# Land Carbon Cycle uncertainties

## ➔ Input uncertainties

## ➔ C flux & stocks uncertainties

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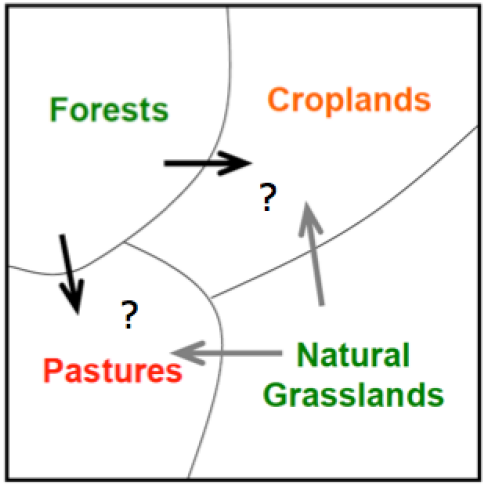
# Land carbon cycle uncertainties from:

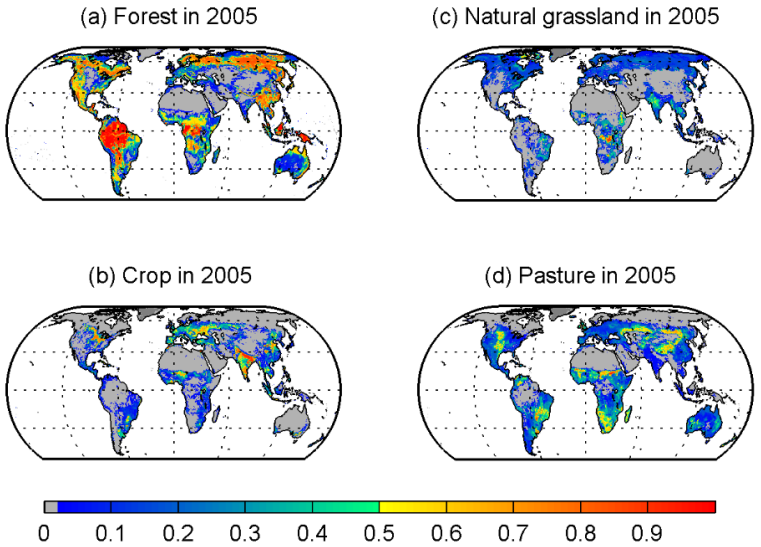
| Forcing error error | Model parameter error | Model structure error |
|---|---|---|
| - Land Use Change scenarios<br>- Meteo. forcing<br>- Soil property uncertainties | - Parametric equations with Uncertain parameters (photosynthesis, respiation C allocation,…) | - Missing processes<br>- Wrong process representation |
| ➔ Test different scenarios From LCC & different Meteo forcing | ➔ Optimize parameter using a 4D-var system with<br>- Atm. CO2 data<br>- FluxNet data<br>- MODIS-NDVI | ➔ Comparison between ORCHIDEE / CTESSEL and other models & approaches |

# Uncertainties from Land cover changes…

Natural transistion (Hurtt et al.)



