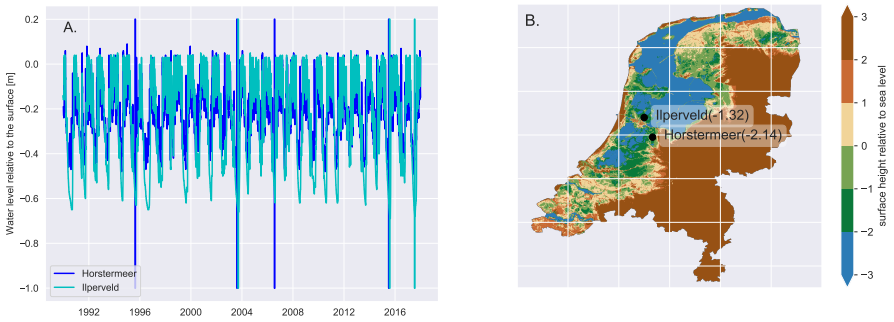

Figure S1. A. The water table heights relative to the land surface over the simulated period, 1990-2018. The sign convention in this paper is that the water table depth is assigned as a negative value when the water table is below the surface. B. The location of the 2 field sites and the land surface height in the Netherlands.

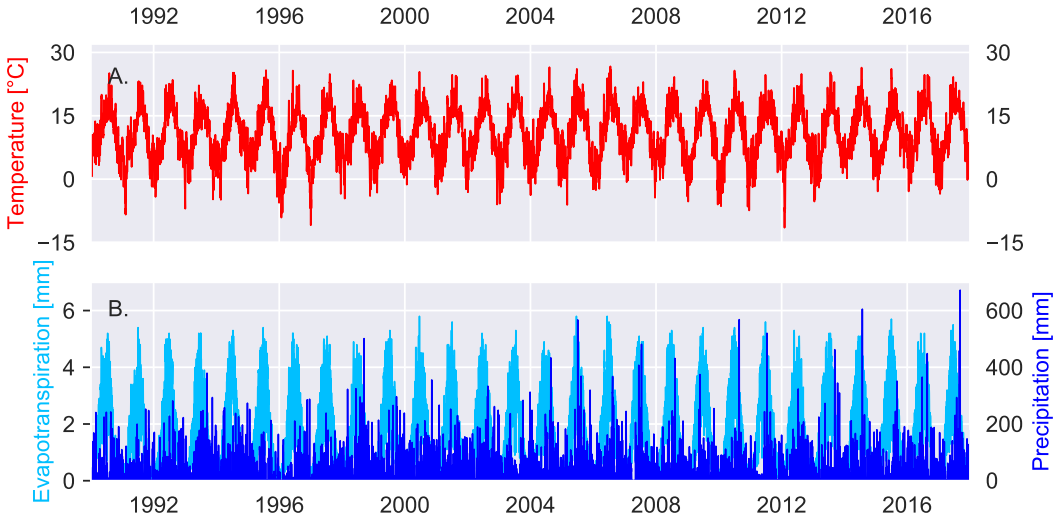

Figure S2. Daily precipitation, evapotranspiration, and temperature observations recorded at nearby weather station, Schiphol. Shown for the years 1990 - 2019.

Figure S3. Examples of the vegetation and the chambers at the Horstermeer (left) and the Ilperveld (right) sites.

Table S1. Range and scope of current peatland models using PFTs. We've only counted the number of peatland specific PFTs. Some models use more PFTs than what have been counted here.

