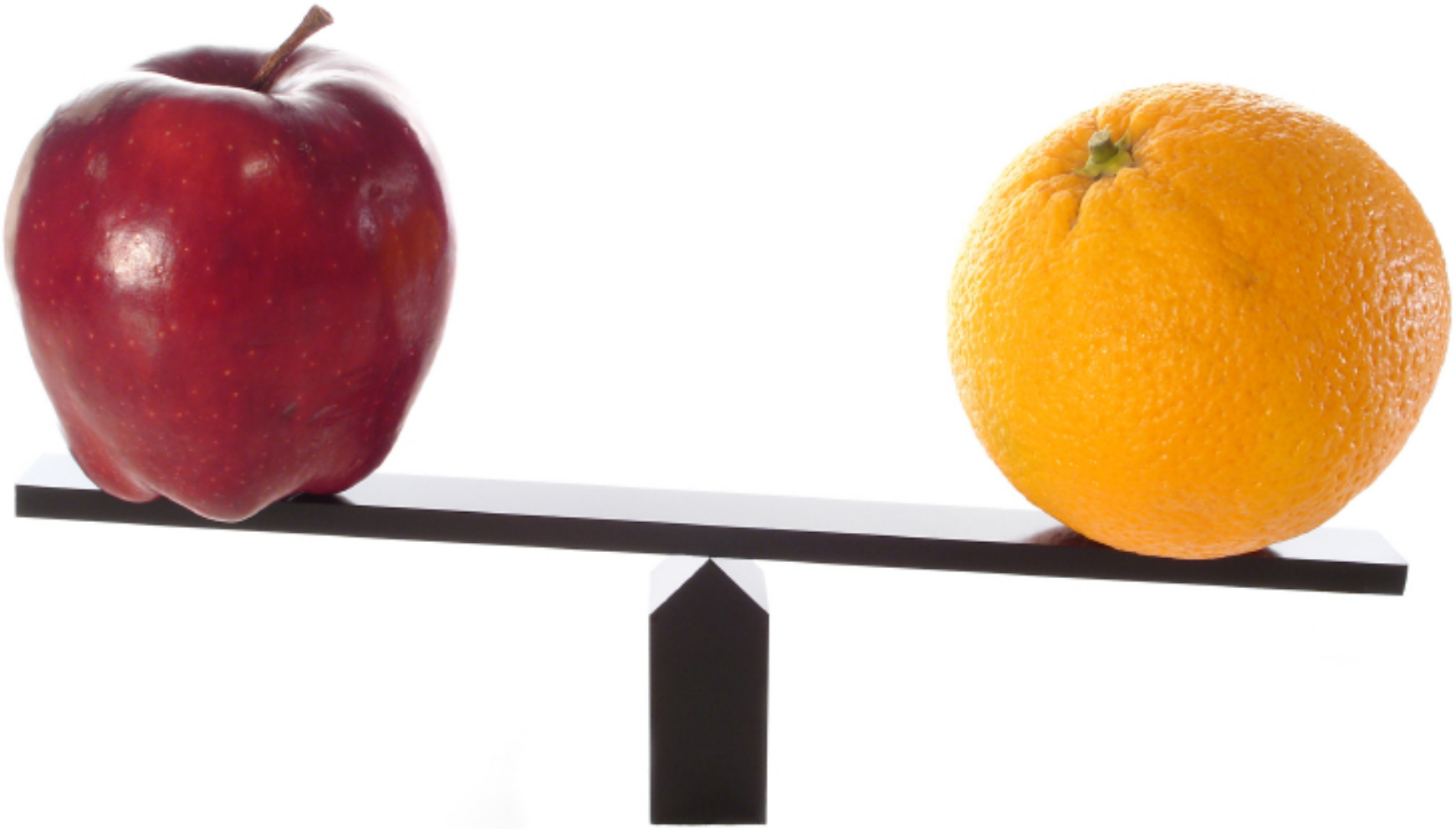
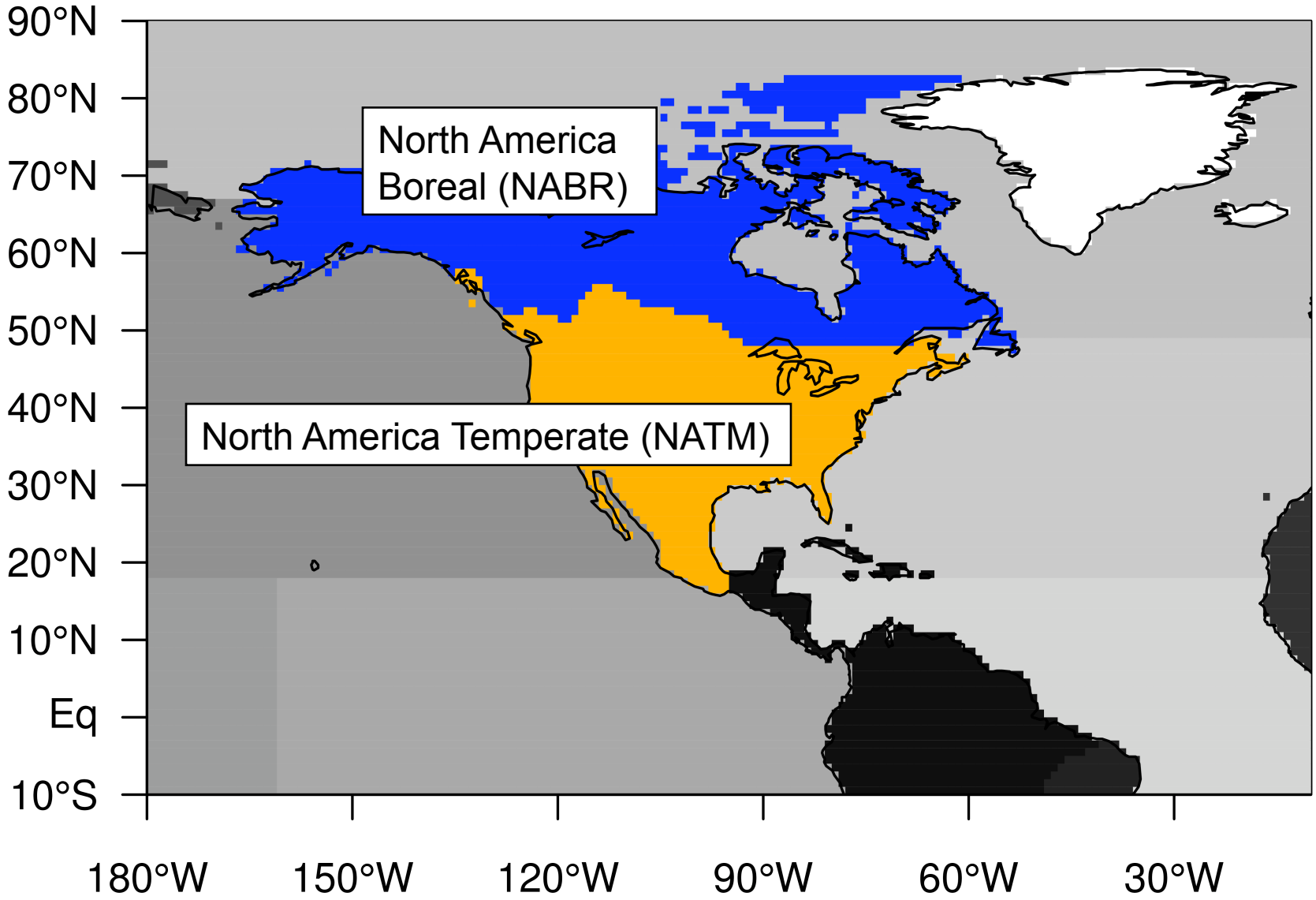
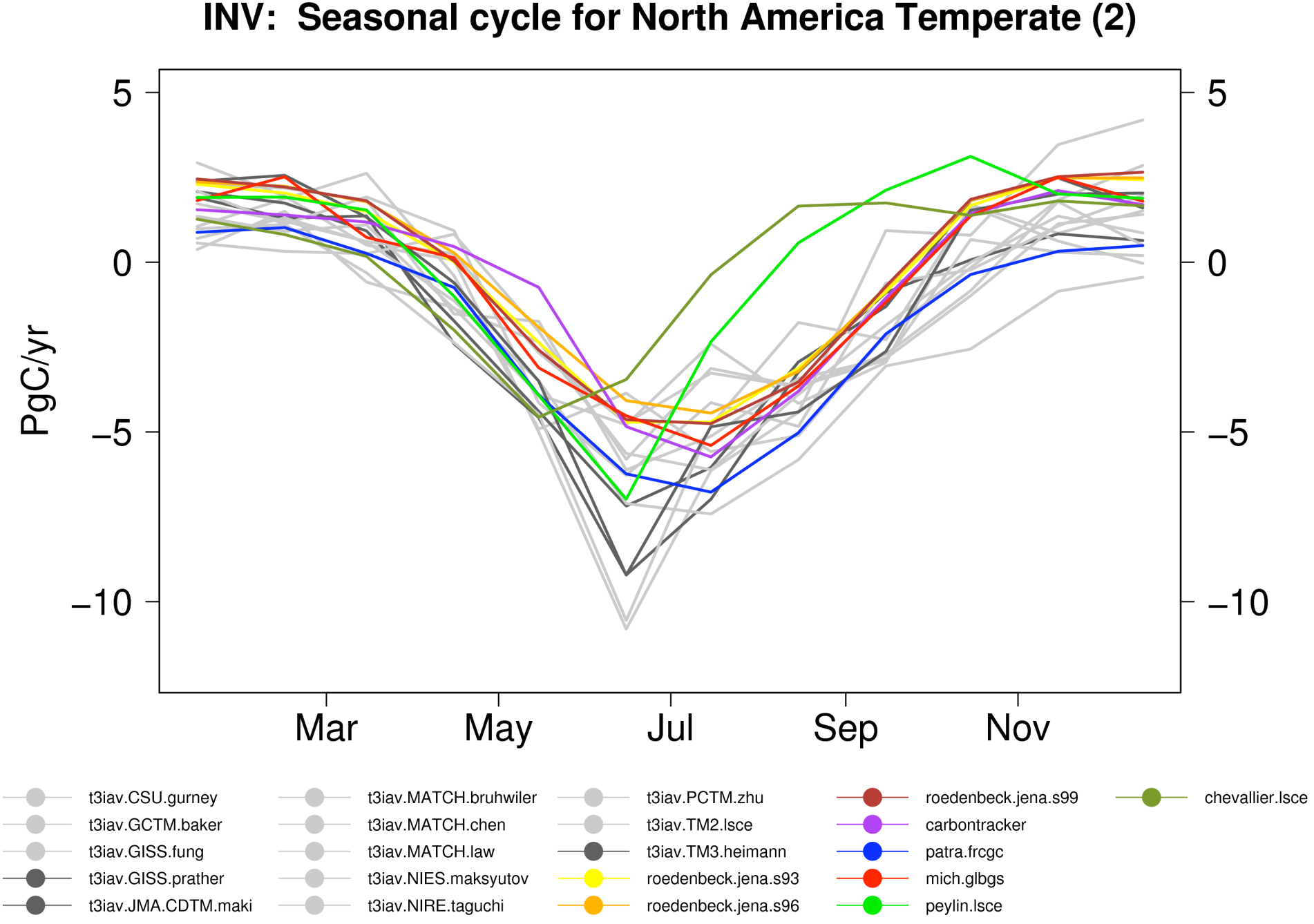
NACP Interim Synthesis: Continental Fluxes from Forward and Inverse Models

