



ORCHIDEE
LAND SURFACE MODEL

Few diagnostics on the C-cycle

Results from several simulations / projects (ERACLIM2)

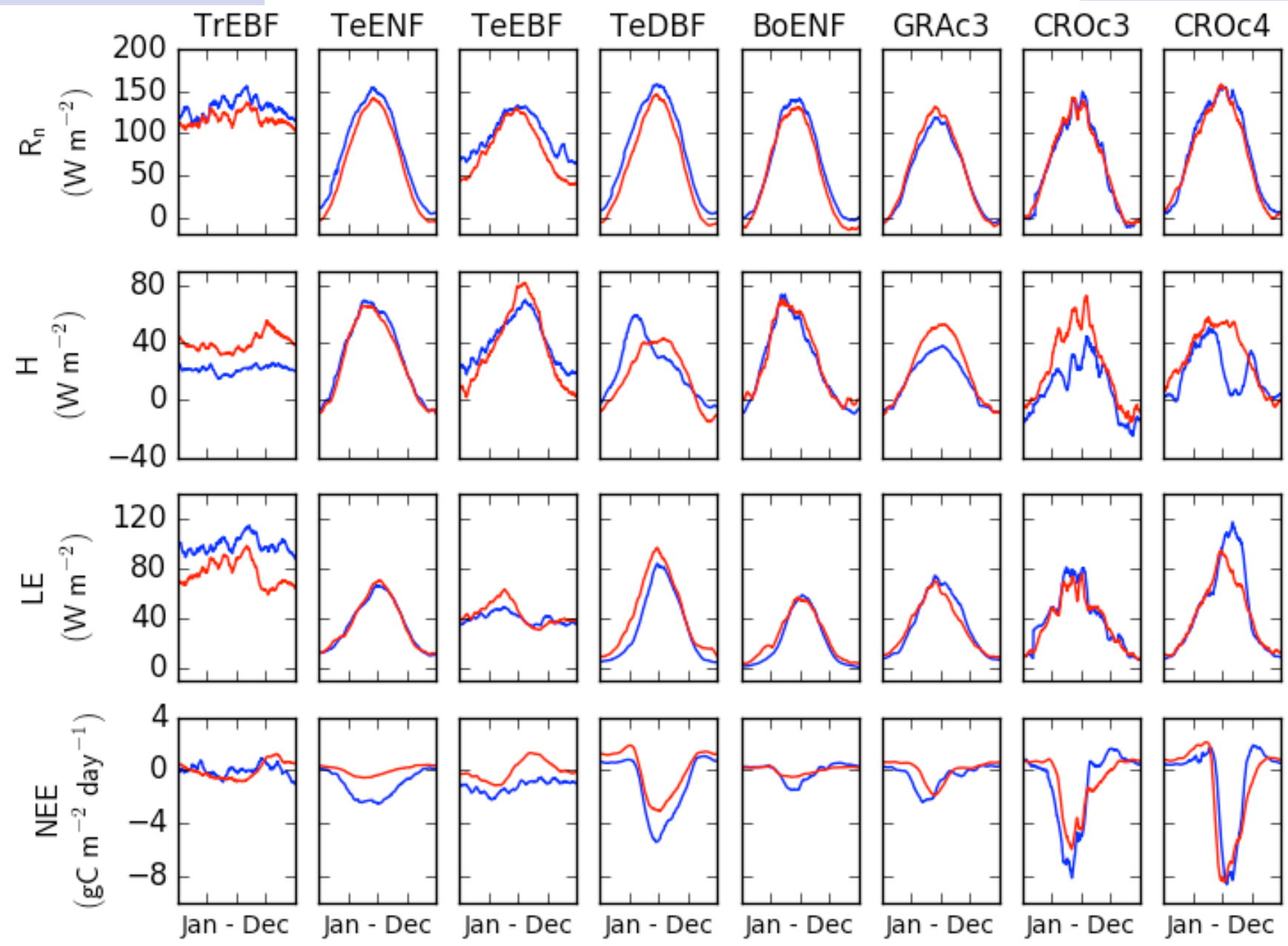
*Philippe Peylin for the whole ORCHIDEE group
(with specific contribution from: Vladislav, Nicolas 1-2,
Fabienne, Patricia Sebastiaan, Bertrand, Josefine)*

