Update on CarbonTracker

Europe, China, and South America

Wouter Peters, Ingrid van der Laan-Luijkx, Ivar van der Velde, John Miller, Luciana Gatti, Arby Zhang, Jiang Fei, Yu Liu, Aki Koyoma, Karolina Stanislawska, Arne Babenhauserheide

Current efforts

Netherlands (Wouter, Ingrid, Ivar, Maarten)

China, Nanjing University (Jing Chen & Jiang Fei)

Brazil (John Miller, Luciana Gatti, Ingrid van der Laan)

Switzerland (Niki Gruber, Dominik Brunner, & Yu Liu)

China, Chinese Academy (Baozhang Chen & Arby Zhang)

Finland (Aki Koyoma, Leif Backman, Karolina Stanislawska)

Germany (Andre Butz, Arne Babenhauserheide)

Recent progress

- Karolina Stanislawska updated the code base for CTDAS with many improvements, now released as version 1.0
- Aki Koyoma now has a prototype of a CTDAS based system for methane
- Ivar van der Velde developed a dual tracer version ($^{12}CO_2$ and $^{13}CO_2$) and started to optimize for biosphere parameters
- Ingrid van der Laan added CO into CTDAS and can now run high-resolution South America with different fire products (GFED-SIBCASA)
- Ingrid, Maarten, and John will proceed to develop a CO+CO_2 optimization scheme for South America
- Arby Zhang submitted a paper on the CarbonTracker estimates for Asia (TM5 1x1 degree zoom) to ACP

Recent progress

- Jiang Fei visited Wageningen and obtained CTDAS, now switched from ‘old’ base function approach (published this summer) to the new ensemble approach

- Feng Deng published a paper on the use of forest stand-age information in a TM5 based optimization scheme for North America

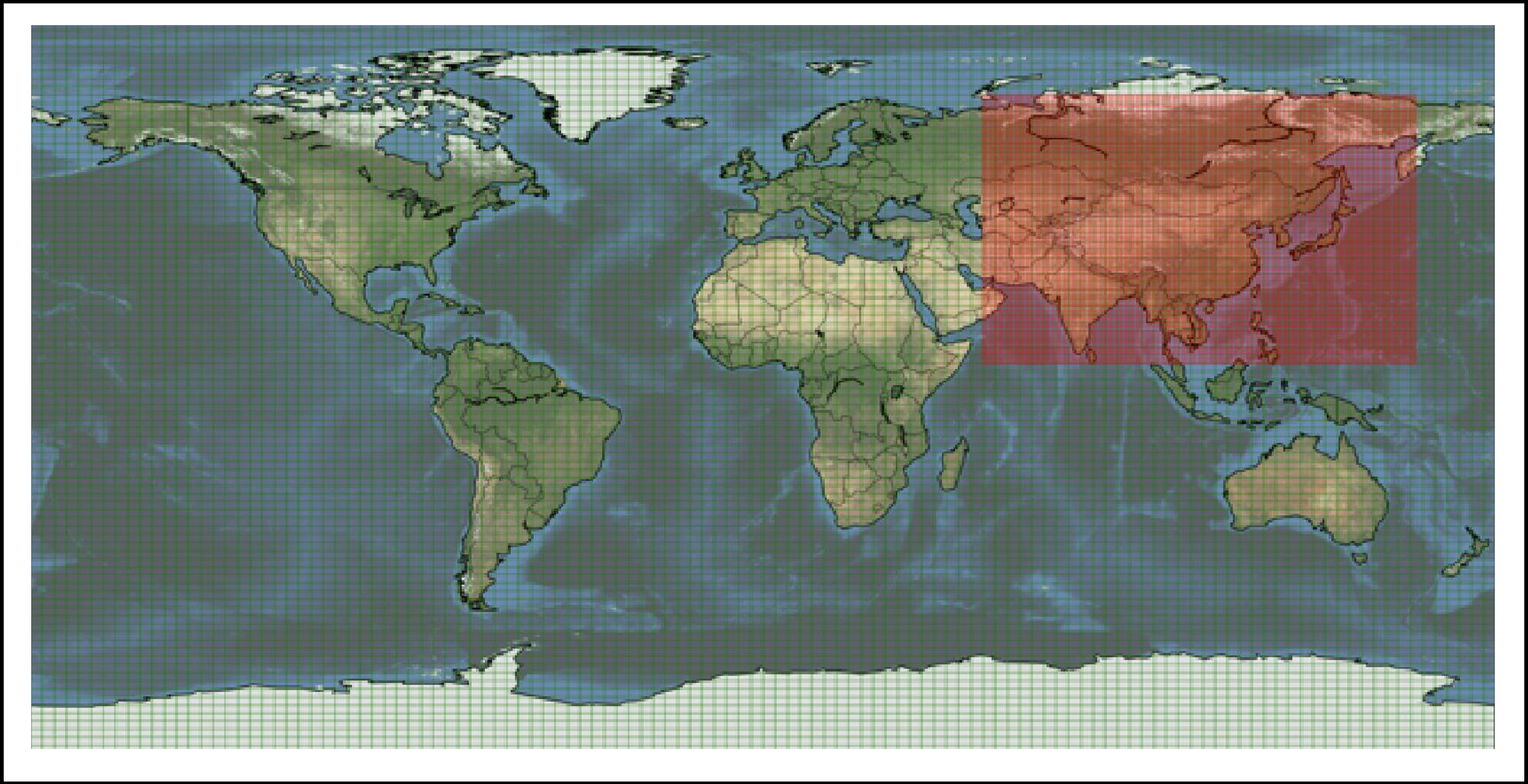
- Yu Liu is preparing to run a high resolution version of COSMO for Switzerland inside the CTDAS optimization system

- Arne is presenting his work today

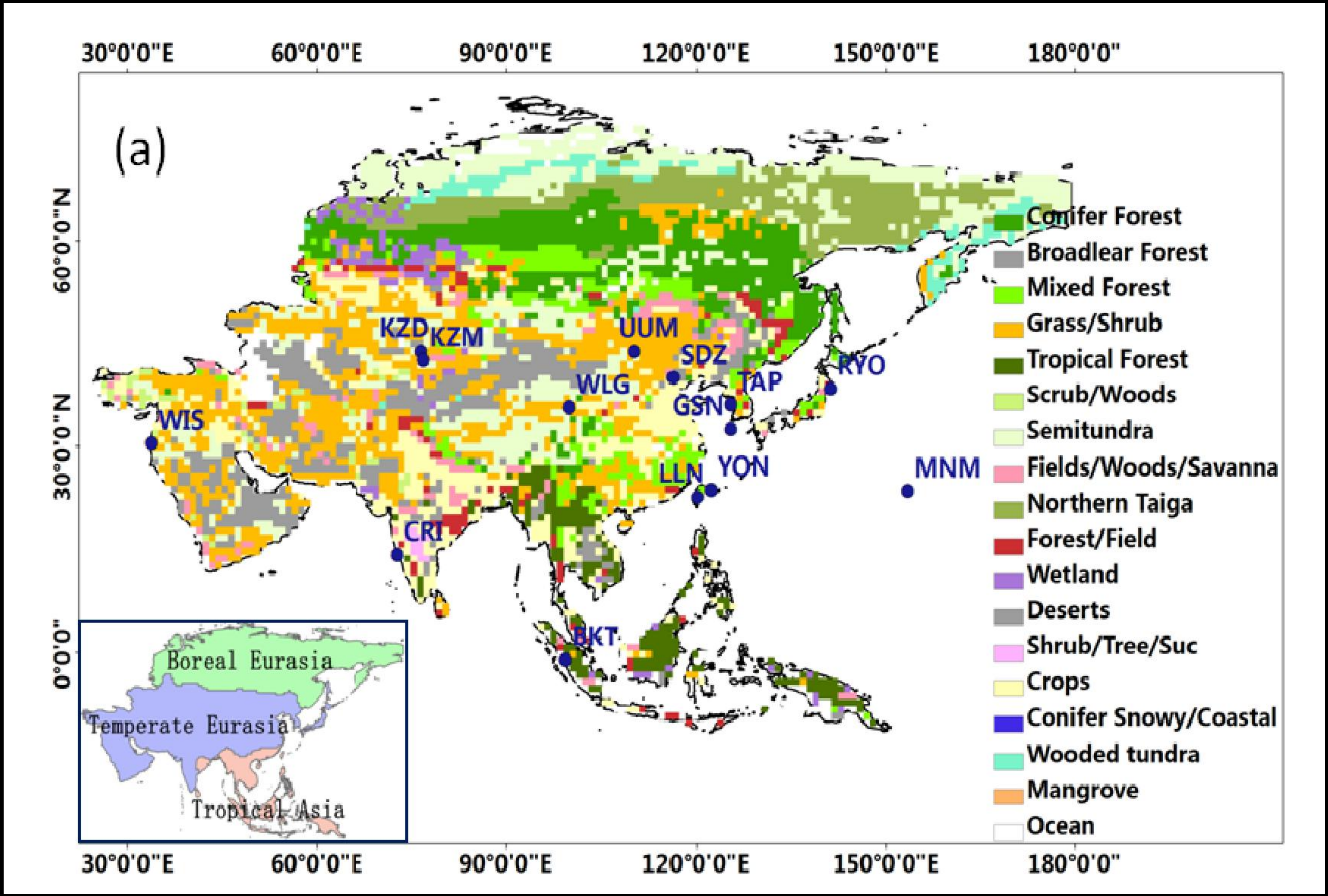
- Ingrid and Wouter have tested and released a new gridded CO_2 exchange estimate made with the new CTDAS code (release 1.0) and are now focusing on ocean carbon fluxes