Andy Jacobson, Mac Post, Debbie Huntzinger, Bob Cook, and lots of modelers



1° x 1° TransCom region map




INV: Seasonal cycle for North America Temperate (2)
PgC/yr
5
0
−5
−10
Mar
May
Jul
Sep
Nov
t3iav.CSU.gurney
t3iav.GCTM.baker
t3iav.GISS.fung
t3iav.GISS.prather
t3iav.JMA.CDTM.maki
t3iav.MATCH.bruhwiler
t3iav.MATCH.chen
t3iav.MATCH.law
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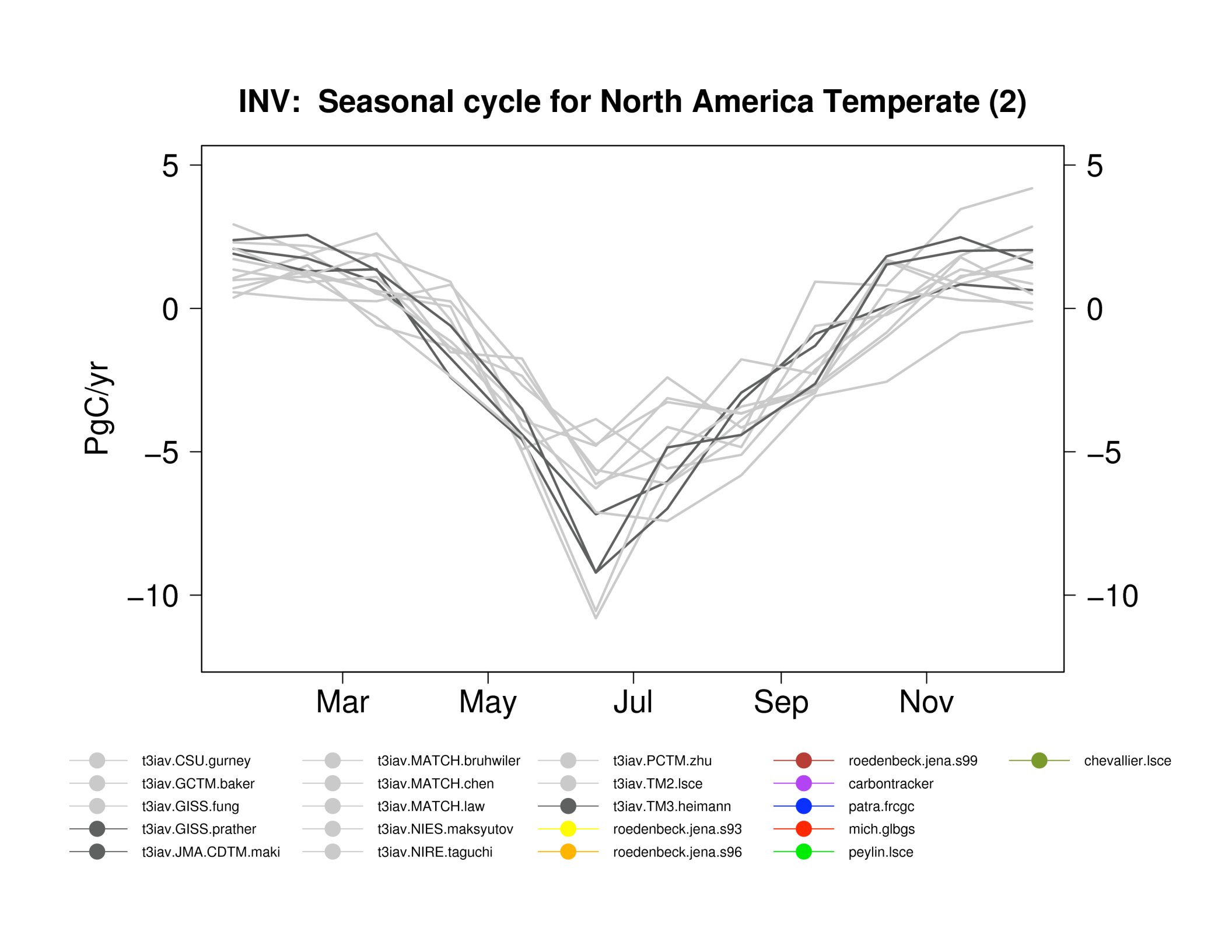
roedenbeck.jena.s99
carbontracker
patra.frcgc
mich.glbgs
peylin.lsce
chevallier.lsce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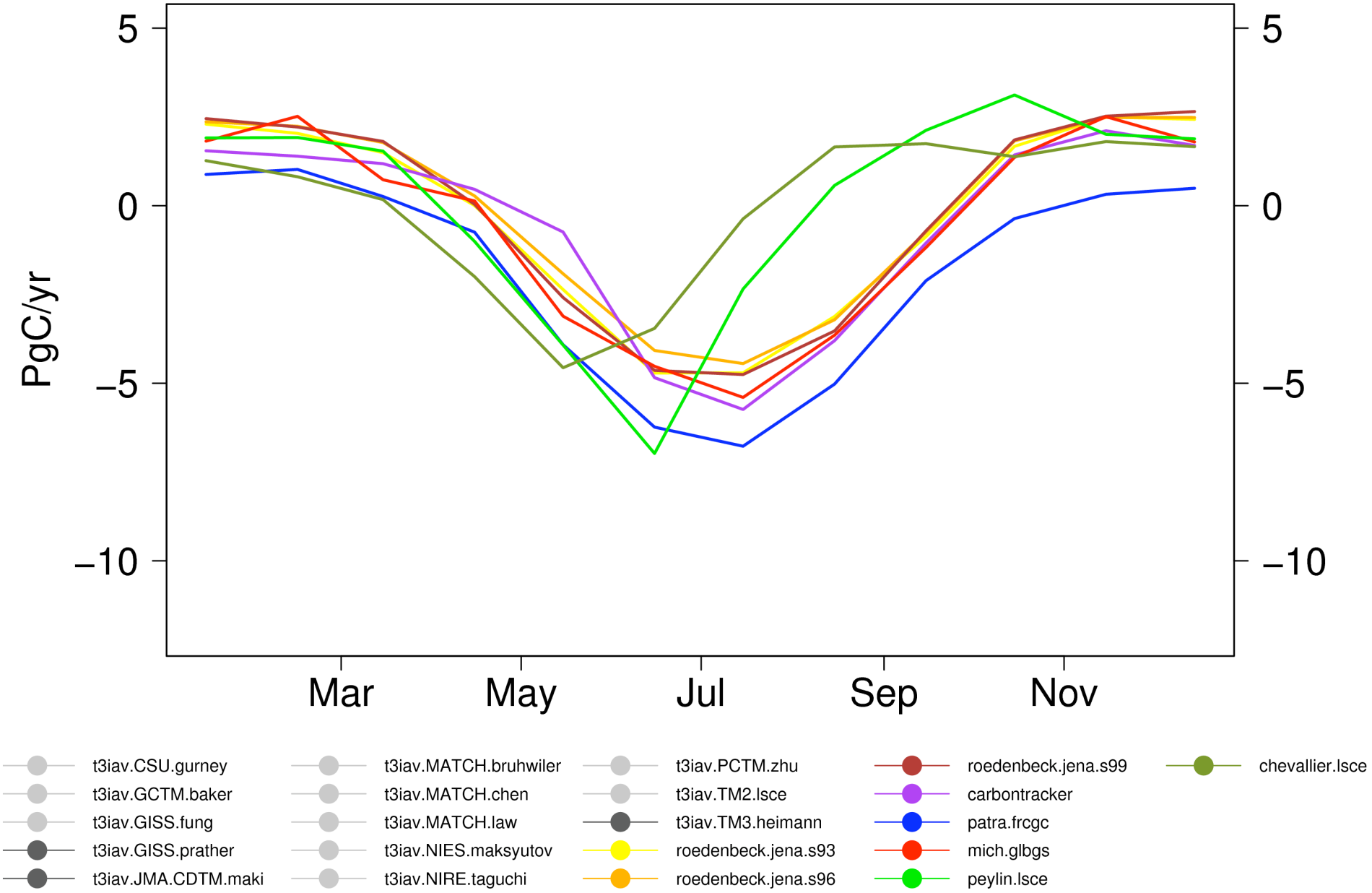
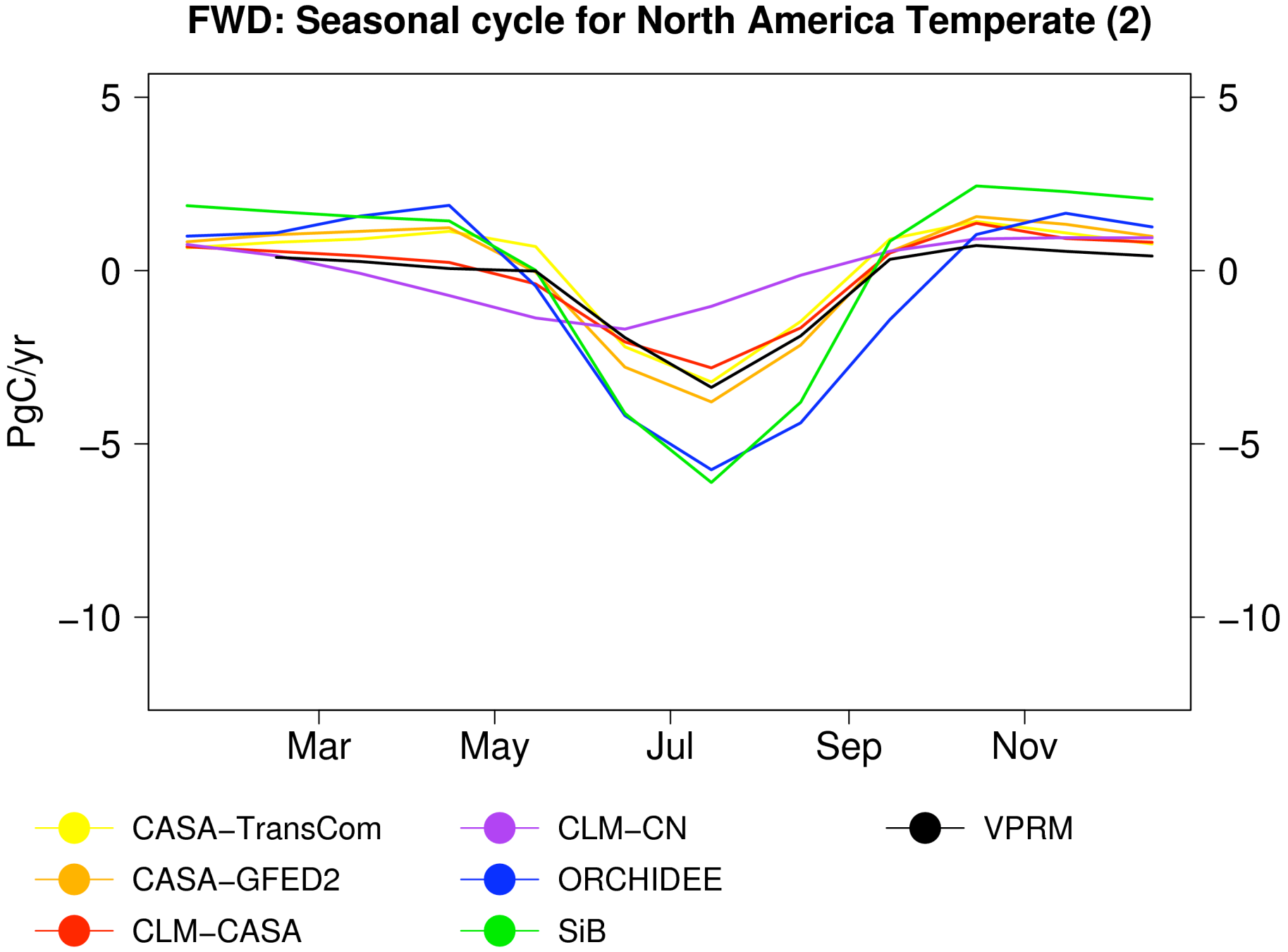
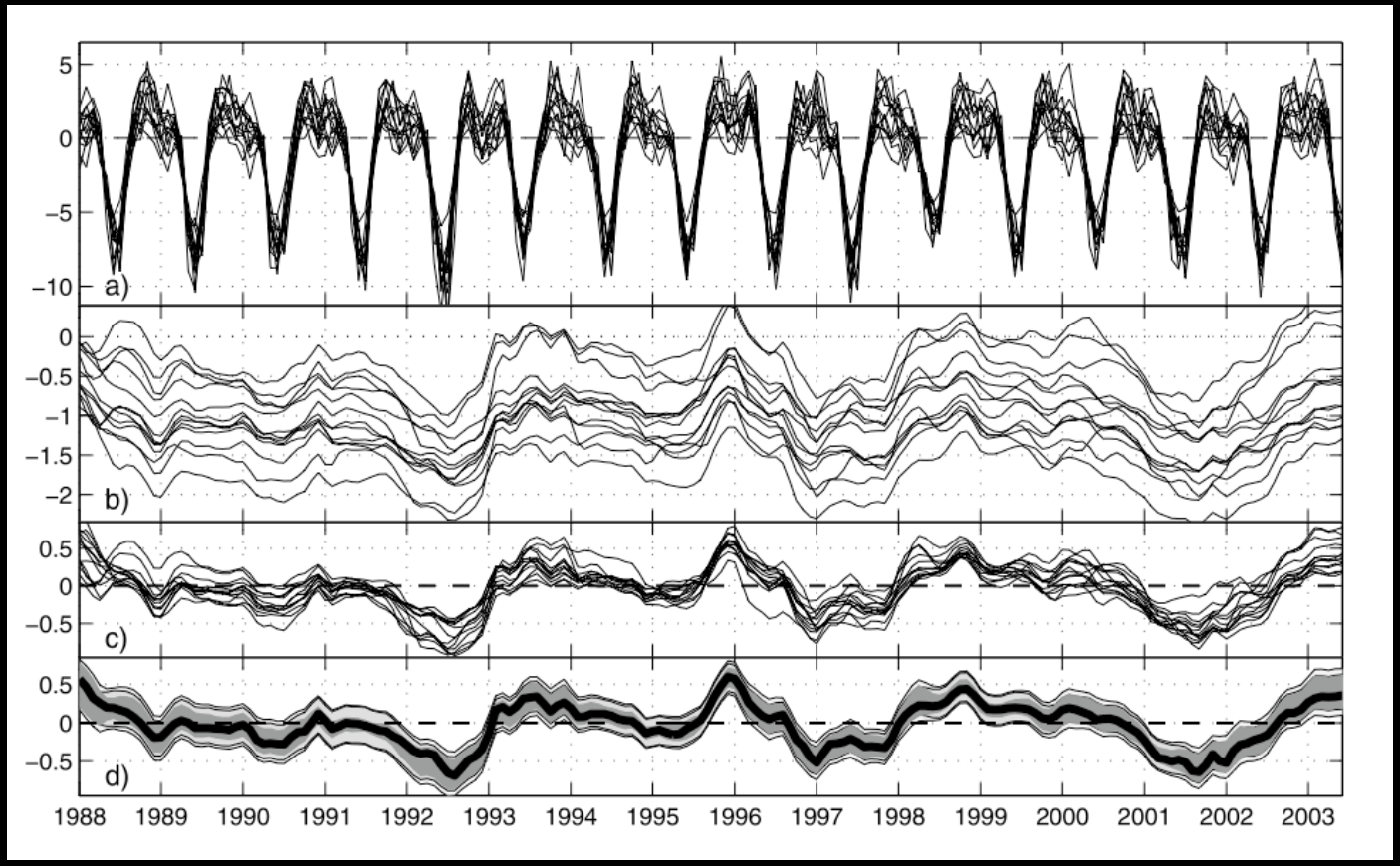
INV: Seasonal cycle for North America Temperate (2)