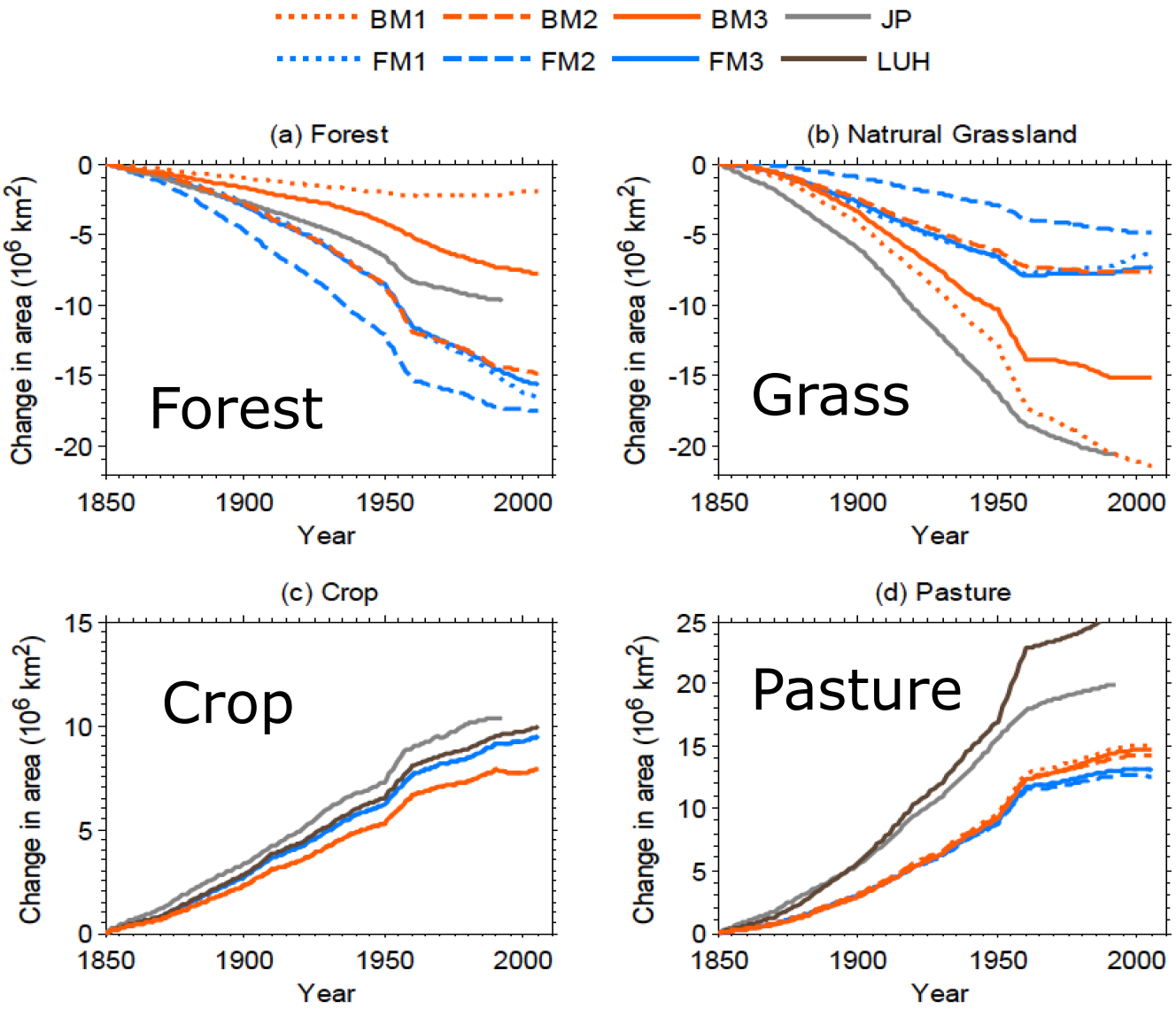

Current Plant Functional Type (PFT) distribution (ESA-CCI Land Cover)