- Wouter and Emma have worked on the N-S transport of SF6 and its impact on CO_2 exchange estimates

CarbonTracker China



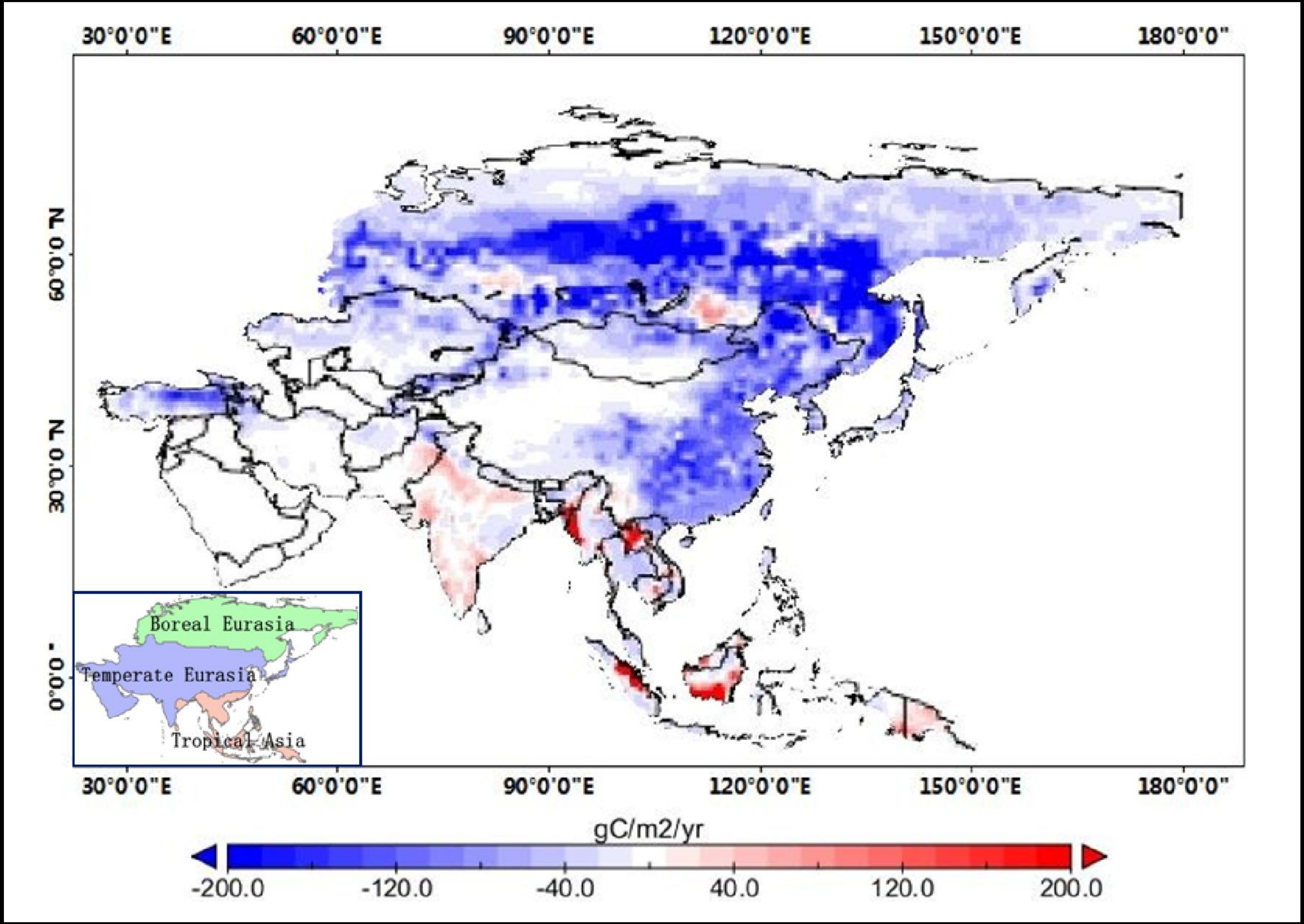
CarbonTracker China



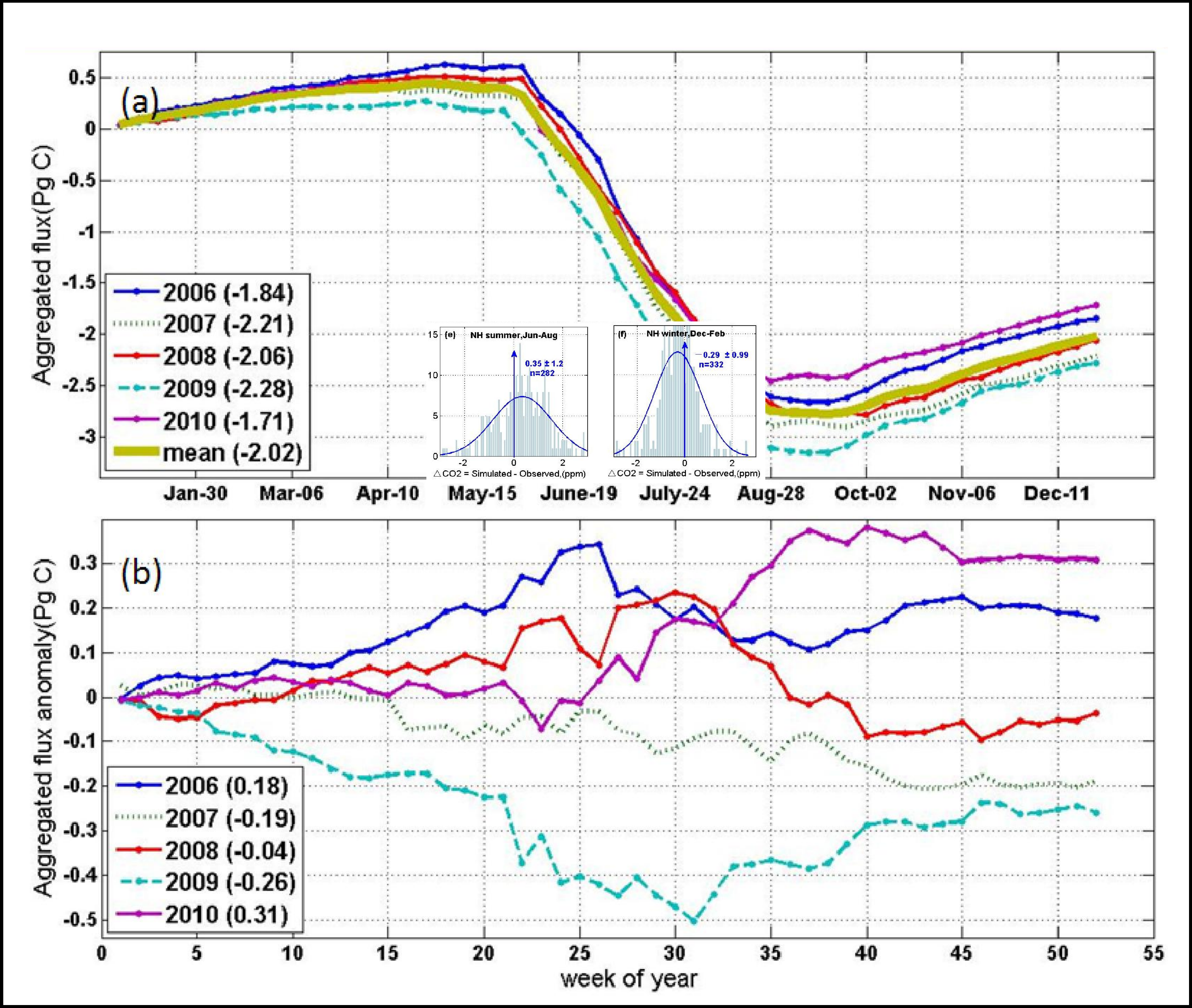
CarbonTracker China

Site	Name	Lat., Lon., Elev.	Lab	N (flagged)	MDM	Inn. X^2	Bias
Discrete samples:							
WLG	Waliguan, China	36.29° N, 100.90° E, 3810 m	CMA/ESRL	254(19)	1.5	0.83	−0.10
BKT	Bukit Kototabang, Indonesia	0.20° S, 100.312° E, 864 m	ESRL	172(0)	7.5	0.73	5.53
WIS	Sede Boker, Israel	31.13° N, 34.88° E, 400 m	ESRL	239(1)	2.5	0.62	−0.10
KZD	Sary Taukum, Kazakhstan	44.45° N, 77.57° E, 412 m	ESRL	167(6)	2.5	1.16	−0.08
KZM	Plateau Assy, Kazakhstan	43.25° N, 77.88° E, 2519 m	ESRL	155(2)	2.5	0.96	0.50
TAP	Tae-ahn Peninsula, Korea	36.73° N, 126.13° E, 20 m	ESRL	181(3)	7.5	0.60	1.82