FWD: Seasonal cycle for North America Temperate (2)
PgC/yr
5
0
−5
−10
Mar
May
Jul
Sep
Nov
CASA−TransCom
CASA−GFED2
CLM−CASA
CLM−CN
ORCHIDEE
SiB
VPRM

Transcom IAV inversion, fluxes over Europe
Baker *et al.* (2006)



Monthly

Deseasonalized

IAV

Interannual variability over North America (boreal + temperate)

Inversion name	Time span	Annual Uptake (year)		IAV	
		Biggest	Smallest	peak-peak	stddev
t3iav.CSU.gurney	18 years (1988-2005)	-2.2 (1994)	-0.5 (2000)	1.7	0.5
t3iav.GCTM.baker	18 years (1988-2005)	-1.6 (1994)	0.2 (2002)	1.8	0.5
t3iav.GISS.fung	18 years (1988-2005)	-1.5 (1994)	-0.2 (2000)	1.3	0.3
t3iav.GISS.prather	18 years (1988-2005)	-1.3 (1993)	0.4 (2001)	1.7	0.4
t3iav.JMA.CDTM.maki	18 years (1988-2005)	-2.2 (1994)	-0.3 (2001)	1.9	0.6
t3iav.MATCH.bruhwiler	18 years (1988-2005)	-1.8 (1994)	-0.8 (2000)	1.0	0.3
t3iav.MATCH.chen	18 years (1988-2005)	-2.0 (1994)	-1.1 (2001)	0.9	0.3
t3iav.MATCH.law	18 years (1988-2005)	-2.3 (1994)	-0.9 (1992)	1.4	0.4
t3iav.NIES.maksyutov	18 years (1988-2005)	-1.9 (1994)	0.2 (2001)	2.1	0.5
t3iav.NIRE.taguchi	18 years (1988-2005)	-2.6 (1994)	-1.2 (1996)	1.4	0.4
t3iav.PCTM.zhu	18 years (1988-2005)	-1.9 (1994)	-1.0 (1992)	0.9	0.3
t3iav.TM2.lsce	18 years (1988-2005)	-2.5 (1994)	-0.1 (2001)	2.3	0.6
t3iav.TM3.heimann	18 years (1988-2005)	-2.5 (1994)	-1.2 (2001)	1.3	0.4
roedenbeck.jena.s93	14 years (1993-2006)	-1.2 (2004)	-0.3 (1994)	0.8	0.3
roedenbeck.jena.s96	11 years (1996-2006)	-0.9 (2004)	-0.1 (2000)	0.7	0.3
roedenbeck.jena.s99	8 years (1999-2006)	-1.0 (1999)	-0.4 (2002)	0.5	0.2
carbontracker	7 years (2000-2006)	-0.9 (2004)	-0.1 (2002)	0.8	0.3
patra.frcgc	6 years (2000-2005)	-2.0 (2004)	-1.4 (2000)	0.6	0.3
mich.glbgs	5 years (1997-2001)	-0.9 (1997)	-0.4 (2001)	0.4	0.2
peylin.lsce	8 years (1996-2003)	-0.6 (2002)	0.7 (2000)	1.3	0.4
chevallier.lsce	7 years (2000-2006)	-0.7 (2004)	-0.2 (2002)	0.5	0.2
rayner.2008	14 years (1992-2005)	-2.2 (1994)	-1.2 (2002)	1.0	0.4

Interannual variability over North America (boreal + temperate)