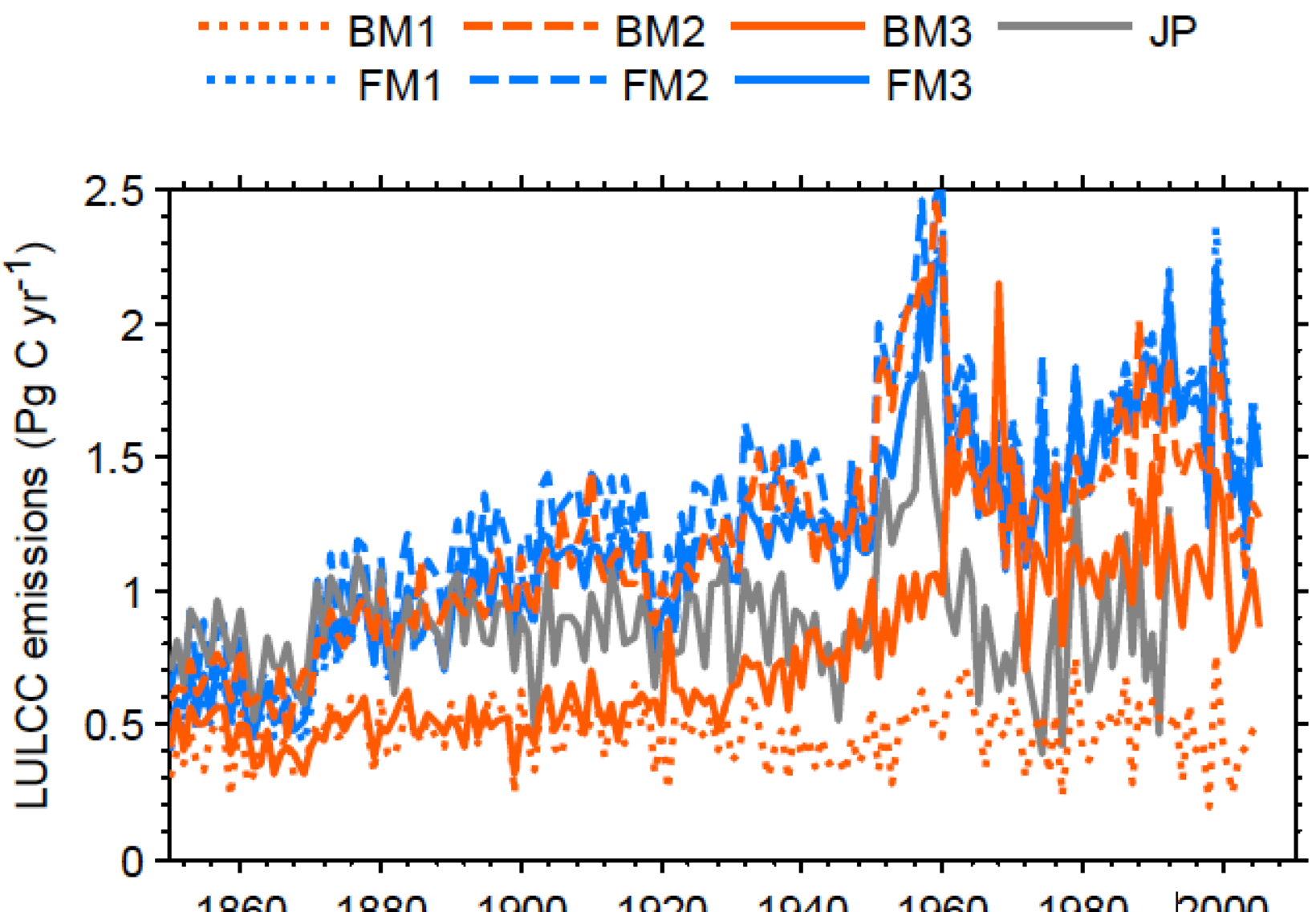

➔ Derive Historical record of land cover maps

➔ Several possible choices…

# Uncertainties in the change of Forest / grass / crop / pasture areas…

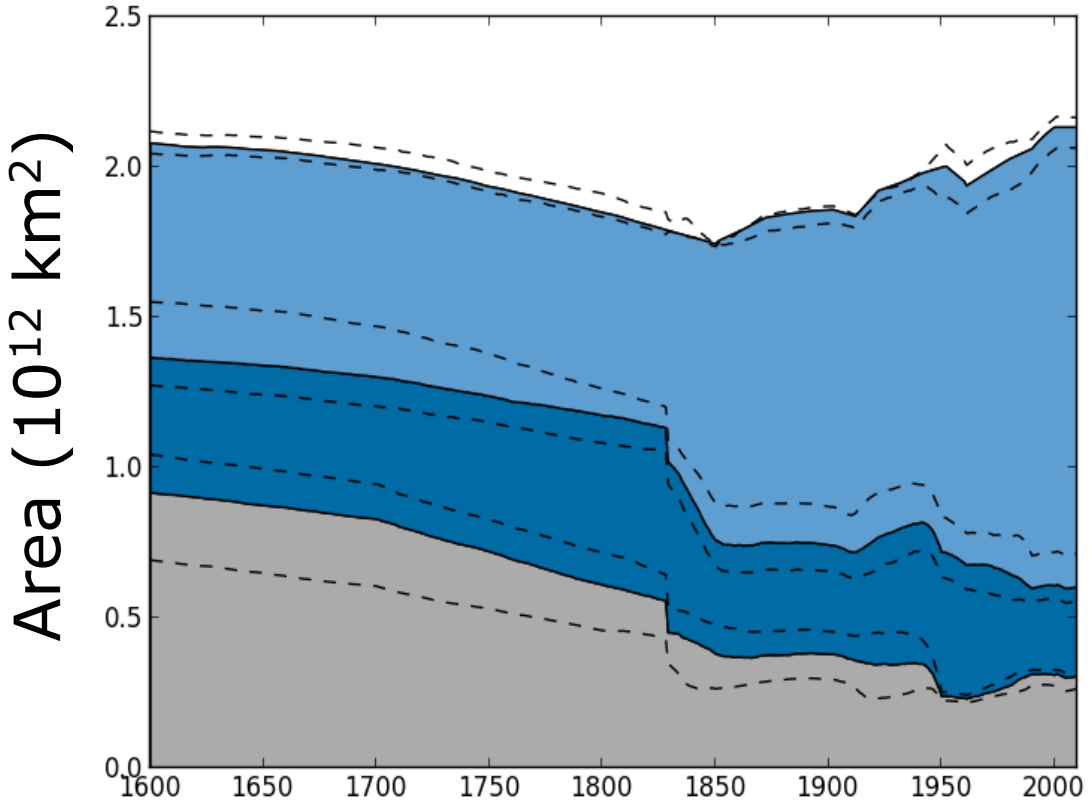