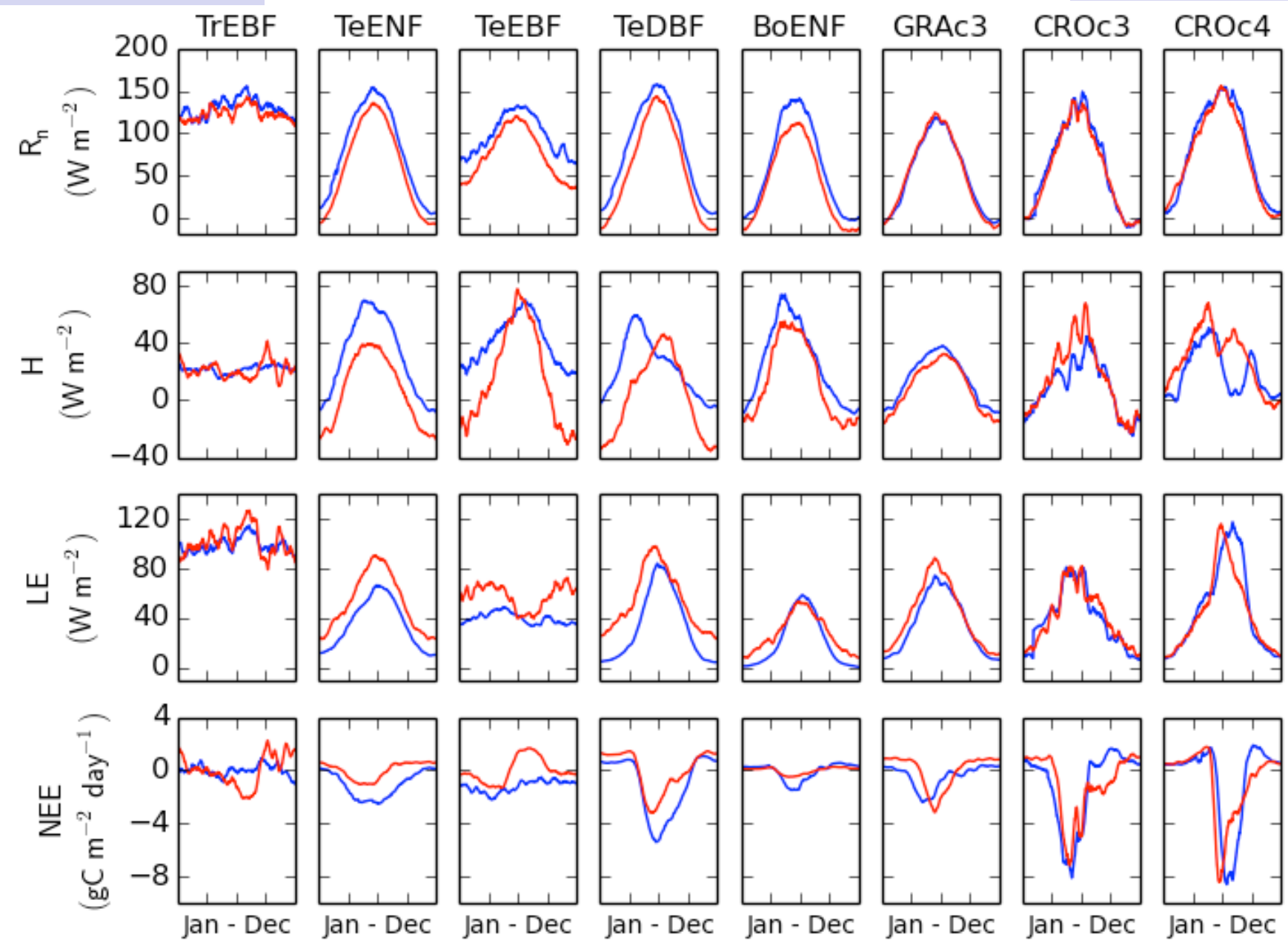


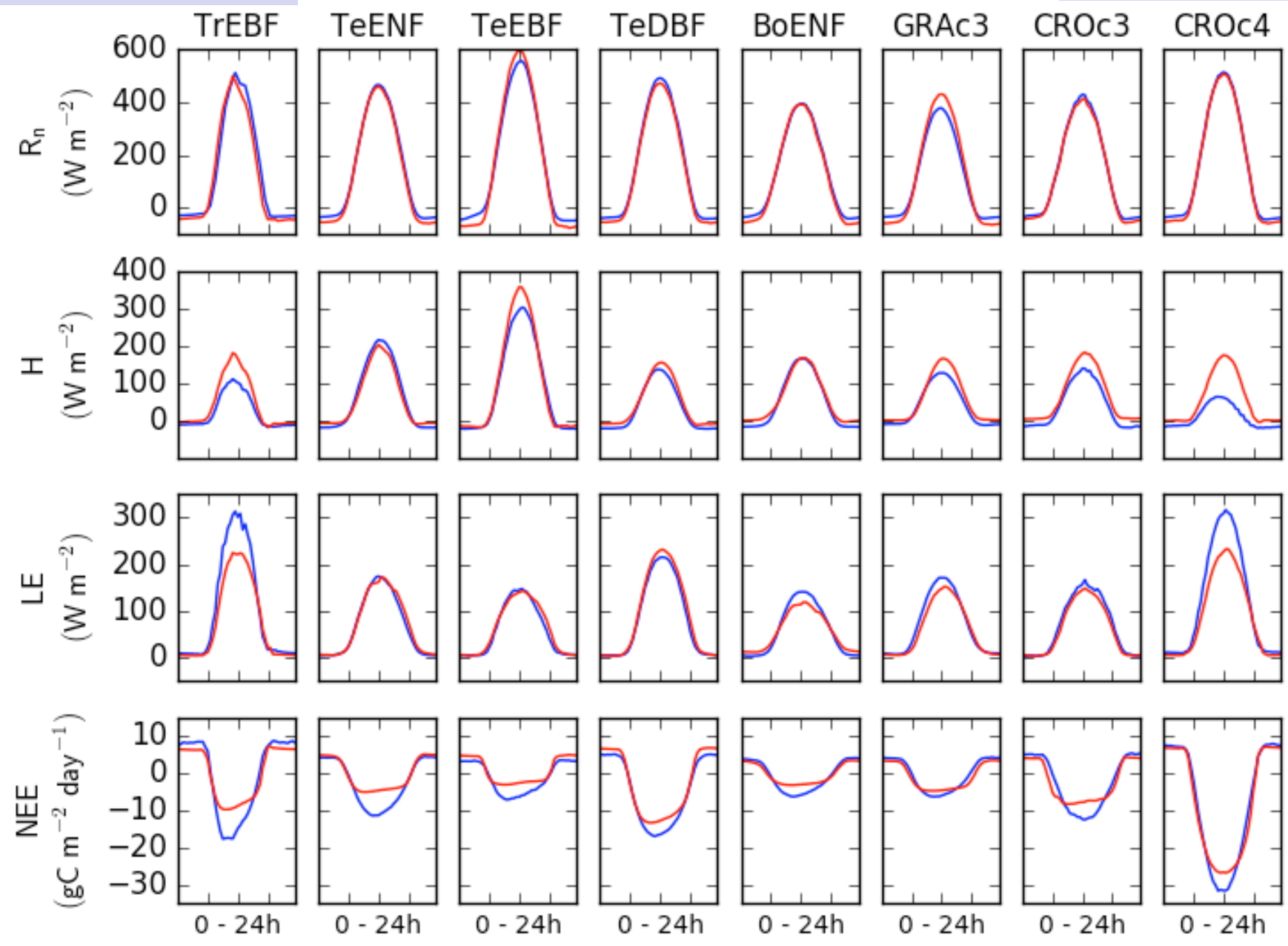
Site scale evaluation : FluxNet

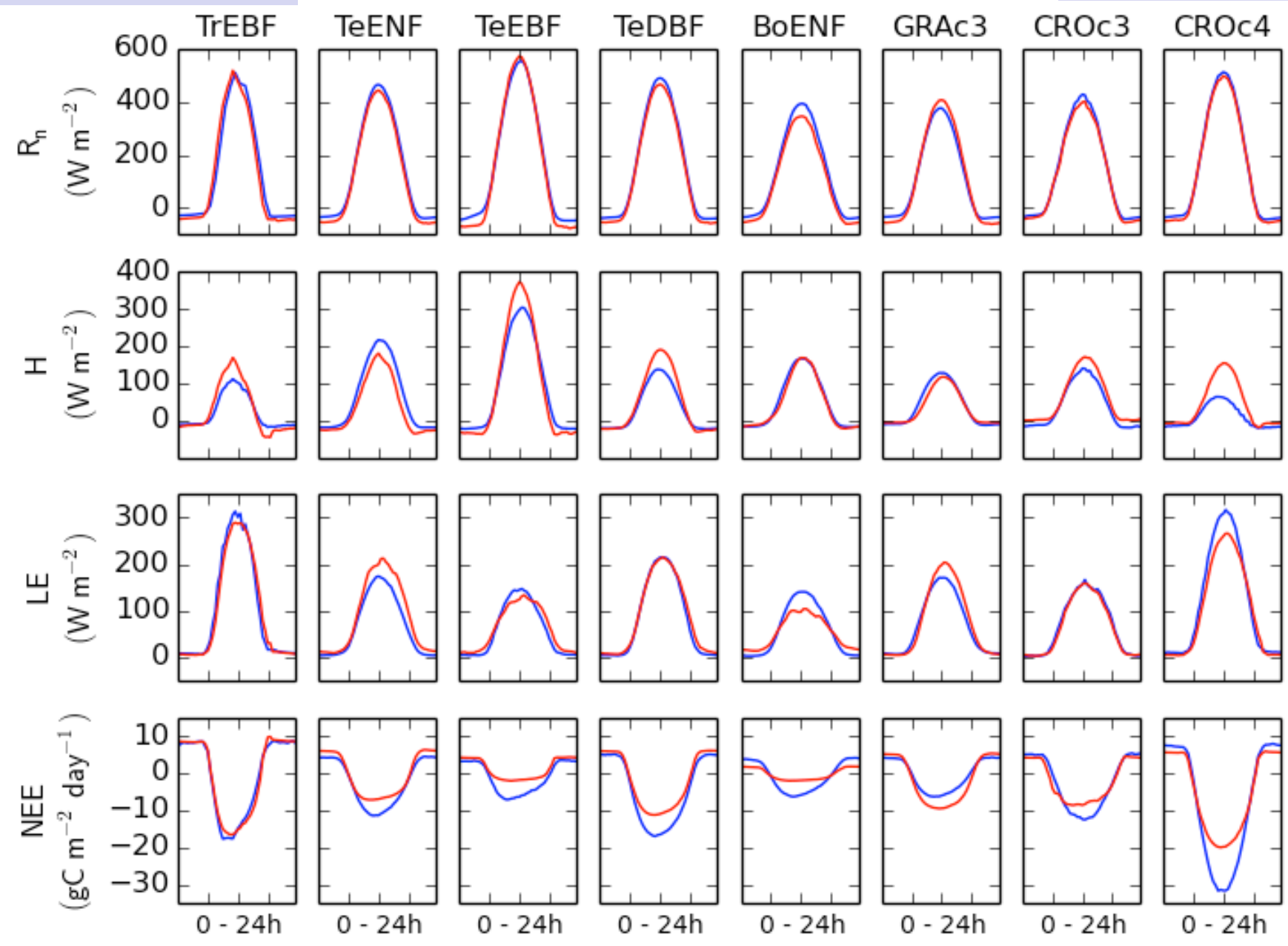
Nicolas Vui., Vladislav

- Comparison Revision 4919 (CMIP6) to 2425 (2yr old)
- Sites:
 - **TrEBF** = ["BR-Sa3", "ID-Pag"]
 - **TeENF** = ["IL-Yat", "ES-ES1", "IT-SRo", "US-Blo", "US-Me4", "US-SP1", "US-SP2", "US-SP3", "US-SP4", "DE-Bay", "DE-Tha", "DE-Wet", "IT-Lav", "IT-Ren", "NL-Loo", "UK-Gri", "CZ-BK1", "RU-Fyo", "SE-Nor", "SE-Sk1", "SE-Sk2", "SK-Tat", "US-Ho1", "US-Ho2", "US-Wi0", "US-Wi2", "US-Wi4", "US-Wi5", "US-Wi9"]
 - **TeEBF** = ["FR-Pue", "IT-Cpz", "IT-Lec", "PT-Esp", "PT-Mi1", "AU-Tum", "AU-Wac"]
 - **TeDBF** = ["IT-Col", "IT-Non", "IT-PT1", "IT-Ro1", "IT-Ro2", "US-MMS", "US-MOz", "US-WBW", "DE-Hai", "DK-Sor", "FR-Fon", "FR-Hes", "IS-Gun", "UK-Ham", "UK-PL3", "US-Bar", "US-Ha1", "US-Oho", "US-UMB", "US-WCr", "US-Wi1", "US-Wi8"]
 - **BoENF** = ["CA-Man", "CA-NS2", "CA-NS3", "CA-NS4", "CA-NS5", "CA-Qcu", "CA-Qfo", "CA-SF1", "CA-SF2", "FI-Hyy", "FI-Sod", "RU-Zot", "SE-Fla"]
 - **GRAc3** = ["RU-Ha1", "RU-Ha2", "RU-Ha3", "US-Aud", "US-FPe", "IT-Amp", "PT-Mi2", "US-Goo", "US-Var", "AT-Neu", "CH-Oe1", "DE-Gri", "DE-Meh", "DK-Lva", "ES-VDA", "FR-Lq1", "FR-Lq2", "HU-Bug", "HU-Mat", "IE-Dri", "IT-LMa", "IT-Mal", "IT-MBo", "NL-Ca1", "NL-Haa", "UK-EBu", "UK-Tad", "US-Bkg"]
 - **CROc3** = ["DK-Ris", "FR-Gri", "NL-Lut"]
 - **CROc4** = ["US-Bo1", "US-Ne1", "US-Ne2", "US-Ne3", "NL-Lan"]











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LAND SURFACE MODEL

Global scale evaluation (force mode)

- Results from the ERA-CLIM2 project (20th century reanalysis with different forcing)
- Simulations for the « optimization of CMIP6 version »

⇒ Revision 4783

⇒ MAPPER web site (from Vlad)

⇒ Atlas visualisation (from Patrick)

Reanalysis with ERA-20C

Analysis & comparison to other products

A dedicated web site

<http://eraclim.globalcarbonatlas.org/>

User/Passwd: eraclim / eraclim2017

Clear selections ?

CREATE PLOT

1 REGIONS

Filter... x

- Global
 - 05 Global Land
 - 17 Global Ocean
- Land
- Ocean
- TransCom

2 AVERAGING PERIOD

Monthly mean

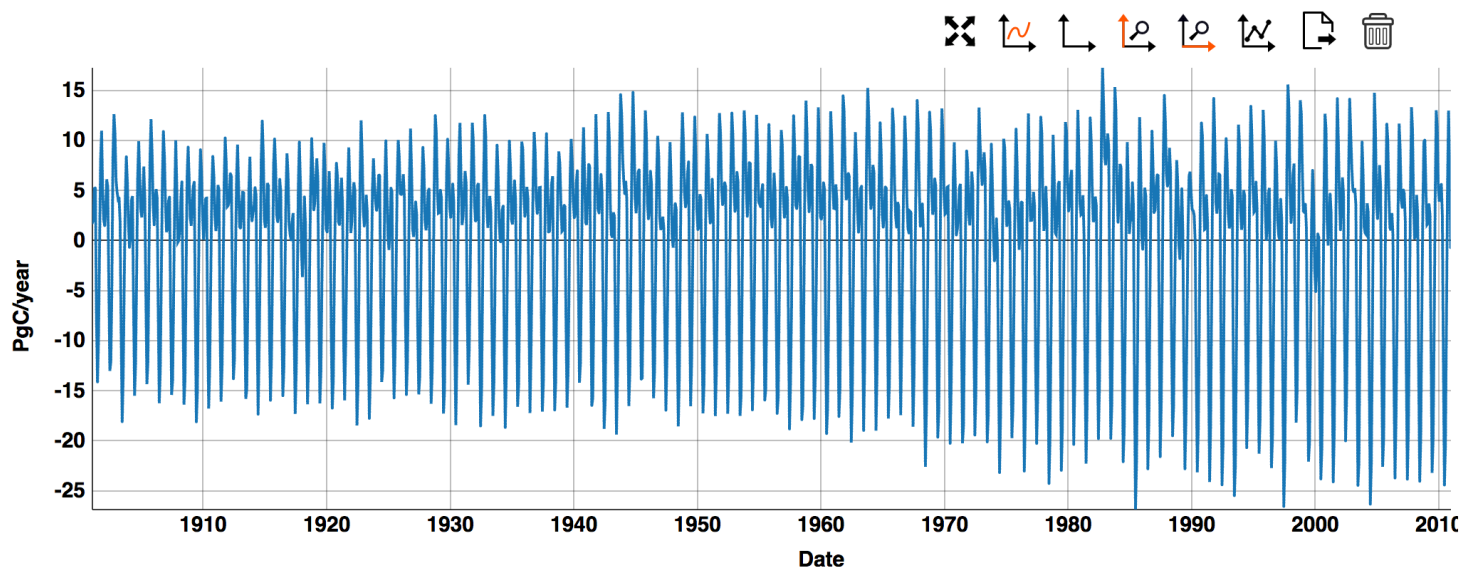
3 RESOURCES

Filter... x

- CMIP5
- Data-driven
- ERACLIM2
- FOSSIL
- Inversions
- Land (TRENDY)
- Ocean (TRENDY)

4 VARIABLE

- Terrestrial_flux
- Terrestrial_flux_lu



● ORCv3 CERA20C LU6v2 / Terrestrial_flux / 05 Global Land / Monthly mean

- Mapping facility
- Regional total time series



Mapping / Time series facilities (Vladislav)

MAP COMPARISON

ORCHIDEE revision : 4783
simulation type : FG1-FG1trans-FG2
simulation period : 1901-2010
list of simulations :

- FG2.4783.v3
- FG2.4783.v4

[← to the full list](#)

Maps Time-series

Energy Budget
Water Budget
Carbon Budget
River Discharge

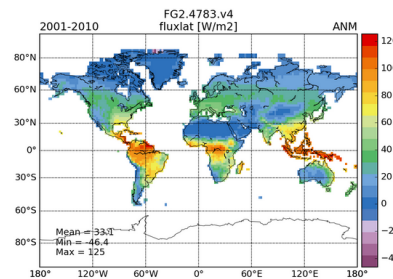
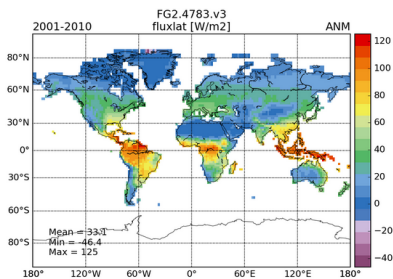
yearly maps

seasonal diff vs OBS

diff vs FG2.4783.v3

Show Plots

Latent Heat Flux

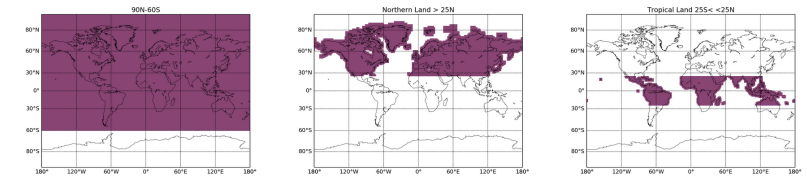


ORCHIDEE simulations comparison

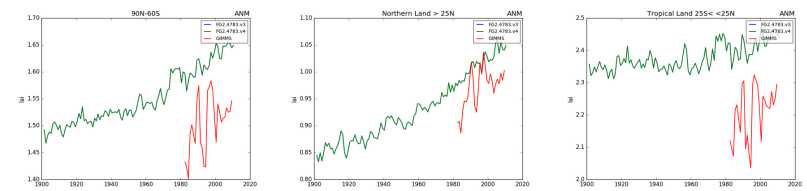
Revision 4783		
FG2	FG2.4783.v3	setup : /ccc/work/cont003/dsm/p529bast/ORCHIDEE/ORC4783/modipls/config/ORCHIDEE_OL/f storage : /ccc/store/cont003/gencmip6/p529bast/IGCM_OUT/OL2/PROD/ref4783/FG2.4783.v3
	FG2.4783.v4	setup : /ccc/work/cont003/dsm/p529bast/ORCHIDEE/ORC4783/modipls/config/ORCHIDEE_OL/f storage : /ccc/store/cont003/gencmip6/p529bast/IGCM_OUT/OL2/PROD/ref4783/FG2.4783.v4
FG3	FG3.4783.v3	setup : /ccc/work/cont003/dsm/p529bast/ORCHIDEE/ORC4783/modipls/config/ORCHIDEE_OL/f storage : /ccc/store/cont003/gencmip6/p529bast/IGCM_OUT/OL2/PROD/ref4783/FG3.4783.v3
	FG3.4783.v4	setup : /ccc/work/cont003/dsm/p529bast/ORCHIDEE/ORC4783/modipls/config/ORCHIDEE_OL/f storage : /ccc/store/cont003/gencmip6/p529bast/IGCM_OUT/OL2/PROD/ref4783/FG3.4783.v4

