

Section A: InTEC Principles

A.1. Response of NPP to disturbance and non-disturbance factors

Calculating NPP is an important step to determine the accuracy of long-term C cycle modeling in InTEC. In theory, NPP changes with climate variability, atmospheric CO₂ concentration, N deposition, disturbances, etc. We group the factors into disturbance effect ($\phi_{dis}(i)$, from disturbance events and subsequent forest regrowth) and non-disturbance effect ($\phi_{nondis}(i)$, from climate variability, changing atmospheric CO₂ concentration and N deposition). Therefore, the C balance of a forest region is a function of these external forcing factors [[Chen et al., 2000b](#)]. Since we assume stands are in an equilibrium state in pre-industrial time (before 1900), the functions of $\phi_{NPPd}(i)$ and $\phi_{NPPn}(i)$ in year (i) are used to describe the corresponding accumulated disturbance and non-disturbance effects since pre-industrial time. Thus, the historical annual NPP in year i is progressively estimated from the beginning year by [[Chen et al., 2000a, 2000b, 2003](#)]

$$\text{NPP}(i) = \text{NPP}_0 \times \phi_{NPPn}(i) \times \phi_{NPPd}(i), \quad (\text{A1})$$

NPP_0 is the initial value of NPP in a dynamic equilibrium state at an equilibrium age.

We run the model with full climate change iteratively to get true initial values (NPP_0) until the difference between NPP value reconstructed by InTEC and the reference NPP value (in this study, we use MODIS NPP in 2006 as reference values) in the reference year is smaller than a threshold, typically $\pm 1\%$. Using $\text{NPP}(i)$, the sizes of pre-industrial C pools are re-estimated through a spin-up procedure under the equilibrium

assumption. If the true NPP_0 , $\phi_{NPPn}(i)$ and $\phi_{NPPd}(i)$ are known for each grid cell, the values of $NPP(i)$ in historical year i can be retrospectively estimated using equation (A1).

A.1.1. Non-disturbance function (ϕ_{NPPn})

Total annual GPP of a forest region in year i over areas (y) and time period (t) can be calculated by

$$GPP(i) = \int_t \int_y P_{can}(y, t) dy dt . \quad (A2)$$

The canopy photosynthesis rate $P_{can}(y, t)$ is upscaled from a two-leaf Farquhar, von Caemmerer and Berry (FvCB) photosynthetic rate model using the scheme in [Chen et al. \[1999\]](#).

Despite that it is theoretically possible to estimate GPP for each year since the pre-industrial period, the calculation is practically limited by data availability. Here we used an alternative to calculate total annual GPP, i.e. to calculate GPP only for a given year and to determine GPP in other years using a relationship between the inter-annual relative change ($\frac{dGPP}{di}$). Thus, if GPP in a certain year (i_0) and the accumulated inter-annual relative changes in GPP are known, GPP in another year (i) can be determined alternatively by

$$\begin{cases} GPP(i) = GPP(i_0) + \sum_{i_0}^i \frac{dGPP}{dt} & i \geq i_0 \\ GPP(i) = GPP(i_0) - \sum_i^{i_0} \frac{dGPP}{dt} & i < i_0 \end{cases} . \quad (A3)$$

The changes of GPP are calculated by [Chen et al. \[2000c\]](#):

$$\frac{dGPP(i)}{di} = \int_t P_{can}(y, t) \frac{\partial y}{\partial i} dt + \int_y P_{can}(y, t) \frac{\partial l_g(t)}{\partial i} dy + \int_t \int_y dP_{can}(y, t) dy dt , \quad A4)$$

The first term represents the effects caused by changes in forest areas; the second term represents the effects caused by the changes of growing season length (l_g); and the third represents the effects on annual GPP changes caused by accumulated changes in $P_{can}(y, t)$. Details on how to calculate these three terms can be found in *Chen et al.* [2000a, 2000c].

