Contribution from LSCE (UVSQ) to ERACLIM2: « land carbon cycle reanalysis»

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Overall proposed contribution

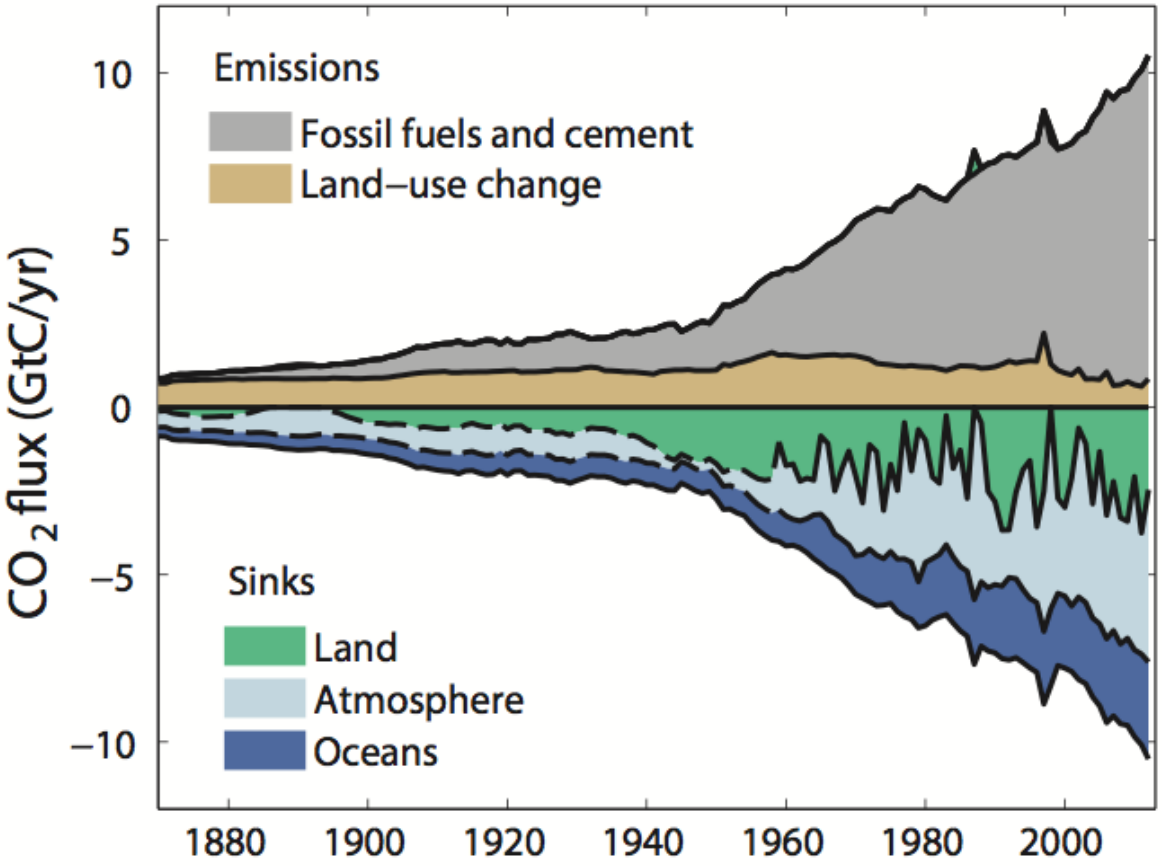
➔Adding the C-cycle to the reanalysis

- 100-year reanalysis with CERA-20C
- 30-year reanalysis with CERA-SAT

- Surface C fluxes & uncertainties:
  - land (Net and Gross) fluxes
  - anthropogenic (fossil + LUC)

- Land C stocks & uncertainties:
  - Aboveground & Belowground C pools
  - separated for Forests, Grass, Crops

Global Carbon Budget



Since 1750, human activities have emitted 555 ± 85 PgC (Fossil fuel + Luse)

Fossil fuel CO_2 emissions are ≈ 10 PgC yr-1 in 2015 (55% > 1990 level)

Over the past 50 years, 44 ± 6 % of emissions remains in the atmosphere

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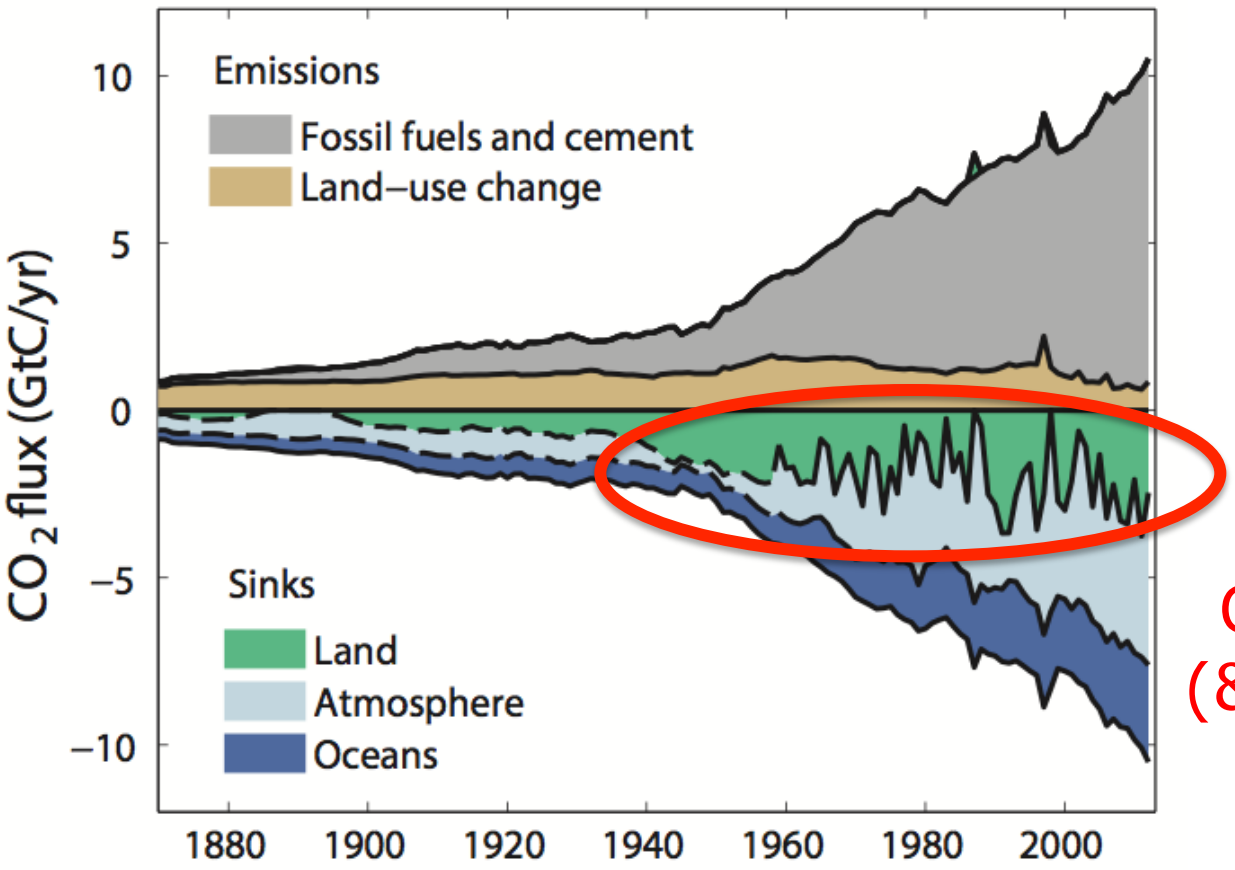

LAND focuss with ORCHIDEE (& CTESSEL)

