6 Biomes

6.1 Scenarios

Since the pre-industrial simulations are an important part of the experiments, the spin-up has to finish before the pre-industrial simulations start. The spin-up should be using pre-industrial climate (**picontrol**) and year 1860 levels of "other human influences". For this reason, the pre-industrial climate data should be replicated as often as required. The precise implementation of the spin up will be model specific, the description of which will be part of the reporting process.

Climate & CO_2 scenarios	
picontrol	Pre-industrial climate and 286ppm CO_2 concentration. The climate data for the entire period (1661-2299) are unique – no (or little) recycling of data has taken place.
historical	Historical climate and CO_2 concentration.
rcp26	Future climate and CO_2 concentration from RCP2.6.
rcp60	Future climate and CO_2 concentration from RCP6.0.
rcp85	Future climate and CO_2 concentration from RCP8.5.
2005co2	CO2 concentration fixed at 2005 levels at 378.81ppm.
Human influence and land-use scenarios	
1860soc	Constant pre-industrial (1860) land use, nitrogen deposition, and fertilizer input.
histsoc	Varying historical land use, nitrogen deposition and fertilizer input.
2005soc	Fixed year-2005 land use, nitrogen deposition and fertilizer input.
rcp26soc	Varying land use, water abstraction, nitrogen deposition and fertilizer input according to SSP2 and RCP2.6.
rcp60soc	Varying land use, water abstraction, nitrogen deposition and fertilizer input according to SSP2 and RCP6.0.
2100rcp26soc	Land use, nitrogen deposition and fertilizer input fixed at year 2100 levels according to RCP2.6 in 2100.

Table 13 ISIMIP2b scenarios for the global biomes simulations.

	Experiment	Input	Pre-industrial 1661-1860	Historical 1861-2005	Future 2006-2099	Extended future 2100-2299
I	no climate change, pre-industrial CO_2	Climate & CO_2	**picontrol**	**picontrol**	**picontrol**	**picontrol**
	varying LU & human influences up to 2005, then fixed at 2005 levels thereafter	Human & LU	**1860soc**	**histsoc**	**2005soc**	**2005soc**
II	RCP2.6 climate & CO_2	Climate &	Experiment I	**historical**	**rcp26**	**rcp26**

		CO_2				
	varying LU & human influences up to 2005, then fixed at 2005 levels thereafter	Human & LU		**histsoc**	**2005soc**	**2005soc**
IIa	RCP2.6 climate, CO_2 after 2005 fixed at 2005 levels	Climate & CO_2	Experiment I	Experiment II	**rcp26, 2005co2**	**rcp26, 2005co2**
	varying LU & human influences up to 2005, then fixed at 2005 levels thereafter	Human & LU			**2005soc**	**2005soc**
III	RCP6.0 climate & CO_2	Climate & CO_2	Experiment I	Experiment II	**rcp60**	not simulated
	varying LU & human influences up to 2005, then fixed at 2005 levels thereafter	Human & LU			**2005soc**	
IV	no climate change, pre-industrial CO_2	Climate & CO_2	Experiment I	Experiment I	**picontrol**	**picontrol**
	varying human influences & LU up to 2100 (RCP2.6), then fixed at 2100 levels thereafter	Human & LU			**rcp26soc**	**2100rcp26soc**
V	no climate change, pre-industrial CO_2	Climate & CO_2	Experiment I	Experiment I	**picontrol**	not simulated
	varying human influences & LU (RCP6.0)	Human & LU			**rcp60soc**	
VI	RCP2.6 climate & CO_2	Climate & CO_2	Experiment I	Experiment II	**rcp26**	**rcp26**
	varying human influences & LU up to 2100 (RCP2.6), then fixed at 2100 levels thereafter	Human & LU			**rcp26soc**	**2100rcp26soc**
VII	RCP6.0 climate & CO_2	Climate & CO_2	Experiment I	Experiment II	**rcp60**	not simulated
	varying human influences & LU (RCP6.0)	Human & LU			**rcp60soc**	
VIII	RCP8.5 climate & CO_2	Climate & CO_2	Experiment I	Experiment II	**rcp85**	not simulated
	varying LU & human influences up to 2005, then fixed at 2005 levels thereafter	Human & LU			**2005soc**	

Table 14 Additional sector-specific simulations for the biome sector.