UUM	Ulaan Uul, Mongolia	44.45° N, 111.10° E, 914 m	ESRL	231(5)	2.5	1.17	0.10
CRI	Cape Rama, India	15.08° N, 73.83° E, 60 m	CSIRO	33(1)	3	1.40	−1.97
LLN	Lulin, China	23.47° N, 120.87° E, 2867 m	ESRL	220(20)	7.5	0.99	2.62
SDZ	Shangdianzi, China	40.39° N, 117.07° E, 287 m	CMA/ESRL	60(15)	3	1.18	0.15
Continuous samples:							
MNM	Minamitorishima, Japan	24.29° N, 153.98° E, 8 m	JMA	1624(0)	3	0.76	0.15
RYO	Ryori, Japan	39.03° N, 141.82° E, 260 m	JMA	1663(48)	3	0.90	0.46
YON	Yonagunijima, Japan	24.47° N, 123.02° E, 30 m	JMA	1684(3)	3	0.78	1.53
GSN	Gosan, Republic of Korea	33.15° N, 126.12° E, 72 m	NIER	1274(39)	3	1.99	−1.01

CarbonTracker China



CarbonTracker China



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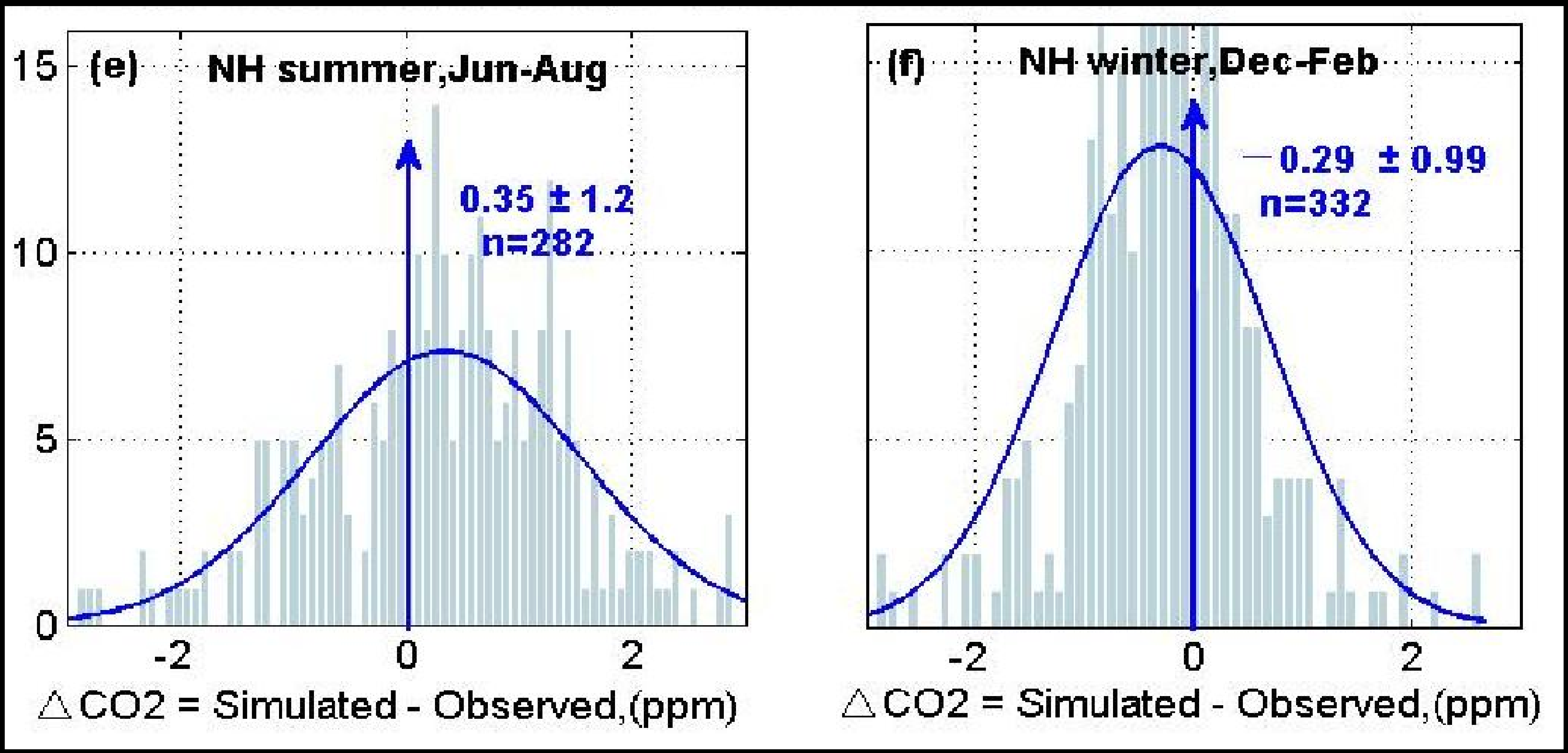

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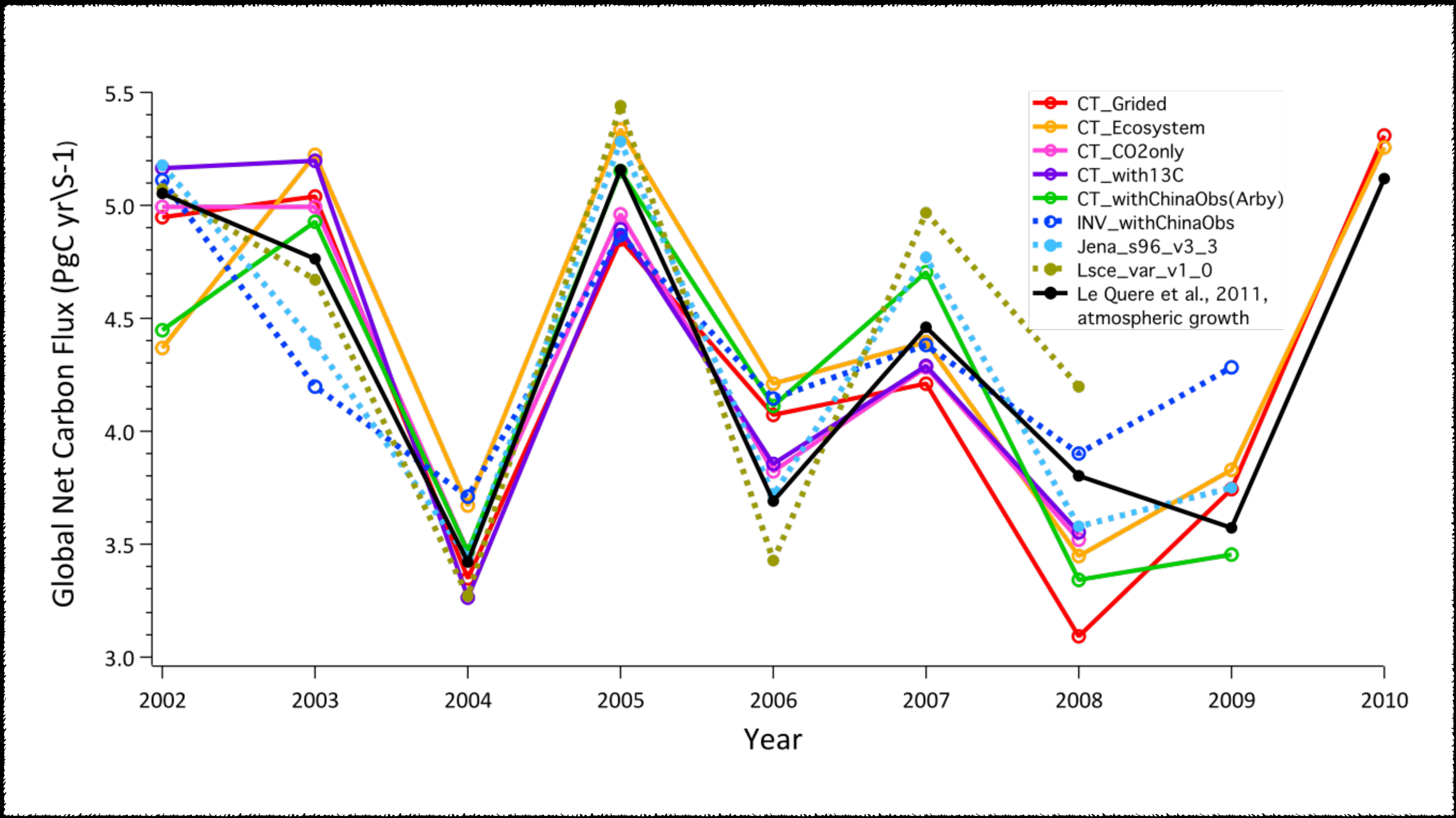