The integrated effects of non-disturbance factors on GPP are derived by a set of differential equations [*Chen et al.*, 2000a, 2000c] as

$$\phi_{GPPn}(i) = \prod_{j=1}^i \frac{2+\chi(j)}{2-\chi(j)}, \quad (\text{A5})$$

$$\begin{aligned} \chi(i) = \{ & f_p(i) [\xi_{L_{1,1}} \overline{L_{1,1}}(i) \Delta C_a + \xi_{L_{2,1}} \overline{L_{2,1}}(i) \Delta \alpha + \xi_{L_{3,1}} \overline{L_{3,1}}(i) \Delta \Gamma + \xi_{L_{5,1}} \overline{L_{5,1}}(i) \Delta J_{mt} \\ & + \xi_{L_{N1}} \overline{L_{N1}}(i) \Delta N_l(i) + \xi_{L_{1,1}} \overline{L_{L1,1}}(i) \Delta L_{sun}(i) + \xi_{L_{1,2}} \overline{L_{L1,2}}(i) \Delta L_{shad}(i)] \\ & + (1 - f_p(i)) [\xi_{L_{1,2}} \overline{L_{1,2}}(i) \Delta C_a + \xi_{L_{2,2}} \overline{L_{2,2}}(i) \Delta \alpha + \xi_{L_{3,2}} \overline{L_{3,2}}(i) \Delta \Gamma \\ & + \xi_{L_{4,2}} \overline{L_{4,2}}(i) \Delta k_{co} + \xi_{L_{5,2}} \overline{L_{5,2}}(i) \Delta V_{mt} + \xi_{L_{N2}} \overline{L_{N2}}(i) \Delta N_l(i)] \} + L_g \Delta l_g \end{aligned}, \quad (\text{A6})$$

where f_p is the fraction of P_{can} limited by electron transport; $\chi(j)$ is a function of climate variables, atmospheric CO₂ concentration (C_a), growing season length (l_g), N content (N_l), soil temperature, and available soil water. It is the sum of derivatives of GPP with respect to these variables, and these derivatives are either derived from process models or experimental data [*Chen et al.*, 2000b; *Ju et al.*, 2007]. Δx represents the inter-annual variability of variable x ; L_x is the coefficient accounting for the effects of non-disturbance factors on GPP; ξ_{L_x} is the scalar accounting for the effect of diurnal and seasonal variations of L_x and P_{can} on dP_{can} ; L_{shad} and L_{sun} are leaf index areas of sunlit leaves and shaded leaves; k_{co} is the coefficient associated with enzyme kinetics; α is the ratio of intercellular CO₂ concentration to C_a ; J_{mt} is electron transport rate; Γ is CO₂

compensation point; The calculations of each term and each variable are referenced in *Chen et al. [2000b]* and *Ju et al. [2007]*.

Annual NPP of the forest region in year i is annual GPP reduced by total autotrophic respiration (R_a). Through a series of derivations, $NPP_u(i)$ is calculated [*Ju et al., 2007*] as

$$\left\{ \begin{array}{l} NPP_u(i) = NPP_u(i-1) \frac{1+B(i)}{1-B(i)} = NPP_u(i-1) \phi_{NPPn}(i) \\ \frac{NPP_u(i) - NPP_u(i-1)}{NPP_u(i) + NPP_u(i-1)} = \frac{GPP(i) - GPP(i-1) - R_a(i) + R_a(i-1)}{GPP(i) + GPP(i-1) - R_a(i) - R_a(i-1)}, \\ \qquad \qquad \qquad = \frac{(X(i)-1) - \beta(i-1)(Y(i)-1)}{(X(i)+1) - \beta(i-1)(Y(i)+1)} = B(i) \end{array} \right. \quad (A7)$$

where $NPP_u(i)$ is the NPP value determined by non-disturbance factors; $R_a(i)$ is autotrophic respiration; $\phi_{NPPn}(i)$ integrates all effects of non-disturbance factors on NPP; $X(i)$ is the inter-annual variability of GPP between year i and year $i-1$, which is calculated by equations (A2)–(A6); $Y(i)$ is the inter-annual variability of respiration rate between year i and year $i-1$; $\beta(i-1)$ is the ratio of respiration to GPP in year $i-1$.