	Experiment	Input	Pre-industrial 1661-1860	Historical 1861-2005	Future 2006-2099	Extended future 2100-2299
Ia	no climate change, pre-industrial CO_2	Climate & CO_2	**picontrol**	**picontrol**	**picontrol**	**picontrol**
	LU & human influences fixed at 1860 levels	Human & LU	**1860soc**	**1860soc**	**1860soc**	**1860soc**
IIb	RCP2.6 climate & CO_2	Climate & CO_2	Experiment I	**historical**	**rcp26**	**rcp26**
	LU & human influences fixed at 1860 levels	Human & LU		**1860soc**	**1860soc**	**1860soc**
IIIa	RCP6.0 climate, CO_2 after 2005 fixed at 2005 levels	Climate & CO_2	Experiment I	Experiment II	**rcp60, 2005co2**	not simulated
	varying LU & human influences up to 2005, then fixed at 2005 levels thereafter	Human & LU			**2005soc**	
IIIb	RCP6.0 climate & CO_2	Climate & CO_2	Experiment I	Experiment II	**rcp60**	not simulated
	LU & human influences fixed at 1860 levels	Human & LU			**1860soc**	
IIIc	RCP8.5 climate, CO_2 after 2005 fixed at 2005 levels	Climate & CO_2	Experiment I	Experiment II	**rcp85, 2005co2**	not simulated
	varying LU & human influences up to 2005, then fixed at 2005 levels thereafter	Human & LU			**2005soc**	

6.2 Output data

Table 15 Variables to be reported by biomes models. Variables marked by * are also relevant for the permafrost sector and also listed in **Table 40**. **Note**: If you cannot provide the data at the temporal or spatial resolution specified, please provide it the highest possible resolution of your model.

Variable (long name)	Variable name	Unit (NetCDF name)		Resolution	Comment
Essential outputs					
Pools					
*Carbon Mass in Vegetation biomass	**cveg-<pft>**	kg m-2	per pft and gridcell total	annual	Gridcell total cveg is essential. Per PFT information is desirable.
*Carbon Mass in aboveground vegetation biomass	**cvegag-<pft>**	kg m-2	per pft and gridcell total	annual	Gridcell total cvegag is essential. Per PFT information is desirable.

*Carbon Mass in belowground vegetation biomass	**cvegbg-<pft>**	kg m-2	per pft and gridcell total	annual	Gridcell total cvegbg is essential. Per PFT information is desirable.
*Carbon Mass in Litter Pool	**clitter**	kg m-2	per gridcell total	annual	Info for each individual pool.
*Carbon Mass in Soil Pool	**csoil**	kg m-2	per gridcell total	annual	Info for each individual pool.
*Total Carbon Mass in Soil Pool	**soilc**	kg m-2	per gridcell total	annual	Integrated over the entire soil depth
Fluxes					
*Carbon Mass Flux out of atmosphere due to Gross Primary Production on Land	**gpp**	kg m-2 s-1	gridcell total	daily (monthly)	
*Carbon Mass Flux out of atmosphere due to Gross Primary Production on Land	**gpp-<pft>**	kg m-2 s-1	per pft	annual	
*Carbon Mass Flux into atmosphere due to Autotrophic (Plant) Respiration on Land	**ra**	kg m-2 s-1	gridcell total	daily (monthly)	
*Carbon Mass Flux out of atmosphere due to Net Primary Production on Land	**npp**	kg m-2 s-1	gridcell total	daily (monthly)	
*Carbon Mass Flux out of atmosphere due to Net Primary Production on Land	**npp-<pft>**	kg m-2 s-1	per pft	annual	
*Carbon Mass Flux into atmosphere due to Heterotrophic Respiration on Land	**rh**	kg m-2 s-1	gridcell total	daily (monthly)	
*Carbon Mass Flux into atmosphere due to total Carbon emissions from Fire	**fireint**	kg m-2 s-1	gridcell total	daily (monthly)	
*Carbon loss due to peat burning	**somcfire**	kg m-2 s-1	gridcell total	monthly	
*Carbon Mass Flux out of Atmosphere due to Net biome Production on Land (NBP)	**ecoatmflux**	kg m-2 s-1	gridcell total	daily (monthly)	This is the net mass flux of carbon between land and atmosphere calculated as photosynthesis MINUS the sum of plant and soil respiration, carbon fluxes from fire, harvest, grazing and land use change. Positive flux is into the land.
Structure					

