Supplementary material

Table 1 Names, locations, vegetation types, and references of the eddy covariance sites used in this study. The vegetation types used are: evergreen needleleaf forests (ENF), deciduous broadleaf forests (DBF), mixed forests (MF), open shrublands (OSH), closed shrublands (CSH), woody savannas (WSA), grasslands (GRA), and croplands (CRO).

Site ID	Site name	Lat	Lon	IGBP	References
CA-Ca1	Campbell River - Mature Forest	49.87	-125.33	ENF	Humphreys et al., 2006
CA-Ca2	Campbell River - Clearcut	49.87	-125.29	ENF	Humphreys et al., 2006
CA-Ca3	Campbell River - Young Plantation	49.53	-124.90	ENF	Humphreys et al., 2006
CA-Man	BOREAS NSA - Old Black Spruce	55.88	-98.48	ENF	Dunn et al., 2007
CA-NS1	UCI-1850 burn site	55.88	-98.48	ENF	Goulden et al., 2006
CA-NS2	UCI-1930 burn site	55.91	-98.52	ENF	Goulden et al., 2006
CA-NS3	UCI-1964 burn site	55.91	-98.38	ENF	Goulden et al., 2006
CA-NS5	UCI-1981 burn site	55.86	-98.49	ENF	Goulden et al., 2006
CA-NS6	UCI-1989 burn site	55.92	-98.96	ENF	Goulden et al., 2006
CA-Obs	SSA Old Black Spruce	53.99	-105.12	ENF	Krishnan et al., 2006
CA-Ojp	SSA Old Jack Pine	53.92	-104.69	ENF	Zha et al., 2009
CA-Qcu	Quebec Boreal Cutover Site	49.27	-74.04	ENF	Giasson et al., 2006
CA-Qfo	Quebec Mature Boreal Forest Site	49.69	-74.34	ENF	Bergeron et al., 2007
CA-SF1	Sask.- Fire 1977	54.49	-105.82	ENF	Mkhabela et al., 2009
CA-SF2	Sask.- Fire 1989	54.25	-105.88	ENF	Mkhabela et al., 2009
CA-SF3	Sask.- Fire 1998	54.09	-106.01	ENF	Mkhabela et al., 2009
CA-SJ1	Sask.- 1994 Harv. Jack Pine	53.91	-104.66	ENF	Amiro et al., 2006
CA-SJ2	Sask.- 2002 Harvested Jack Pine	53.95	-104.65	ENF	Zha et al., 2009
CA-SJ3	Sask.- SSA 1975 Harv. Young Jack Pine	53.88	-104.65	ENF	Zha et al., 2009
CA-TP1	Turkey Point Seedling White Pine	42.66	-80.56	ENF	Peichl et al., 2010
CA-TP2	Turkey Point Young White Pine	42.77	-80.46	ENF	Peichl et al., 2010
CA-TP3	Turkey Point Middle-aged White Pine	42.71	-80.35	ENF	Peichl et al., 2010
CA-TP4	Turkey Point Mature White Pine	42.71	-80.36	ENF	Arain and Restrepo-Coupe, 2005
US-Blo	Blodgett Forest	38.90	-120.63	ENF	Goldstein et al., 2000
US-Bn1	Bonanza Creek, 1920 Burn site	63.92	-145.38	ENF	
US-Bn3	Bonanza Creek, 1999 Burn site	63.92	-145.74	ENF	
US-Dk3	Duke Forest - loblolly pine	35.98	-79.09	ENF	Oren et al., 2006
US-Fmf	Flagstaff - Managed Forest	35.14	-111.73	ENF	Dore et al., 2010
US-Fuf	Flagstaff - Unmanaged Forest	35.09	-111.76	ENF	Dore et al., 2010
US-Fwf	Flagstaff - Wildfire	35.45	-111.77	ENF	Dore et al., 2010
US-Ha2	Harvard Forest Hemlock Site	42.54	-72.18	ENF	Hadley and Schedlbauer, 2002
US-Ho1	Howland Forest main tower	45.20	-68.74	ENF	Hollinger et al., 1999
US-Ho2	Howland Forest west tower	45.21	-68.75	ENF	Hollinger et al., 1999
US-KS2	Kennedy Space Center scrub oak	28.61	-80.67	ENF	Dore et al., 2003
US-Me1	Metolius - Eyerly burn	44.58	-121.50	ENF	Irvine et al., 2007
US-Me2	Metolius-intermediate aged pine	44.45	-121.56	ENF	Law et al., 2003
US-Me3	Metolius-second young aged pine	44.32	-121.61	ENF	Vickers et al., 2012
US-Me4	Metolius-old aged ponderosa pine	44.50	-121.62	ENF	Law et al., 2003
US-NC1	NC_Clearcut	35.81	-76.71	ENF	Sun et al., 2010
US-NC2	NC_Loblolly Plantation	35.80	-76.67	ENF	Noormets et al., 2010
US-NR1	Niwot Ridge Forest	40.03	-105.55	ENF	Monson et al., 2002