A.1.2. Disturbance function ($\phi_{NPPd}(i)$)

Disturbances affect NPP by altering age-class distribution, forest areas and subsequent forest regrowth. The distribution of forest stand age x in a given year i , $A(x, i)$, can be estimated from historical disturbance records, length of regeneration period, and rate of survival after regeneration [*Chen et al., 2000a, 2000b, 2000c*]:

$$A(x, i) = A_t \frac{q(i)}{\varphi(1/s + 1)} e^{-[q(i)x]^s}, \quad (A8)$$

q is the total forest disturbance occurrence frequency; A_t is the total forest area; φ is the gamma function; s is the shape parameter [Kasischke *et al.*, 2000]. With $A(x,i)$ and a normalized NPP (i.e. F_{npp}) at age x (details in [section 2.3 in the main text](#)) the overall effect of disturbances on NPP is then given [Chen *et al.*, 2000a] by

$$\phi_{NPPd}(i) = \int_0^{\infty} F_{npp}(x)A(x,i)dx / \int_0^{\infty} F_{npp}(x)A(x,0)dx . \quad (A9)$$

During simulation years, stand age increases progressively affecting forest productivity and ecosystem C balance. In years when disturbance events occur, stand ages are dropped to zero, and stands regenerate in the following years ([section 2.3 in the main text](#)).

A.2. Disturbance emissions ($D(i)$)

The total amount of C losses at the time of disturbance events (from combustion or decomposition of abundant dead wood and detritus) in year (i) is estimated by

$$D(i) = D_{fire}(i) + D_{harvest}(i) + D_{insect}(i) , \quad (A10)$$

where $D_{fire}(i)$, $D_{harvest}(i)$, and $D_{insect}(i)$ are the amounts of C release due to fire, clearcut harvest and insect-induced mortality, respectively.

During the simulation period of this study, all C emissions were assumed from fire and harvest due to shortage of spatially-explicit insect-induced disturbance datasets. Due to sparse information about the severity of damage of insect-impacted forests, insect infestations were treated the same as harvested forests, since stand-replacing insect disturbances may have similar impacts on ecosystem dynamics except for producing a deadwood pool which would emit C or increase soil C pools in the subsequent years. In a disturbance year, we estimated the C from harvested wood products from harvest volume

data [Ince, 2000; Adam et al., 2006; Smith et al., 2009] using the methods of Smith et al. [2006]. For simplicity, average conversion parameters from volume to C density were used within a given region although they were suggested to be different among forest types within the same regions [Smith et al., 2006]. Otherwise, forests experienced a pulse of C losses from fires. The amount of C directly emitted from fire is estimated as the sum of 100% of foliage C, 25% of woody C, and 100% of C in surface structural and metabolic detritus pools [Kasischke et al., 2000]. The remaining biomass C is transferred to woody litter, surface metabolic detritus and surface structural detritus [Chen et al., 2003]. After disturbances, forest stands start to regenerate immediately in the year after disturbances, and net C change becomes more positive and reaches a peak as plants regenerate and soil detritus decays.

A.3. Carbon cycle

In the InTEC model, annual NPP(*i*) is partitioned into four living biomass C pools (foliage, wood, fine root, and coarse root) which further decompose into nine soil C pools. Figure 1 (in the main text) shows the thirteen conceptual C pools defined in the model and the fate of harvested wood products. The sizes of these C pools for each year are determined by their C sizes in previous year (*i*-1) and C changes (ΔC) in year (*i*). For biomass ΔC is calculated by

$$\Delta C_j(i) = \frac{f_j(i)NPP(i) - k_j(i)C_j(i-1)}{1 + k_j(i)}. \quad (A11)$$

For soil ΔC ,

$$\Delta C_j(i) = \frac{\sum_{m=1}^n k_{m,j}(i)C_m(i-1) - k_j(i)C_j(i-1)}{1 + k_j(i)}, \quad (A12)$$

where $\Delta C_j(i)$ is the j^{th} C pool change in the i^{th} year; f_j is the allocation coefficient of the j^{th} biomass pool; k_j is the turnover rate for biomass C pools and the decomposition rate for soil C pools; $k_{m,j}$ is the C transfer rate from the m^{th} to j^{th} C pool. The calculation of C changes is summarized in [Section A.3.1 in the auxiliary materials](#). Available N changes with N fixation, mineralization, loss and uptake which alter the C/N ratio for biomass and soil C pools ([Figure 1 in the main text](#)) [[Chen et al., 2000a](#); [Ju et al., 2007](#)].

Total annual ecosystem heterotrophic respiration ($R_h(i)$) is the sum of C released to the atmosphere during decomposition, calculated as a function of C pools and abiotic factors such as soil temperature, soil moisture, texture, N availability and lignin content [[Ju et al., 2007](#)], i.e.

$$R_h(i) = \sum_{m=1}^9 k_{m,a}(i) C_m(i), \quad (\text{A13})$$

where $k_{m,a}$ is the rate of C released from the m^{th} C pool to the atmosphere. The C pools are estimated as a function of NPP over a specified period of time, which has a direct relationship with stand age, and therefore R_h is indirectly influenced by stand age.