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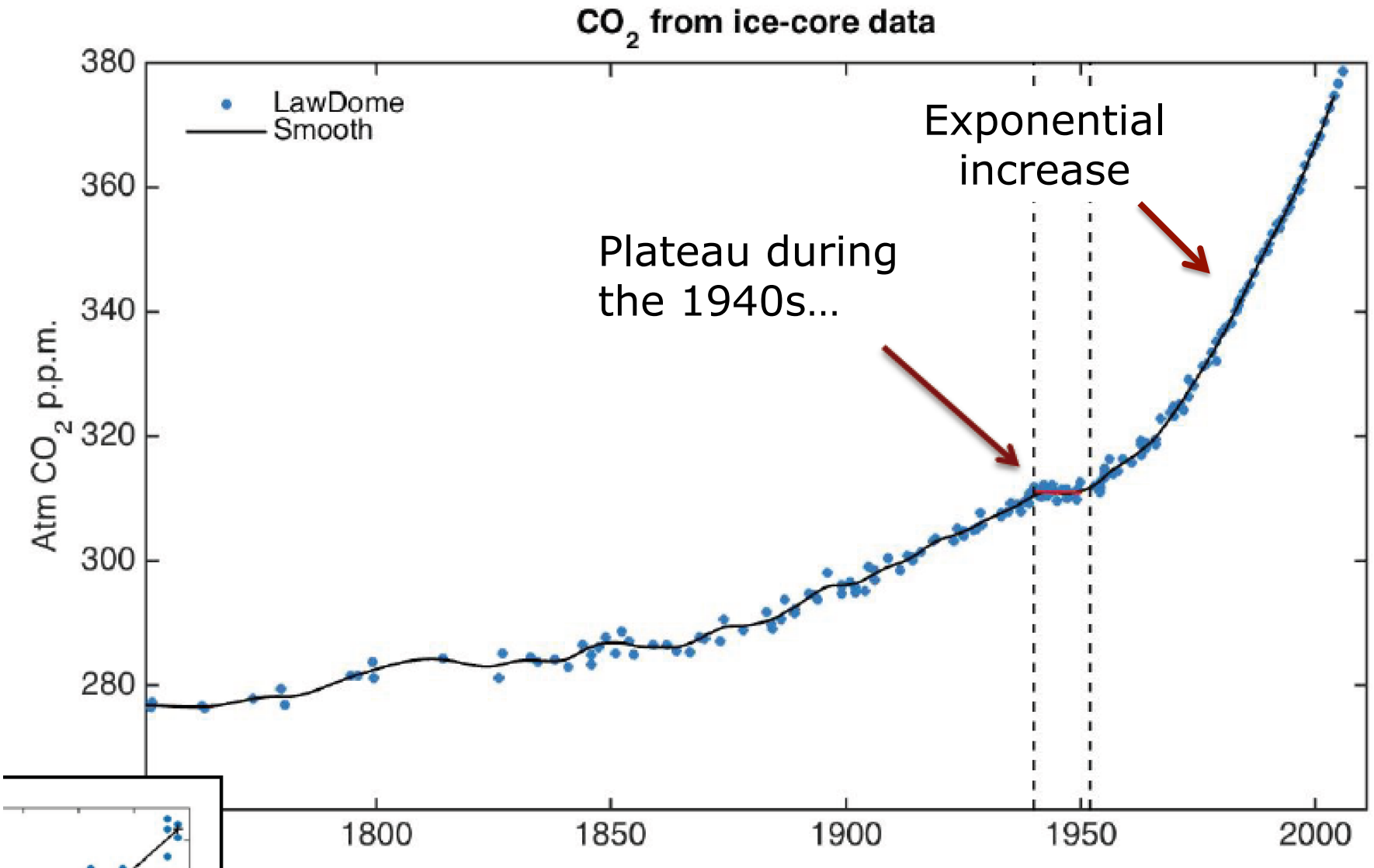
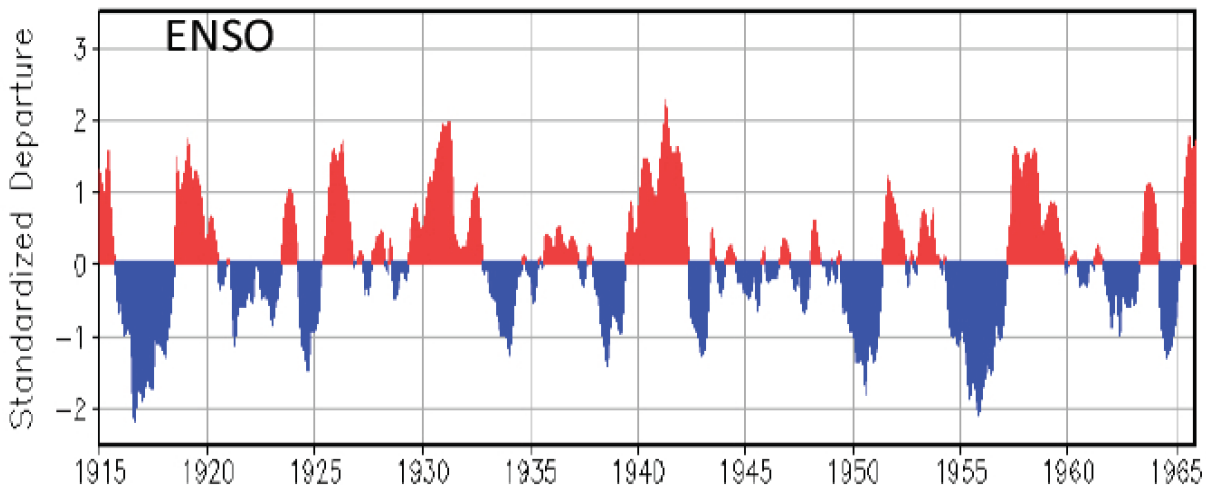
Key features of the global C cycle over the 20th Century