US-SP1	Slashpine-Austin Cary	29.74	-82.22	ENF	Powell et al., 2008
US-SP2	Slashpine-Mize	29.76	-82.24	ENF	Clark et al., 2004
US-SP3	Slashpine-Donaldson	29.75	-82.16	ENF	Clark et al., 2004
US-Wi0	Young red pine	46.62	-91.08	ENF	Noormets et al., 2008a
US-Wi2	Intermediate red pine	46.69	-91.15	ENF	Noormets et al., 2008a
US-Wi4	Mature red pine	46.74	-91.17	ENF	Noormets et al., 2008a
US-Wi5	Mixed young jack pine	46.65	-91.09	ENF	Noormets et al., 2008a
US-Wi7	Red pine clearcut	46.65	-91.07	ENF	Noormets et al., 2008a
US-Wi9	Young Jack pine	46.62	-91.08	ENF	Noormets et al., 2008a
US-Wrc	Wind River Crane Site	45.82	-121.95	ENF	Falk et al., 2008
US-Bar	Bartlett Experimental Forest	44.06	-71.29	DBF	Jenkins et al., 2007
US-Bn2	Bonanza Creek	63.92	-145.38	DBF	Liu et al., 2005
US-Dk2	Duke Forest-hardwoods	35.97	-79.10	DBF	Pataki and Oren, 2003
US-Ha1	Harvard Forest EMS Tower	42.54	-72.17	DBF	Urbanski et al., 2007
US-Los	Lost Creek	46.08	-89.98	DBF	Sulman et al., 2009
US-LPH	Little Prospect Hill	42.54	-72.19	DBF	Hadley et al., 2008
US-MMS	Morgan Monroe State Forest	39.32	-86.41	DBF	Schmid, 1994
US-MOz	Missouri Ozark Site	38.74	-92.20	DBF	Gu et al., 2006
US-Oho	Oak Openings	41.55	-83.84	DBF	Noormets et al., 2008b
US-UMB	Univ. of Mich. Biological Station	45.56	-84.71	DBF	Gough et al., 2008
US-WCr	Willow Creek	45.81	-90.08	DBF	Cook et al., 2004
US-Wi1	Intermediate hardwood	46.73	-91.23	DBF	Noormets et al., 2008a
US-Wi8	Young hardwood clearcut	46.72	-91.25	DBF	Noormets et al., 2008a
CA-Gro	Groundhog River	48.22	-82.16	MF	McCaughey et al., 2006
CA-WP1	Western Peatland	54.95	-112.47	MF	Flanagan and Syed, 2011
US-PFa	Park Falls/WLEF	45.95	-90.27	MF	Davis et al., 2003
US-Syv	Sylvania Wilderness Area	46.24	-89.35	MF	Desai et al., 2005
US-Ivo	Ivotuk	68.49	-155.75	OSH	
US-SO2	Sky Oaks- Old Stand	33.37	-116.62	CSH	Lipson et al., 2005
US-SO3	Sky Oaks- Young Stand	33.38	-116.62	CSH	Lipson et al., 2005
US-SO4	Sky Oaks- New Stand	33.38	-116.64	CSH	
US-FR2	Freeman Ranch- Mesquite Juniper	29.95	-98.00	WSA	
US-SRM	Santa Rita Mesquite	31.82	-110.87	WSA	Scott et al., 2009
US-Ton	Tonzi Ranch	38.43	-120.97	WSA	Ma et al., 2007
CA-Let	Lethbridge	49.71	-112.94	GRA	Flanagan and Adkinson, 2011
US-ARb	ARM Southern Great Plains burn site	35.55	-98.04	GRA	
US-ARc	ARM Southern Great Plains control site	35.55	-98.04	GRA	
US-ARM	ARM Southern Great Plains site	36.61	-97.49	GRA	Fischer et al., 2007
US-Aud	Audubon Research Ranch	31.59	-110.51	GRA	
US-Bkg	Brookings	44.35	-96.84	GRA	
US-CaV	Canaan Valley	39.06	-79.42	GRA	
US-Dk1	Duke Forest-open field	35.97	-79.09	GRA	Oren et al., 2006
US-FPe	Fort Peck	48.31	-105.10	GRA	
US-Goo	Goodwin Creek	34.25	-89.87	GRA	
US-IB2	FNAL- Batavia Prairie site	41.84	-88.24	GRA	
US-Var	Vaira Ranch- Ione	38.41	-120.95	GRA	Xu and Baldocchi, 2004
US-Wkg	Walnut Gulch Kendall Grasslands	31.74	-109.94	GRA	Scott et al., 2010
US-Bo1	Bondville	40.01	-88.29	CRO	Hollinger et al., 2005
US-Bo2	Bondville companion site	40.01	-88.29	CRO	Hollinger et al., 2005
US-IB1	FNAL- Batavia Agricultural site	41.86	-88.22	CRO	
US-Ne1	Mead - irrigated continuous maize site	41.17	-96.48	CRO	Verma et al., 2005
US-Ne2	Mead - irrigated maize-soybean rotation site	41.16	-96.47	CRO	Verma et al., 2005
US-Ne3	Mead - rainfed maize-soybean rotation site	41.18	-96.44	CRO	Verma et al., 2005