Annual NBP(i) is the total changes of ecosystem C pools obtained from the reconstructed NPP(i) deducting $R_h(i)$ and direct C release from disturbances ($D(i)$), that is,

$$NBP(i) = NPP(i) - R_h(i) - D(i) . \quad (\text{A14})$$

In a disturbance year, forests experience a pulse of C loss, and the amount of C directly emitted is assumed to be the sum of emissions from fire, harvest and insects (see [Section A.2](#)). The successional trends of C changes after disturbance events are based on

relative proportions of growing and decomposing tissues [Odum, 1969]. If no disturbance events occur in year i ($D(i)=0$), NBP equals annual net ecosystem productivity (NEP).

A.3.1. Equations for calculating ΔC_x

$$\begin{aligned} \Delta C_l(i) &= \left[f_l \text{NPP}(i) - k_{l,\text{smd}} C_l(i-1) - k_{l,\text{ssd}} C_l(i-1) - \xi_l C_l(i-1) \right] / \left[1 + k_{l,\text{smd}} + k_{l,\text{ssd}} + \xi_l \right] \\ \Delta C_w(i) &= \left[f_w \text{NPP}(i) - k_{w,\text{cd}} C_w(i-1) - \xi_w C_w(i-1) \right] / \left[1 + k_{w,\text{cd}} + \xi_w \right] \\ \Delta C_{cr}(i) &= \left[f_{cr} \text{NPP}(i) - k_{cr,\text{cd}} C_{cr}(i-1) - \xi_{cr} C_{cr}(i-1) \right] / \left[1 + k_{cr,\text{cd}} + \xi_{cr} \right] \\ \Delta C_{fr}(i) &= \left[f_{fr} \text{NPP}(i) - k_{fr,\text{fmd}} C_{fr}(i-1) - k_{fr,\text{fsd}} C_{fr}(i-1) - \xi_{fr} C_{fr}(i-1) \right] / \left[1 + k_{fr,\text{fmd}} + k_{fr,\text{fsd}} + \xi_{fr} \right] \\ \Delta C_{cd}(i) &= \left[(1 - \xi_w) k_{w,\text{cd}} C_w(i) + (1 - \xi_{cr}) k_{cr,\text{cd}} C_{cr}(i) - \xi_{cd} C_{cd}(i-1) \right. \\ &\quad \left. - \Lambda(i)(1 - \xi_{cd})(k_{cd,a} + k_{cd,m} + k_{cd,s}) C_{cd}(i-1) \right] / \left[1 + \Lambda(i)(k_{cd,a} + k_{cd,m} + k_{cd,s}) \right] \\ \Delta C_{fsd}(i) &= \left\{ (1 - F_m(i))(1 - \xi_{fr}) k_{fr,\text{fsd}} C_{fr}(i) \right. \\ &\quad \left. - \Lambda(i)(k_{fsd,a} + k_{fsd,m} + k_{fsd,s}) C_{fsd}(i-1) \right\} / \left[1 + \Lambda(i)(k_{fsd,a} + k_{fsd,m} + k_{fsd,s}) \right] \\ \Delta C_{ssd}(i) &= \left\{ (1 - F_m(i))(1 - \xi_l) k_{l,\text{ssd}} C_l(i) - \xi_{ssd} C_{ssd}(i-1) \right. \\ &\quad \left. - \Lambda(i)(1 - \xi_{ssd})(k_{ssd,a} + k_{ssd,sm} + k_{ssd,s}) C_{ssd}(i-1) \right\} / \left[1 + \Lambda(i)(k_{ssd,a} + k_{ssd,sm} + k_{ssd,s}) \right] \\ \Delta C_{fmd}(i) &= \left\{ F_m(i)(1 - \xi_{fr}) k_{fr,\text{fmd}} C_{fr}(i) - \xi_{fmd} C_{fmd}(i-1) \right. \\ &\quad \left. - \Lambda(i)(k_{fmd,a} + k_{fmd,m}) C_{fmd}(i-1) \right\} / \left[1 + \Lambda(i)(k_{fmd,a} + k_{fmd,m}) \right] \\ \Delta C_{smd}(i) &= \left\{ F_m(i)(1 - \xi_l) k_{l,\text{md}} C_l(i) - \xi_{smd} C_{smd}(i-1) \right. \\ &\quad \left. - \Lambda(i)(1 - \xi_{smd})(k_{smd,a} + k_{smd,sm}) C_{smd}(i-1) \right\} / \left[1 + \Lambda(i)(k_{smd,a} + k_{smd,sm}) \right] \\ \Delta C_{sm}(i) &= \left\{ \Lambda(i)(k_{smd,m} C_{smd}(i) + k_{ssd,m} C_{ssd}(i)) - \Lambda(i) k_{m,s} C_{sm}(i-1) \right\} / \left[1 + \Lambda(i) k_{m,s} \right] \\ \Delta C_m(i) &= \left\{ \Lambda(i)(k_{cd,m} C_{cd}(i) + k_{fsd,m} C_{fsd}(i) + k_{fmd,m} C_{fmd}(i) + k_{s,m} C_s(i) + k_{p,m} C_p(i-1)) \right. \\ &\quad \left. - \left[\Lambda(i)(k_{m,a} + k_{m,s}) + k_{m,p} \right] C_m(i-1) \right\} / \left[1 + \Lambda(i)(k_{m,a} + k_{m,s}) + k_{m,p} \right] \\ \Delta C_s(i) &= \left\{ \Lambda(i)(k_{cd,s} C_{cd}(i) + k_{fsd,s} C_{fsd}(i) + k_{m,s} C_m(i) + k_{sm,s} C_{sm}(i) + k_{ssd,s} C_{ssd}(i)) \right. \\ &\quad \left. - \left[\Lambda(i)(k_{s,a} + k_{s,m}) + k_{s,p} \right] C_s(i-1) \right\} / \left[1 + \Lambda(i)(k_{s,a} + k_{s,p} + k_{s,m}) \right] \\ \Delta C_p(i) &= \left\{ k_{s,p} C_s(i) + k_{m,p} C_m(i) - \Lambda(i) \left[k_{p,a} + k_{p,m} \right] C_p(i-1) \right\} / \left[1 + \Lambda(i)(k_{p,a} + k_{p,m}) \right] \end{aligned}$$