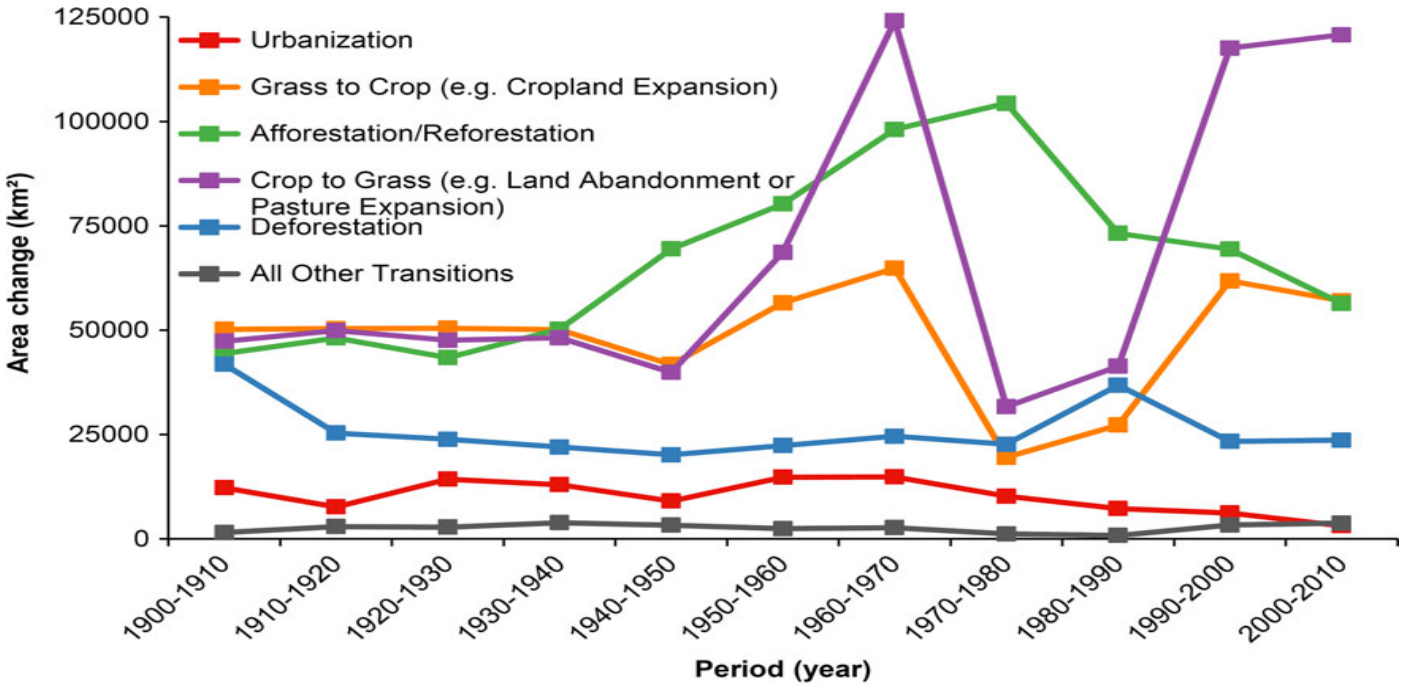
Few major drivers of the C-cycle

Climate



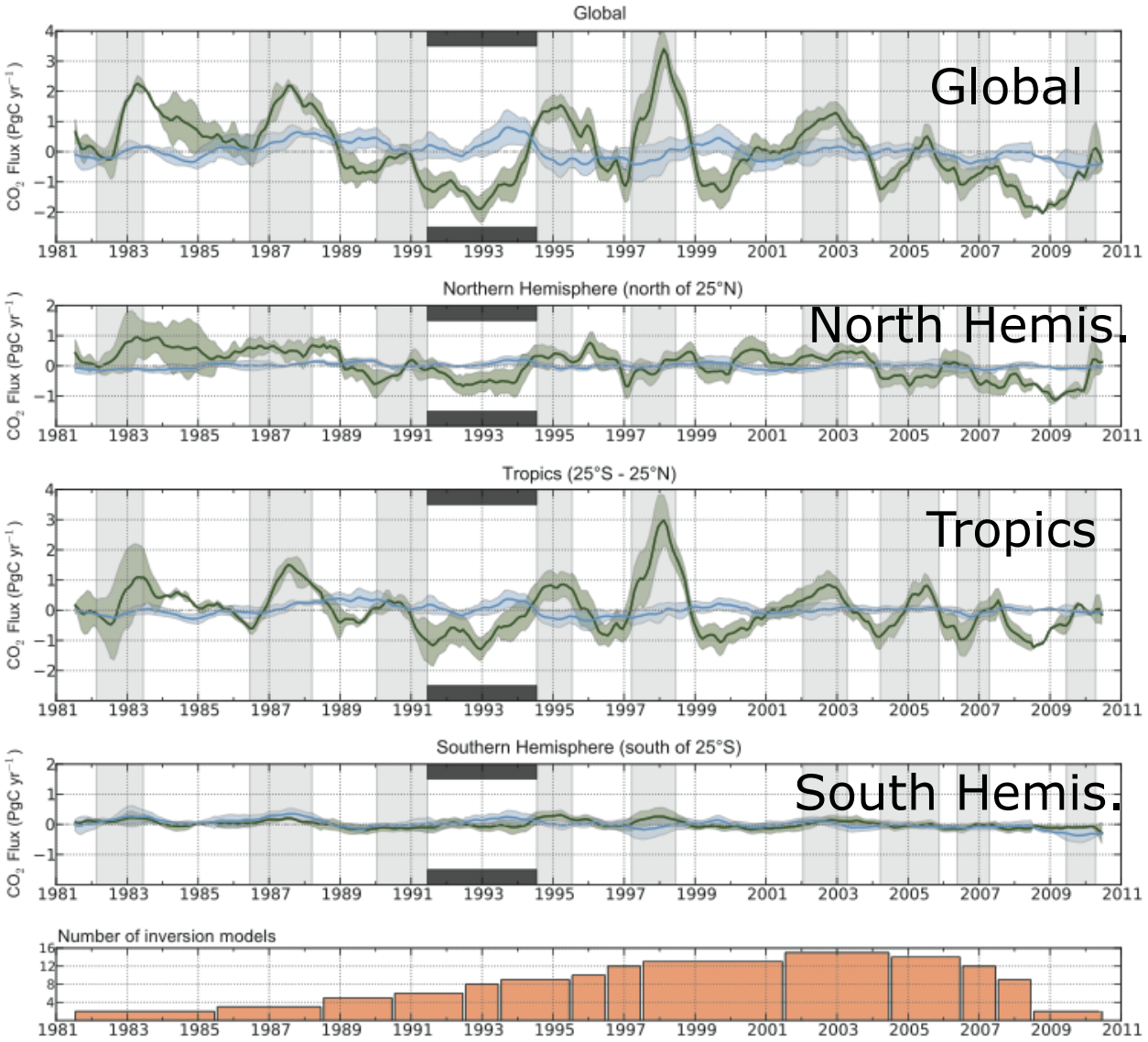
Land use change

Ex: data from Fuchs et al. 2015 (HILDA)



Current land / ocean carbon flux anomalies

(from atmospheric CO2 inversion)

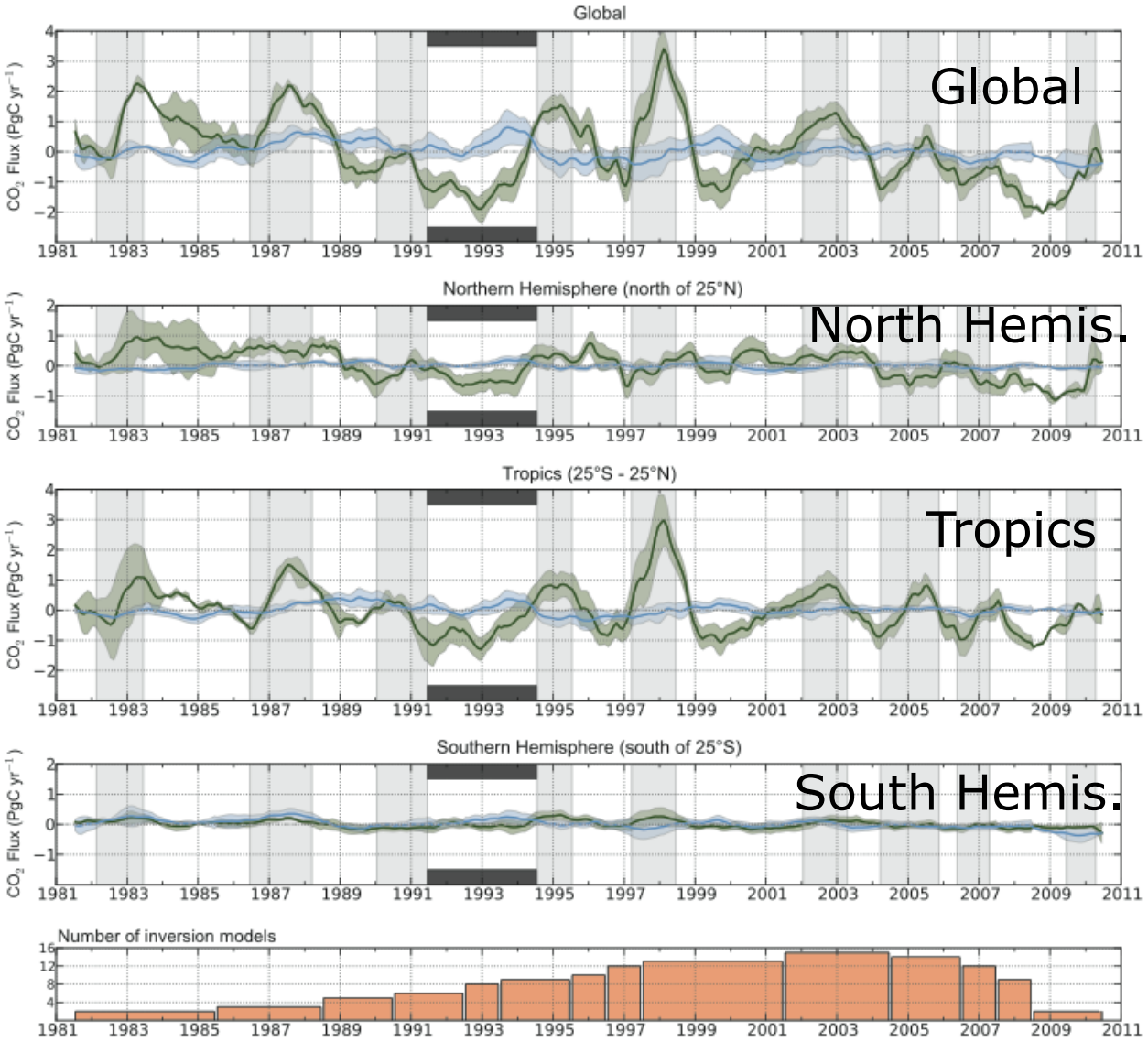


1980 2010

Current land / ocean carbon flux anomalies
(from atmospheric CO2 inversion)