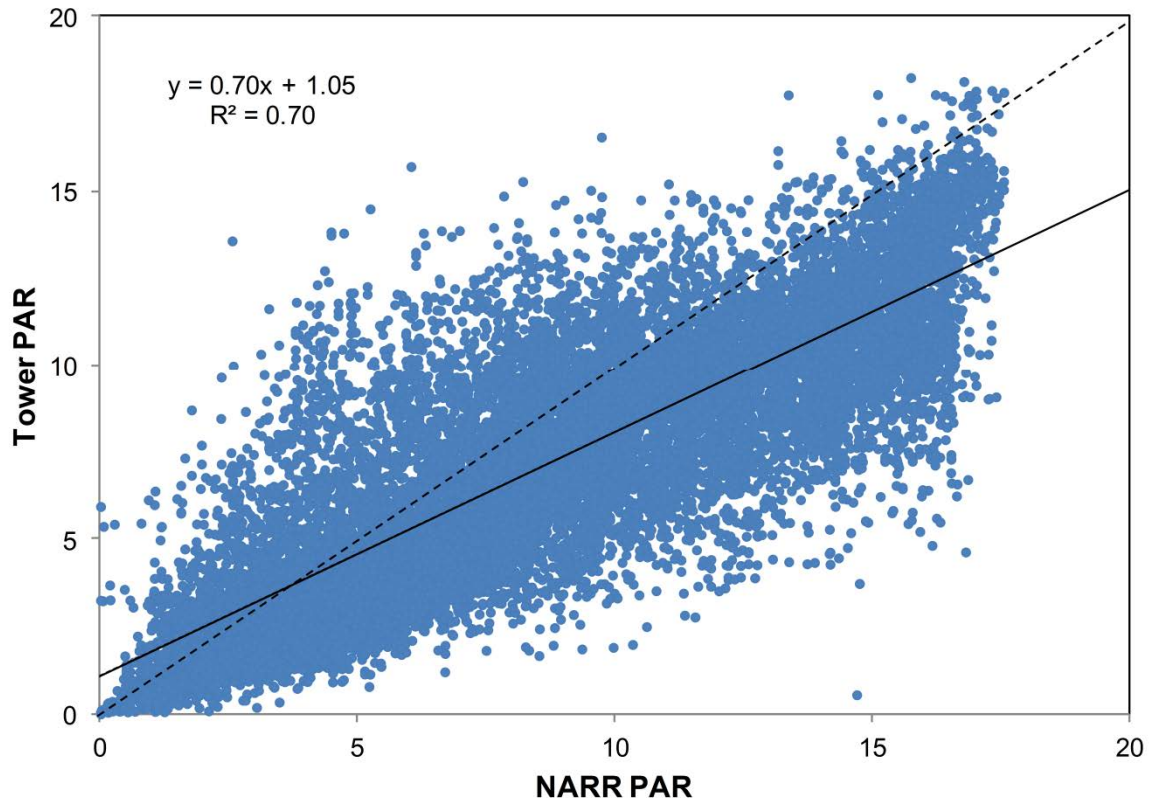

Fig. 1 Calibration of NARR PAR data with PAR observations from eddy covariance flux sites. The units of PAR are MJ m^{-2} d^{-1}.