Revision 4778		
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	FG2.4778.v1	setup : /ccc/work/cont003/dsm/p529bast/ORCHIDEE/ORC4778/modipls/config/ORCHIDEE storage : /ccc/store/cont003/gencmip6/p529bast/IGCM_OUT/OL2/PROD/ref4778/FG2.477
	FG2.4778.v2.qsurf	setup : /ccc/work/cont003/dsm/p529bast/ORCHIDEE/ORC4778/modipls/config/ORCHIDEE storage : /ccc/store/cont003/gencmip6/p529bast/IGCM_OUT/OL2/PROD/ref4778/FG2.477

Region Mask



Leaf Area Index

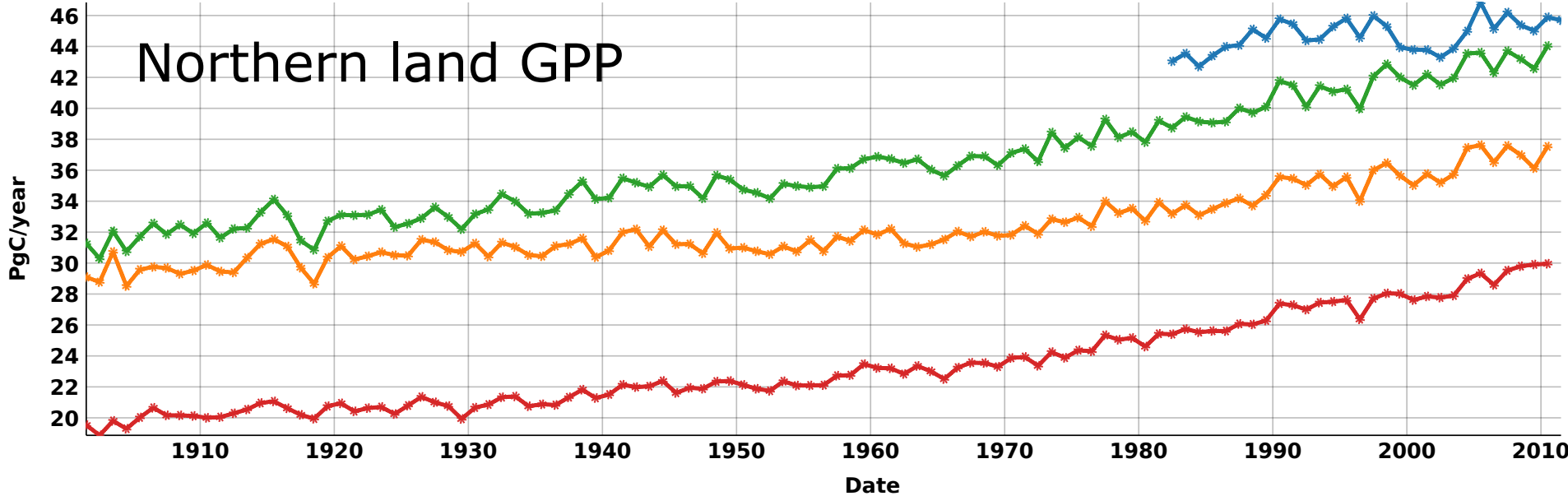




Simulations performed

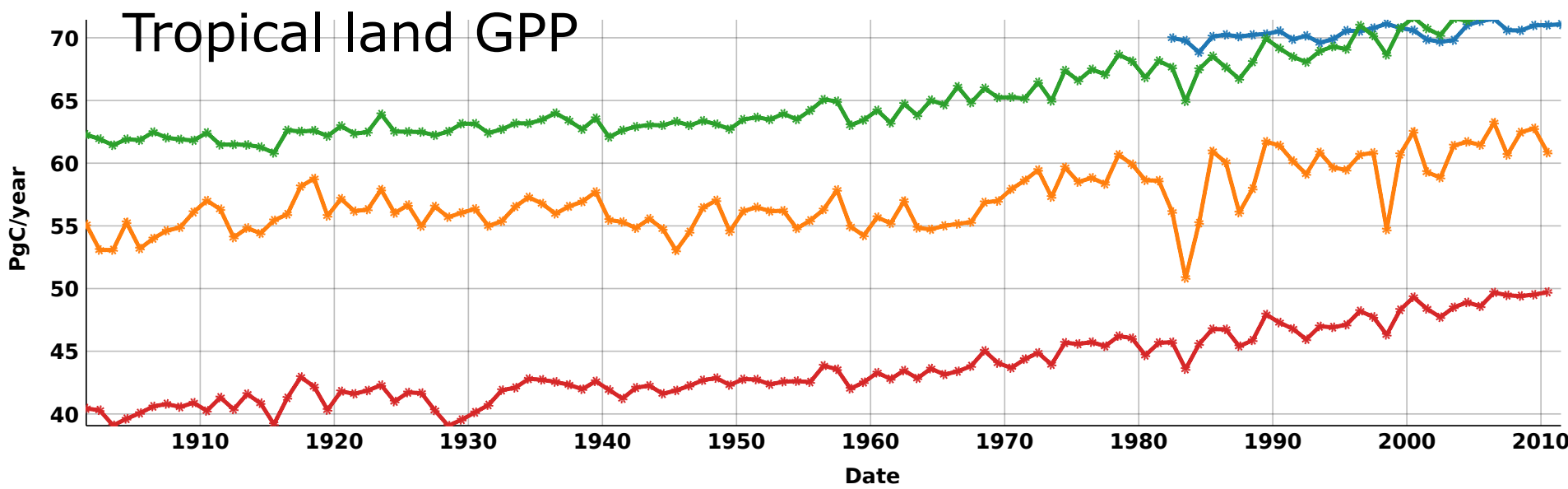
- 3 model versions : R3977, R4661, R4783
- 5 climate forcing: CERA-20C, CRUNCEP, GSWP3, CERA-SAT, WFDEI
- 3 land cover : CM6_v1, CM6_v2, CM5

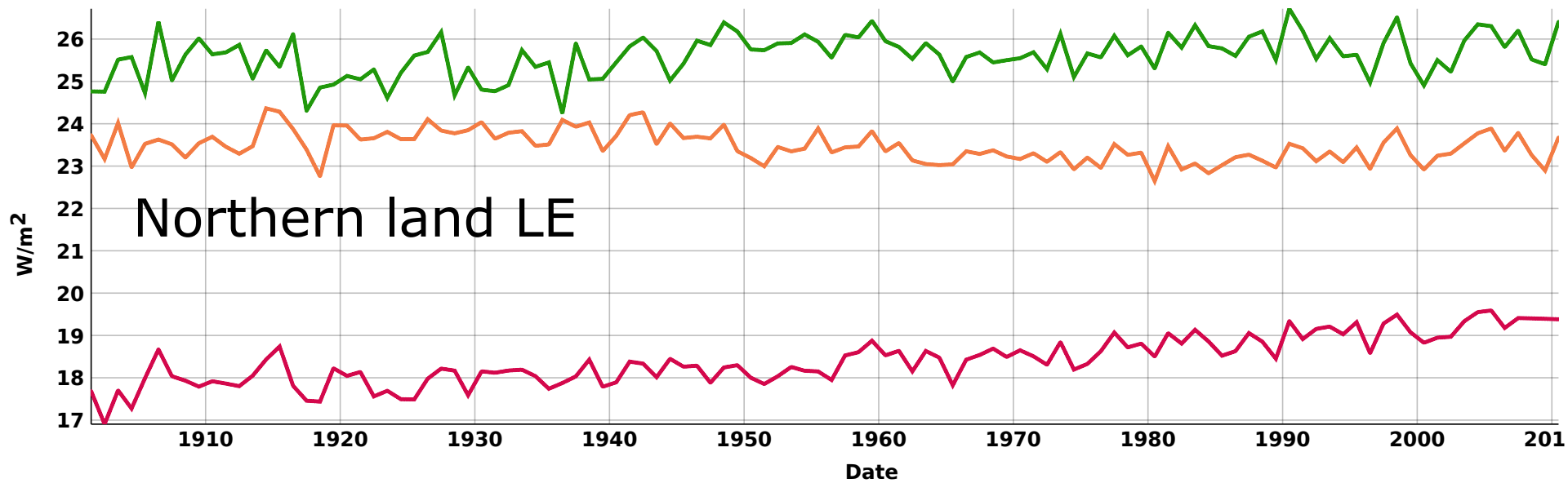
Title	Model version	Resolution	Meteo forcing	Land cover	Period
<i>ORCv1_CERA20C_LU6v1</i>	<i>Rev_3977</i>	<i>1°</i>	<i>CERA-20C</i>	<i>CM6_v1</i>	<i>1901-2010</i>
<i>ORCv1_CERA20C_LU5</i>	<i>Rev_3977</i>	<i>1°</i>	<i>CERA-20C</i>	<i>CM5</i>	<i>1901-2010</i>
<i>ORCv3_CERA20C_LU6v2</i>	<i>Rev_4783</i>	<i>1°</i>	<i>CERA-20C</i>	<i>CM6_v2</i>	<i>1901-2010</i>
<i>ORCv3_CERA20C_LU5</i>	<i>Rev_4783</i>	<i>1°</i>	<i>CERA-20C</i>	<i>CM5</i>	<i>1901-2010</i>
<i>ORCv1_CRUNCEP_LU6v1</i>	<i>Rev_3977</i>	<i>1°</i>	<i>CRU-NCEP</i>	<i>CM6_v1</i>	<i>1901-2010</i>
<i>ORCv3_CRUNCEP_LU6v2_2</i>	<i>Rev_4783</i>	<i>2°</i>	<i>CRU-NCEP</i>	<i>CM6_v2</i>	<i>1901-2010</i>
<i>ORCv3_CRUNCEP_LU6v2</i>	<i>Rev_4783</i>	<i>1°</i>	<i>CRU-NCEP</i>	<i>CM6_v2</i>	<i>1901-2010</i>
<i>ORCv3_CERASAT_LU6v2</i>	<i>Rev_4783</i>	<i>0.5°</i>	<i>CERA-SAT</i>	<i>CM6_v2</i>	<i>2008-2014</i>
<i>ORCv3_CERASAT_LUesa</i>	<i>Rev_4783</i>	<i>0.5°</i>	<i>CERA-SAT</i>	<i>ESA-CCI</i>	<i>2008-2014</i>
<i>ORCv3_GSWP3_LU6v2</i>	<i>Rev_4783</i>	<i>1°</i>	<i>GSWP3</i>	<i>CM6_v2</i>	<i>1901-2007</i>
<i>ORCv2_WFDEI_LU6v1</i>	<i>Rev_4661</i>	<i>0.5°</i>	<i>WFDEI</i>	<i>CM6_v1</i>	<i>1979-2009</i>



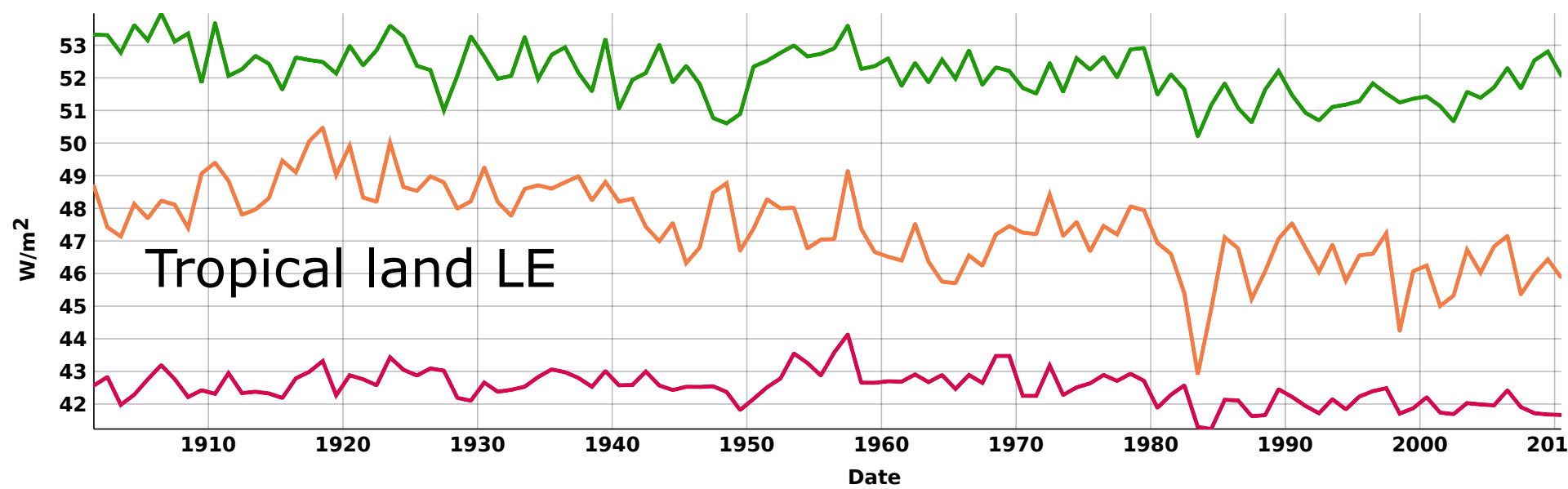
- MTE JUNG / gpp / 06 Northern Land / Yearly mean
- ORCv3 CERA20C LU6v2 / gpp / 06 Northern Land / Yearly mean
- ORCv3 CRUNCEP LU6v2 1 / gpp / 06 Northern Land / Yearly mean
- ORCv3 GSWP3 LU6v2 / gpp / 06 Northern Land / Yearly mean

