GCP-COCOS RECCAP meeting
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A new global, data-driven, spatially explicit, bottom-up CO_2 flux data stream for RECCAP

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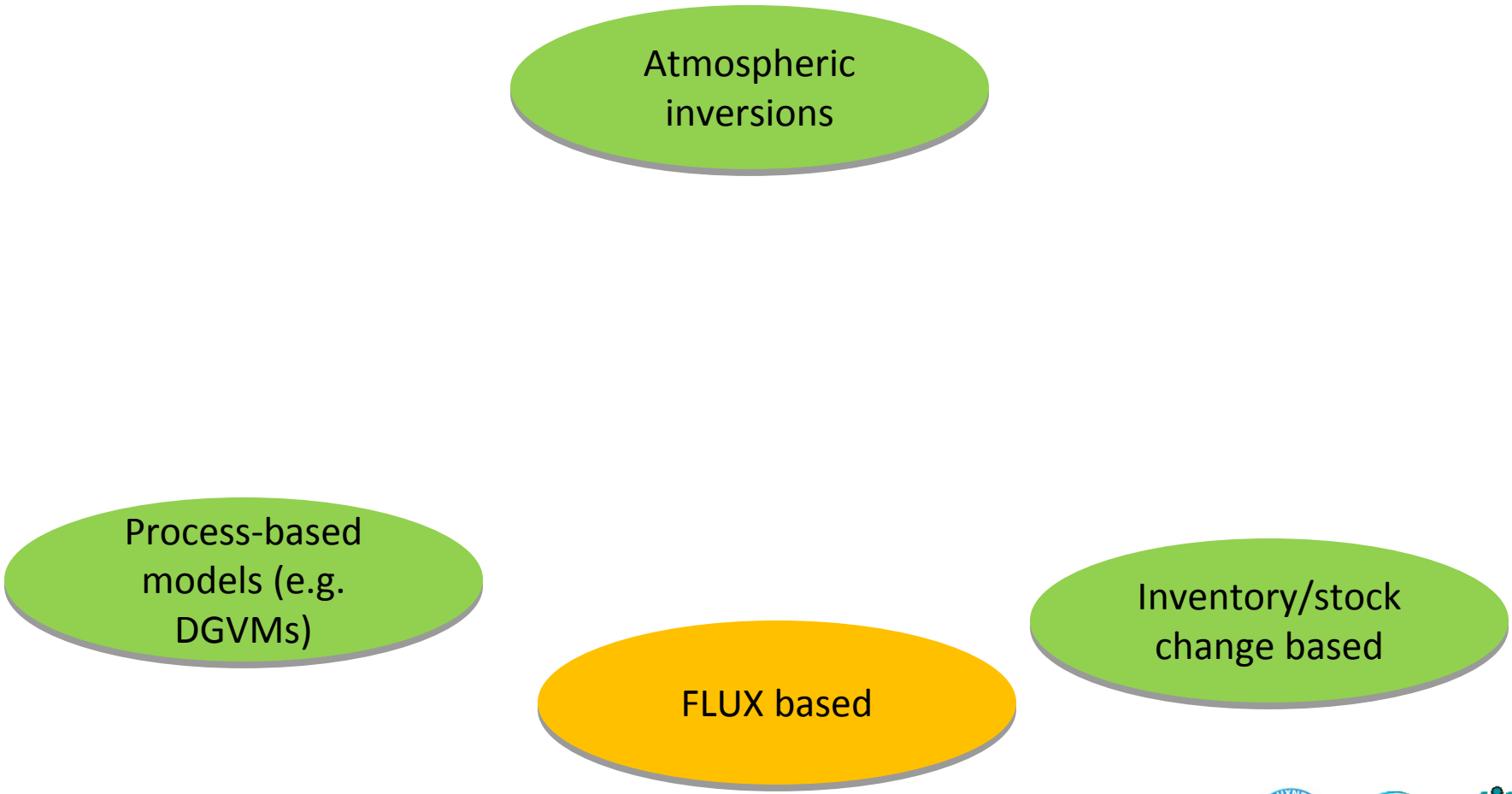
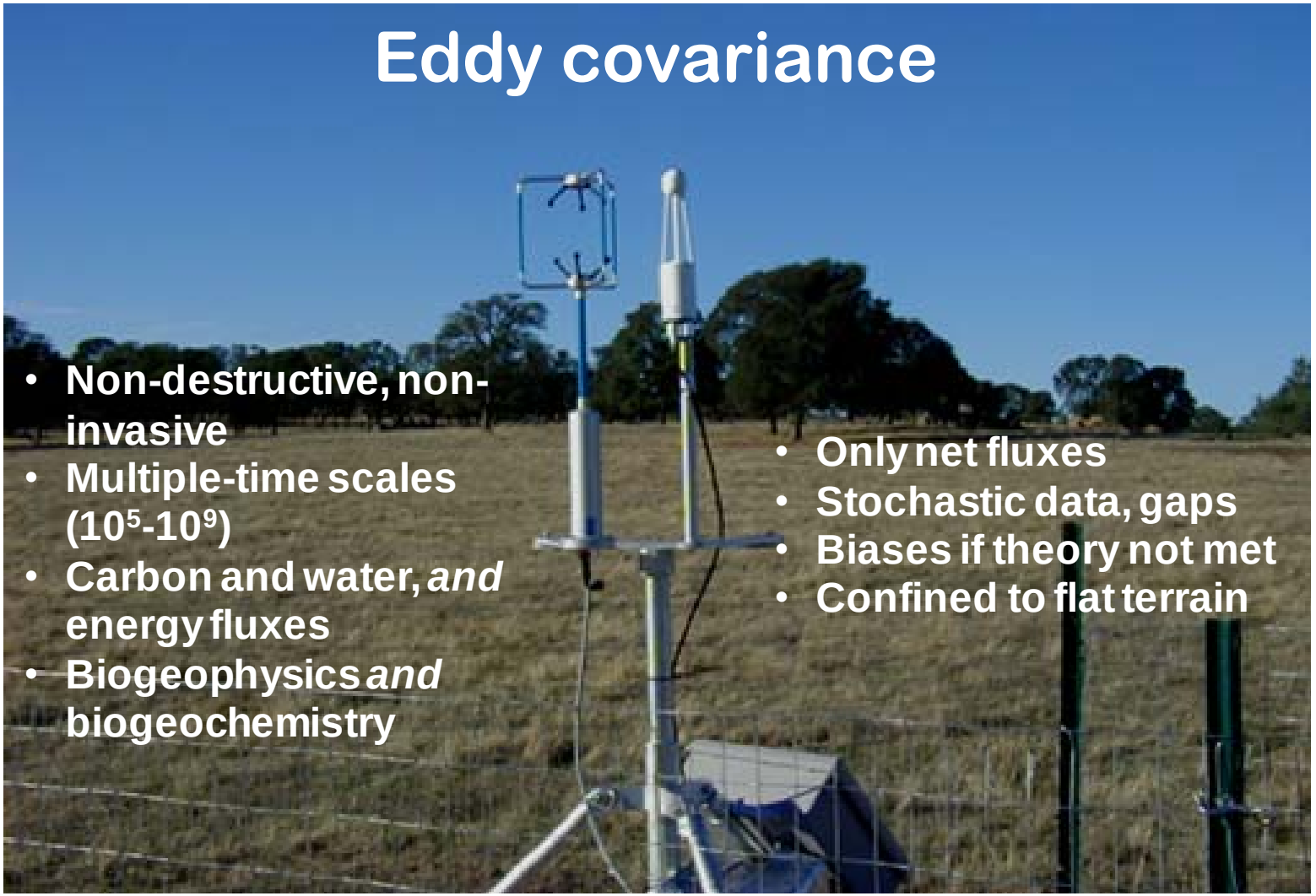
www.fluxdata.org