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t3iav.NIRE.taguchi	18 years (1988-2005)	-2.6 (1994)	-1.2 (1996)	1.4	0.4
t3iav.PCTM.zhu	18 years (1988-2005)	-1.9 (1994)	-1.0 (1992)	0.9	0.3
t3iav.TM2.lsce	18 years (1988-2005)	-2.5 (1994)	-0.1 (2001)	2.3	0.6
t3iav.TM3.heimann	18 years (1988-2005)	-2.5 (1994)	-1.2 (2001)	1.3	0.4
roedenbeck.jena.s93	14 years (1993-2006)	-1.2 (2004)	-0.3 (1994)	0.8	0.3
roedenbeck.jena.s96	11 years (1996-2006)	-0.9 (2004)	-0.1 (2000)	0.7	0.3
roedenbeck.jena.s99	8 years (1999-2006)	-1.0 (1999)	-0.4 (2002)	0.5	0.2
carbontracker	7 years (2000-2006)	-0.9 (2004)	-0.1 (2002)	0.8	0.3
patra.frcgc	6 years (2000-2005)	-2.0 (2004)	-1.4 (2000)	0.6	0.3
mich.glbgs	5 years (1997-2001)	-0.9 (1997)	-0.4 (2001)	0.4	0.2
peylin.lsce	8 years (1996-2003)	-0.6 (2002)	0.7 (2000)	1.3	0.4
chevallier.lsce	7 years (2000-2006)	-0.7 (2004)	-0.2 (2002)	0.5	0.2
rayner.2008	14 years (1992-2005)	-2.2 (1994)	-1.2 (2002)	1.0	0.4

T3IAV: effect of *transport*; methodology and data held constant

Interannual variability over North America (boreal + temperate)

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rayner.2008	14 years (1992-2005)	-2.2 (1994)	-1.2 (2002)	1.0	0.4

Jena: effect of *data density*; methodology and transport held constant

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Interannual variability over North America (boreal + temperate)

Forward Model	Time span	Annual Uptake (year)		IAV	
		Biggest	Smallest	peak-peak	stddev
CASA-TransCom	2 years (2002-2003)	0.23 (2003)	0.26 (2002)	0.03	0.02
CASA-GFED2	6 years (2000-2005)	-0.28 (2003)	-0.00 (2002)	0.28	0.09
CLM-CASA'	5 years (2000-2004)	-0.65 (2004)	-0.04 (2002)	0.61	0.23
CLM-CN	5 years (2000-2004)	-0.40 (2004)	-0.20 (2003)	0.20	0.08
ORCHIDEE	7 years (2001-2007)	-2.12 (2004)	-1.32 (2002)	0.80	0.29
SiB	6 years (2000-2005)	-0.01 (2005)	0.01 (2000)	0.02	0.01
VPRM	1 years (2004-2005)	-0.92 (2004)	-0.92 (2004)	0.00	NA

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Interannual variability over North America (boreal + temperate)

Forward Model	Time span	Annual Uptake (year) Biggest	Annual Uptake (year) Smallest	IAV peak-peak	IAV stddev
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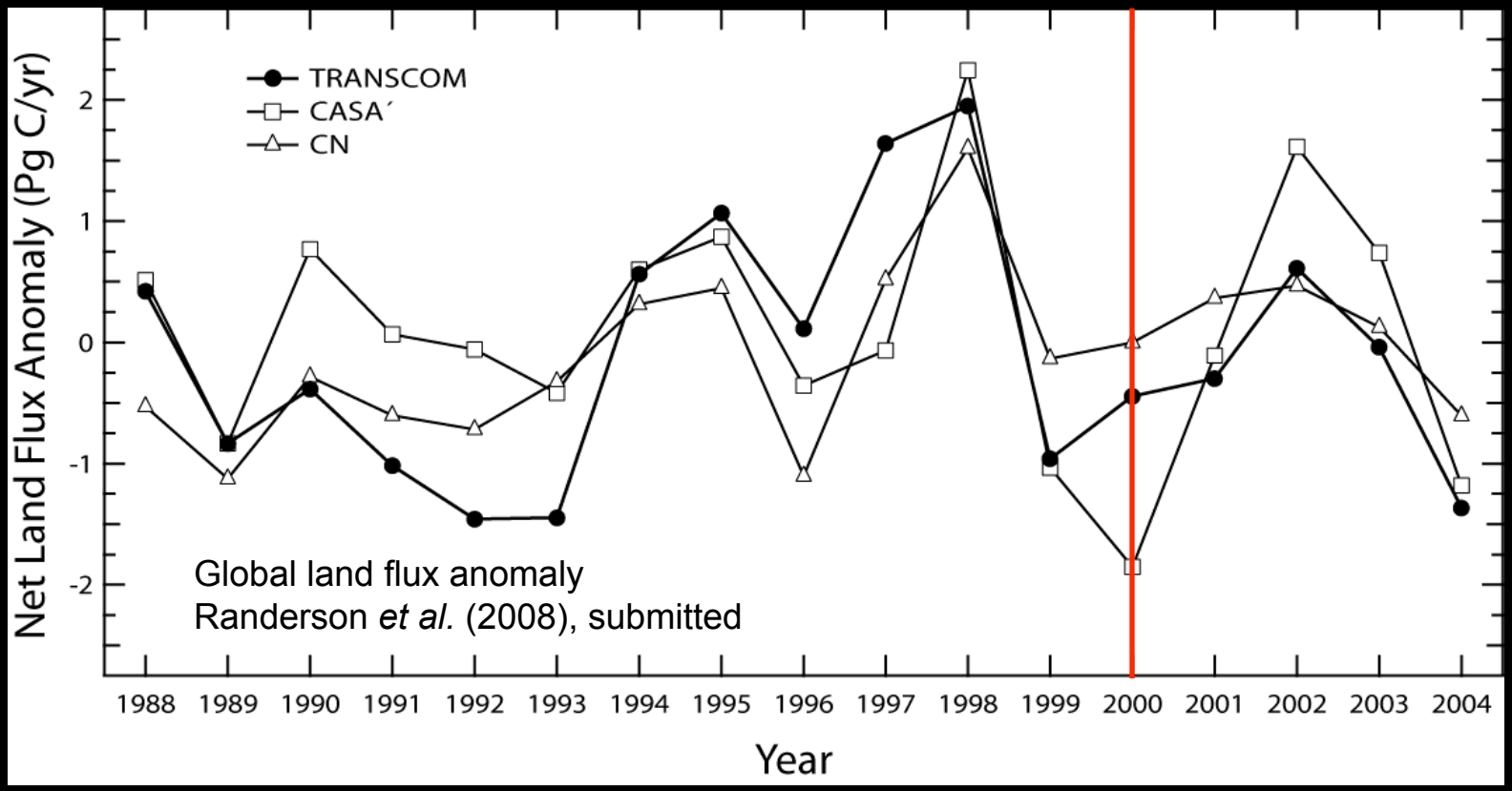
VPRM	1 years (2004-2005)	-0.92 (2004)	-0.92 (2004)	0.00	NA