# Net flux from different Land Use Change scenarios (PgC/yr)



# Uncertainties from land management

European forest management over time…

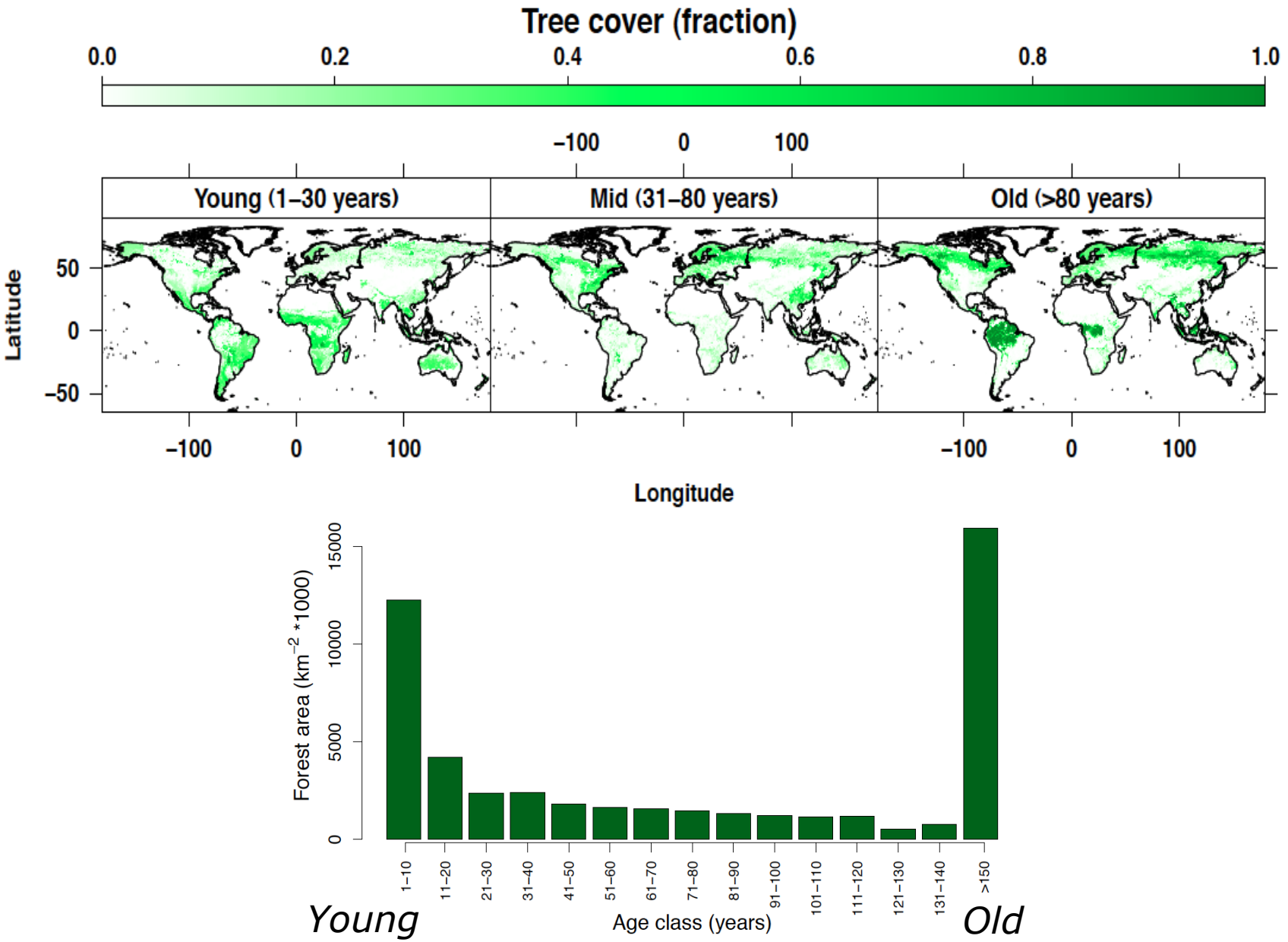



High stand

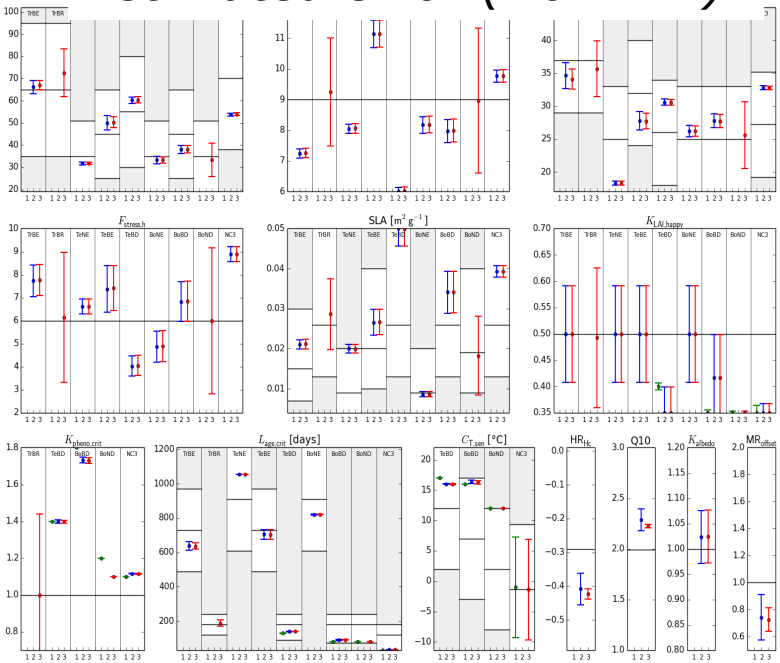
Coppice