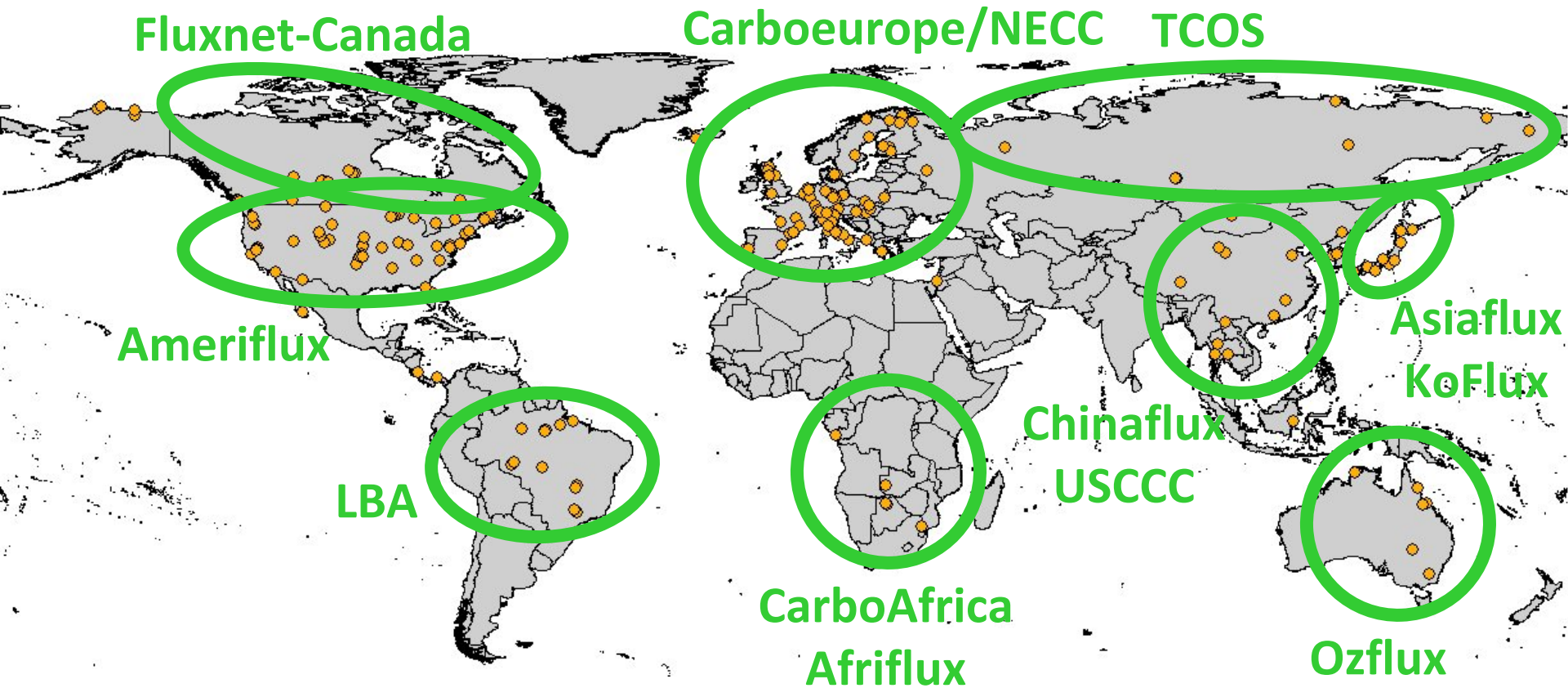
Context: Terrestrial carbon-cycle data streams