Notation

Symbol Definition

f_x NPP allocation coefficient to pool x

- ξ_x C loss from C pool x due to disturbance events
- $k_{x,y}$ C transfer rate from C pool x to C pool y
- C_x C content in C pool x
- F_m Partitioning fraction of leaf and fine-root litters to metabolic detritus C pool
- Λ Abiotic decomposition factor

Subscript notation

- l, w, cr, fr Foliage, wood, coarse root, fine root
- $cd, fsd, fmd,$ Woody litter, soil structural detritus, soil metabolic detritus
- m, s, sm, ssd Soil microbe, slow, surface microbe, surface structural detritus
- smd, p, a Surface metabolic detritus, passive, atmosphere

A.4. Parameters for InTEC

The parameters used to describe C allocation, turnover rates, decomposition rates, and loss rate in the InTEC model are listed in [Table A1](#).

Table A1. Carbon (C) allocation coefficients of net primary productivity (NPP), and turnover rates, decomposition rates, C loss rate in fire and decomposition products of biomass and soil C pools defined in the InTEC model.

NO.	C pools		Allocation/turnover/decomposition rate			Loss rate in fire ξ_{fx}
	NPP allocation	Fate	Coniferous	Deciduous	Mixed	
	f_l		0.2129	0.2326	0.2077	
	f_w		0.3010	0.4024	0.3317	
	f_{fr}		0.3479	0.2160	0.2770	
	f_{cr}		0.1482	0.1590	0.1836	
Biomass C pools						
1	C_l	C_{ssd}, C_{smd}	0.1925	1.0000	0.3945	1
2	C_w	C_{cd}	0.0249	0.0288	0.0279	0.25
3	C_{fr}	C_{fsd}, C_{fmd}	0.5948	0.5948	0.5948	0
4	C_{cr}	C_{cd}	0.0229	0.0448	0.0268	0
Soil C pools						
5	C_{smd}	C_{sm}, C_a	$k_{smd,sm} = 0.4KN_{ssd}(i)A(i)$ $k_{smd,a} = 0.6KN_{ssd}(i)A(i)$ $k_{ssd,sm} = 0.4KN_{ssd}(i)f_{ssd,sm}(LC_l)$			1
6	C_{ssd}	C_s, C_{sm}, C_a	$k_{ssd,s} = 0.7KN_{ssd}(i)f_{ssd,s}(LC_l)$ $k_{ssd,a} = 0.6KN_{ssd}(i)f_{ssd,sm}(LC_l) + 0.3KN_{ssd}(i)f_{ssd,s}(LC_l)$			1
7	C_{sm}	C_s, C_a	$k_{sm,s} = 0.4A(i)$ $k_{sm,a} = 0.6A(i)$ $k_{cd,m} = 0.45KN_{cd}(i)f_{cd,m}(LC_w, LC_{cr})A(i)$			
8	C_{cd}	C_m, C_s, C_a	$k_{cd,s} = 0.7KN_{cd}(i)f_{cd,s}(LC_w, LC_{cr})A(i)$ $k_{cd,a} = 0.55KN_{cd}(i)f_{cd,m}(LC_w, LC_{cr})A(i) + 0.3KN_{cd}(i)f_{cd,s}(LC_w, LC_{cr})A(i)$			1
9	C_{fmd}	C_m, C_a	$k_{fmd,m} = 0.45KN_{fmd}(i)A(i)$ $k_{fmd,a} = 0.55KN_{fmd}(i)A(i)$ $k_{fsd,m} = 0.45KN_{fsd}(i)f_{fsd,m}(LC_{fr})$			
10	C_{fsd}	C_s, C_m, C_a	$k_{fsd,s} = 0.7KN_{fsd}(i)f_{fsd,s}(LC_{fr})$ $k_{fsd,a} = 0.55KN_{fsd}(i)f_{fsd,m}(LC_{fr}) + 0.3f_{fsd,s}(LC_{fr})$ $k_{m,s} = 7.3f_{m,s}(T_m)A(i)$			
11	C_m	C_p, C_s, C_a	$k_{m,p} = 7.3f_{m,p}(T_m)A(i)$ $k_{m,a} = 7.3f_{m,a}(T_m)A(i)$			

			$k_{s,m} = 0.25 f_{s,m}(T_m) A(i)$
12	C_s	$C_m, C_p,$ C_a	$k_{s,p} = 0.25 f_{s,p}(T_m) A(i)$ $k_{s,a} = 0.19 A(i)$
13	C_p	C_m, C_a	$k_{p,m} = 0.003 A(i)$ $k_{p,a} = 0.003 A(i)$

$A(i)$ is the integrated annual abiotic effects of soil temperature and moisture in year i ; $f_{x,y}(T_m)$ is a scalar for the effect of soil texture (T_m); $KN_x(i)$ is a scalar for the effect of N availability; $f_{x,y}(LC_z)$ is the impact of lignin content (LC).

Section B. NPP-Age Relationships Used in the Model

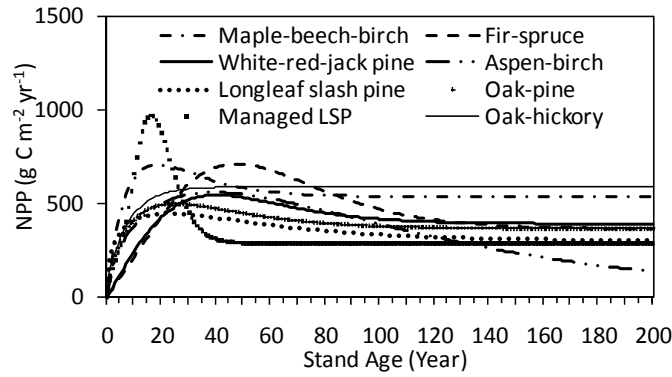


Figure B1. Relationships between net primary productivity (NPP) and forest stand age for different forest species groups.

Table B1. Four regression coefficients in equation (2) (in the main text) for the 18 forest type groups and three major forest types in the United States.