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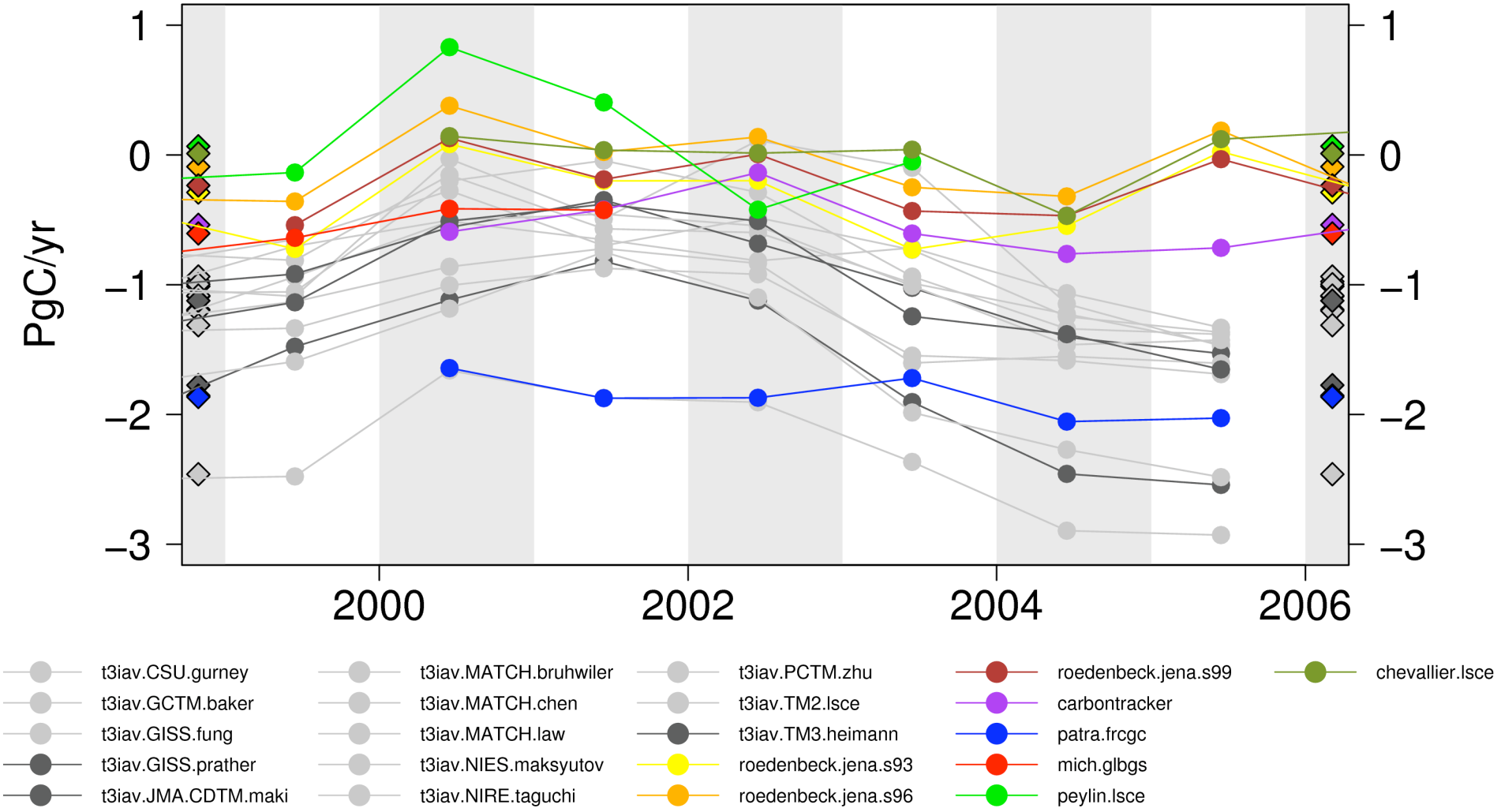
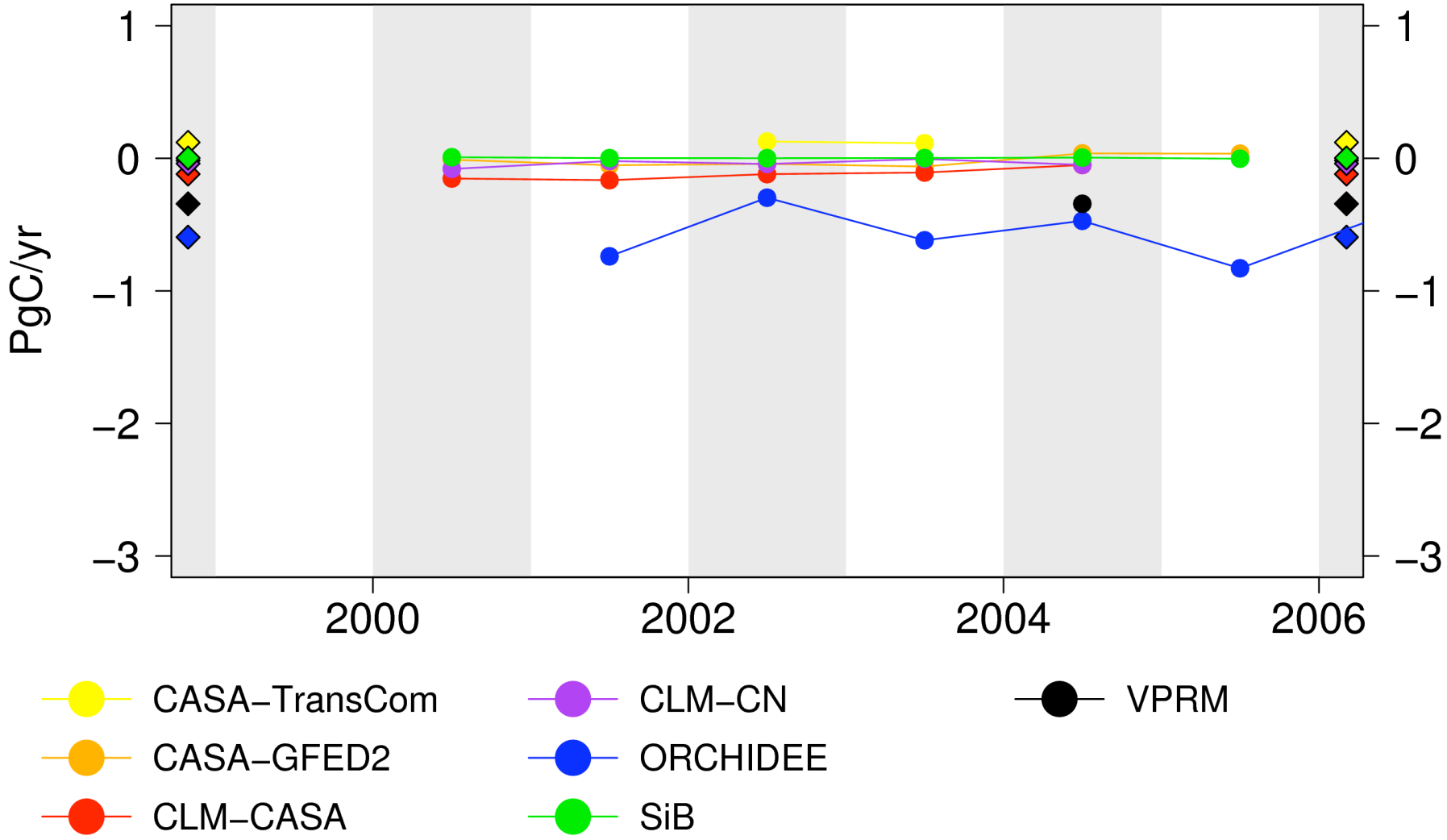
SiB	6 years (2000-2005)	-0.01 (2005)	0.01 (2000)	0.02	0.01
VPRM	1 years (2004-2005)	-0.92 (2004)	-0.92 (2004)	0.00	NA