Quantifying ecosystem-atmosphere interaction



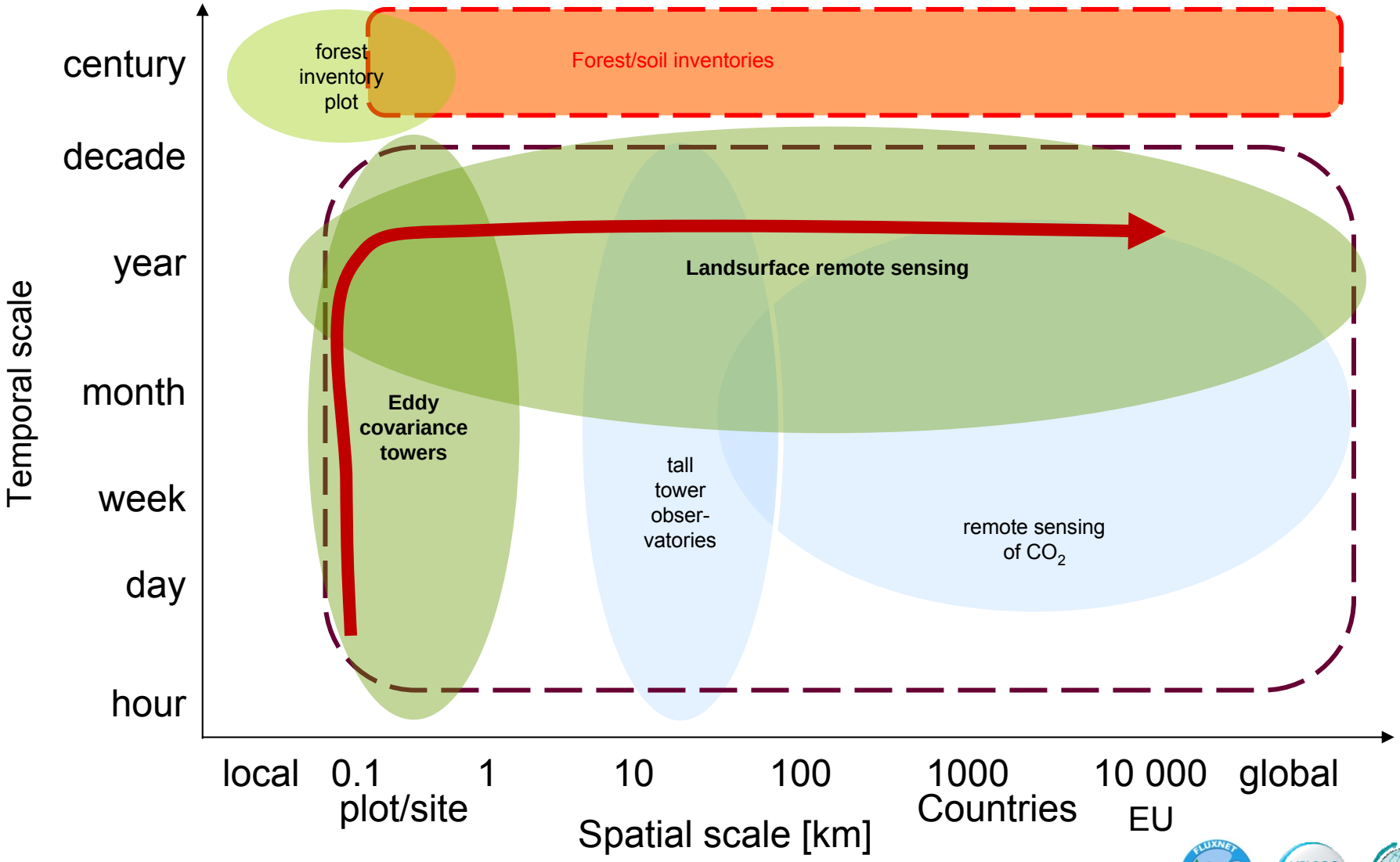
FLUXNET: a network of network of eddy covariance sites



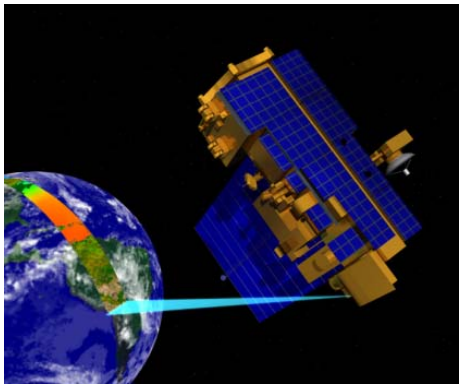
La Thuille data set:

- **>950 site-years from >250 sites**
- **Standardized u*-filtering, gap-filling, flux-partitioning and uncertainties (Aubinet et al. 2001, Foken et al. 2003, Reichstein et al. 2005, Richardson et al. 2006, Papale et al. 2006, Moffat et al. 2007, Desai et al. 2008, Lasslop et al. 2008)**

From point to globe via integration with remote sensing



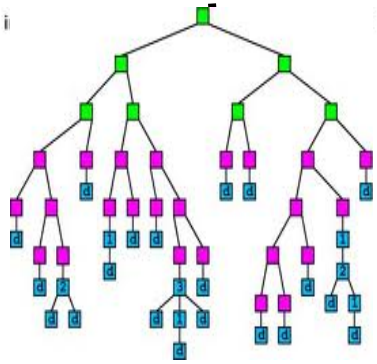
Empirical upscaling methodology



The same gridded explanatory variables

Site-level explanatory variables
- **Meteorology**
- **Vegetation type**
- **Remote sensing indices**

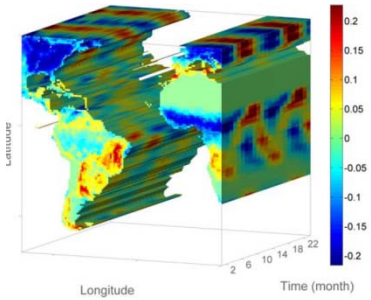
Training



Training

Target variable ecosystem-atmosphere flux

Gridded target variable

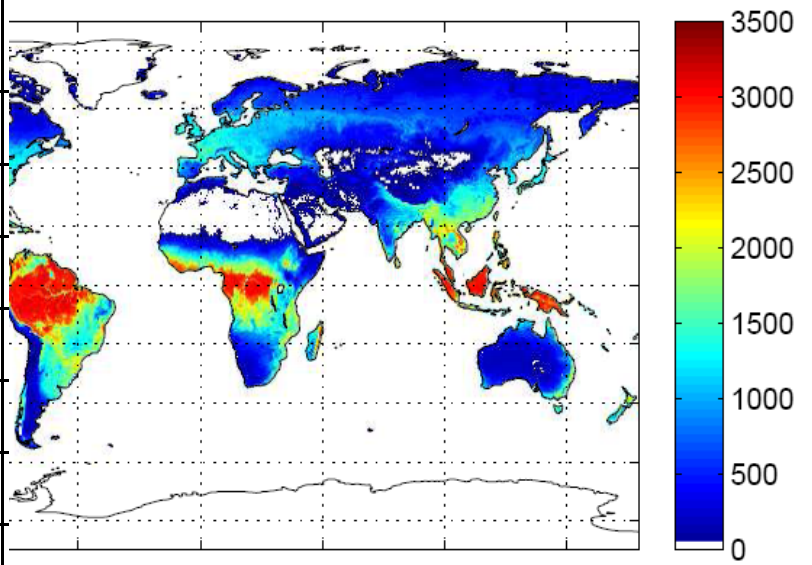


Global estimation of terrestrial gross primary productivity (GPP)