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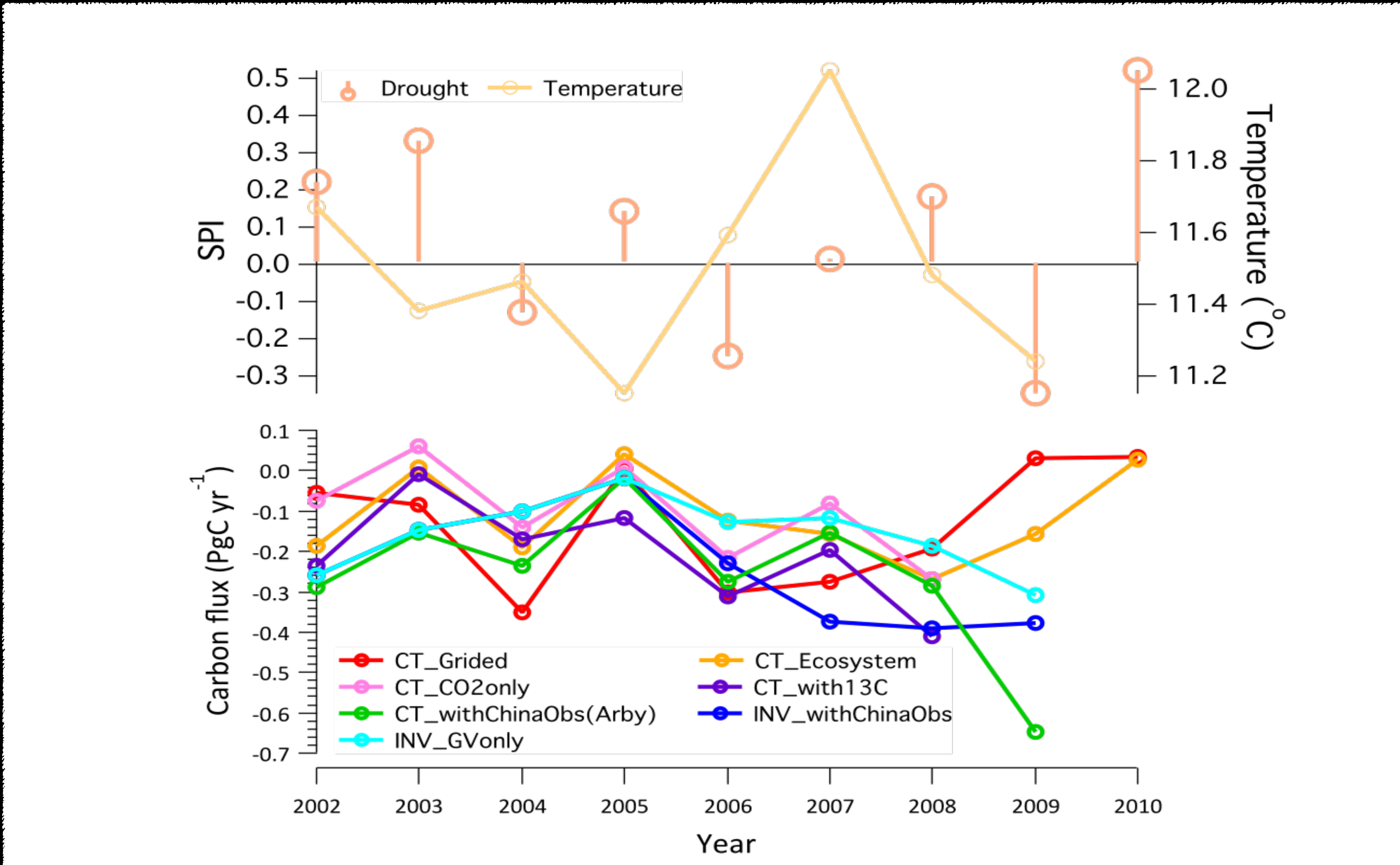


CarbonTracker China

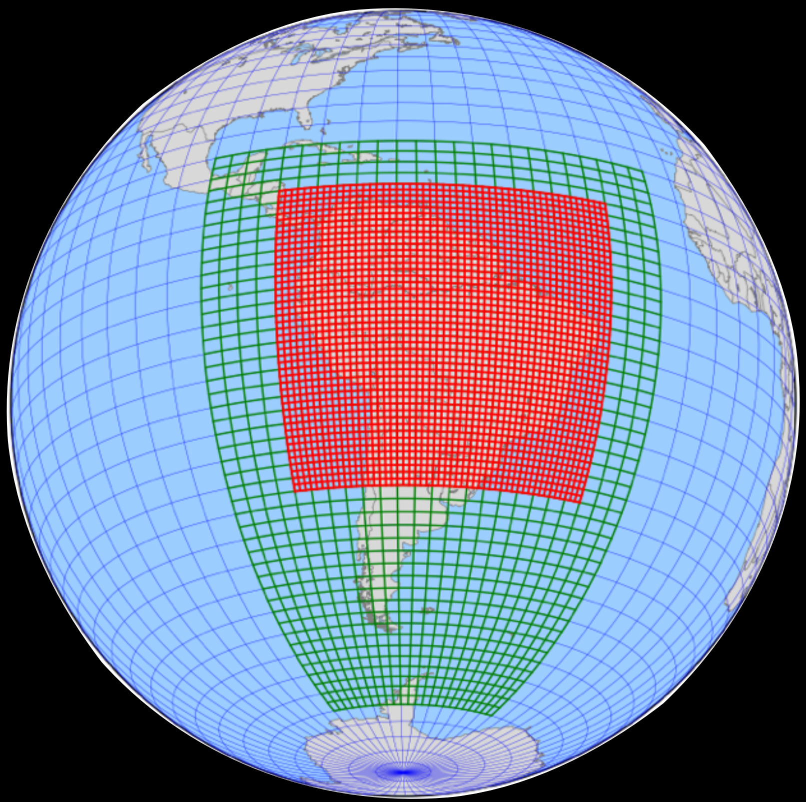
- Much progress on developing systems
- First Chinese CO_2 observations used in these systems, more coming…
- Independent verification, ongoing
- Interannual variations appear consistent

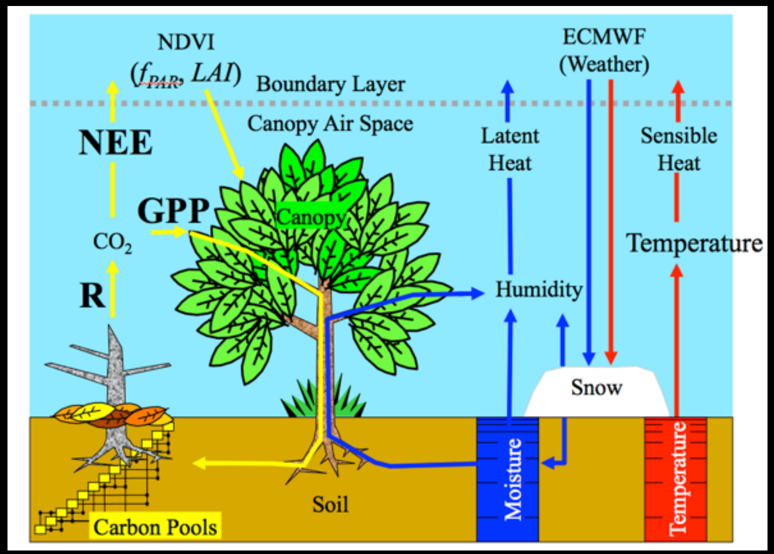
CarbonTracker South America

- Estimates vary substantially:
  - between models and observational estimates
  - between time periods (fires, droughts 2005 & 2010)
- Gloor et al. (2012) review paper:
  - 1980s: net source (0.3-0.4 PgC/yr)
  - 1990s: neutral (0.1 PgC/yr)
  - 2000s: weak source (also Gatti et al. 2010)