Our obejectives for ERACLIM2

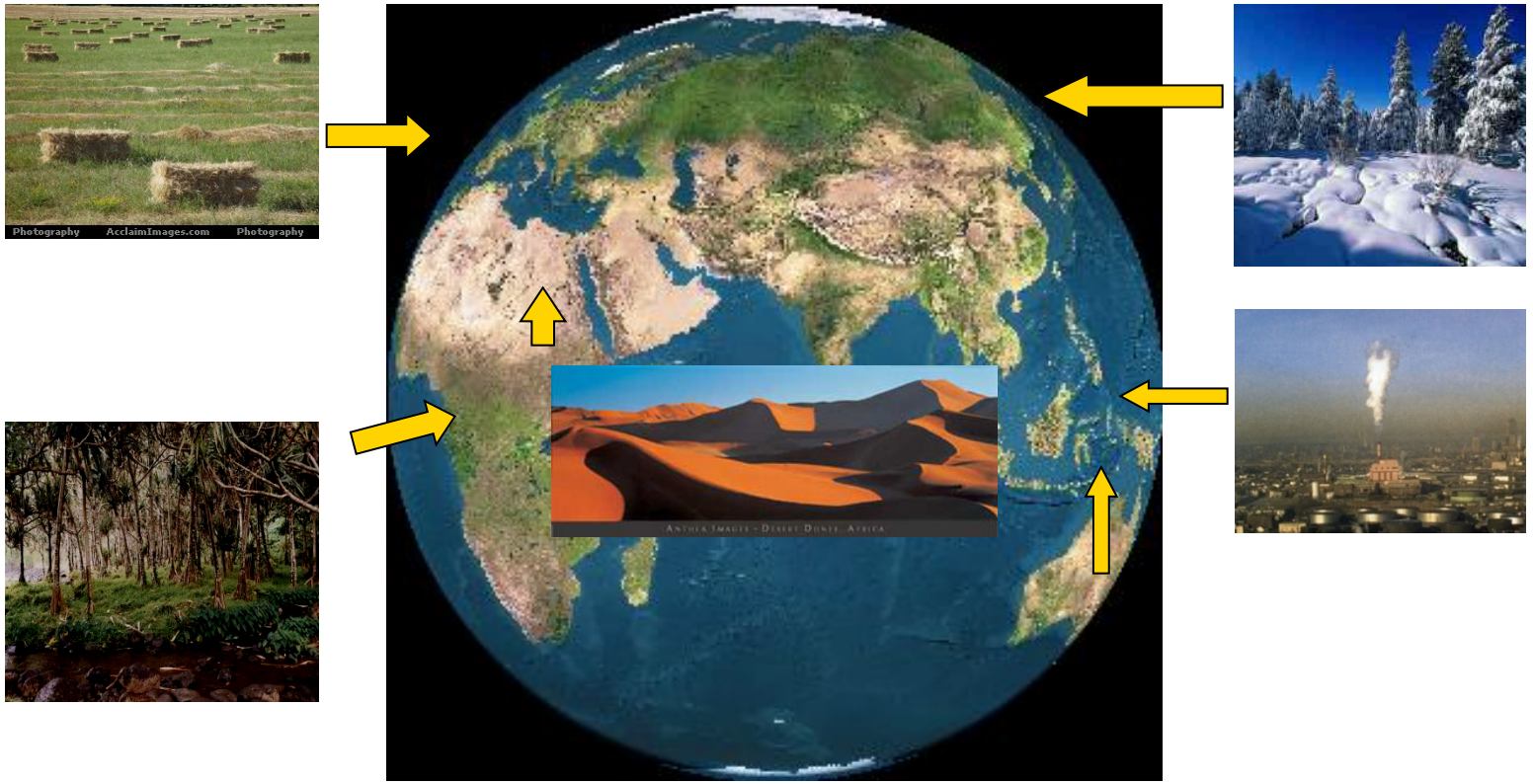
1900



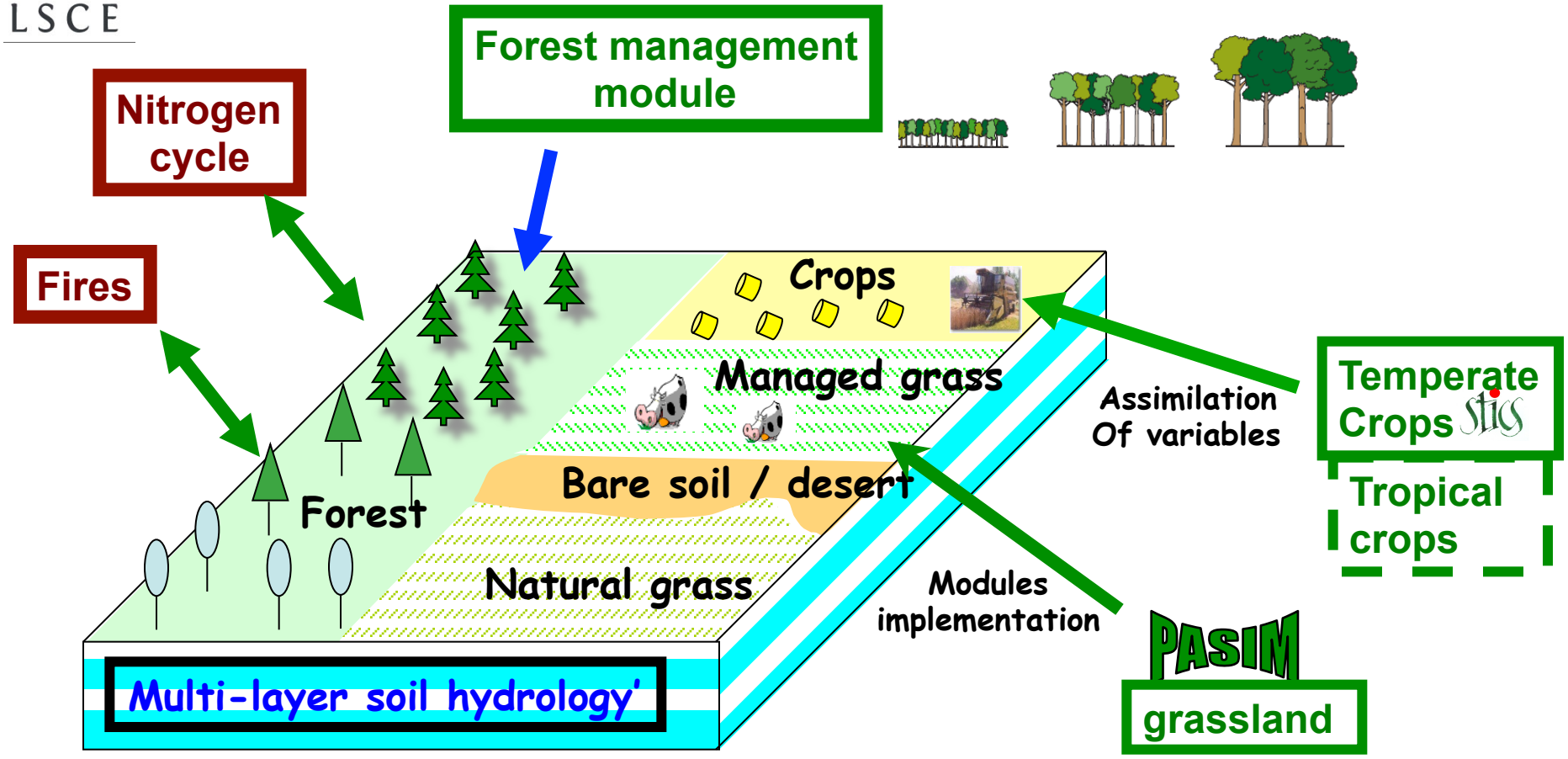
1980 2010

Global Vegetation Model: ORCHIDEE

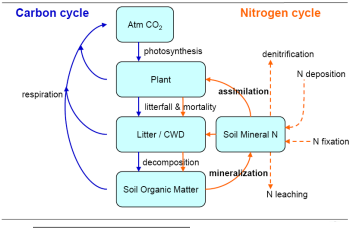
Simulates the Energy, Water and Carbon balance
Land component of the IPSL Earth System Model



ORCHIDEE model: recent improvements



- Generalization of PFT concept (number not limited)
- A 11-layer hydrological scheme
- Scientific documentation



Nitrogen cycle in ORCHIDEE

Implementation of N – C interactions

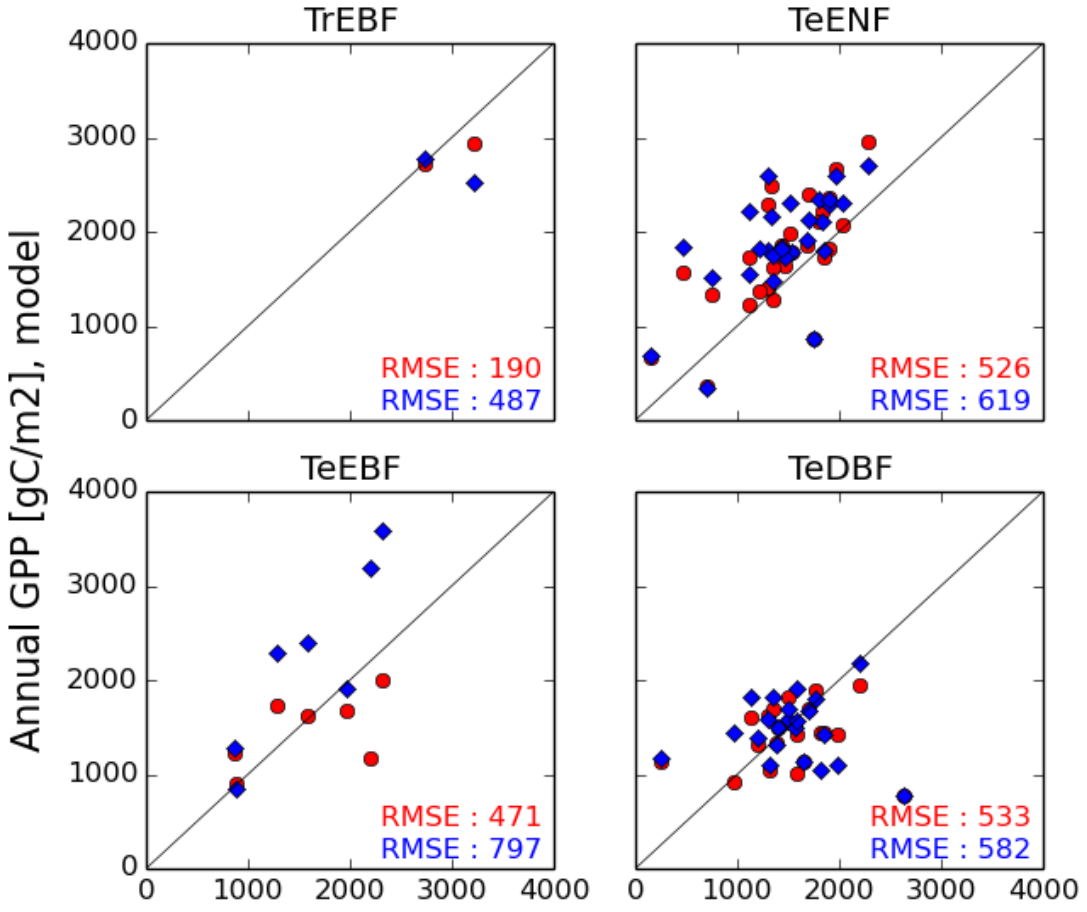
➔ Evaluation at FluxNet sites (improved RMSE)