Global total: 123 +-8 Pg/yr

Ensemble median map

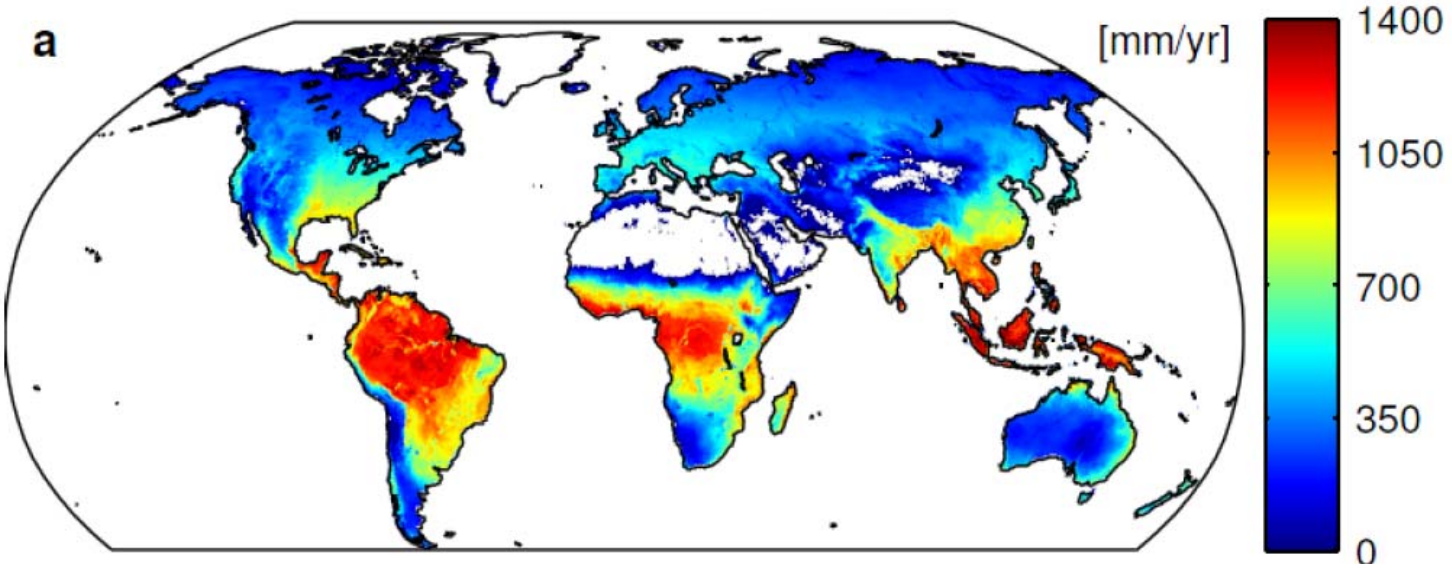
Biome	GPP [Pg C a^{-1}]
Tropical forests	40.8
Temperate forests	9.9
Boreal forests	8.3
Tropical savannahs & grasslands	31.3
Temperate grasslands & shrublands	8.5
Deserts	6.4
Tundra	1.6
Croplands	14.8
Total	121.7



Beer et al. (2010), Science

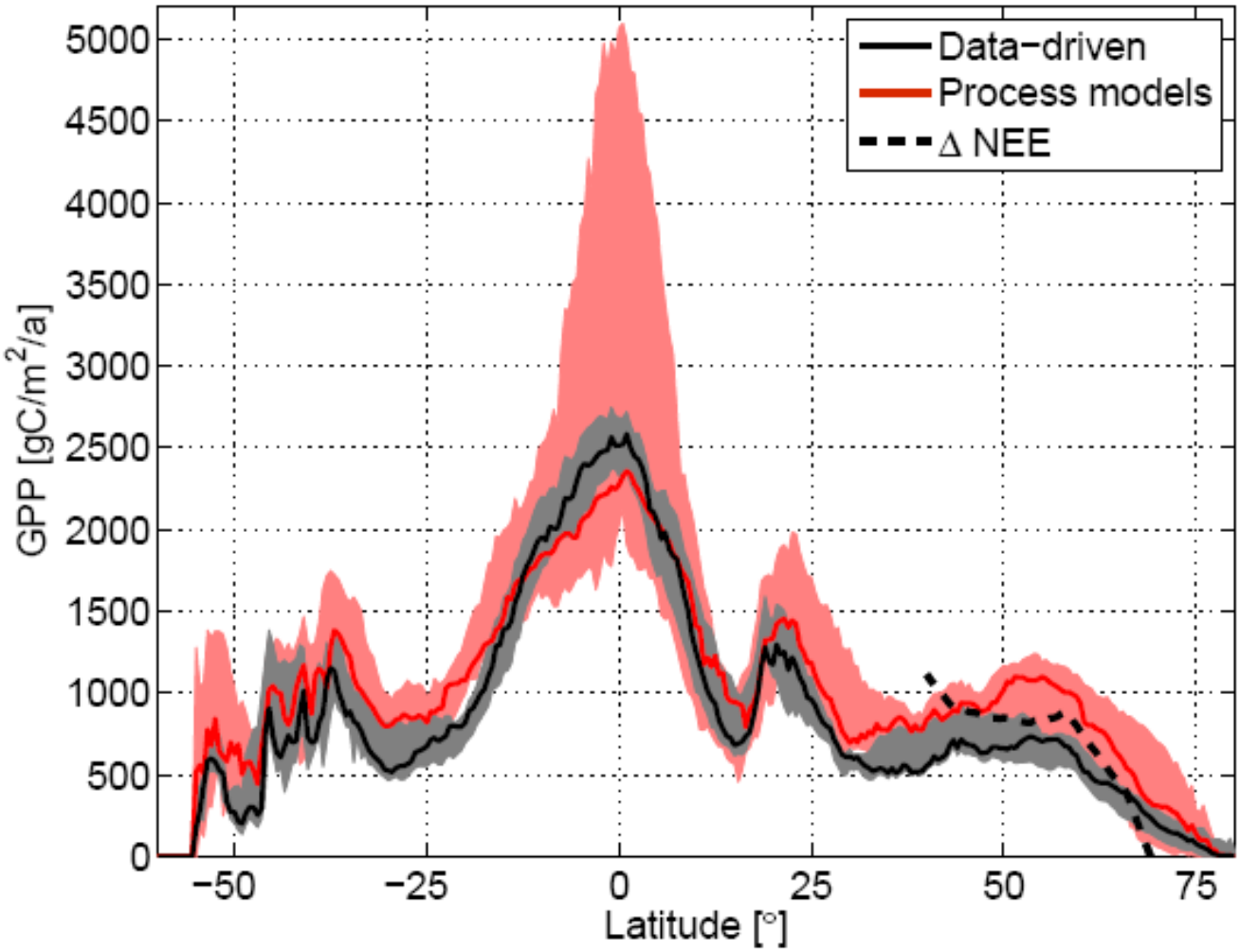
Light-use eff. ignores C4 veg (> 20 Pg)