CarbonTracker South America

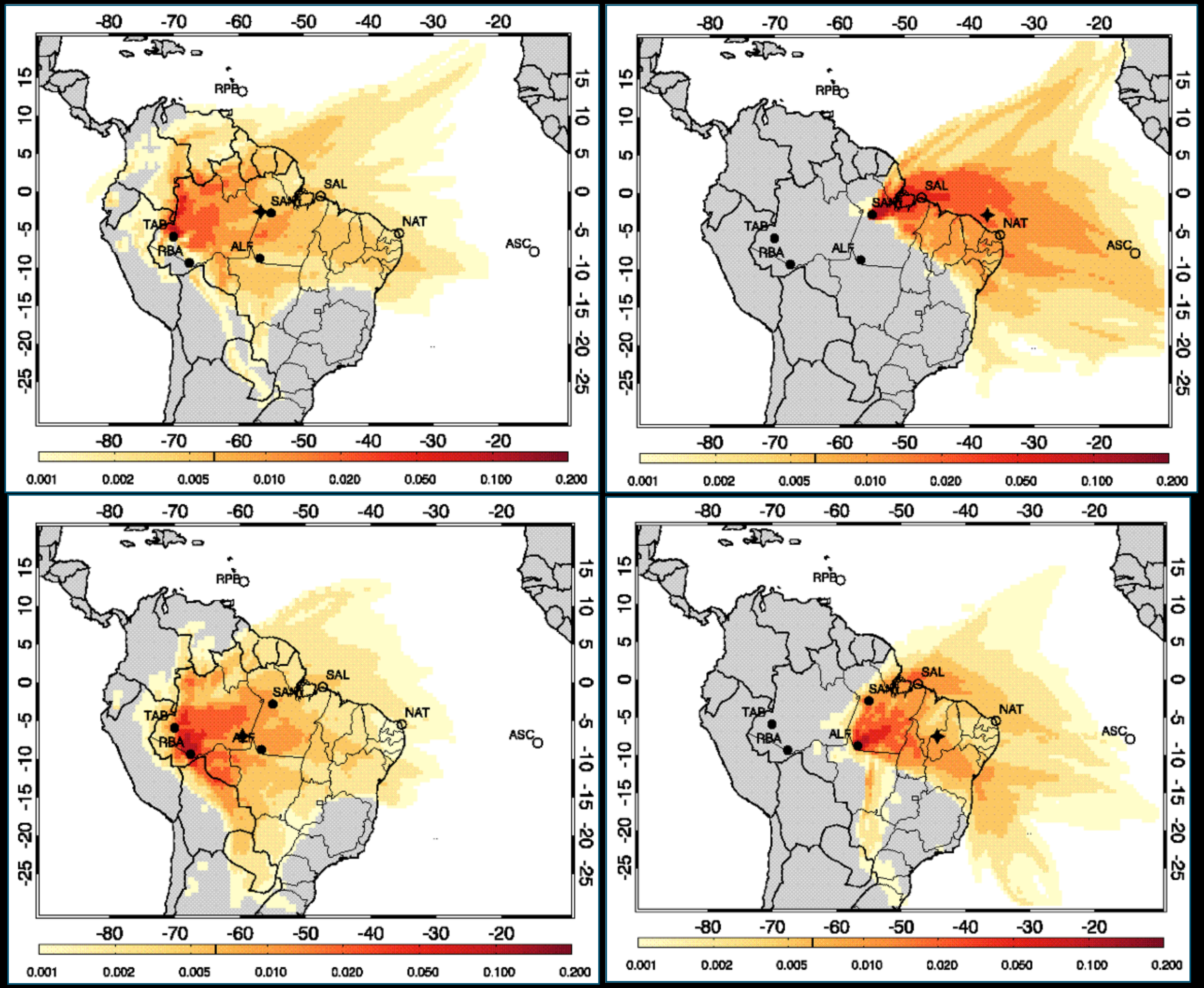
- Transport model with zoomed grid over South America
- Different carbon models for biosphere and fires
- Compare forward simulations to observations (CO_2 & CO)
- Use non-tropical CO_2 budget from CarbonTracker
- Use non-tropical CO budget from Pim Hooghiemstra
- Use biomass burning emission factors from Thijs van Leeuwen