CN_fixed ->

CN_variable

➔ On-going test at global scale

Gross Primary Production



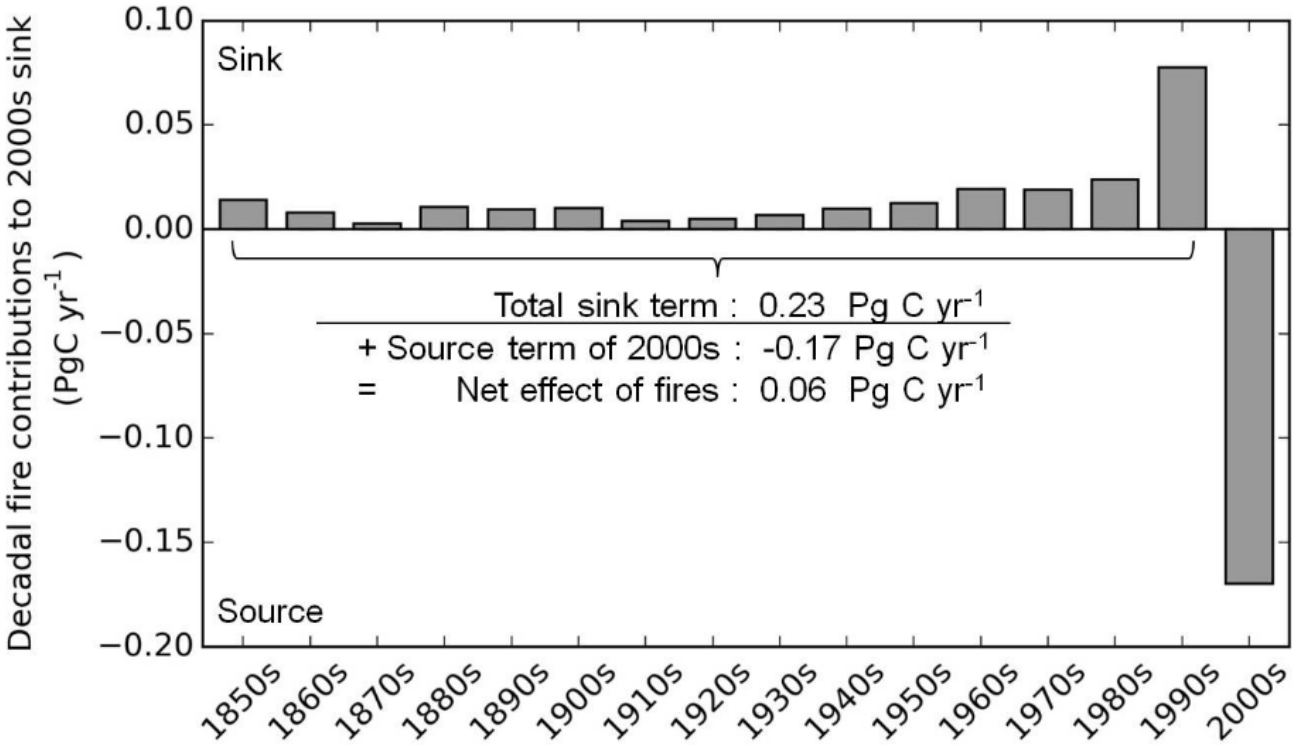
(Vuichard et al., in prep)

FIRE : use of SPITFIRE

➔ SPITFIRE coupled to ORCHIDEE

➔ Ex: impact of past fires on Boreal ecosystems

Contribution of decadal "fire cohorts" of 1850-2009 to the simulated C sink for 2000-2009

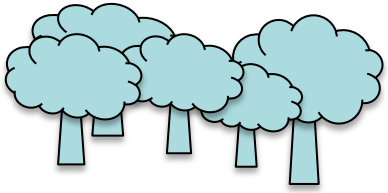


Yue et al., BGD, 2015

New forest structure & management

LSCE

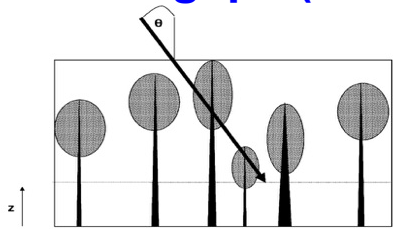
Include diameter & age classes



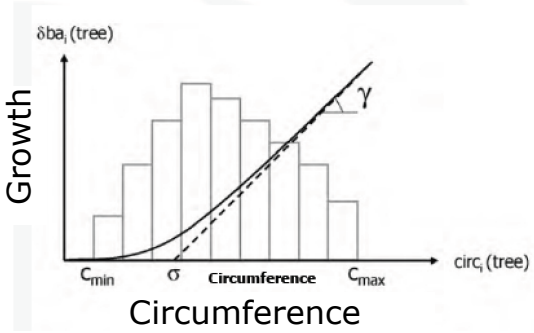
ORCHIDEE - CAN

(Naudts et al., 2015)

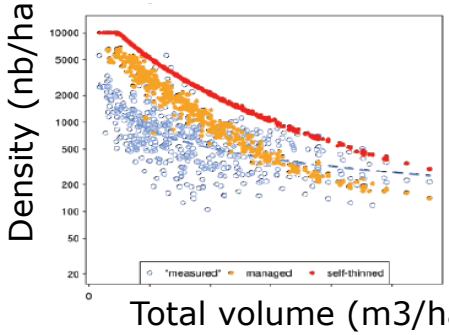
Accounts for gaps (PGAP)



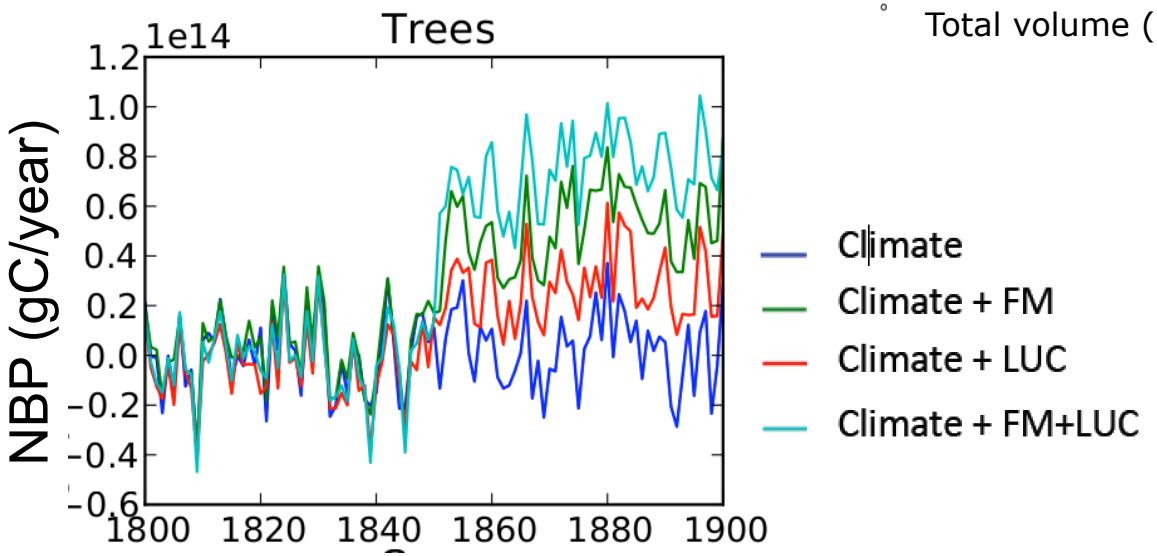
Allocation : "big get bigger"