Global evapotranspiration (ET): ca. 65 Eg yr^{-1}



Jung et al. (in press), Nature

Latitudinal patterns of GPP as model constraint



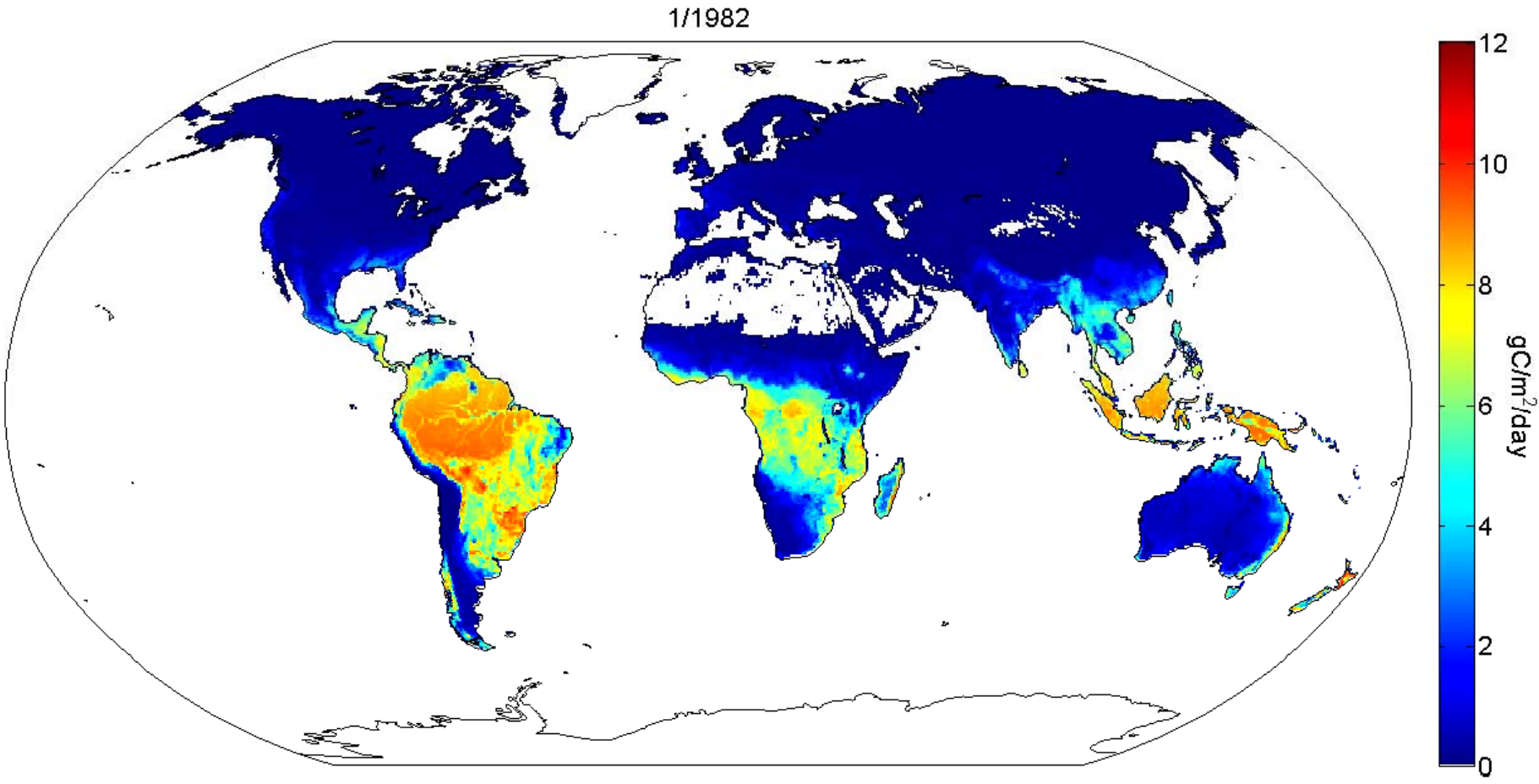
Process models:
CLM-CN
LPJ-DGVM
LPJmL
SDGVM
ORCHIDEE