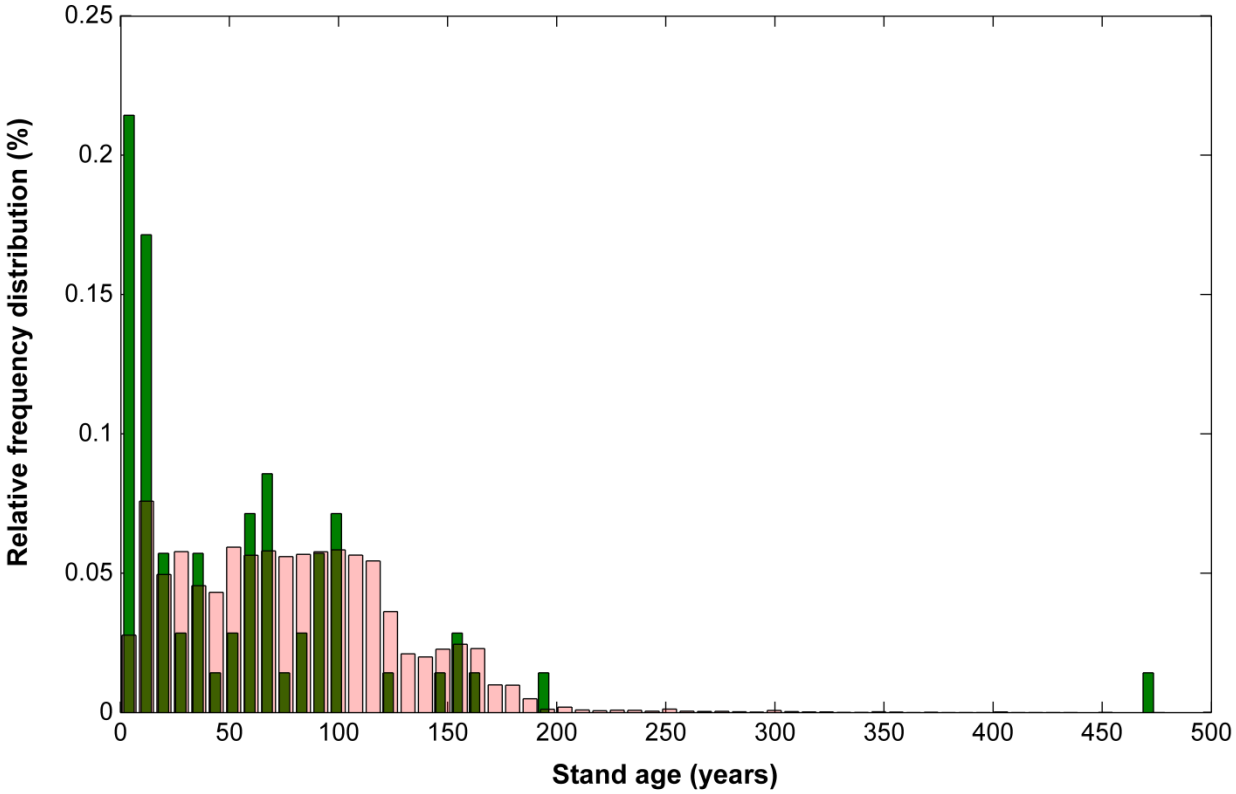

Fig. 2 Relative frequency distributions of stand age over North America. Red bars indicate the stand age distribution of all forested grid cells based on the continental-scale stand age map (Pan et al., 2011). Green bars indicate the stand age distribution of the forested eddy covariance (EC) flux sites across the continent. The means of