Mortality from self-thinning



➔ Impact of climate Forest management Land Use Change on European NBP



Reanalysis with ERA-20C is only in progress!!
First results with CRU-NCEP forcing…

A specific web site to compare model carbon results

http://transcom.globalcarbonatlas.org/

User/Passwd: transcom / transcom2014

Find here applications, initially developped for the Global Carbon Atlas working with the output from several research projects:

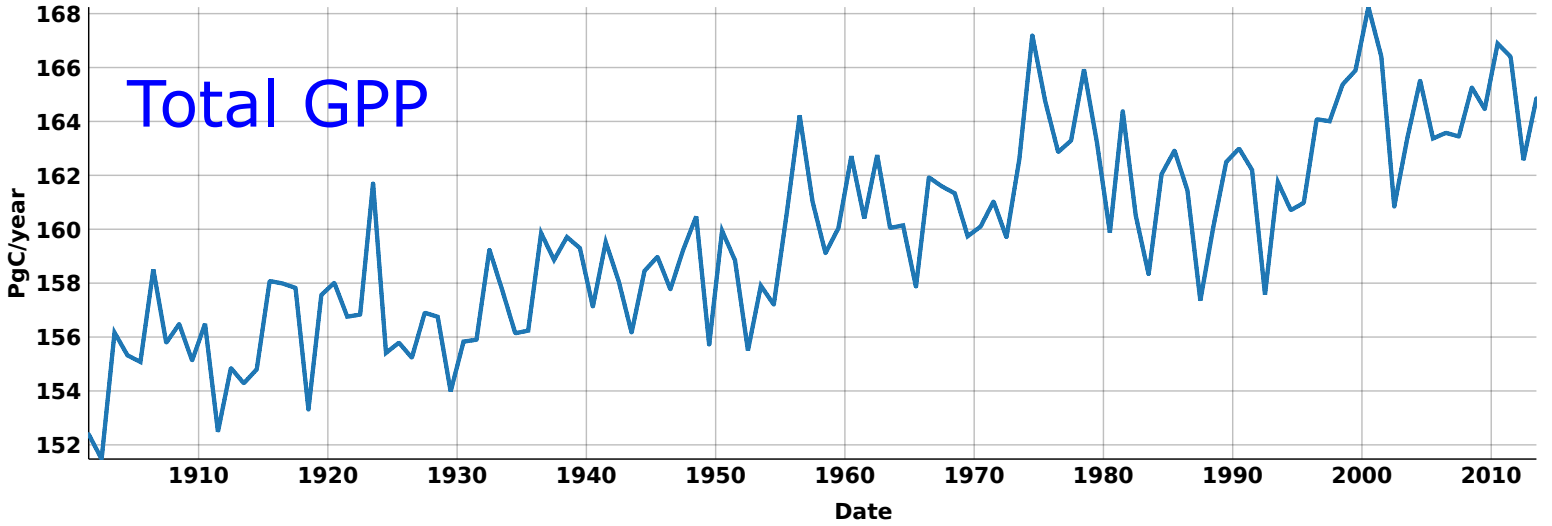
- TRANSCOM project
- GEOCARBON project
- ERACLIM project

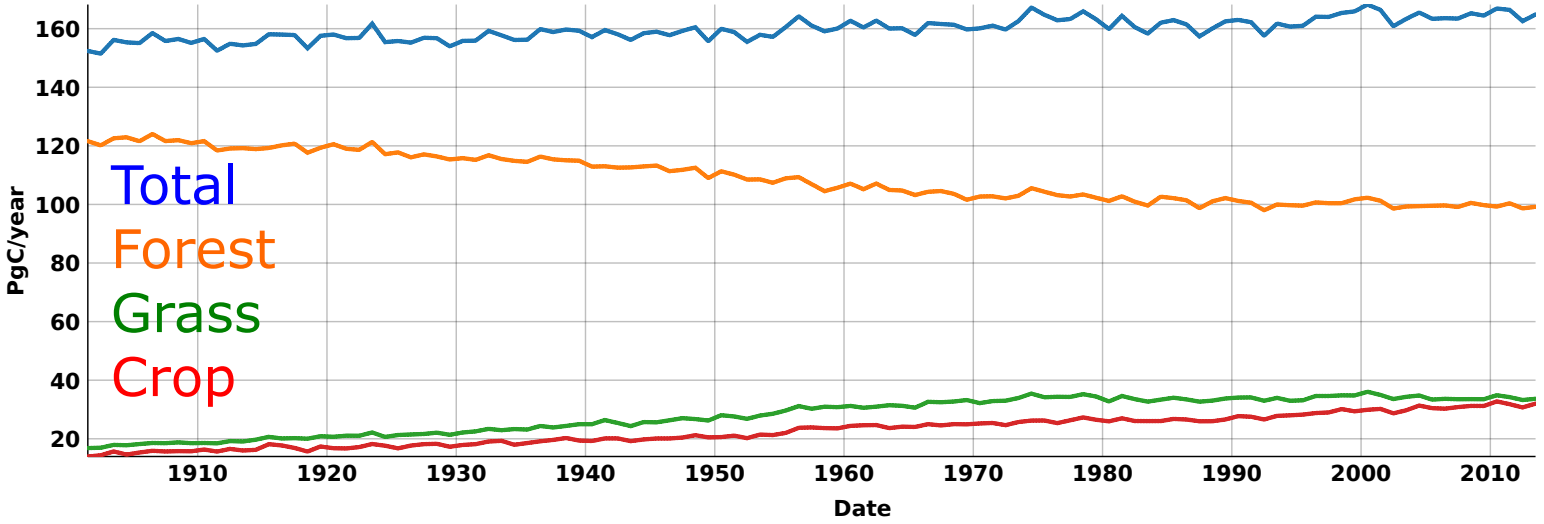
Two different viewing facilities are provided:

- **Carbon flux maps**
- **Regional time series**

First reanalysis with CRU meteo. data

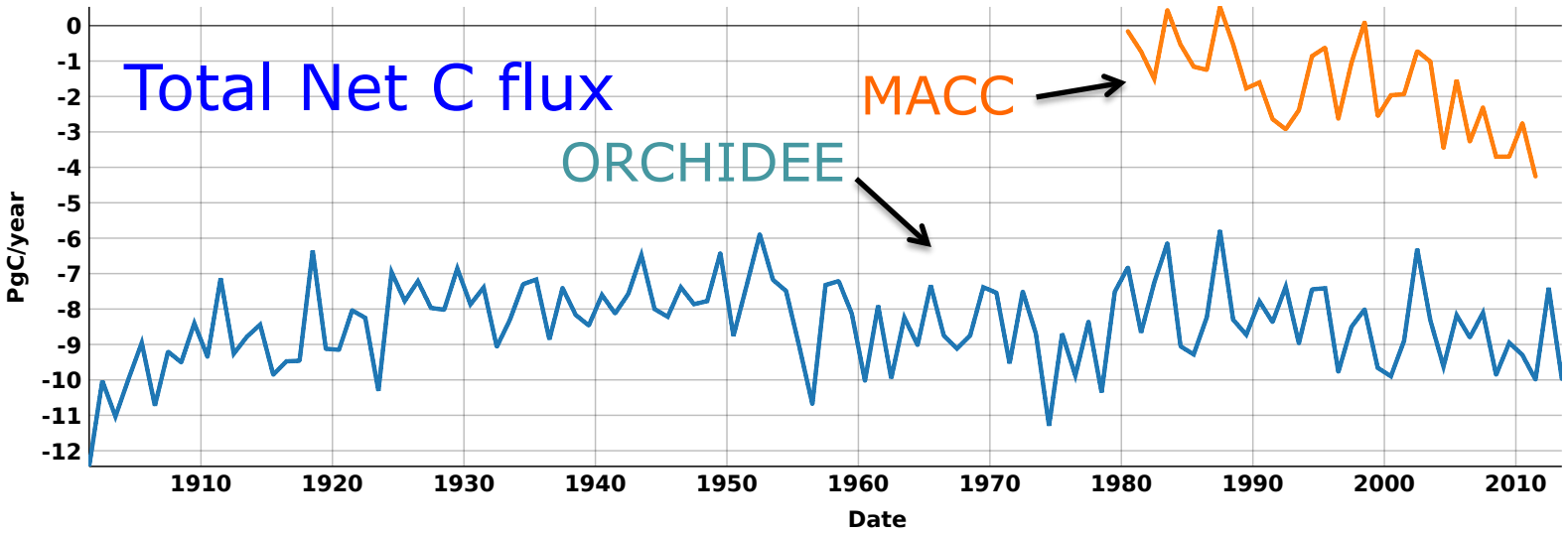
Gross Primary Production (gC/m2/yr)