*Leaf Area Index	**lai-<pft>**	1	per pft	annual	
*Leaf Area Index	**lai**	1	gridcell average	daily (monthly)	
*Plant Functional Type Grid Fraction	**pft-<pft>**	%	per gridcell	annual (or once if static)	The categories may differ from model to model, depending on their PFT definitions. This may include natural PFTs, anthropogenic PFTs, bare soil, lakes, urban areas, etc. Sum of all should equal the fraction of the grid-cell that is land. Value between 0 and 100.
Hydrological variables					
Total Evapo-Transpiration	**evap**	kg m-2 s-1	gridcell total	daily (monthly)	
Evaporation from Canopy (interception)	**intercep<pft>**	kg m-2 s-1	gridcell total	daily (monthly)	The canopy evaporation+sublimation (if present in model). Provide at pft-level if available in the model
Water Evaporation from Soil	**esoil-<pft>**	kg m-2 s-1	per gridcell	daily (monthly)	Includes sublimation. Provide at pft-level if available in the model
Transpiration	**trans-<pft>**	kg m-2 s-1	per gridcell	daily (monthly)	Provide at pft-level if available in the model
*Runoff	**qtot**	kg m-2 s-1	per gridcell	daily** (monthly)	Total (surface + subsurface) runoff (qtot = qs + qsb). ** Especially for models also participating in the water sector. If daily resolution not possible, please provide monthly. If storage issues keep you from reporting daily data, please contact the ISIMIP team to discuss potential solutions.
*Soil Moisture	**soilmoist**	kg m-2	per gridcell	daily (monthly)	If possible, please provide soil moisture for all depth layers (i.e., 3D-field), and indicate depth in m. Otherwise, provide soil moisture of entire column.
Surface Runoff	**qs**	kg m-2 s-1	per gridcell	daily (monthly)	Total surface runoff leaving the land portion of the grid cell.
*Frozen soil moisture for each layer	**soilmoistfroz**	kg m-2	per gridcell	monthly	Please provide soil moisture for all depth levels and indicate depth in m.

*Snow depth	**snd**	m	per gridcell	monthly	Grid cell mean depth of snowpack.
*Snow water equivalent	**swe**	kg m-2	per gridcell	monthly	Total water mass of the snowpack (liquid or frozen), averaged over a grid cell.
*Annual maximum thaw depth	**thawdepth**	m	per gridcell	annual	Calculated from daily thaw depths. Please provide for purposes of permafrost sector.
Other outputs					
*Temperature of Soil	**tsl**	K	per gridcell	daily (monthly)	Temperature of each soil layer. Reported as "missing" for grid cells occupied entirely by "sea". Also needs depths in meters. Daily would be great, but otherwise monthly would work.
Burnt Area Fraction	**burntarea**	%	per gridcell	daily (monthly)	Area percentage of grid cell that has burned at any time of the given day/month/year (for daily/monthly/annual resolution)
Albedo	**albedo**	1	per gridcell	monthly	Average of pfts, snow cover, bare ground and water surfaces, range between 0-1
*N_2O emissions into atmosphere	**n2o**	kg m-2 s-1	gridcell total	monthly	From land, not from industrial fossil fuel emissions and transport
*CH4 emissions into atmosphere	**ch4**	kg m-2 s-1	gridcell total	monthly	From land, not from industrial fossil fuel emissions and transport

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