Forest species group	Coefficients				R ²	RMSE	E
	a	b	c	d			
White/Red/Jack Pine	6.6199	0.2082	10.5144	2.6527	0.9878	0.2286	21
Spruce/Fir	4.8524	1.6787	27.4233	0.7164	0.9933	0.1319	21
Longleaf/Slash Pine	6.2629	0.0059	2.9427	5.9247	0.9782	0.2943	33
Loblolly/Shortleaf Pine	8.5918	0.0035	2.7138	6.0952	0.9946	0.1801	40
Douglas-fir	4.4976	0.1983	7.555	4.5409	0.9817	0.512	42
Ponderosa Pine	5.9579	0.1922	17.1843	2.1798	0.983	0.2501	59
Fir/Spruce/Mountain Hemlock	2.8842	0.4481	12.9304	3.305	0.9665	0.2692	24
Lodgepole Pine	2.5237	4.0976	29.7946	2.0272	0.961	0.4528	52
Hemlock/Sitka Spruce	6.3106	0.5341e	14.5989	3.0267	0.9866	0.3577	11
California Mixed Conifer	8.2567	-0.0868	17.1319	3.3471	0.9729	0.3628	51
Oak/Pine	5.2148	1.5659	44.3112	0.1489	0.9612	0.2564	32
Oak/Hickory	6.024	0.1606	2.9433	2.4978	0.9738	0.2042	17
Oak/Gum/Cypress	5.3819	0.1927	3.5399	2.5693	0.957	0.2643	21
Elm/Ash/Cottonwood	0.1443	42.5177	328.4388	0.0659	0.8868	0.3472	22
Maple/Beech/Birch	3.9451	2.2077	14.7727	0.7295	0.9923	0.1134	18
Aspen/Birch	1.6894	5.7741	56.9393	0.5894	0.9934	0.0998	23
Alder/Maple	5.2969	0.027	5.9199	5.27	0.9424	0.59	12
Western Oak	3.9878	0.0933	12.0158	4.3351	0.9324	0.5206	24

The R² and RMSE (root mean squared error) quantified the errors for fitting the NPP estimates to equation (2). E% denoted the average of e% for each stand age in a NPP-age curve, where e% is a standard deviation of NPP estimate for each stand age and expressed by percentage of the mean value (L. He et al., submitted manuscript, 2011).

Section C. Comparisons of Simulated NBP and NPP with EPA and MODIS Results

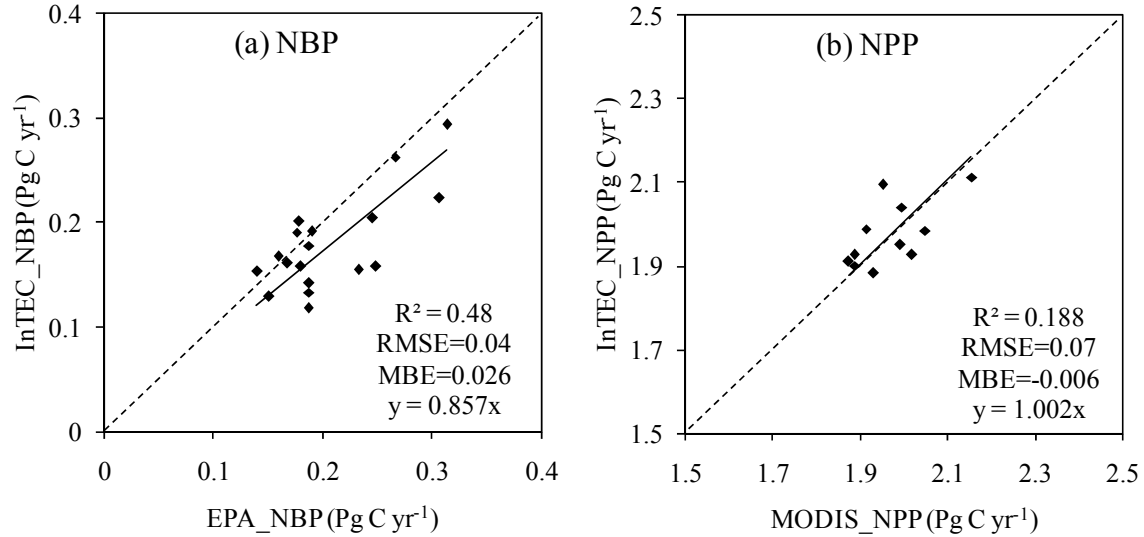


Figure C1. Comparisons of (a) simulated net biome productivity (NBP) with EPA estimates from 1990 to 2007, and (b) simulated net primary productivity (NPP) with MODIS NPP from 2000 to 2010. MBE is the mean bias error (=average($Y - Y_{\text{predicted}}$)); RMSE is the root mean square error; R^2 is the coefficient of determination. All statistics are significant at the 0.01 level. Pg C=1000Tg C.

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