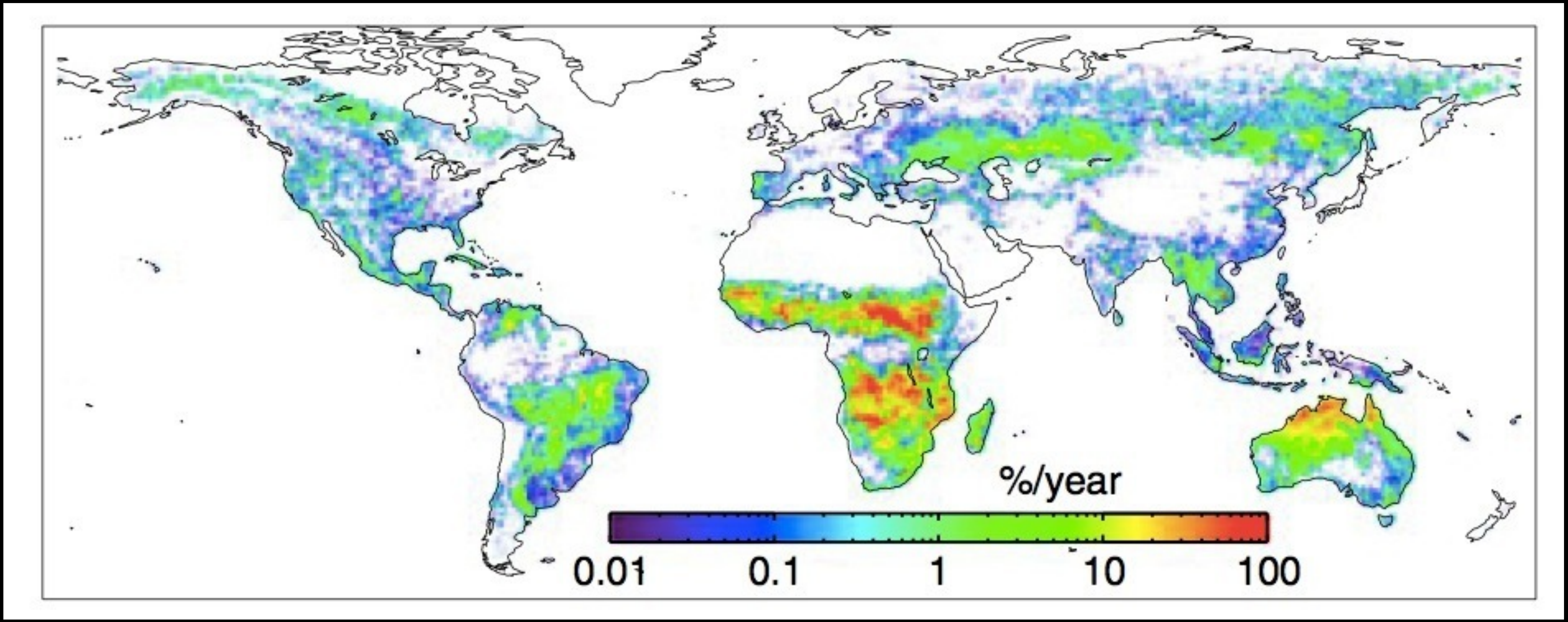
CarbonTracker South America

2010 ~ 80 profiles
2011 ~ 80 profiles

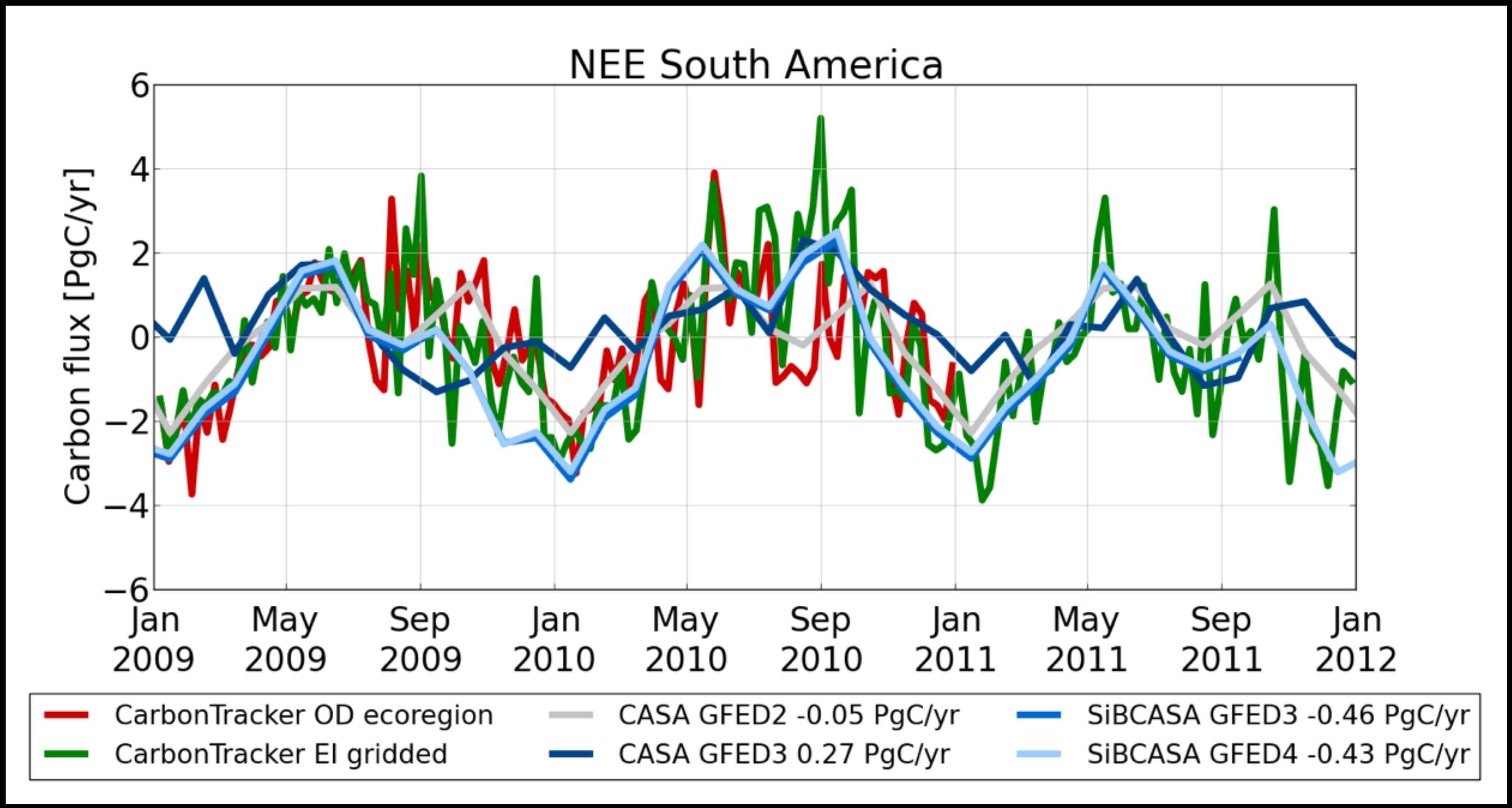


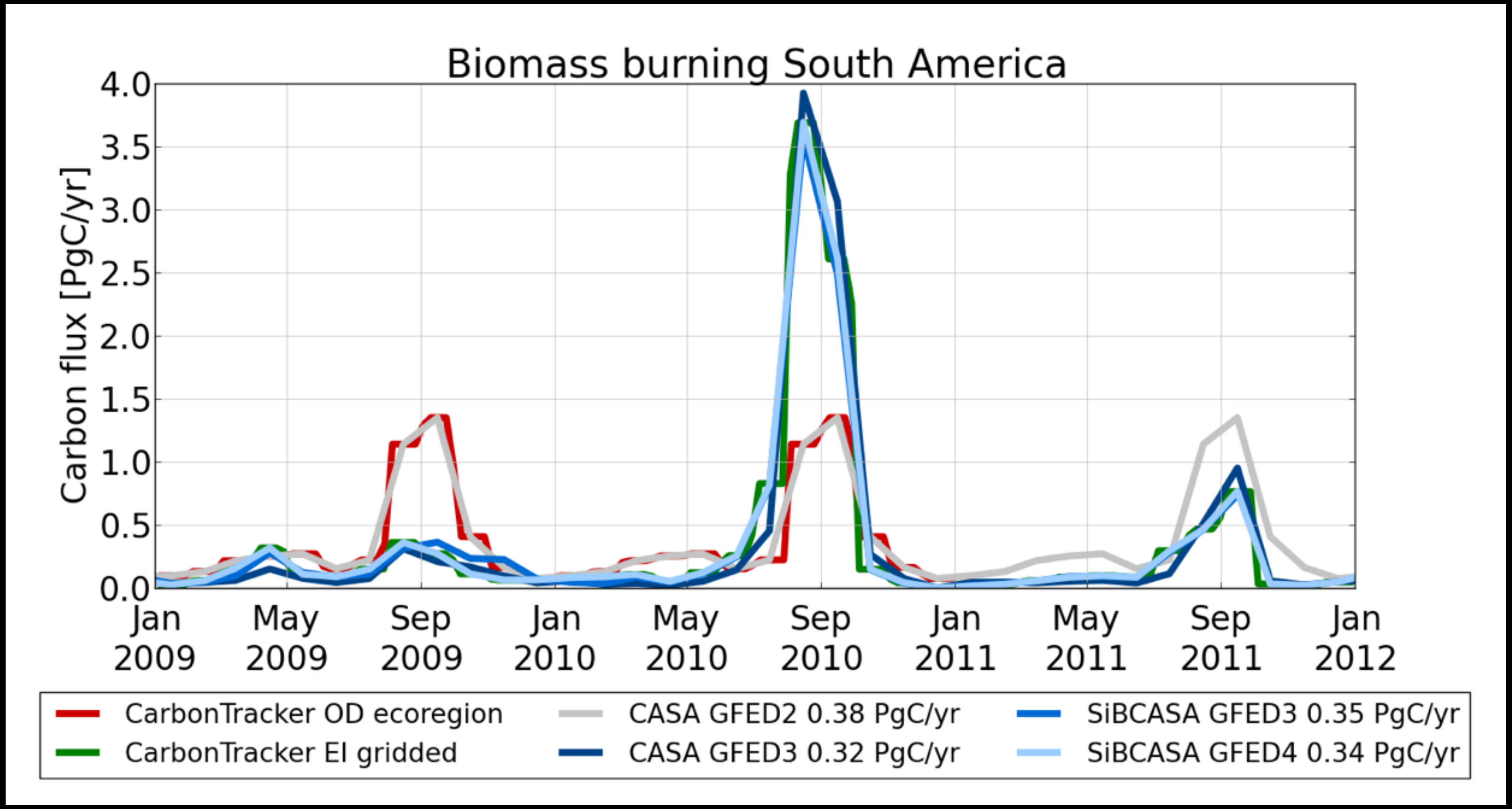
CarbonTracker South America

- GFED3/4 burned area estimates (Giglio et al. 2013) MODIS
- SiBCASA -> emissions CO_2 and CO