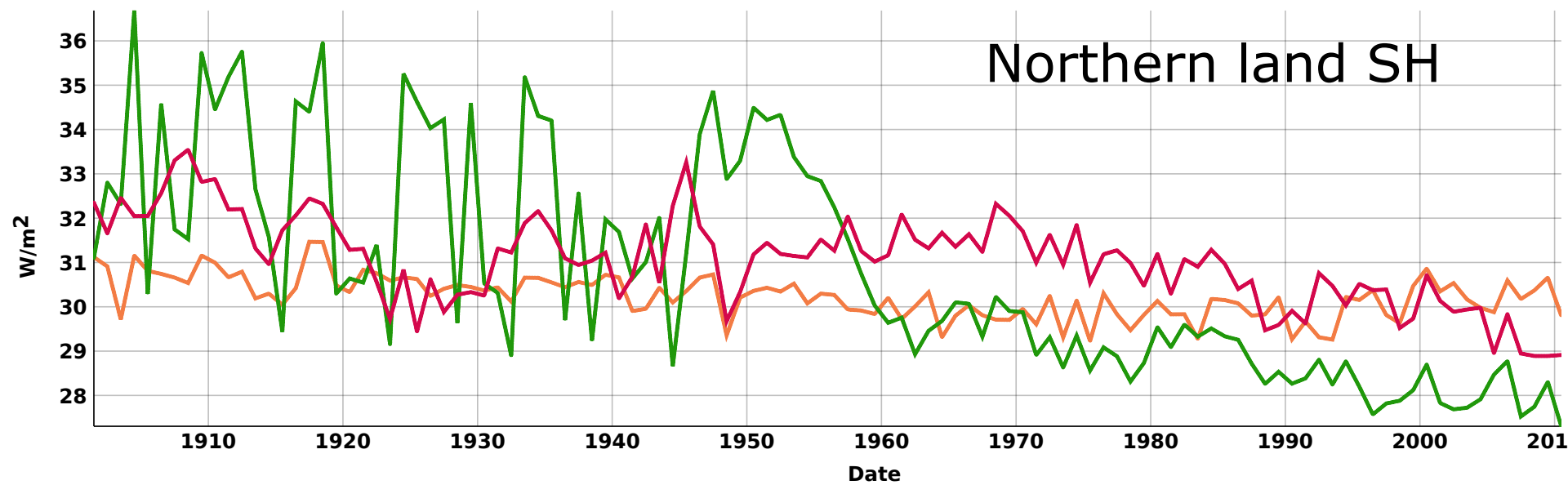
CERA-20C
CRUNCEP
GSWP3





CERA-20C
CRUNCEP
GSWP3



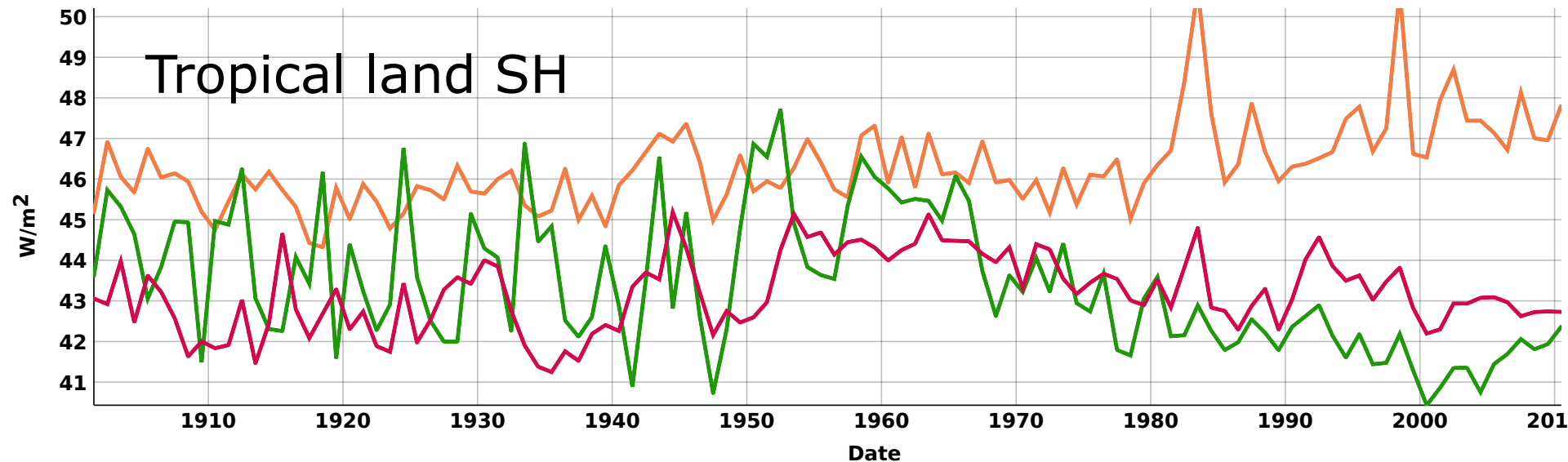


- ORCv3 CERA20C LU6v2 / fluxsens / 06 Northern Land / Yearly mean
- ORCv3 CRUNCEP LU6v2 1 / fluxsens / 06 Northern Land / Yearly mean
- ORCv3 GSWP3 LU6v2 / fluxsens / 06 Northern Land / Yearly mean

CERA-20C

CRUNCEP

GSWP3

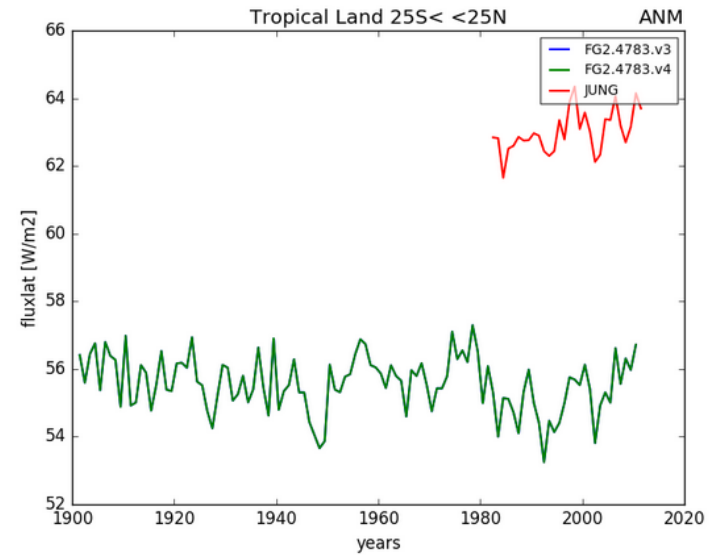
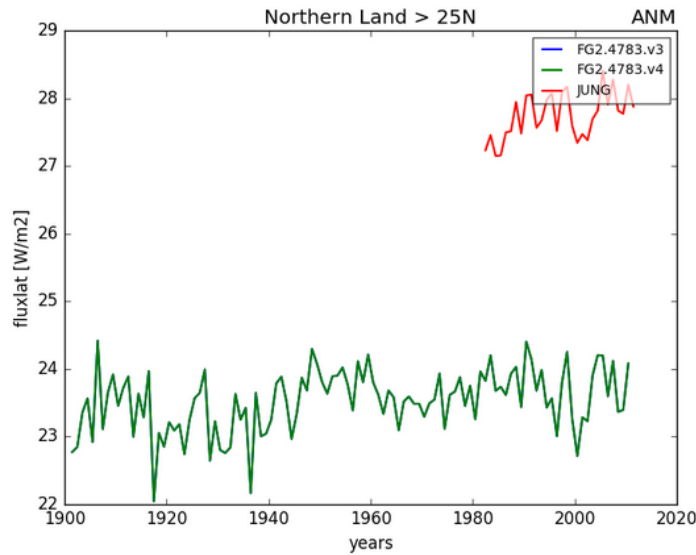




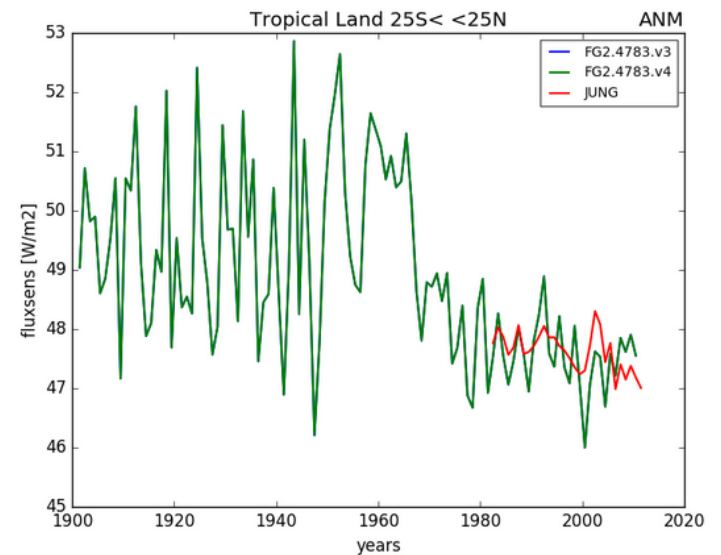
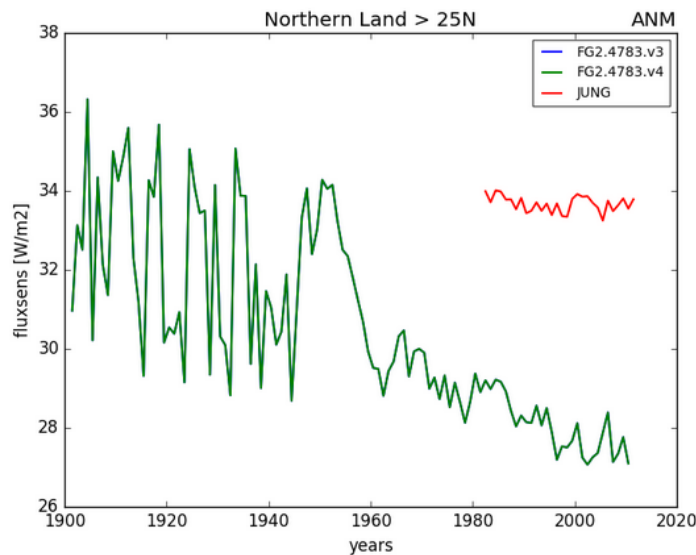
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CRUNCEP
JUNG-et al