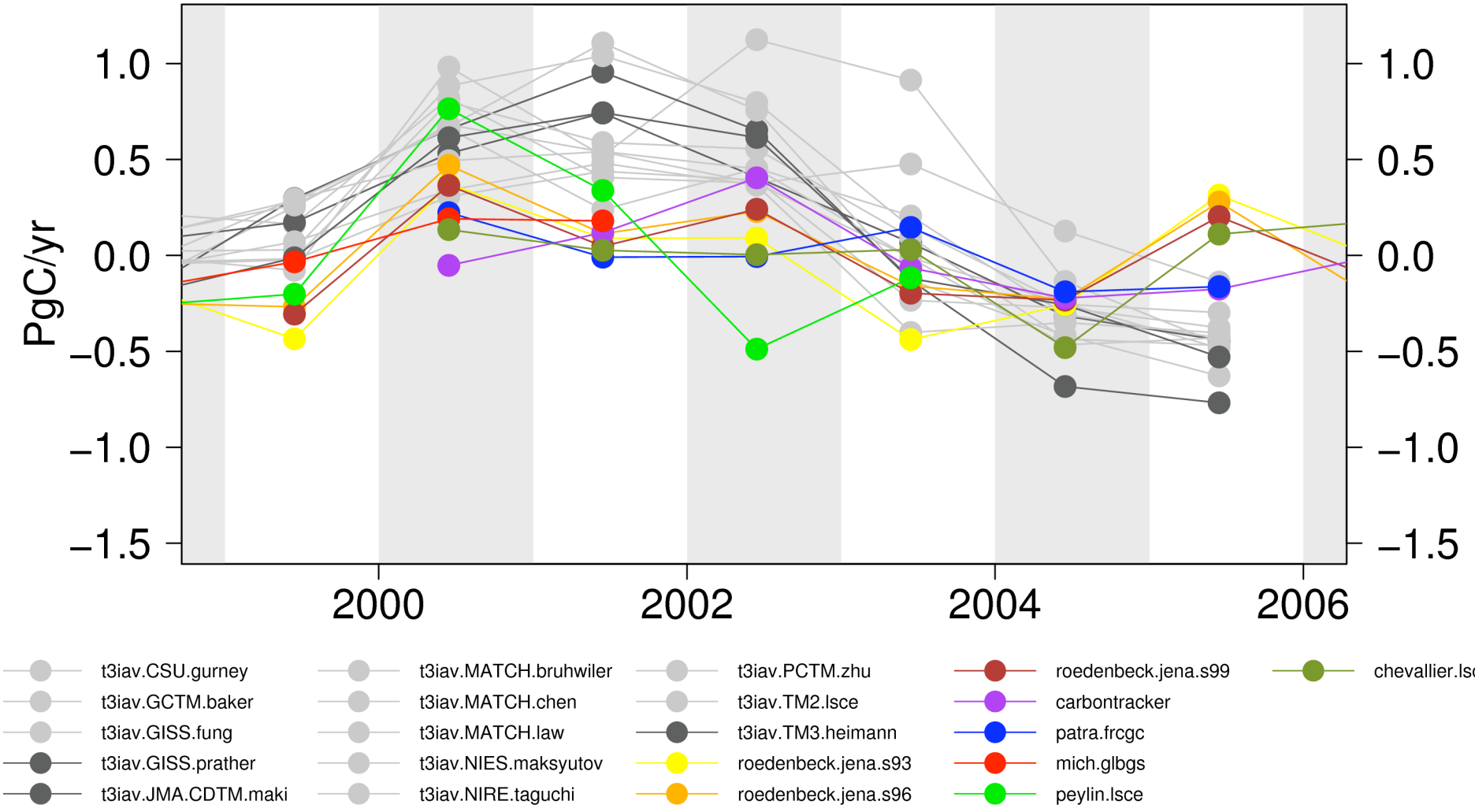
INV: Annual mean for North America Temperate (2)



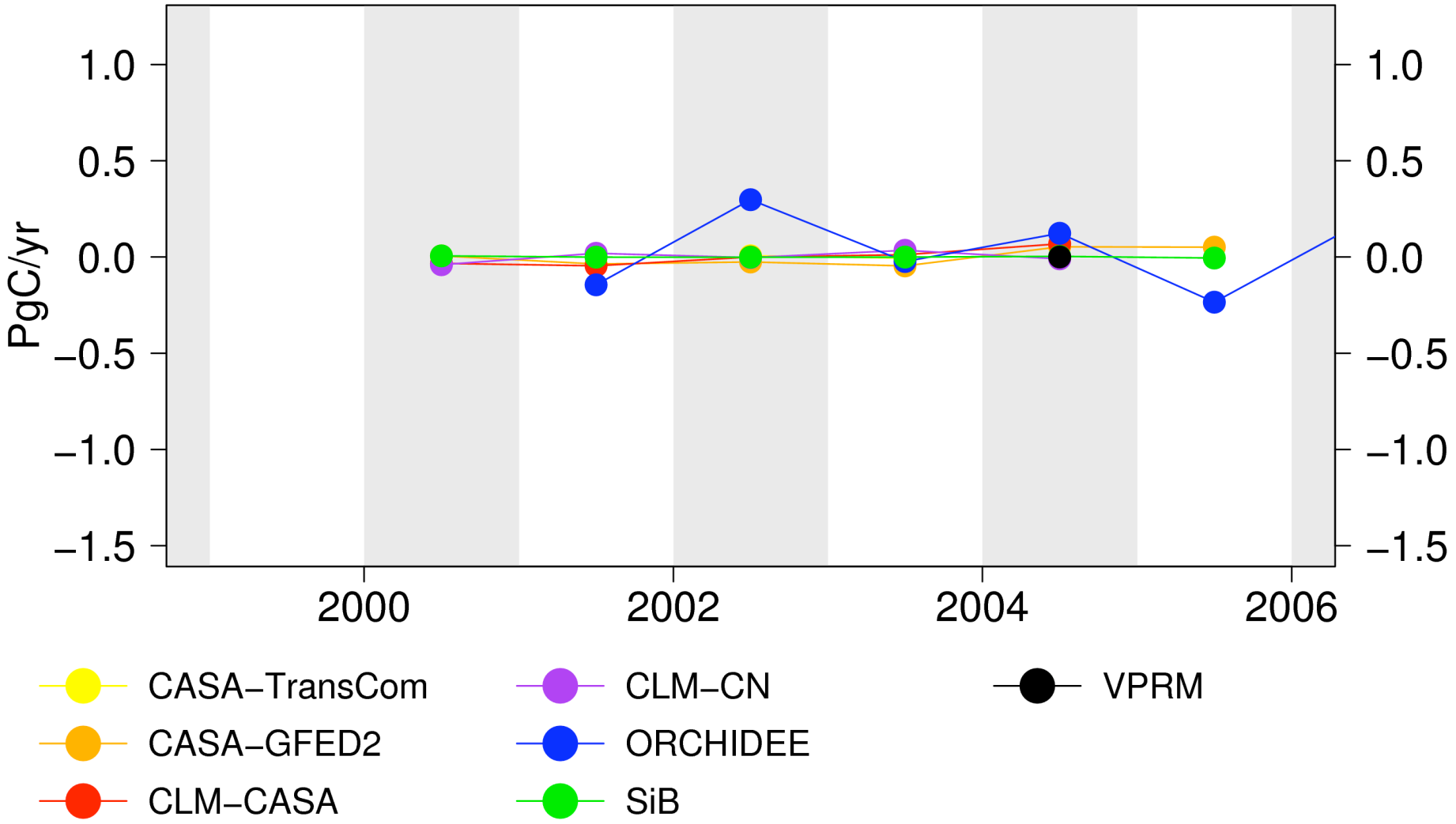
FWD: Annual mean for North America Temperate (2)