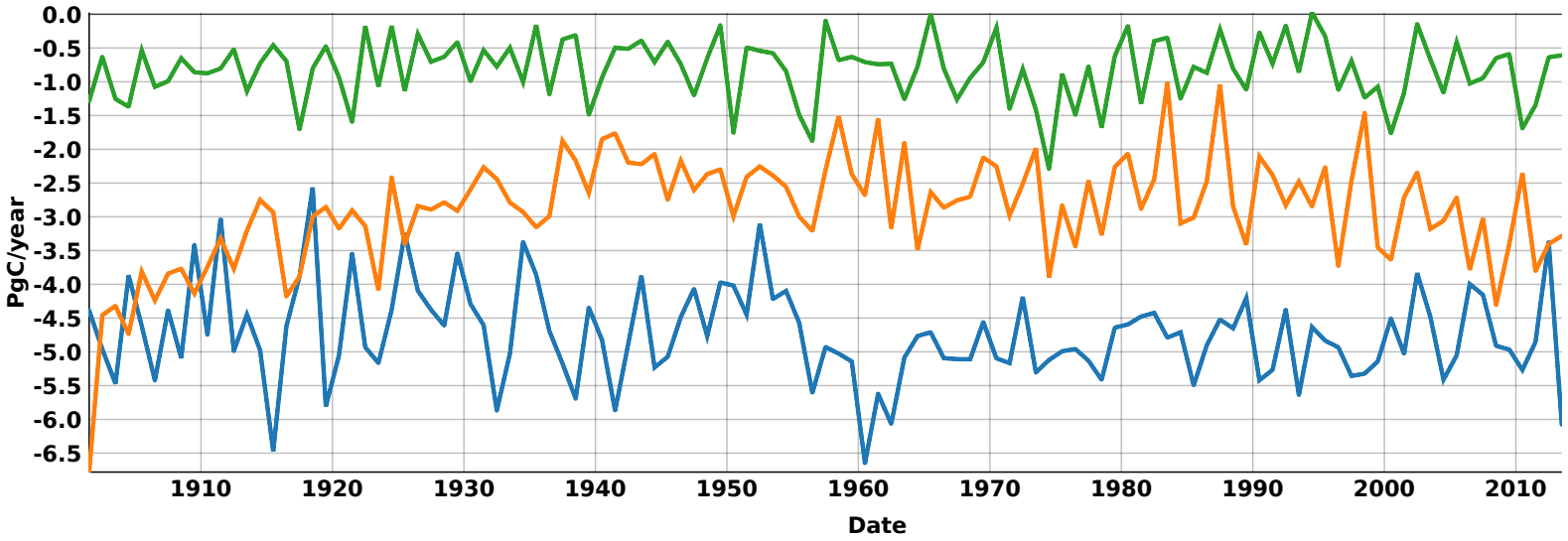


First reanalysis with CRU meteo. data

Net ecosystem exchanges (PgC/yr)