All 1° resolution or higher

Beer et al. (2010), Science

27 years of monthly global biosphere-atmopshere exchange @ 0.5°

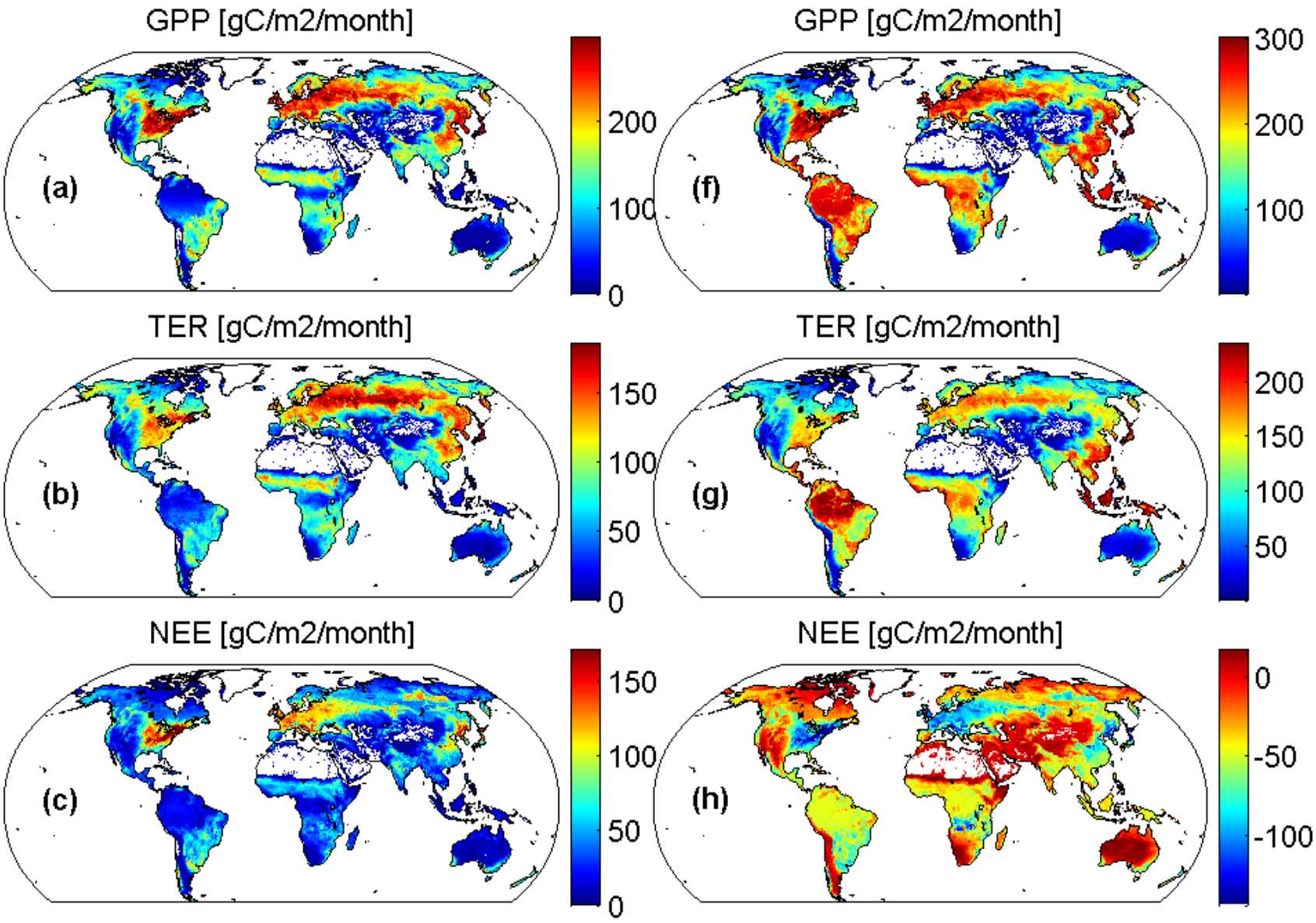
Here: Gross primary productivity



Seasonal patterns

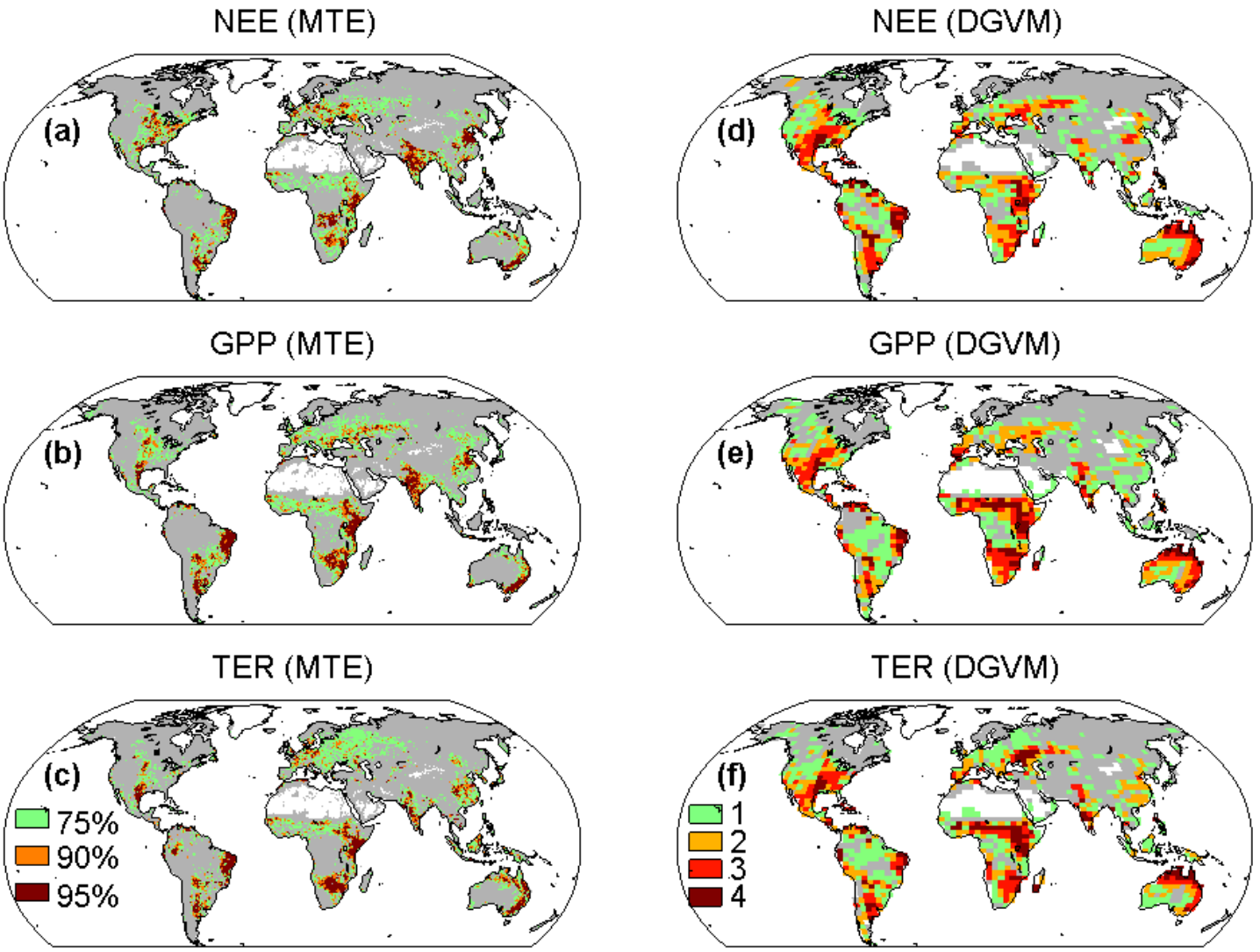
Amplitude of mean seasonal cycle