Model	Gridded	Site specific	PFT competition	CO_2 scheme	CH_4 scheme	Citation
PEATBOG	✓	✓	✓	✓	✓	Wu et al. (2016)
LPJ-WHyMe	✓	-	✓	✓	✓	Wania et al. (2010)
MILENNIA	-	✓	-	✓	✓	Heinemeyer et al. (2010)
$CH4MOD_{wetland}$	-	✓	-	-	✓	Li et al. (2016)
McGill Wetland Model	-	✓	-	✓	-	Wu et al. (2011)
Holocene Peat Model	-	✓	✓	-	-	Frolking et al. (2010)
CLASS3.6–CTEM	✓	-	-	✓	-	Wu et al. (2016)
ORCHIDEE-PEAT	✓	✓	-	✓	-	Largeron et al. (2018); Krinner et al. (2005); Ringeval et al. (2010)
LPJ-GUESS	✓	✓	✓	✓	-	Smith et al. (2001); Chaudhary et al. (2017)
Bauer	-	✓	-	✓	-	Bauer (2004)
LPJ-WHy	✓	-	✓	-	-	Wania et al. (2009)
GUESS-ROMUL	✓	-	-	✓	-	Yurova et al. (2007)
DYPTOP	✓	✓	-	-	-	Stocker et al. (2014)
LPX-Bern DGVM	✓	-	✓	-	-	Müller and Joos (2020)
Community Land Model	✓	✓	-	-	-	Shi et al. (2015)
CaMP	-	✓	-	✓	✓	Bona et al. (2020)
NUCOM	-	✓	✓	✓	-	Heijmans et al. (2008)
PEATLAND-VU	-	✓	-	✓	✓	van Huissteden et al. (2006)
PVN	-	✓	✓	✓	✓	This publication

Table S2. References for parameters in Table 2. VH06 values informed by Peatland-VU van Huissteden et al. (2006, 2009). H16 (HA16) refers to parameters taken directly (adapted) from the NUCOM-BOG model Heijmans et al. (2008). W16 (WA16) refers to values taken directly (adapted) Wu et al. (2016). W09 refers to values taken from Wania et al. (2009). TRY refers to values taken from the TRY database 5.0 (www.try-db.org) Kattge et al. (2020, 2011). W11 (WA11) refers to values taken directly (adapted) Wu et al. (2011). SA03 refers to values informed by Sitch et al. (2003).

Parameter	Tall grasses	Sedges	Typha	Sphagnum	Brown moss	Short grass
BiomassSenescence	HA16	HA16	HA16	H16	H16	HA16
AutumnLitter	VH06	VH06	VH06	H16	H16	TRY
CBiomassRatio	WA11	WA11	WA11	W11	W11	WA11
ShootsFactor	WA16	W16	WA16	H16	H16	HA16
MaxCanopyHeight	TRY	TRY	TRY	H16	H16	TRY
Temp_MaxPhoto	WA16	W16	WA16	W16	W16	WA16
Temp_MinPhoto	WA16	W16	WA16	W16	W16	WA16
TMinGrowth	TRY	HA16	HA16	H16	H16	HA16
TOptMinGrowth	TRY	TRY	TRY	H16	H16	HA16
TOptMaxGrowth	TRY	TRY	TRY	H16	H16	HA16
TMaxGrowth	TRY	TRY	TRY	H16	H16	HA16
LeafRespirationCoeff	SA03	SA03	SA03	SA03	SA03	SA03
MaxGrowthRate	HA16	HA16	HA16	H16	H16	HA16
SpecificLeafArea	HA16	HA16	HA16	H16	H16	TRY
MinLAI	WA16	W16	WA16	WA16	WA16	WA16
MaxLAI	WA16	W16	WA16	WA16	WA16	WA16
LightExtCoeff	H16	H16	H16	H16	H16	TRY
MethanePlantOx	VH06	VH06	VH06	VH06	VH06	VH06
MethanePType	VH06	VH06	VH06	VH06	VH06	VH06
MaxRootDepth	WA16	W16	WA16	WA16	WA16	WA16
RootSenescence	W09	W09	W09	HA16	HA16	HA16
ExudateFactor	VH06	VH06	VH06	VH06	VH06	VH06
SpringCorrection	VH06	VH06	VH06	VH06	VH06	VH06
LitterConversion	VH06	VH06	VH06	VH06	VH06	VH06
ResistFrac	SA03	SA03	SA03	SA03	SA03	SA03
AssimDissim	VH06	VH06	VH06	VH06	VH06	VH06
WLMin	TRY	TRY	TRY	H16	H16	HA16
WLOptMin	TRY	TRY	TRY	H16	H16	HA16
WLOptMax	TRY	TRY	TRY	H16	H16	HA16
WLMax	TRY	TRY	TRY	H16	H16	HA16

