (Esoil) and evaporation of canopy interception (Ecanop).