Max of mean seasonal cycle



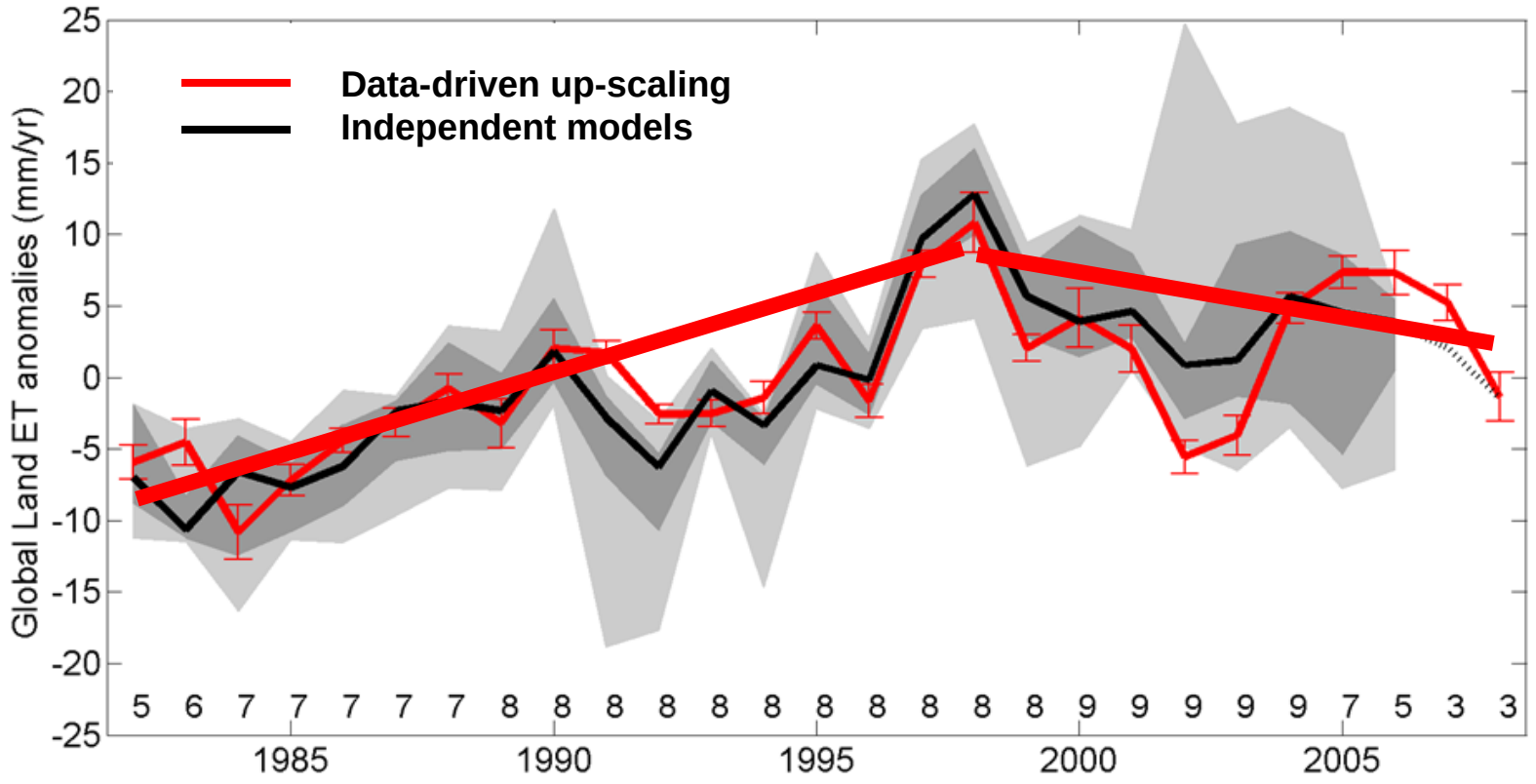
Jung et al., in review

Hot-spots of interannual variability



Jung et al., in review

Inferred global evapotranspiration variability



‚Independent models':

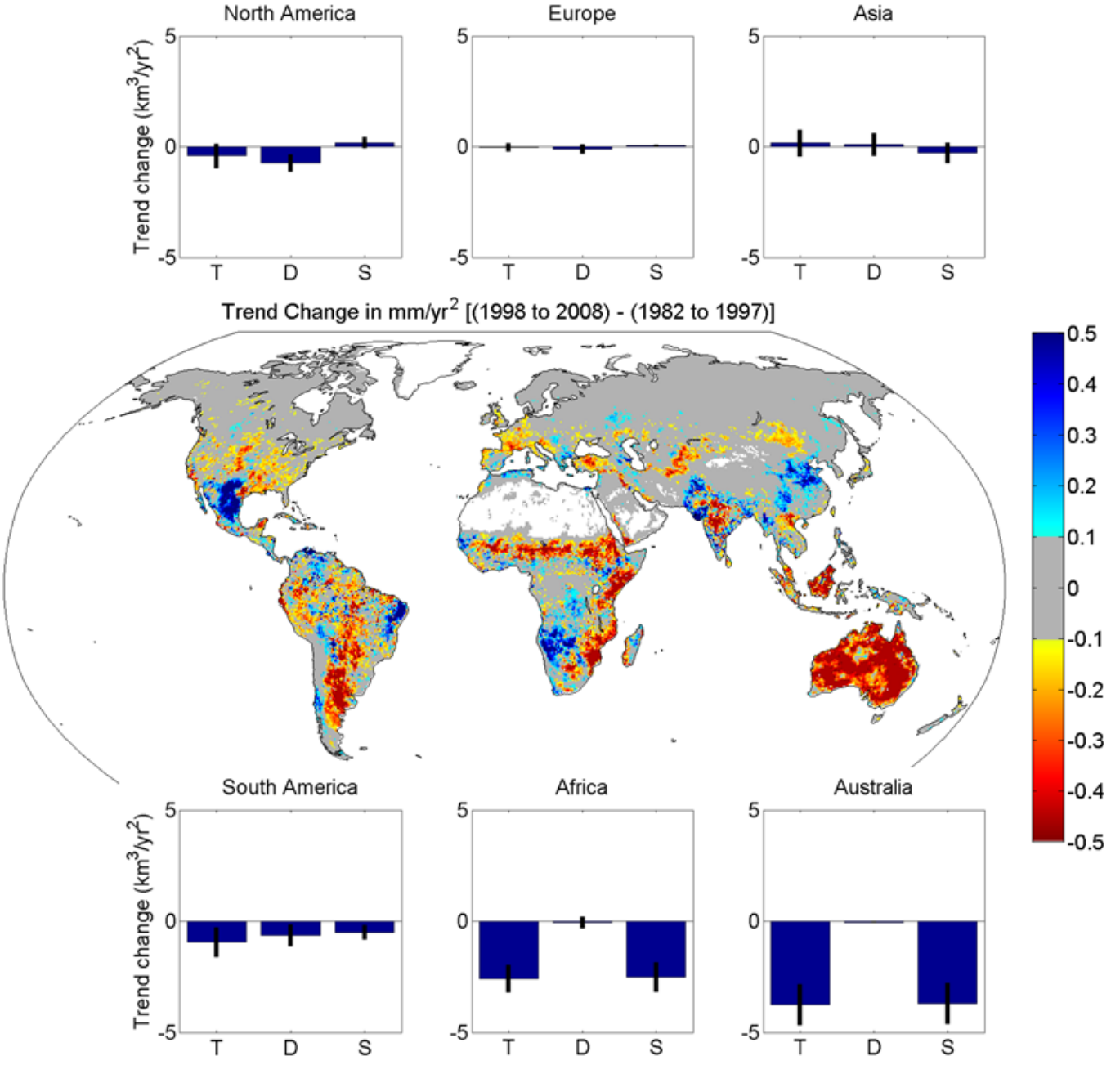
a)LSMs (CLM4-CN, Orchidee, O-CN, LPJmL, VIC)