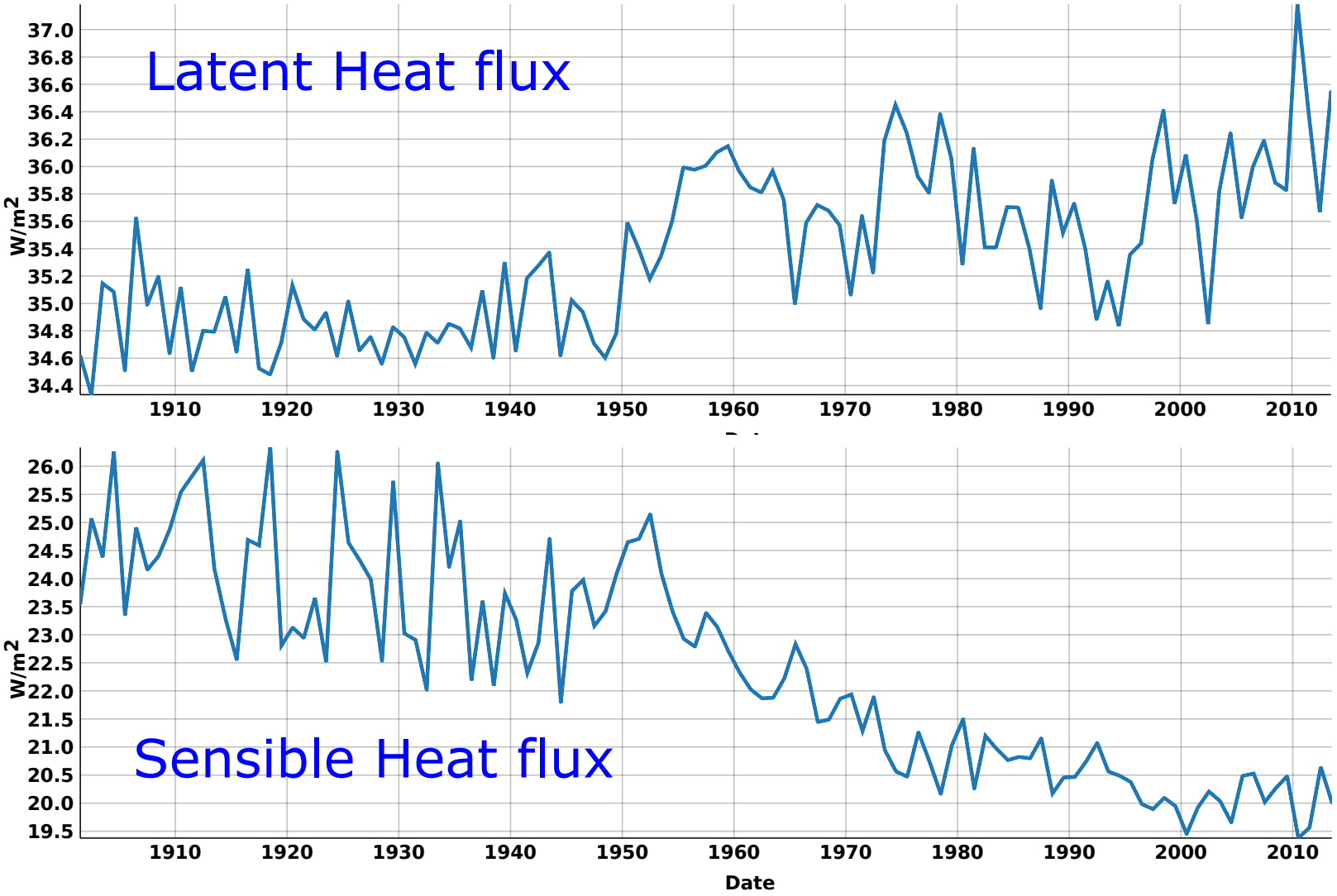


N-Hemis
Tropic
S-Hemis



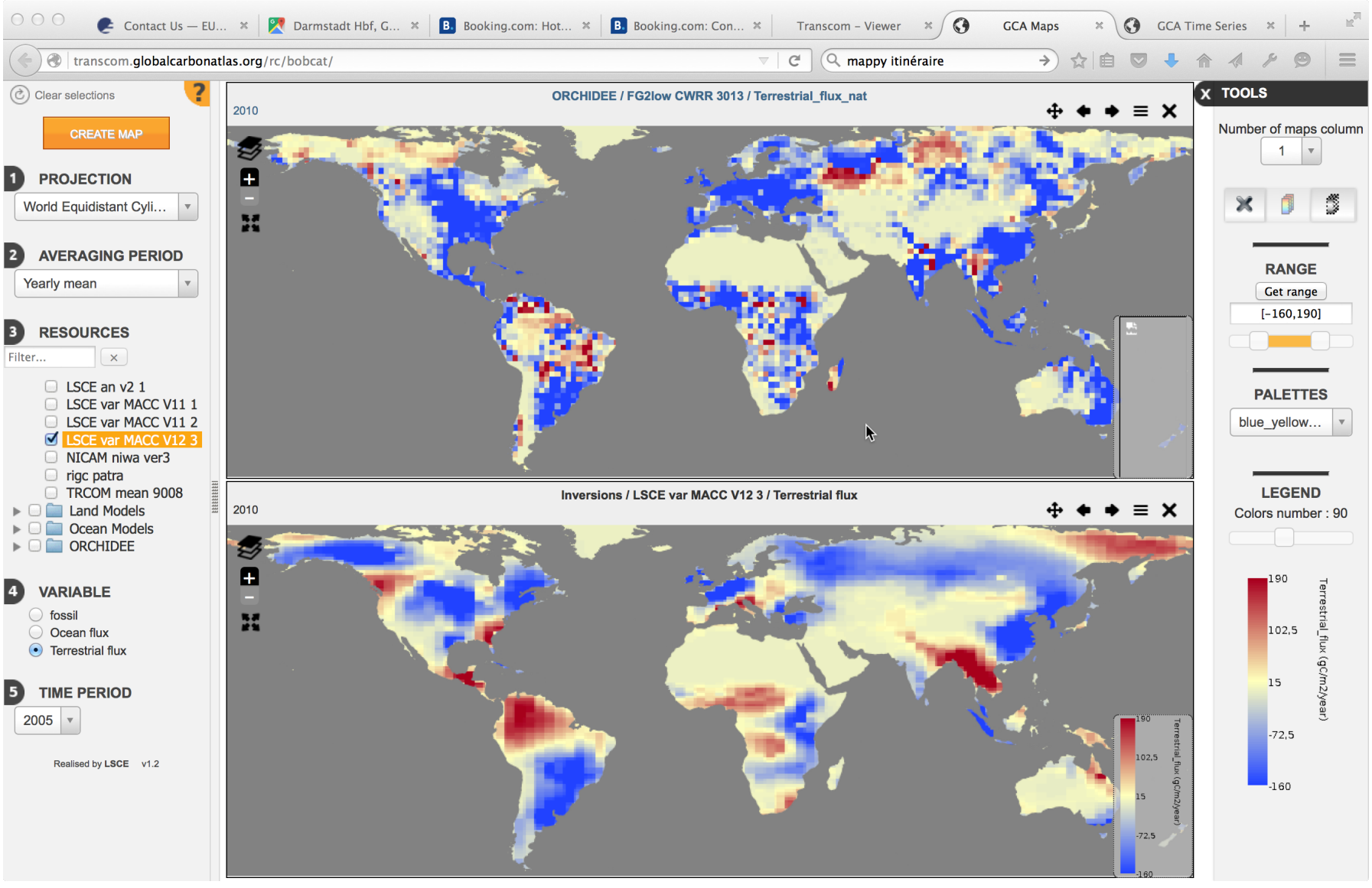
First reanalysis with CRU meteo. data

Energy fluxes at the surface (W/m2)



First reanalysis with CRU meteo. data

See : http://transcom.globalcarbonatlas.org/



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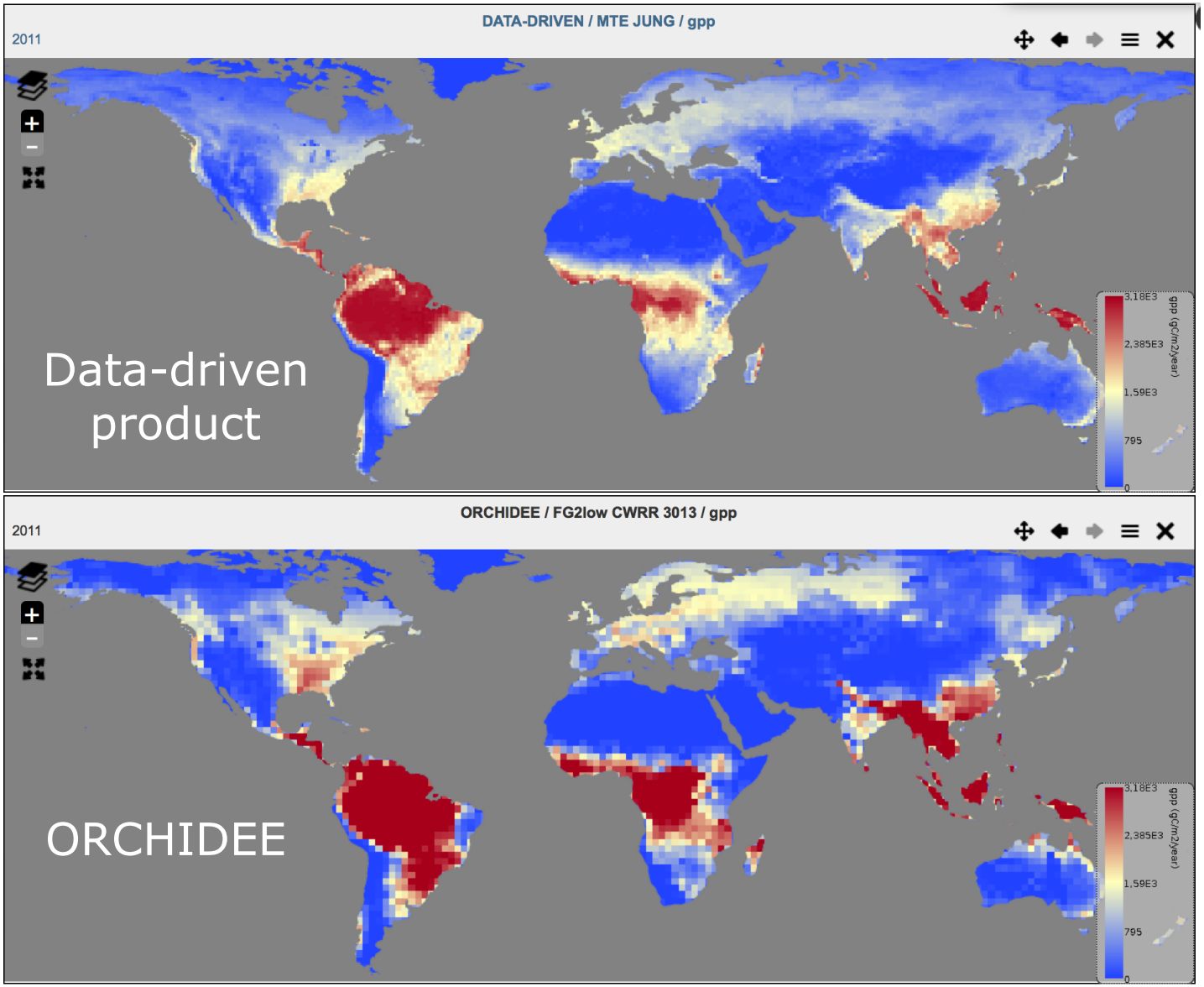


Outlook…

- Consolidate the ORCHIDEE model version
  - Process integration
  - Parameter optimization (see WP2)

- Finalize the selected Land Use Scenarios (and land management)

- Use ERA-20C climate forcing
  - Work in progress (simulation started)
  - Possible correction of Precipitation needed

- Provide 20th century C reanalysis
  => using a Web-tool facility

LSCE

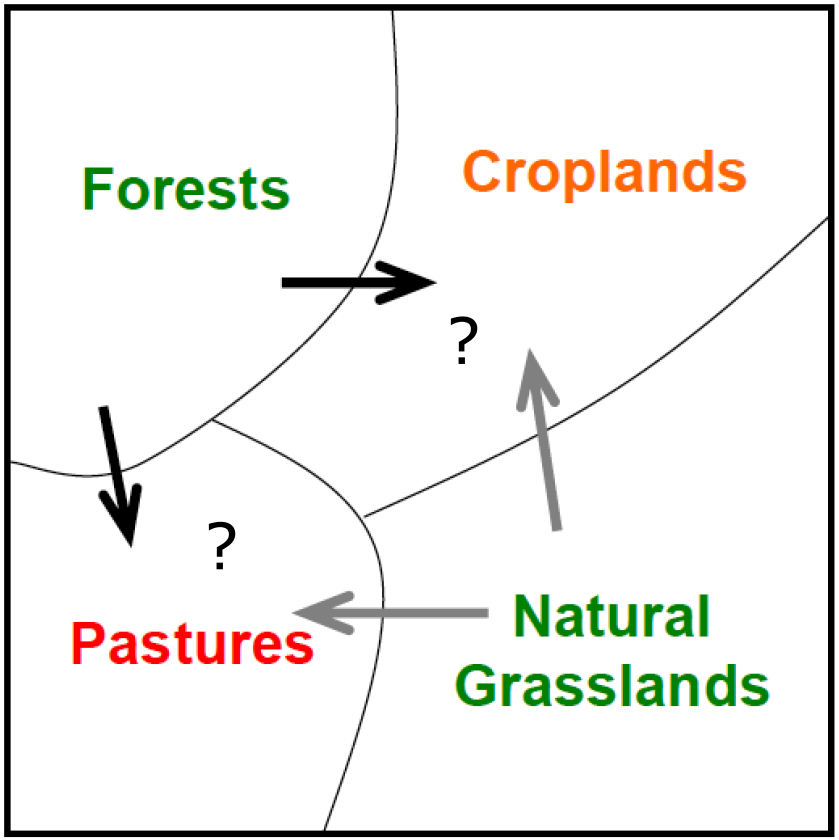
➔Including the C cycle in a global reanalysis may help for future downstream services..

Thank you…

Land cover changes: a crucial driver…

Where did crop / pastures come from ?

Hurtt dataset : transition Natural <-> Managed
Houghton deforestation data set



The ORCHIDEE land surface model