Latent Heat Flux



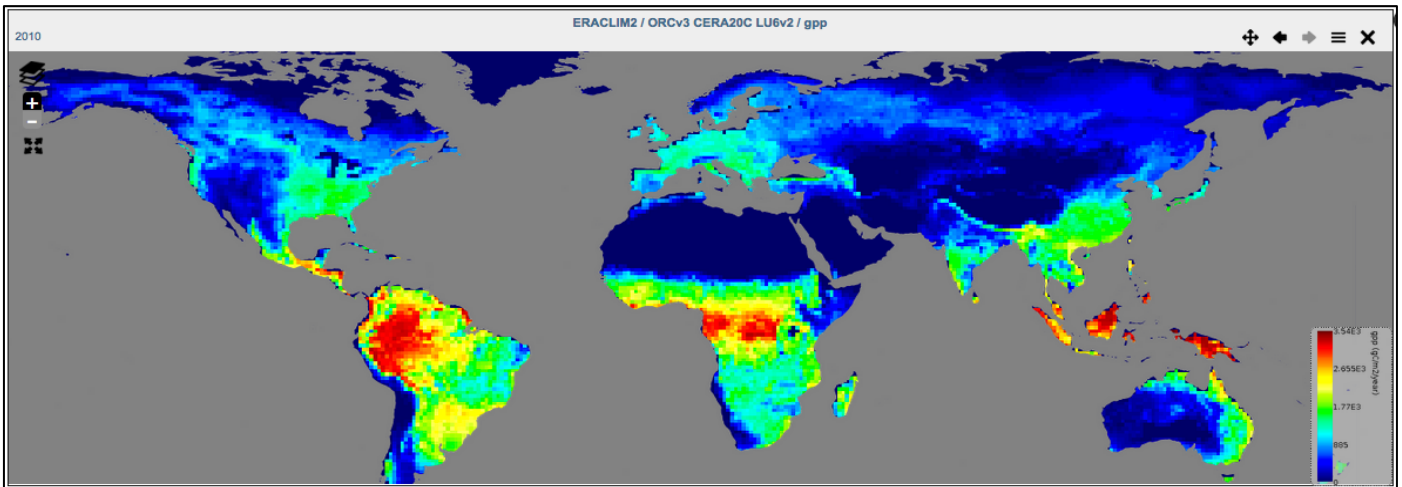
Sensible Heat Flux



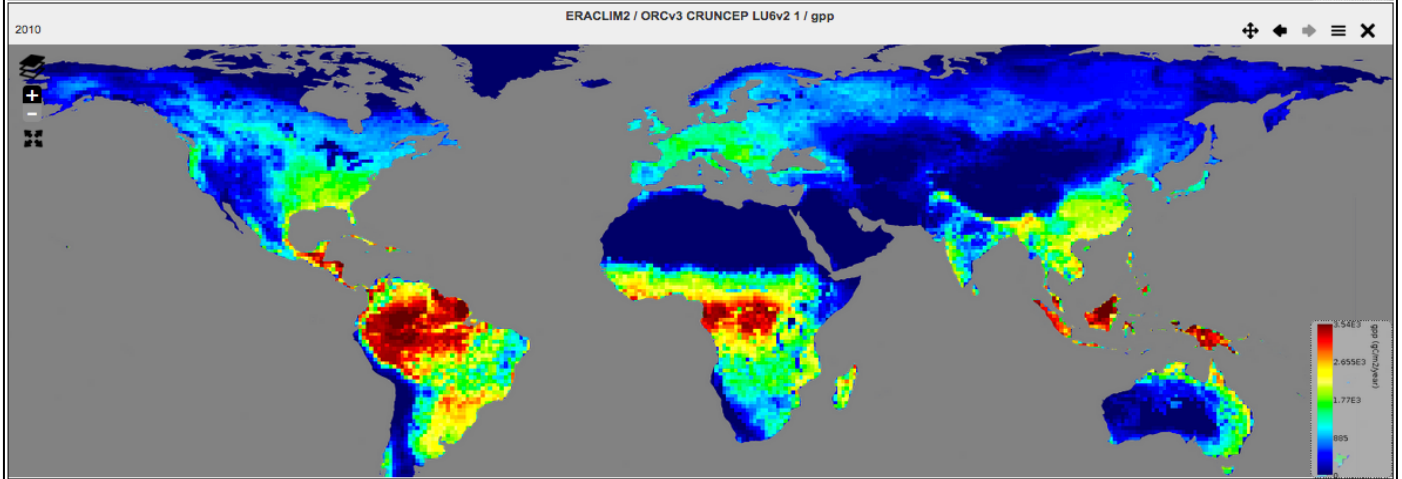


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LAND SURFACE MODEL

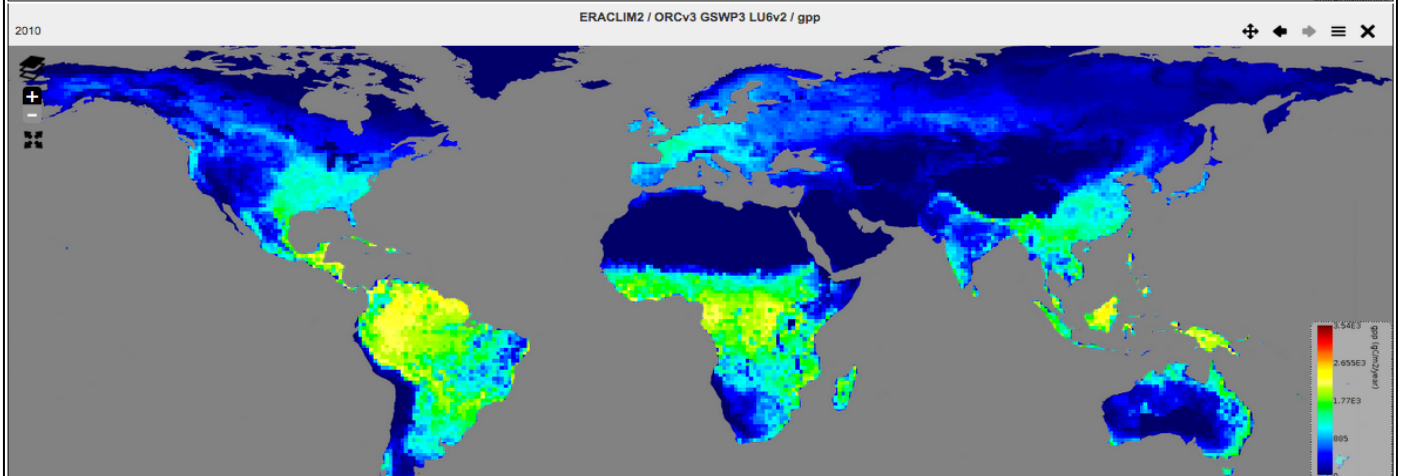
GPP
CERA-20C



GPP
CRUNCEP



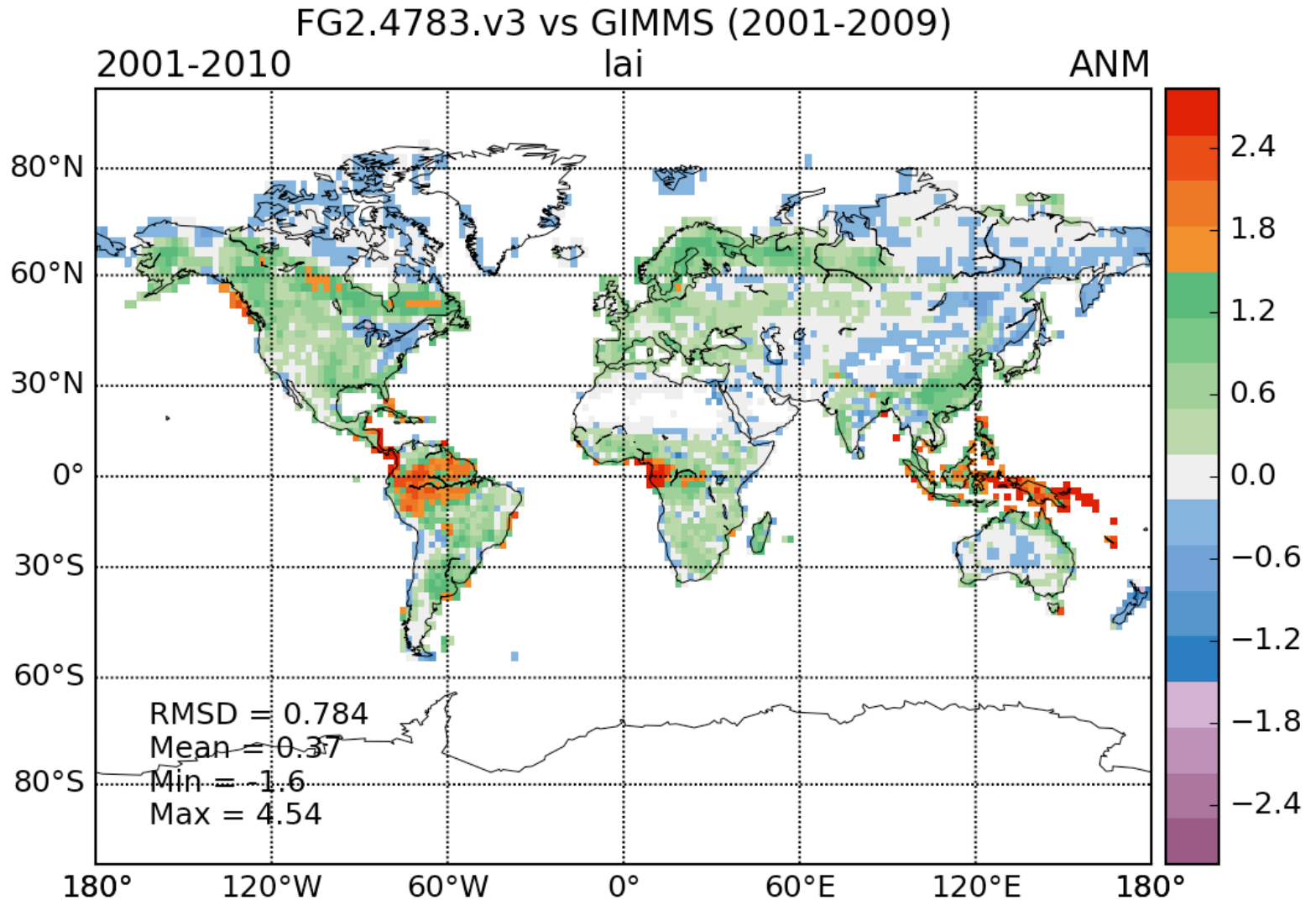
GPP
GSWP3





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LAND SURFACE MODEL

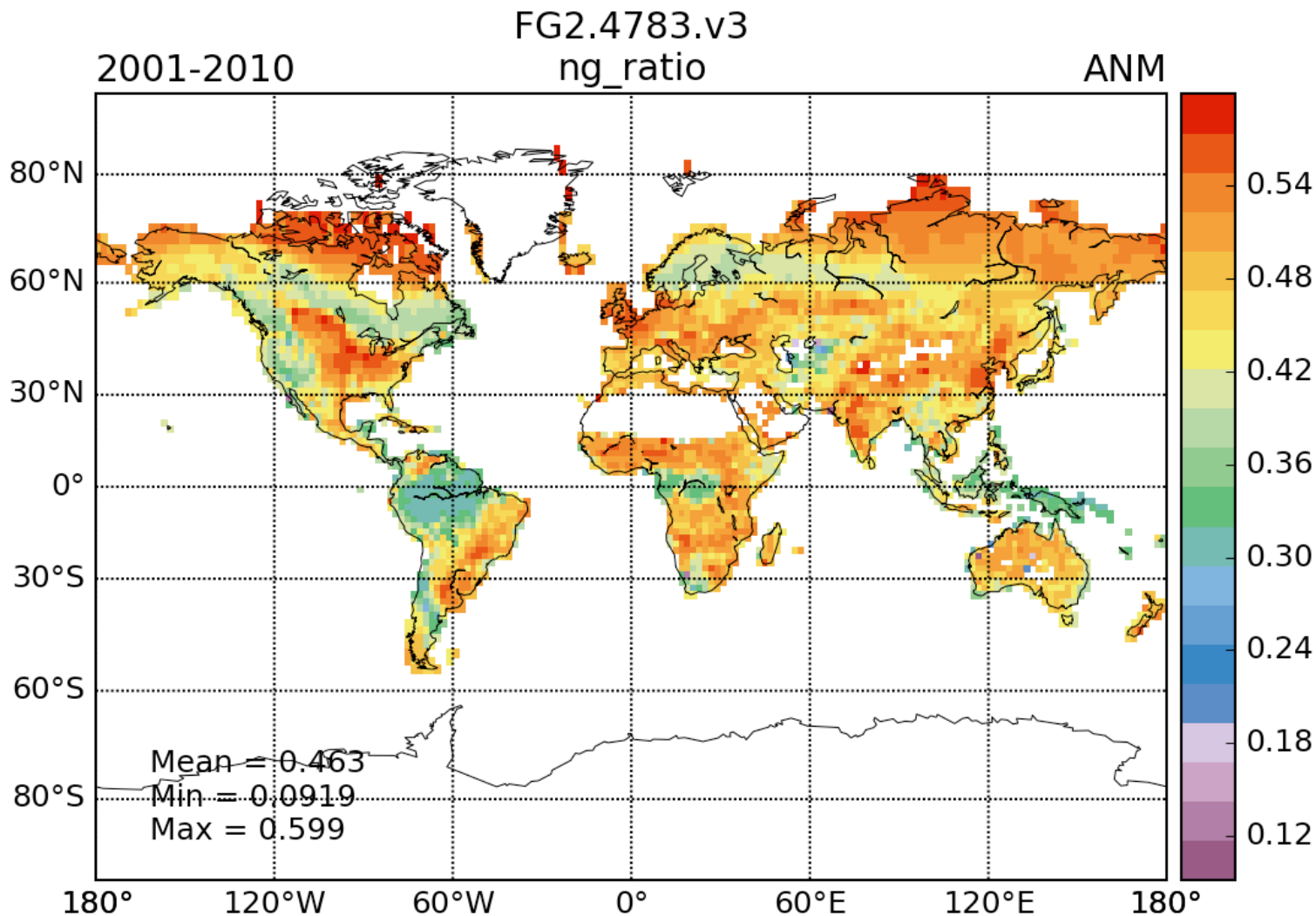
LAI evaluation against GIMMS



NPP / GPP ratio !