Figure S4. The results of the sensitivity tests show the relationship between different temperature inputs and the mean annual daily plant transported CH_4 , for each of the PFTs at the Horstermeer site (top row) and Ilperveld site (bottom row). Temperature input was increased and decreased by 1 & 3 °C, respectively. The legend shows the input change in °Cwhere, ± signs in front of the legend labels show the direction of change. Note the different y axes between the top and bottom panels.

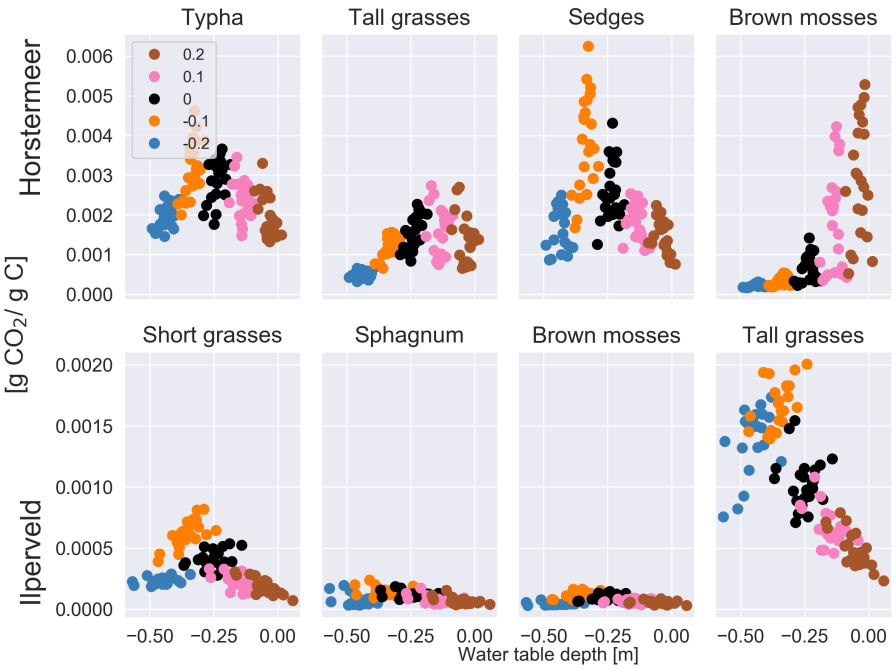

Figure S5. The results of the sensitivity tests show the relationship between different water level inputs and the mean annual daily below-ground CO_2 flux, for each of the PFTs at the Horstermeer site (top row) and Ilperveld site (bottom row). Water level input was decreased by 0.1 & 0.2 m and increased by 0.1 & 0.2 m, respectively. The legend shows the input change, where $\pm$ signs in front of the legend labels indicate the direction of change. Note the different y axes between the top and bottom panels.