Un-managed

# Forest age as proxy for management..



*Estimated error (from DA)*

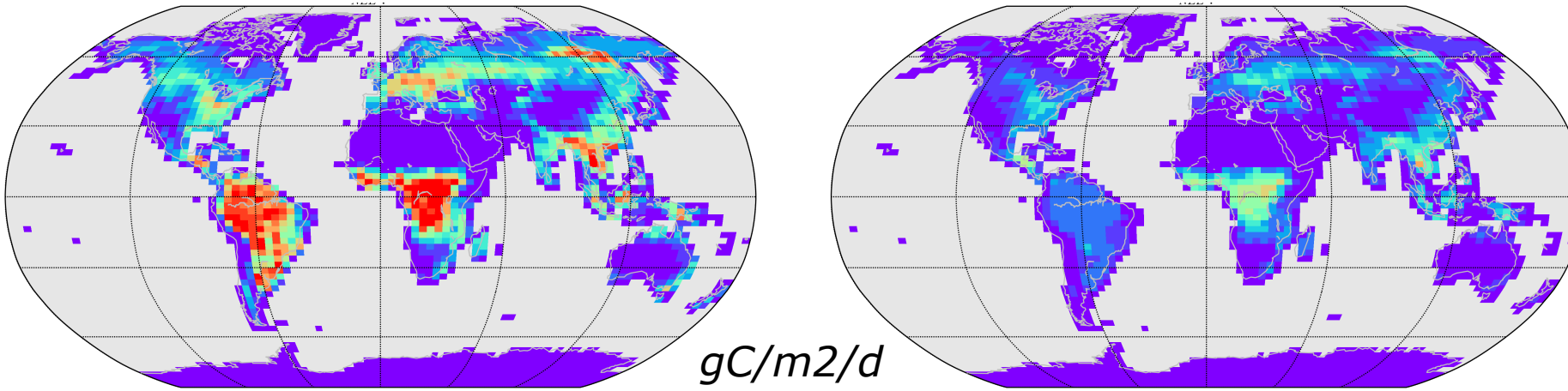



# Model parameter uncertainties…

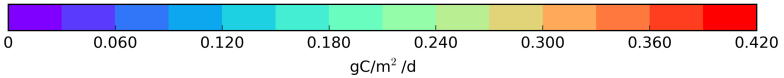
Error propagation on the fluxes