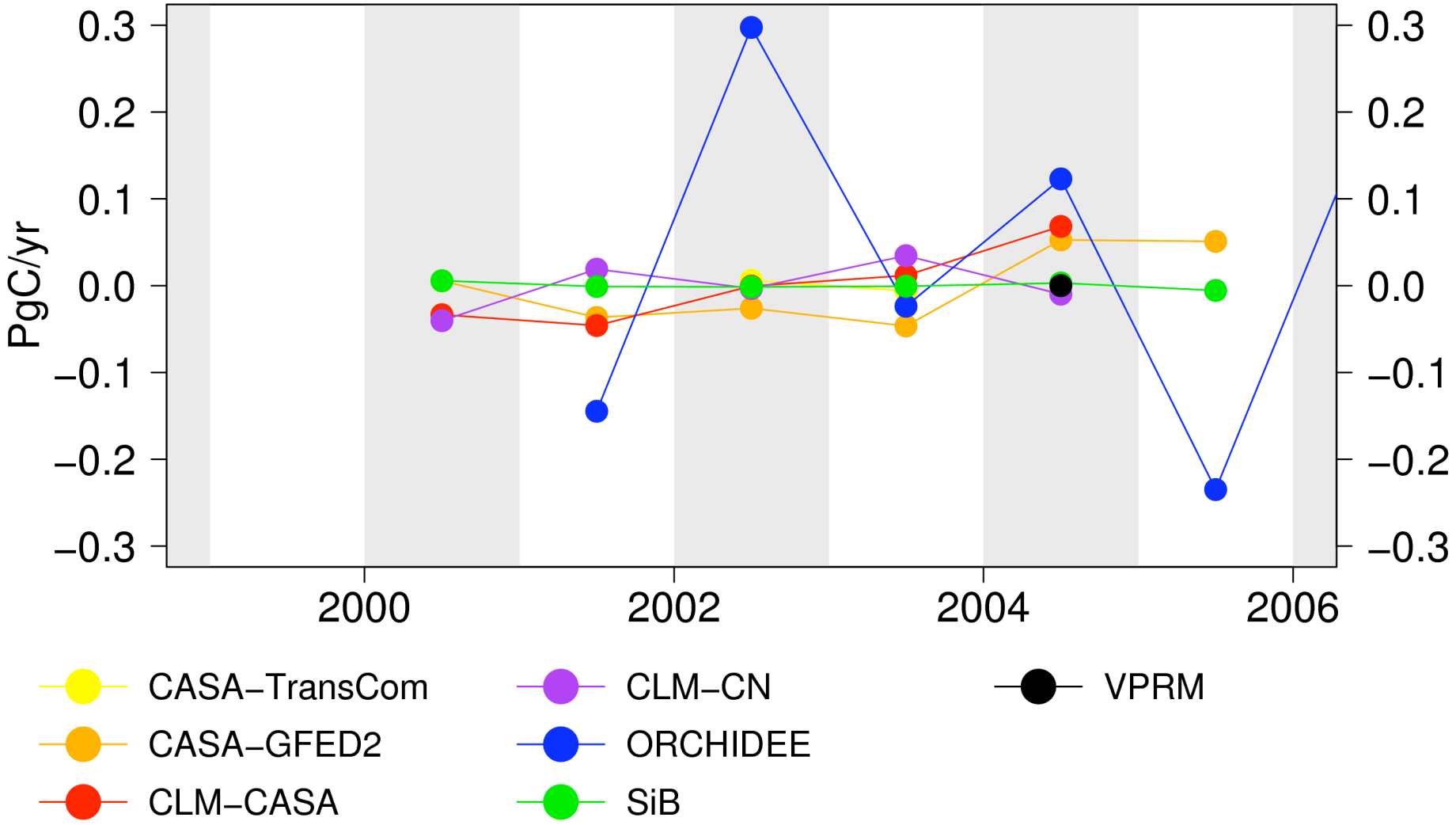
INV: IAV (model mean removed) for North America Temperate (2)



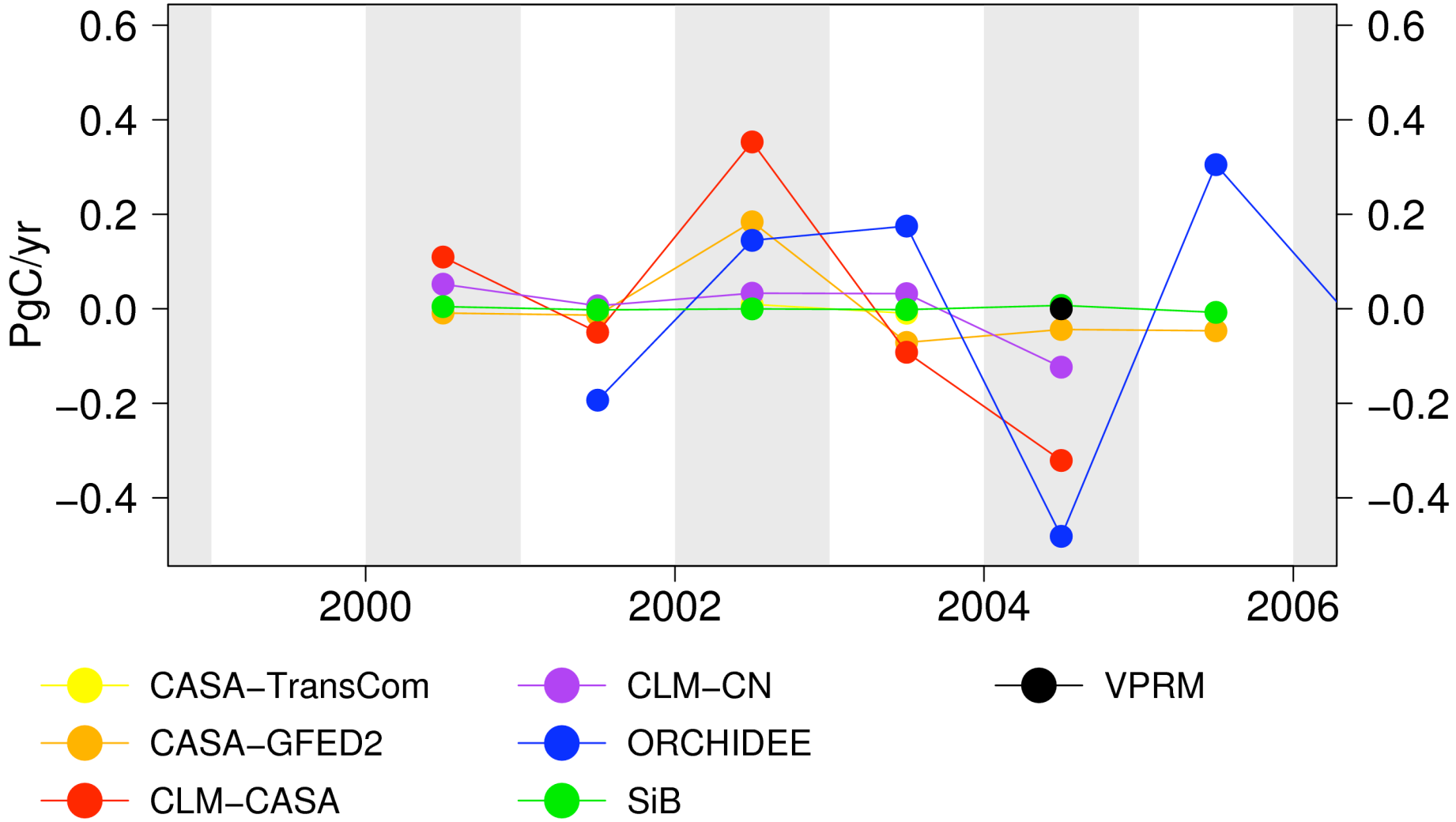
FWD: IAV (model mean removed) for North America Temperate (2)



FWD: IAV (model mean removed) for North America Temperate (2)



FWD: IAV (model mean removed) for North America Boreal (1)



North America (boreal and temperate) summary stats

Inversions	Central	25th percentile	75th percentile
Uptake	1.0	0.7	1.4
IAV peak-peak	1.2	0.8	1.6
IAV (sd)	0.34	0.26	0.44

Forward models	Central	25th percentile	75th percentile
Uptake	0.3-0.5	0.1	0.7
IAV peak-peak	0.2	0	0.4
IAV (sd)	0.10	0.04	0.19

Conclusions

Inversions do manifest more (seasonality, uptake, IAV) over N. America than forward models.

Newer forward models have more IAV.

CASA variants have more IAV in boreal rather than temperate latitudes.

Inversions don't agree as well as one might hope.