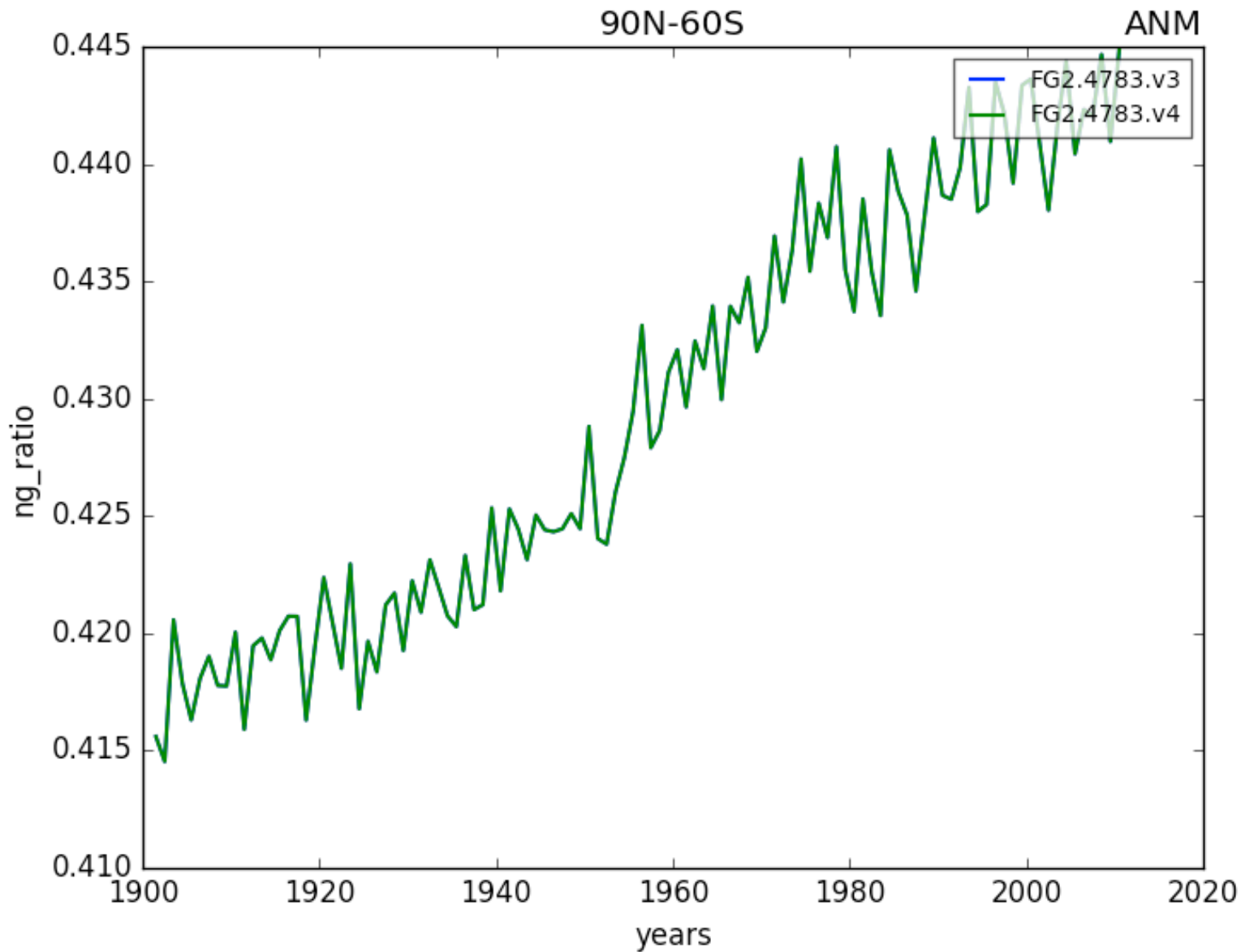
ORCHIDEE
LAND SURFACE MODEL



NPP / GPP ratio !



ORCHIDEE
LAND SURFACE MODEL





Net carbon flux (NBP)

➤ Use NBP variable from stomate ! (Daily time step)

➤ Or compute: (**Sechiba** vs **Stomate** output)

-GPP + hetero_resp + growth_resp + maint_resp
(fluxes at physical time step; per PFTs)

+ HARVEST_ABOVE *(Crop harvest)*

+ CFLUX_PROD100 + CFLUX_PROD10 + CONVFLUX
(Fluxes due to land use chang, i.e. deforestation)

CFLUX_PROD10_HARVEST + CFLUX_PROD100_HARVEST
+ CONVFLUX_HARVEST
(Fluxes due to the wood harvest)



Net carbon flux (NBP)

- Use NBP variable from stomate ! (Daily time step)

ALL variables are expressed

per square meter of land

(need to x by CONTFRAC to compute totals)

(Fluxes due to land use change, net deforestation)

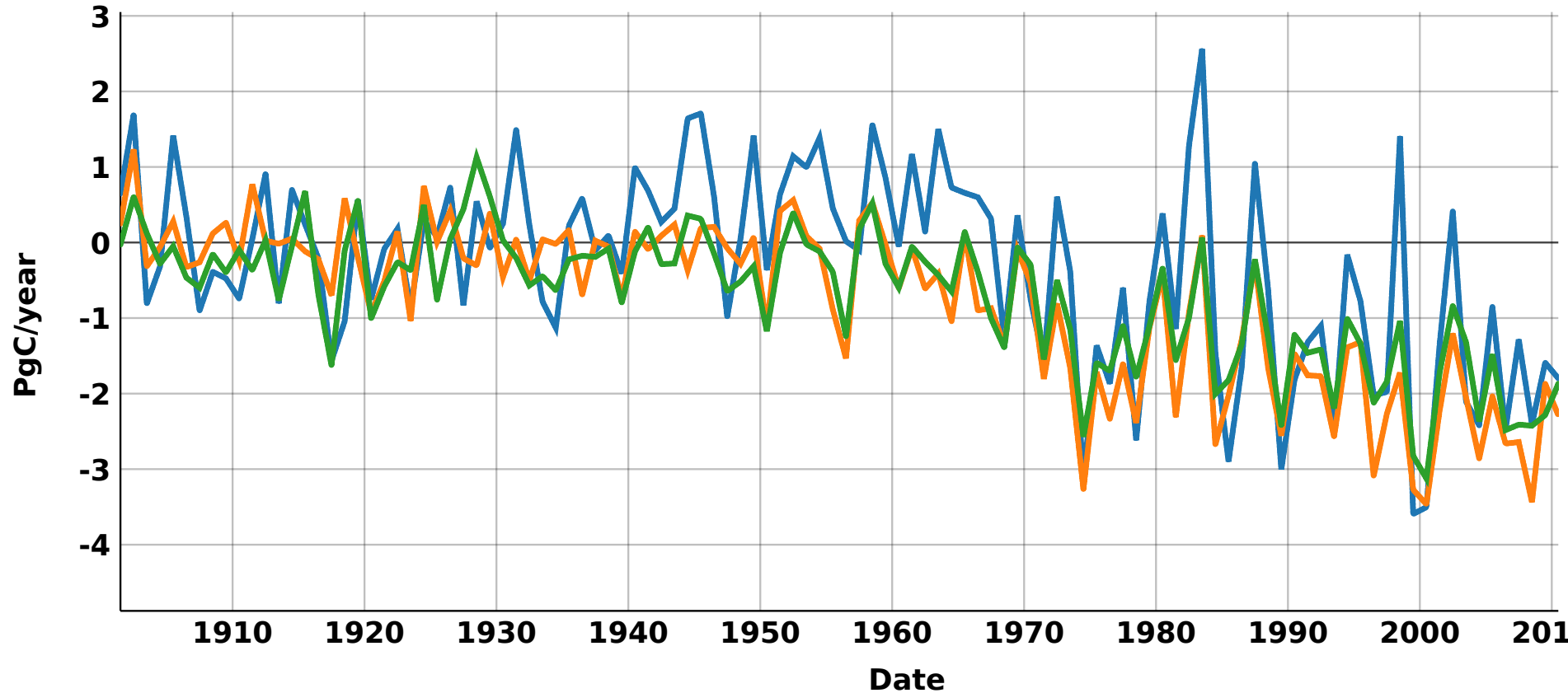
**CFLUX_PROD10_HARVEST + CFLUX_PROD100_HARVEST
+ CONVFLUX_HARVEST**

(Fluxes due to the wood harvest)



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Net CO₂ flux – Meteorological forcings