**σ-NEE - Prior**

**σ-NEE - Posterior**

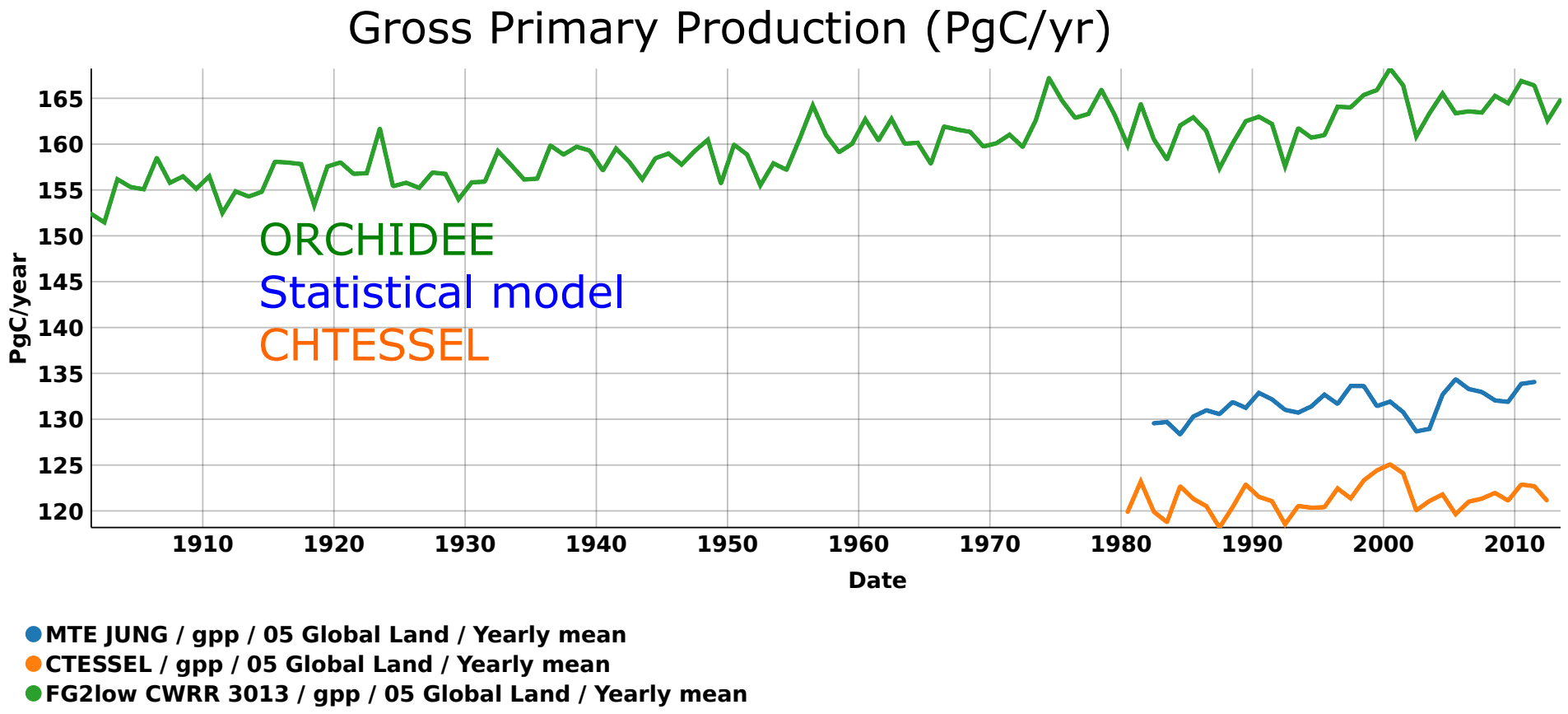


*gC/m2/d*



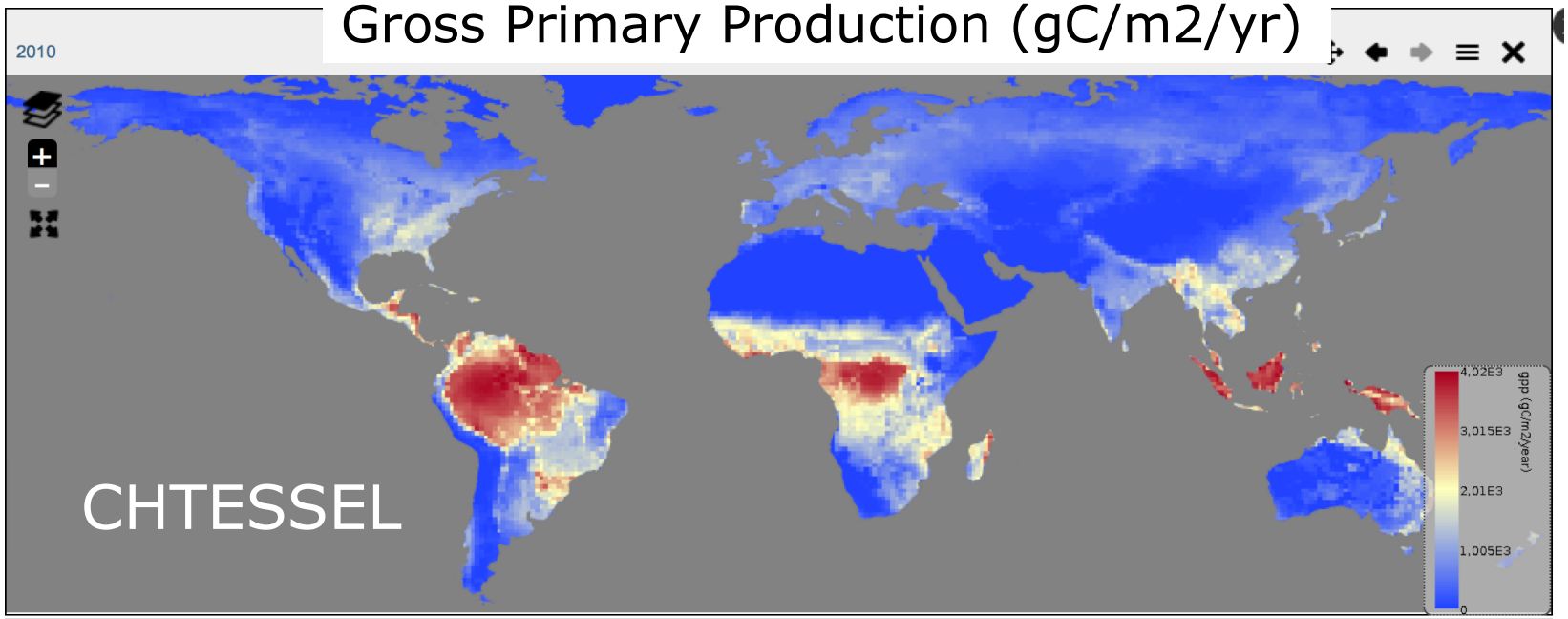
# Model structural error…

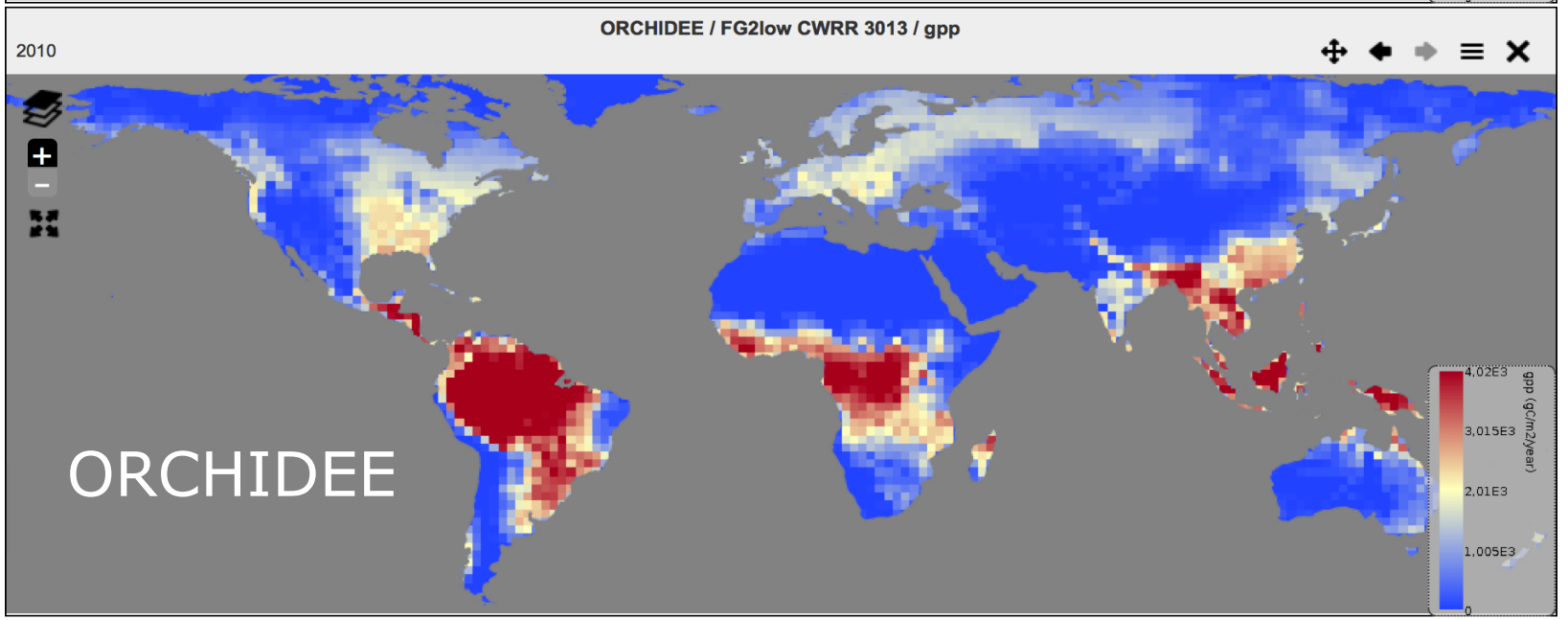
➔Comparison of different land surface models (in particular ORCHIDEE and CHTESSEL)



# Model structural error

Gross Primary Production (gC/m2/yr)



# Summary…

- Estimation of the "input uncertainties" for land carbon cycle

- Land cover changes and land management critical difficult to estimate globally for the 20$^{th}$ century especially for crops

- Uncertainties from meteorological forcing assessed by
  - Ensemble of the CERA-20C ?
  - Using other re-analysis (NCEP)

- ➔ Provide 20$^{th}$ century C cycle uncertainty analysis