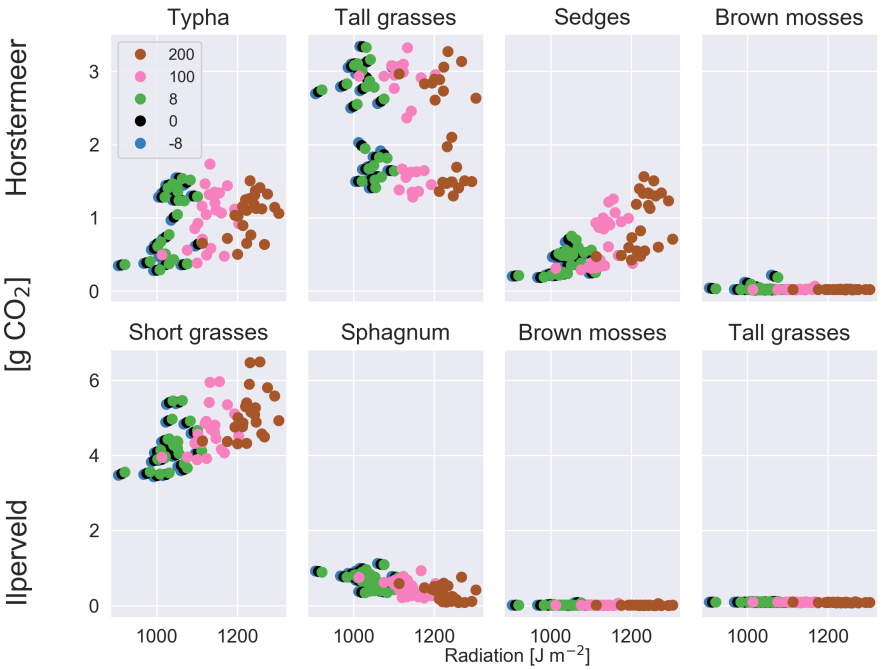

Figure S6. The results of the sensitivity tests show the relationship between the annual mean daily GPP and different radiation inputs, for each of the PFTs at the Horstermeer site (top row) and Ilperveld site (bottom row). Radiation input was increased by 8, 100 and 200J m^{-2}, and decreased by 8 J m^{-2}. The legend shows the input change in J m^{-2} where, $\pm$ signs in front of the legend labels show the direction of change.

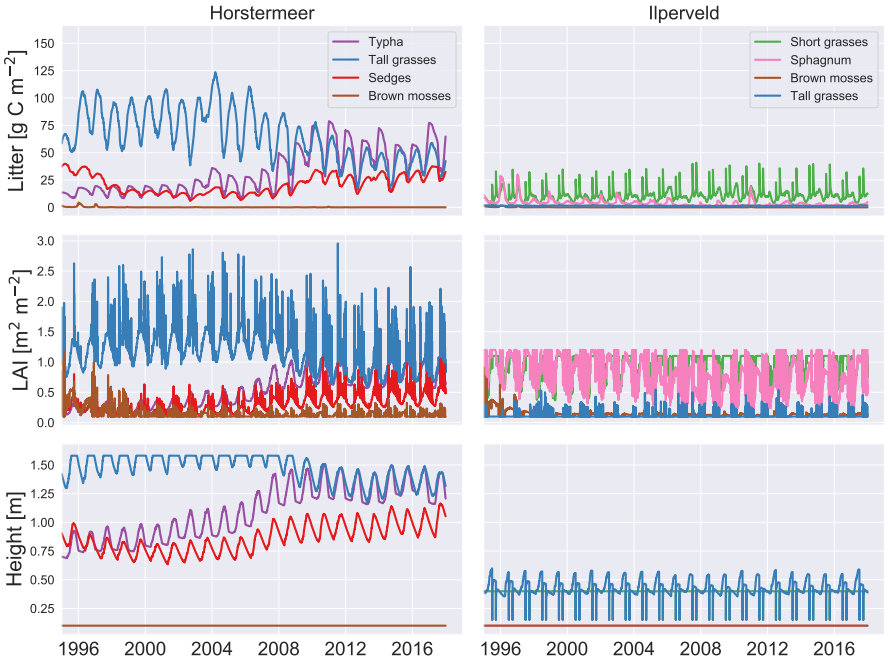

Figure S7. Vegetation dynamics. The results of the Horstermeer site simulation are represented in the left column and the results of the Ilperveld site simulation are represented in the right column.

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