CarbonTracker South America





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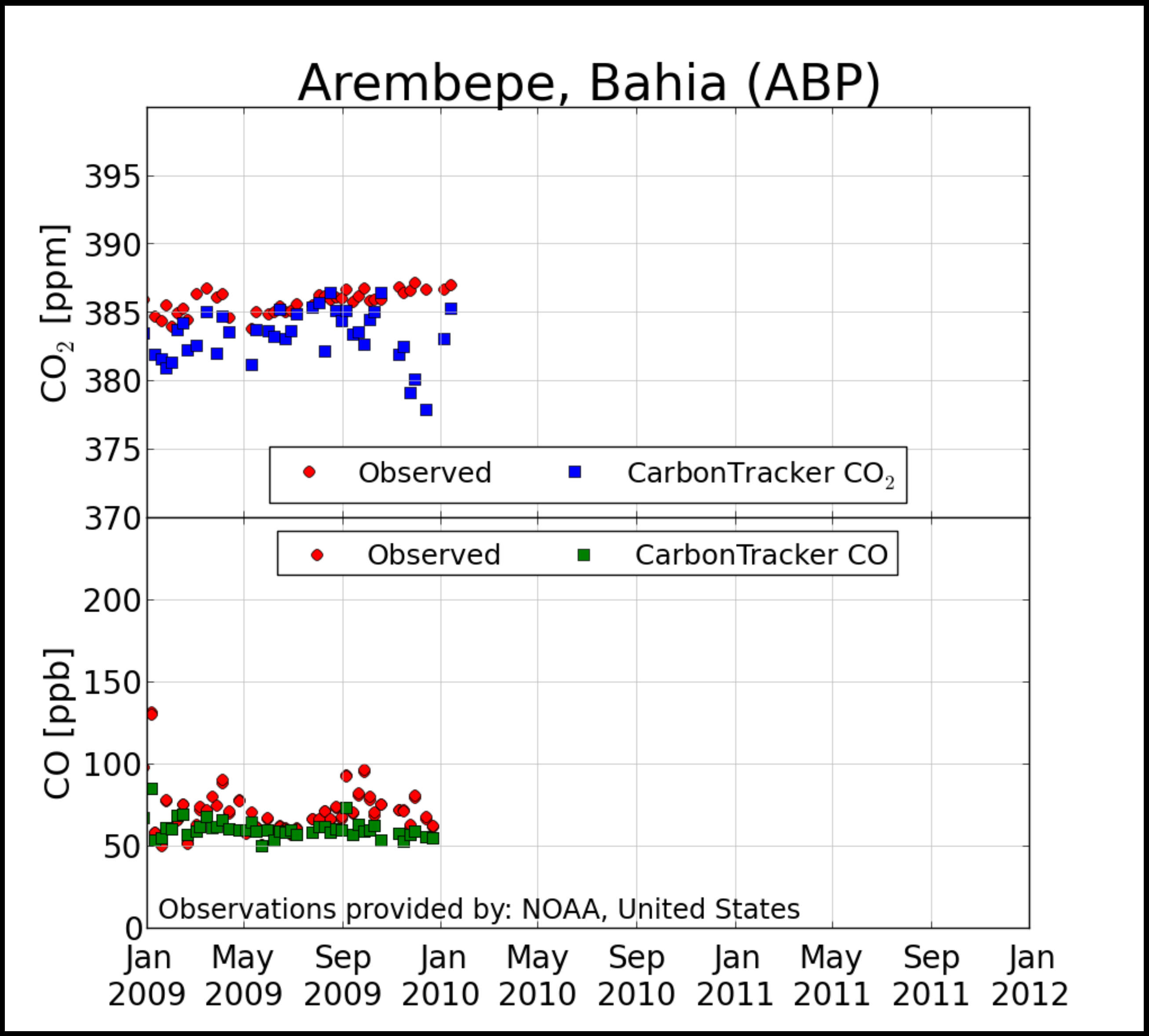

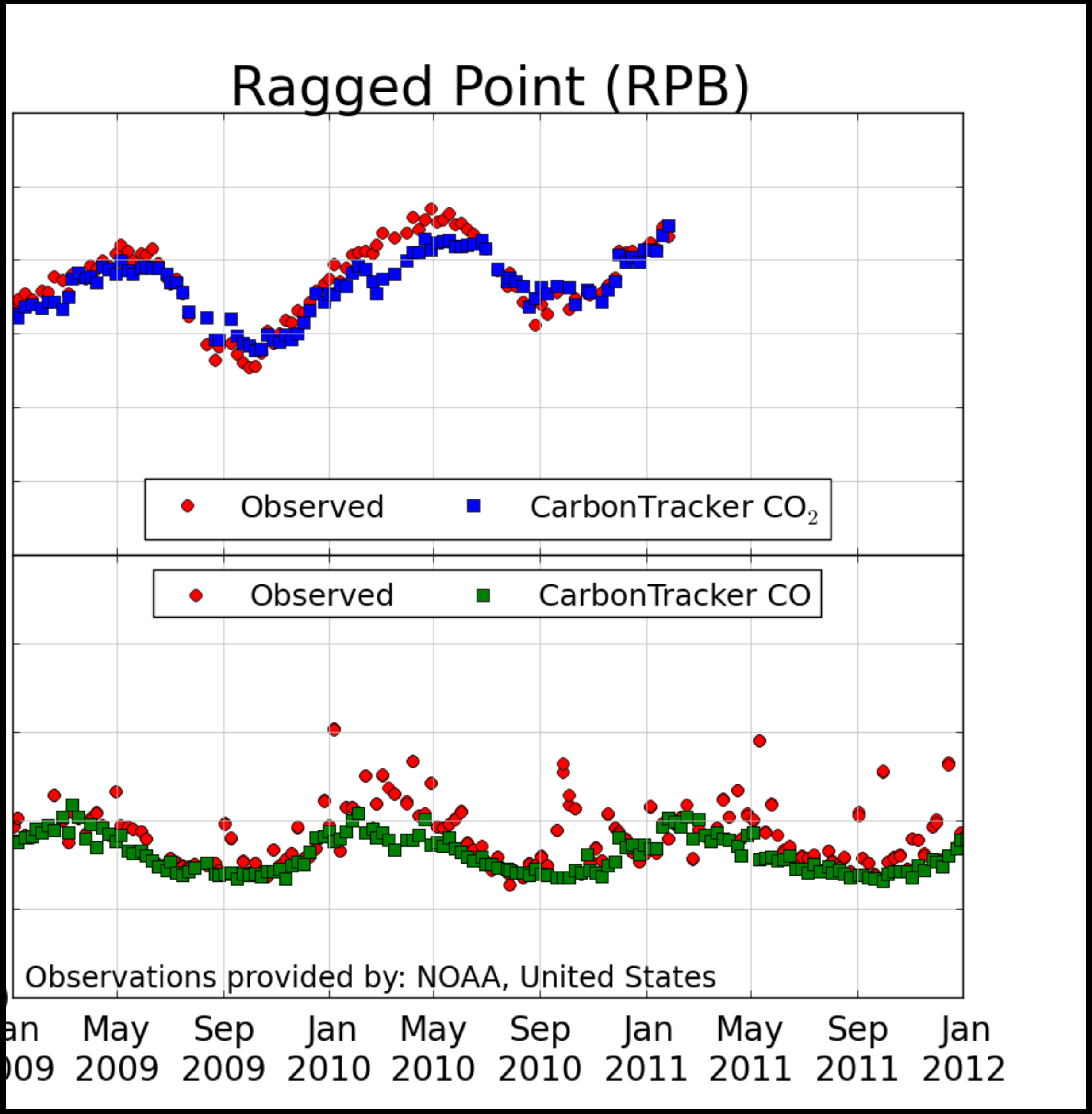

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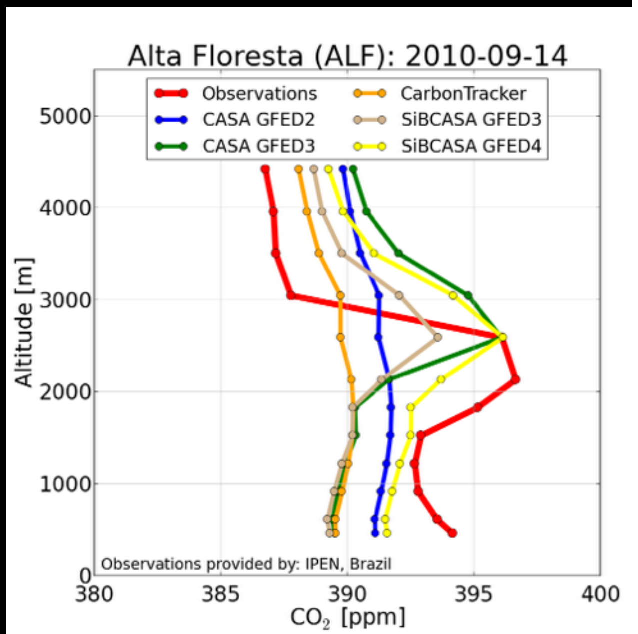