the continental-scale map and the forested EC flux sites are 78.9 and 54.6 years, respectively, and the standard deviations are 51.3 and 69.3, respectively.

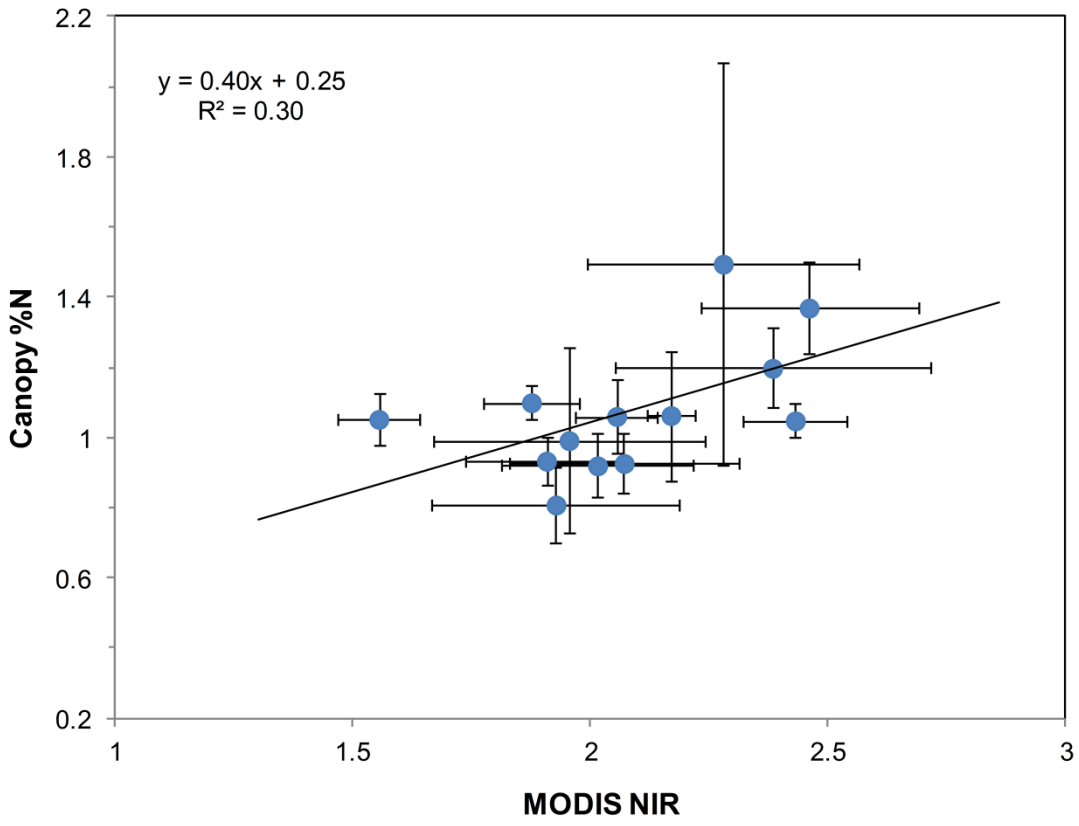

Fig. 3 Relationship between canopy %N and MODIS NIR for 13 sites in Oregon. For each site, the error bars indicate the standard deviations of canopy %N and MODIS NIR across the plots.