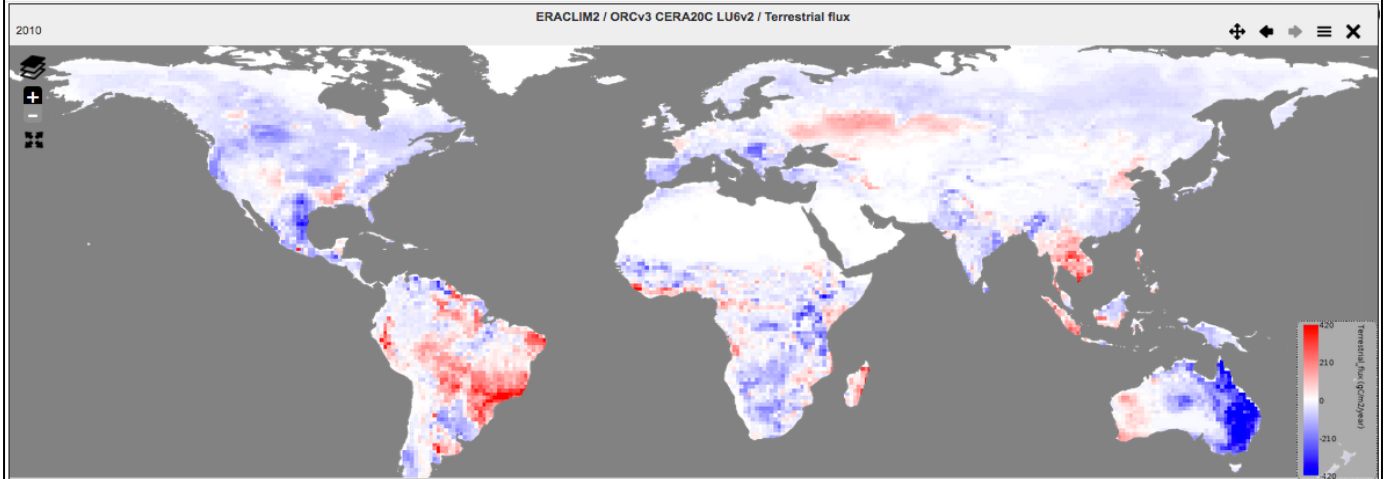


CERA20C
CRUNCEP
GSWP3

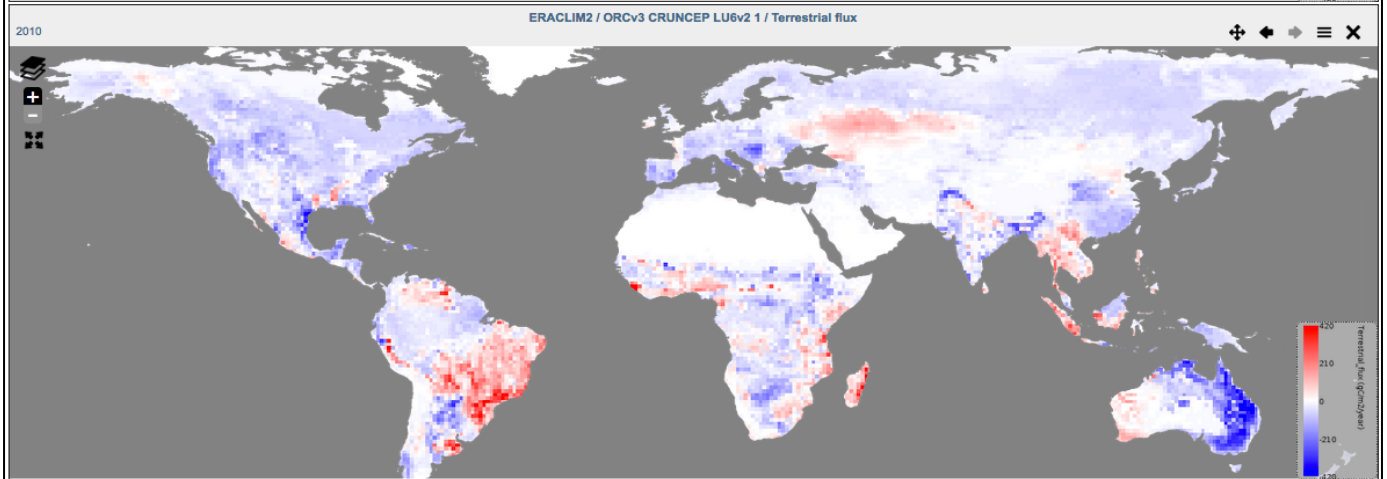


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LAND SURFACE MODEL

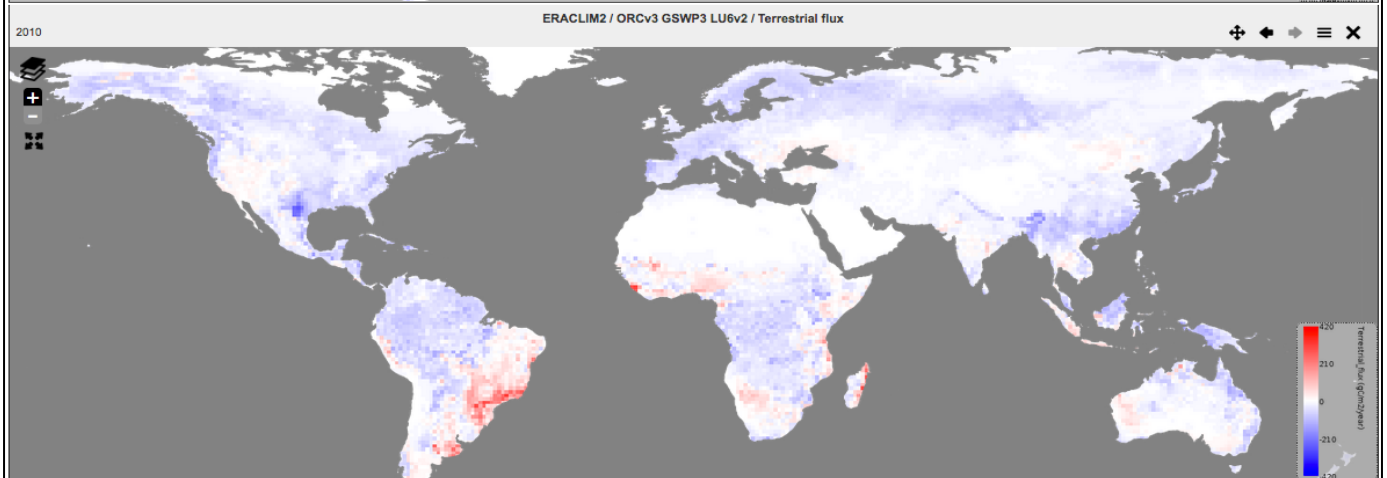
NBP
CERA-20C



NBP
CRUNCEP



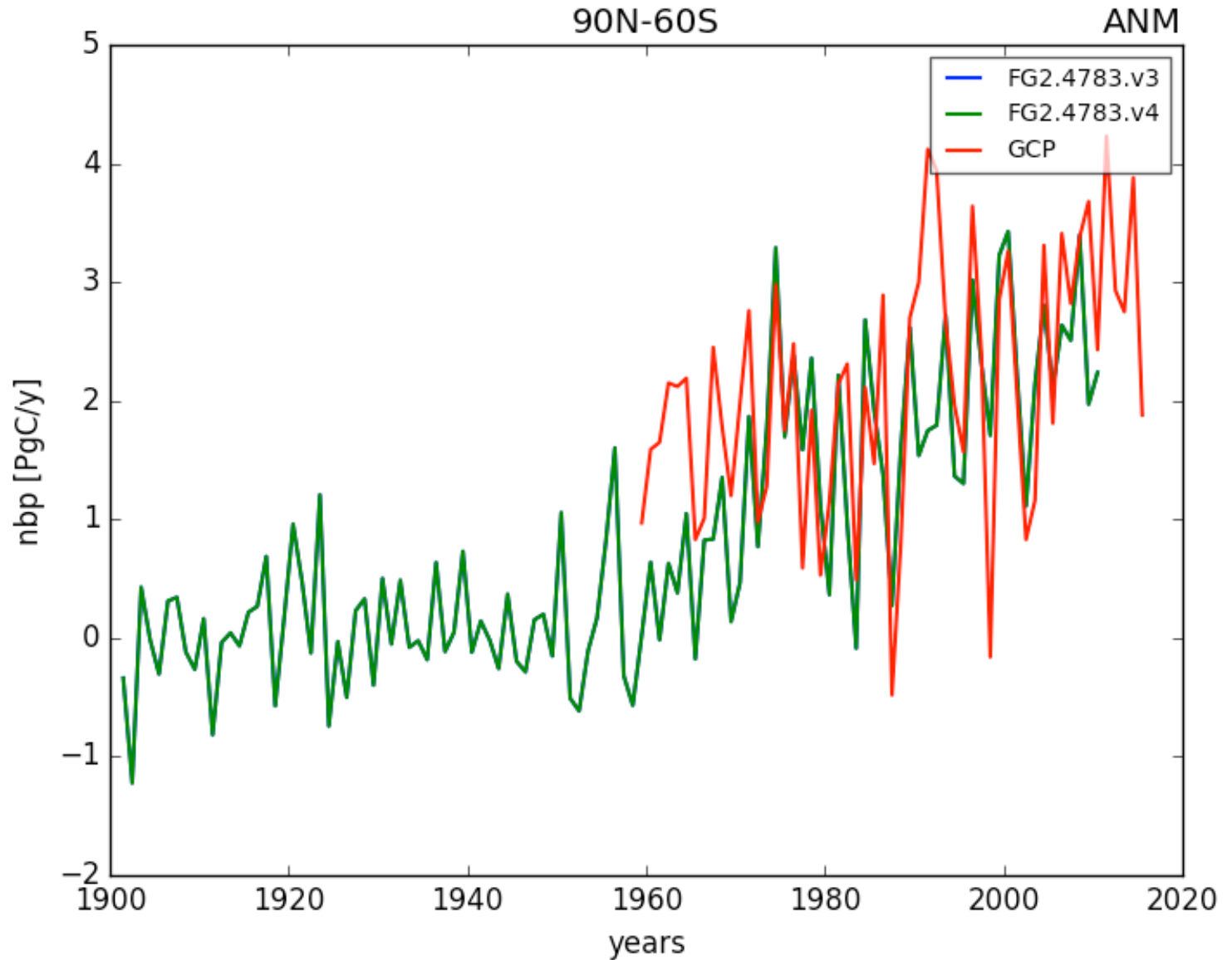
NBP
GSWP3





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NBP from CRUNCEP vs GCP





Net Carbon fluxes evaluation

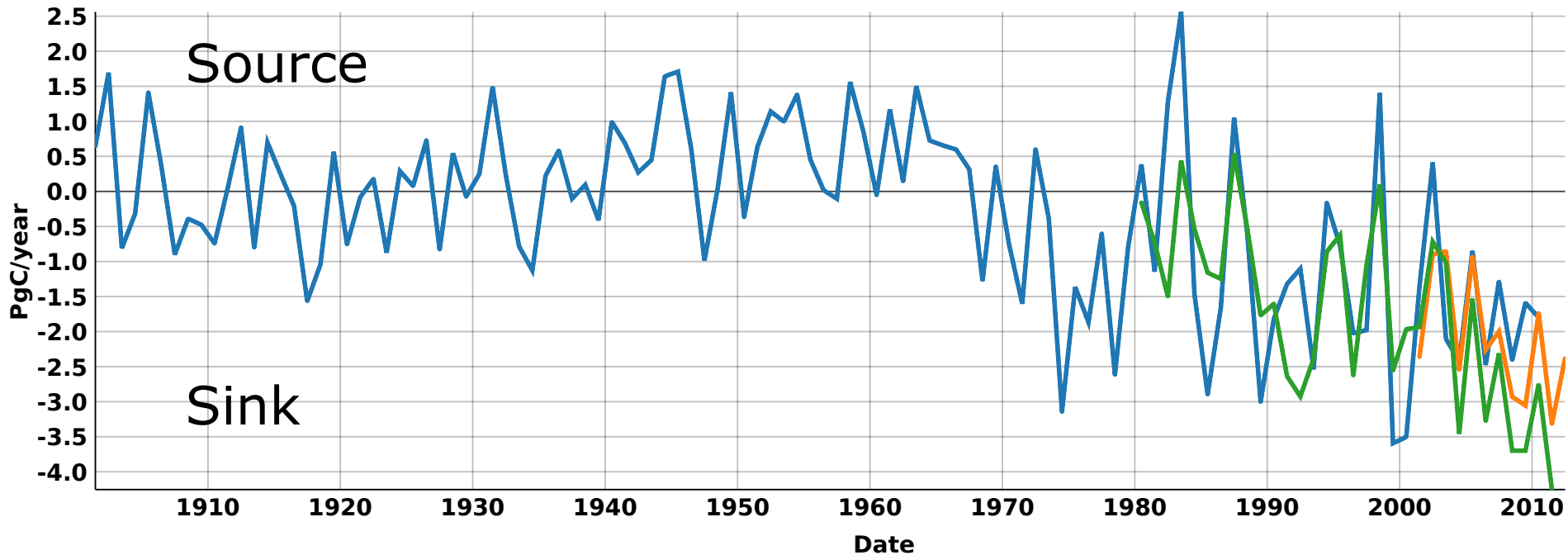
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Global land flux (PgC/yr)

**ORCHIDEE-
CERA20C**

**MACC
inversion**

**CTRACKER
inversion**



- ORCv3 CERA20C LU6v2 / Terrestrial_flux / 05 Global Land / Yearly mean
- CTRACKER US 2013 / Terrestrial_flux / 05 Global Land / Yearly mean
- LSCE var MACC V12 3 / Terrestrial_flux / 05 Global Land / Yearly mean



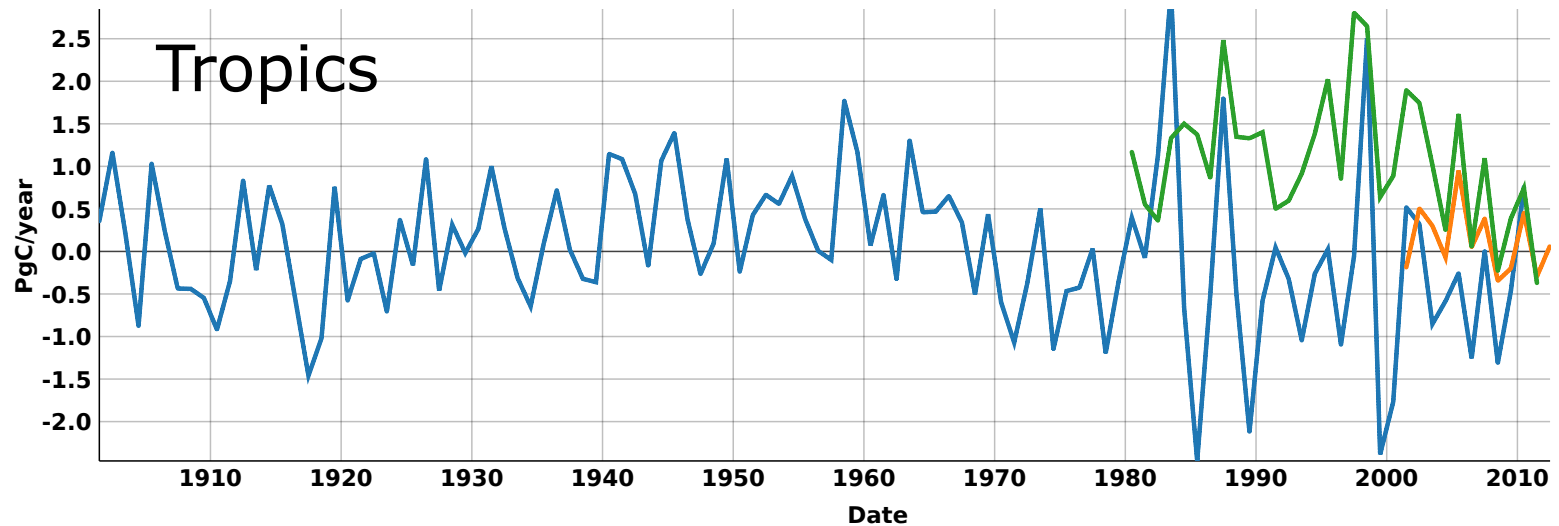
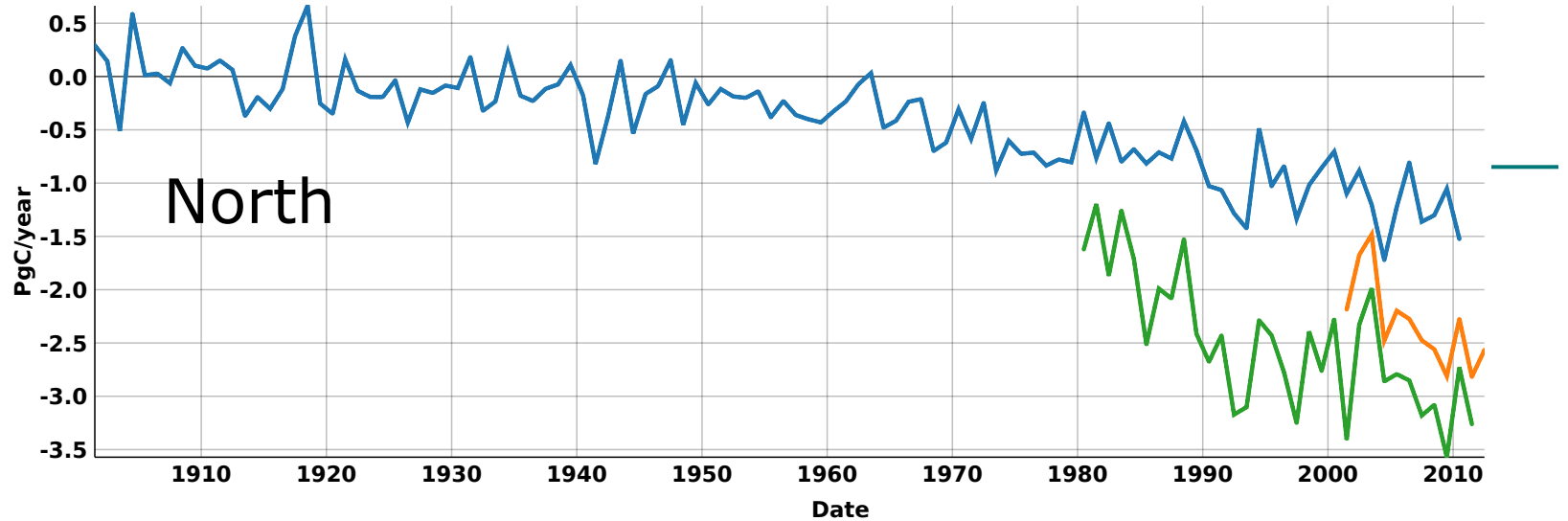
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LAND SURFACE MODEL