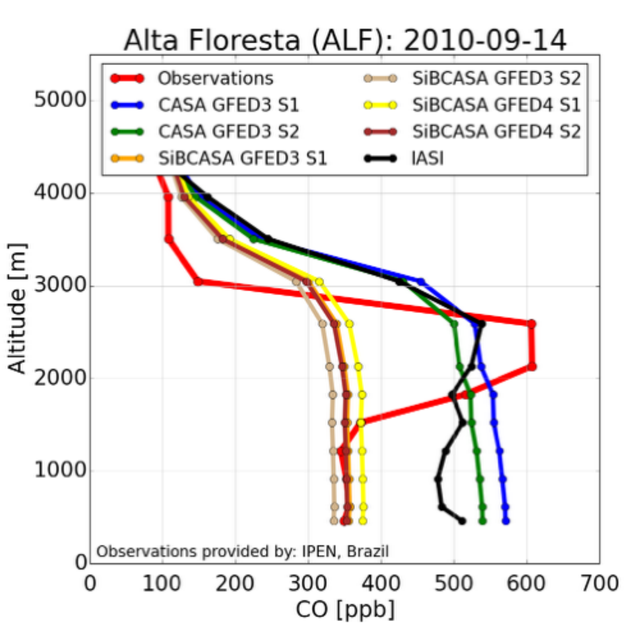

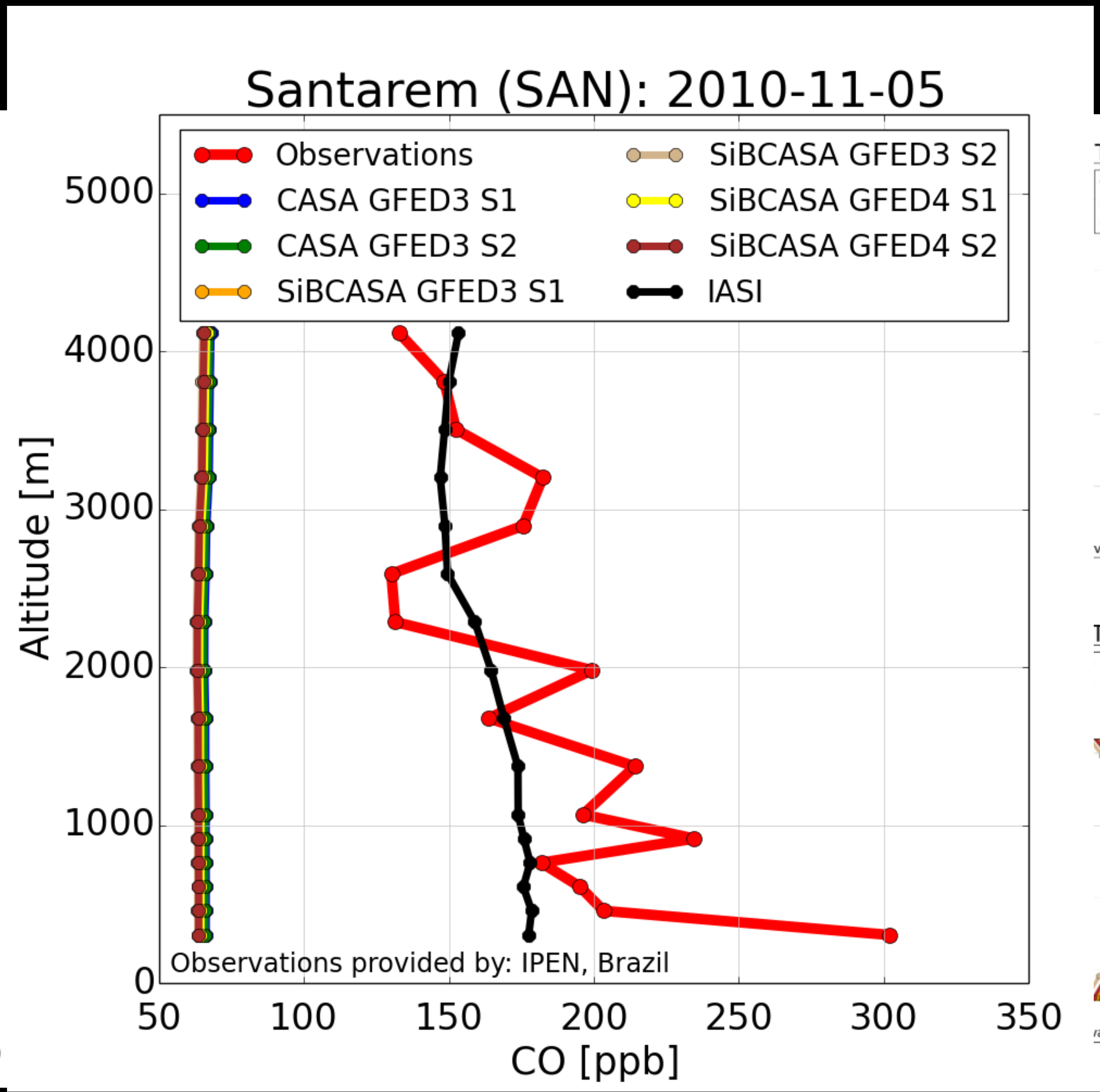

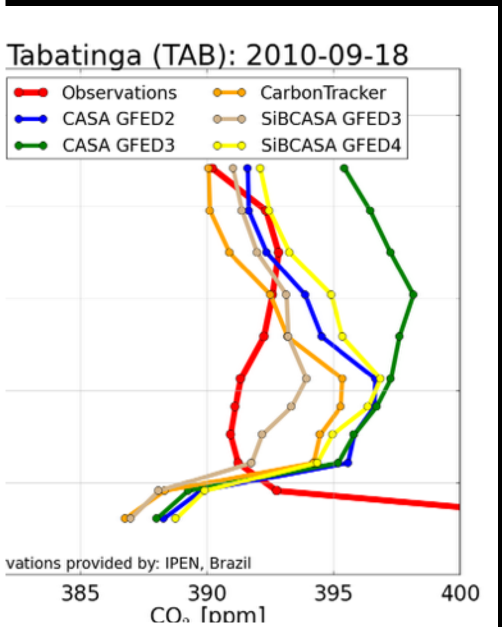

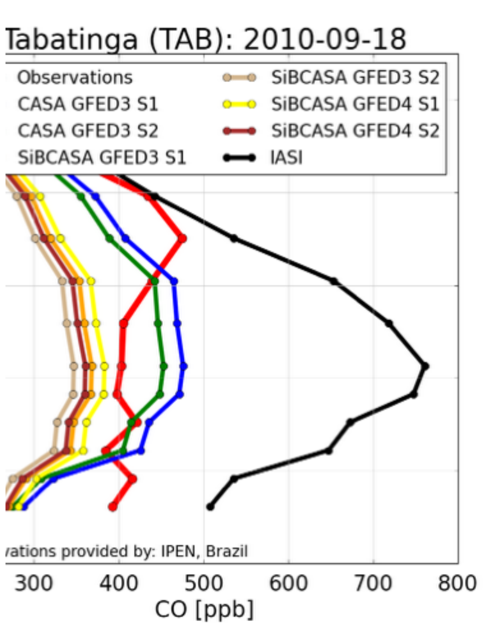

CarbonTracker South America

RMSD CO_2 [ppm]	MLO	ASC	SPO	EIC	TDF	RPB	ABP	ALF	SAN	RBO	TAB
CASA-GFED2 (CT prior)	***0.62***	***0.75***	***0.27***	*0.99*	***0.52***	*1.09*	***1.7***	***4.5***	***2.4***	***4.4***	***4.3***
CASA-GFED3	***0.68***	***0.81***	***0.42***	***1.16***	***0.55***	***1.07***	***1.7***	***5.1***	***2.7***	*4.6*	***4.3***
SiBCASA-GFED3	***0.72***	*0.86*	***0.35***	***0.94***	***0.56***	***1.19***	***3.2***	***3.9***	*2.3*	***4.2***	*3.9*
SiBCASA-GFED4	***0.70***	***0.82***	***0.31***	***0.97***	***0.53***	***1.17***	***3.2***	***3.8***	***2.3***	***3.9***	***3.8***

CarbonTracker South America

RMSD CO [ppb]	MLO	ASC	SPO	EIC	TDF	RPB	BRW	ALF	SAN	RBO	TAB
CASA-GFED3-S1	14.4	24.6	7.6	29.6	8.7	22.8	34.5	185	61.3	83	54.6
CASA-GFED3-S2	14.4	24.8	7.6	29.7	8.8	22.9	35.0	175	61.6	81	55.7
SiBCASA-GFED3-S1	14.9	22.8	7.4	30.0	8.6	22.9	35.3	143	54.3	102	53.4
SiBCASA-GFED3-S2	14.8	23.6	7.6	30.3	8.9	23.1	35.3	140	55.1	96	55.1
SiBCASA-GFED4-S1	14.0	25.1	7.2	29.3	8.5	22.8	33.8	136	58.1	102	54.6
SiBCASA-GFED4-S2	14.1	25.8	7.4	29.6	8.7	23.0	33.8	133	58.8	96	56.2
IASI-INVERSION	9.7	29.4	14.8	26.6	4.5	35.7	8.3	93	23.3	55	72.5

CarbonTracker South America

- SIBCASA-GFED4 good biosphere+fire model
- Optimization of CO with IASI looks promising
- Profile data: demanding on vertical transport
- New observations very valuable!