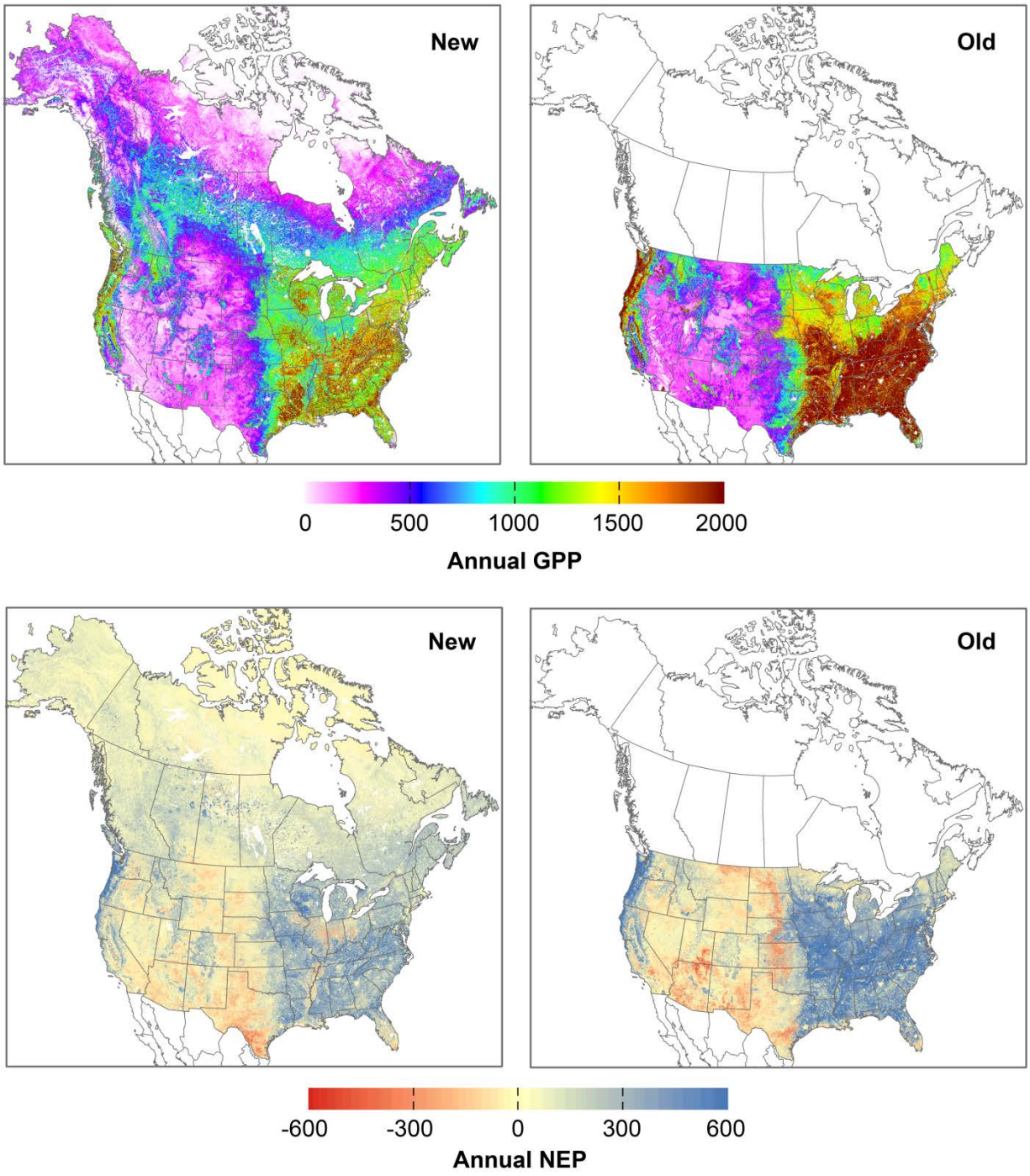

Fig. 4 Comparison of our carbon flux estimates in this study (*new*) with our previous estimates (*old*; GPP - Xiao et al., 2010; NEP – Xiao et al. 2011). The units are g C m^{-2} yr^{-1}.

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