Net Carbon fluxes evaluation

ORCHIDEE-
CERA20C

MACC
inversion

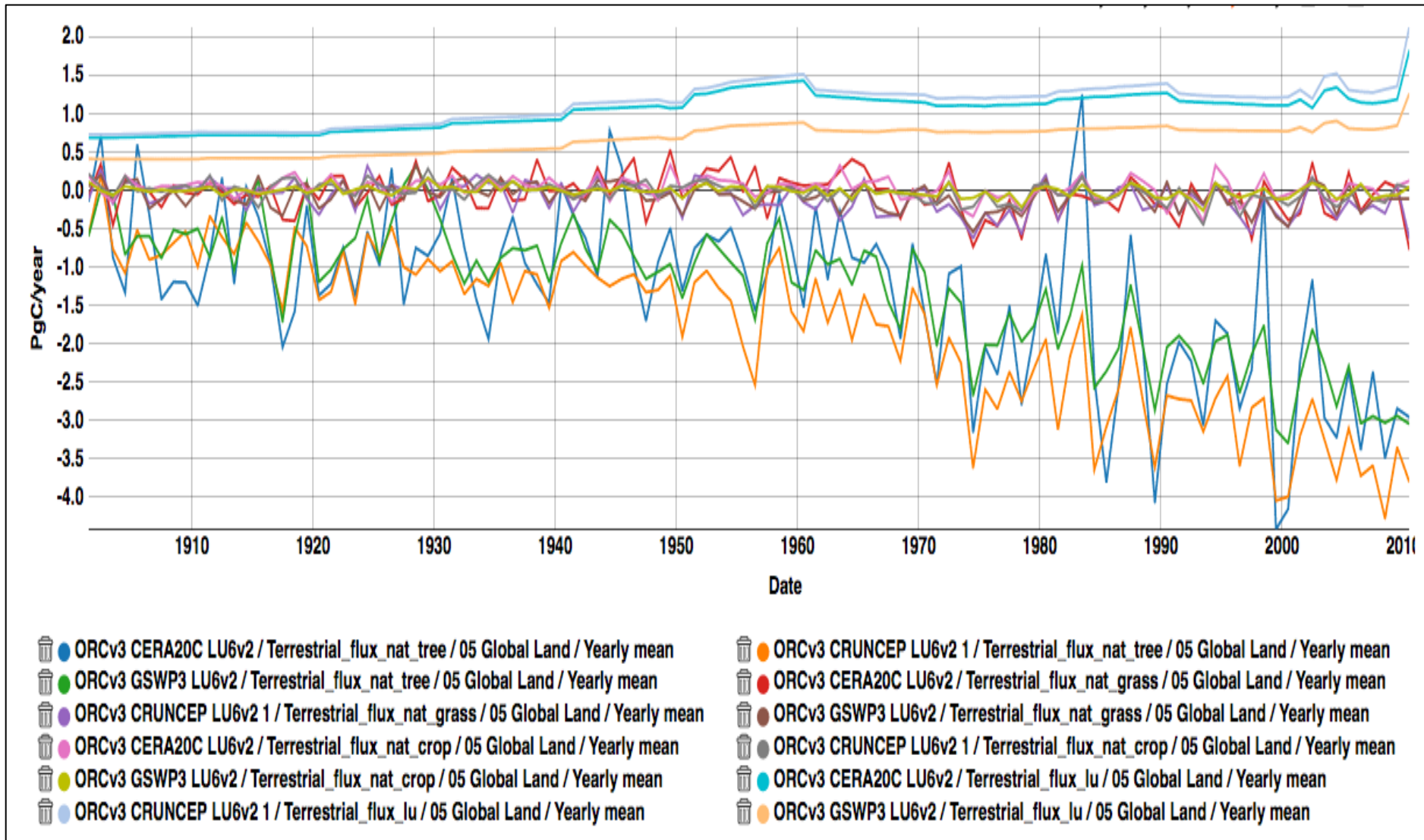
CTRACKER
inversion





Net Carbon fluxes evaluation

ORCHIDEE
LAND SURFACE MODEL



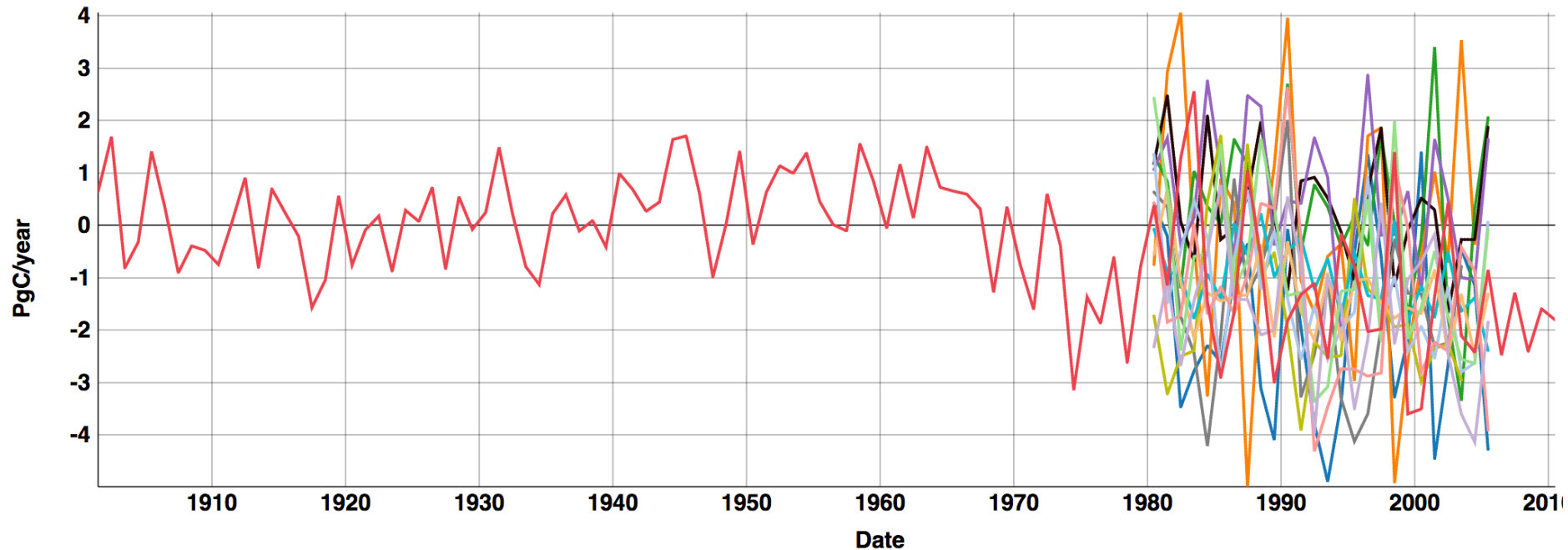


Net Carbon fluxes evaluation

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**ORCHIDEE-
CERA20C**

**CMIP5
MODELS**

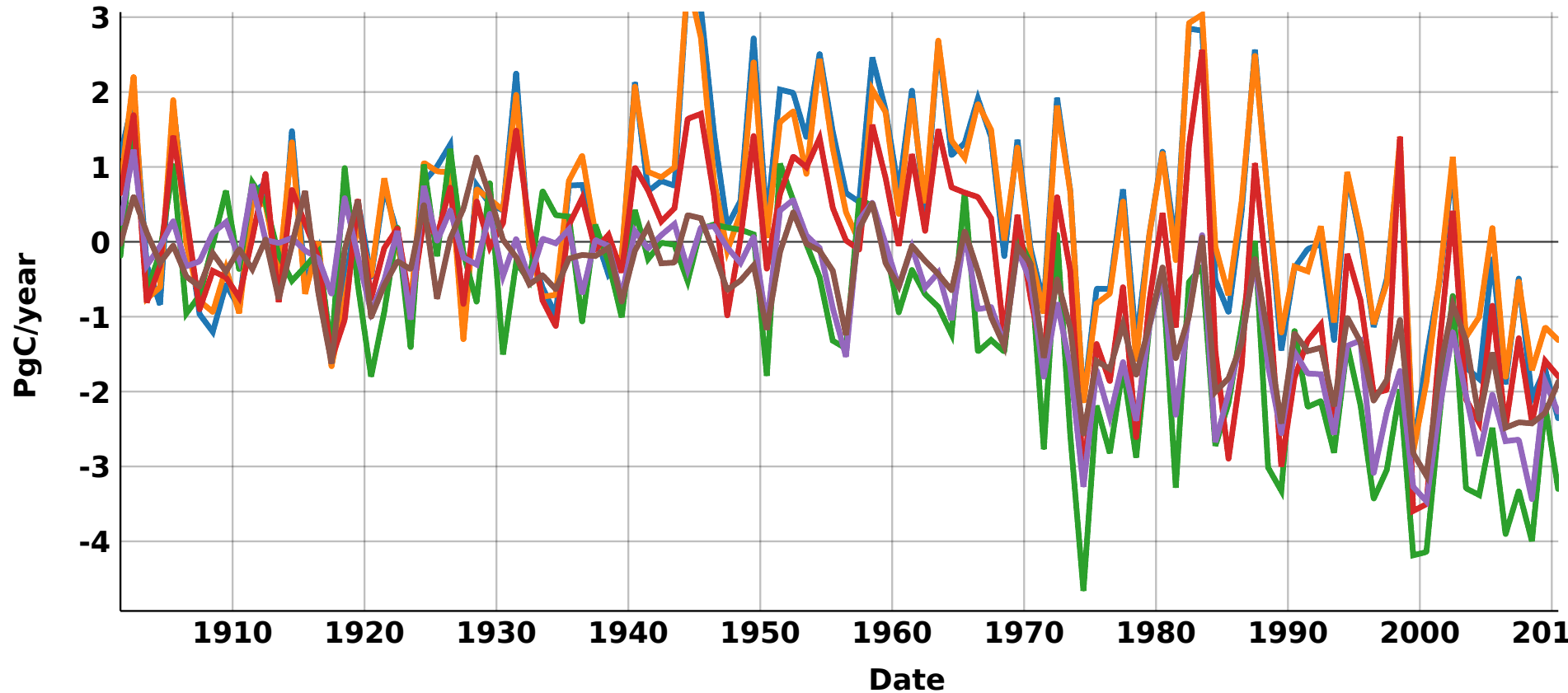


- BNU ESM / Terrestrial_flux / 05 Global Land / Yearly mean
- CCSM4 / Terrestrial_flux / 05 Global Land / Yearly mean
- CESM1 CAM5 / Terrestrial_flux / 05 Global Land / Yearly mean
- HadGEM2 ES / Terrestrial_flux / 05 Global Land / Yearly mean
- IPSL CM5A MR / Terrestrial_flux / 05 Global Land / Yearly mean
- MIROC ESM CHEM / Terrestrial_flux / 05 Global Land / Yearly m...
- MPI ESM MR / Terrestrial_flux / 05 Global Land / Yearly mean
- CanESM2 / Terrestrial_flux / 05 Global Land / Yearly mean
- CESM1 BGC / Terrestrial_flux / 05 Global Land / Yearly mean
- HadGEM2 CC / Terrestrial_flux / 05 Global Land / Yearly mean
- IPSL CM5A LR / Terrestrial_flux / 05 Global Land / Yearly mean
- IPSL CM5B LR / Terrestrial_flux / 05 Global Land / Yearly mean
- MPI ESM LR / Terrestrial_flux / 05 Global Land / Yearly mean
- ORCv3 CERA20C LU6v2 / Terrestrial_flux / 05 Global Land / Ye...



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Net CO₂ flux – All uncertainties





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Thanks you...