b)Remote sensing models (MOD16, ET-M, RS-PM)

c)Reanalysis (ERA-Interim)

Jung et al. (in press), Nature

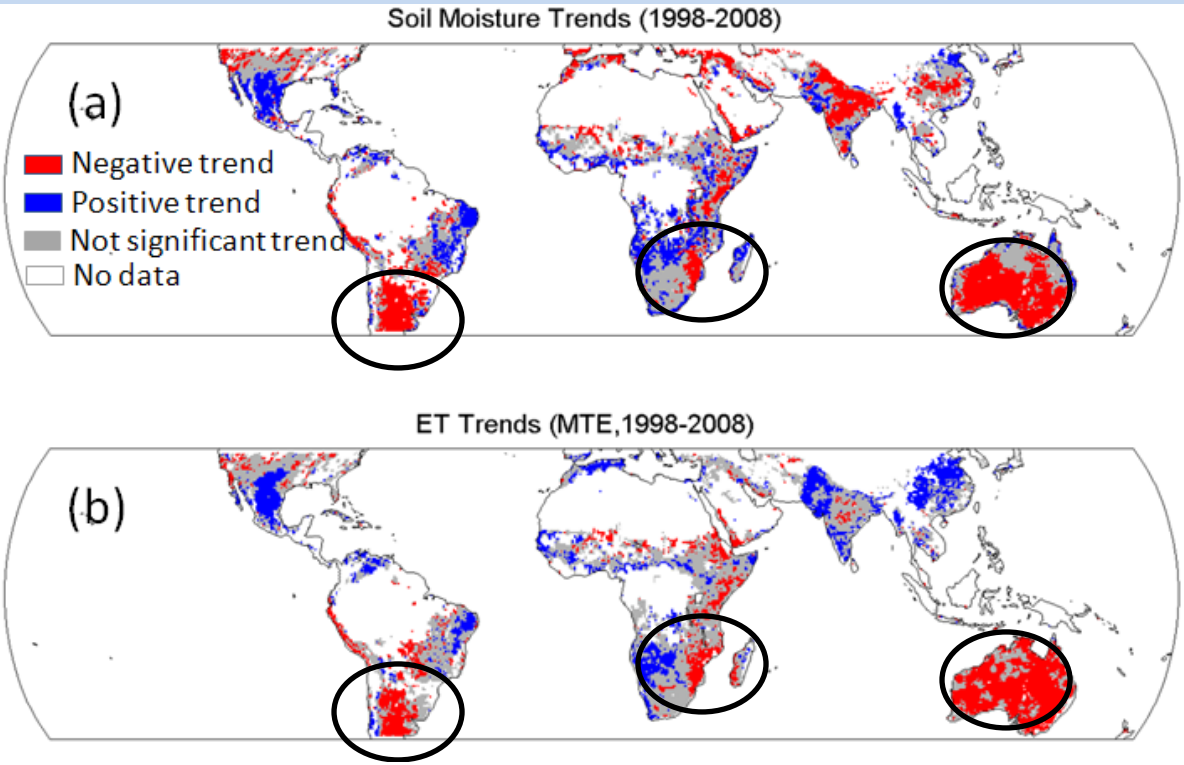
Regional trend changes in ET



Jung et al. (in press), Nature

Water limitation!

1998-2008 ET and soil moisture trends (from TRMM)



Summary

- Observation driven (FLUXNET + remote sensing)
- Bottom-up
- Global
- Spatially explicit 0.5° x 0.5° (regional cut easy)
- 1982-2008 (update possible & planned)

- Young product ➔ many next steps

Use of data stream in RECCAP? – you decide …

	GPP	TER	NEP
Mean flux	>=	<=	< (!)
Seasonal cycle patterns	>=	=	>=
Interannual variability patterns	=	=	=
Decadal Trends	=	=	<=

= : *„at eye level“ with other C-cycle information*

- Complementary strength
- Cross-evaluation of modelling approaches
- Characterization of interannual variability/trends/regional hot spots

Further info (read supplements…)

Jung, M., M. Reichstein, and A. Bondeau. 2009. Towards global empirical upscaling of FLUXNET eddy covariance observations: validation of a model tree ensemble approach using a biosphere model. Biogeosciences 6:2001-2013.

M. Jung, M. Reichstein, P. Ciais, S.I. Seneviratne, J. Sheffield, M. L. Goulden, et al.. 2010, in press, Recent decline in the global land evapotranspiration trend due to limited moisture supply, Nature.

Beer, C., M. Reichstein, E. Tomelleri, P. Ciais, M. Jung, N. Carvalhais, C. Rodenbeck, M.A. Arain, D. Baldocchi, G.B. Bonan, A. Bondeau, A. Cescatti, G. Lasslop, A. Lindroth, M. Lomas, S. Luyssaert, H. Margolis, K.W. Oleson, O. Roupsard, E. Veenendaal, N. Viovy, C. Williams, F.I. Woodward, and D. Papale. 2010. Terrestrial Gross Carbon Dioxide Uptake: Global Distribution and Covariation with Climate. Science 329:834-838.

or here:

Thanks for your attention!