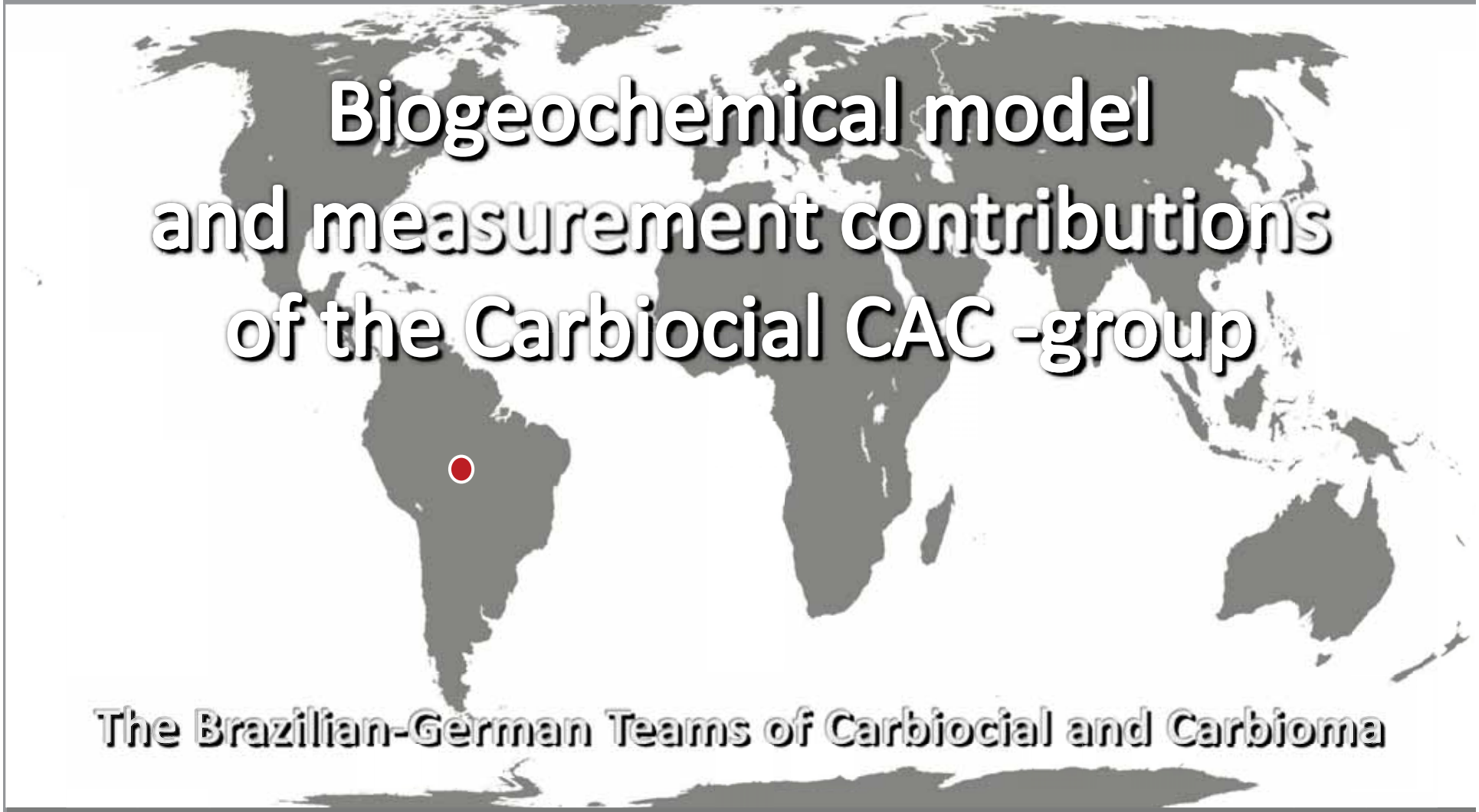
Biogeochemical model and measurement contributions of the Carbiocial CAC -group



The Brazilian-German Teams of Carbiocial and Carbioma

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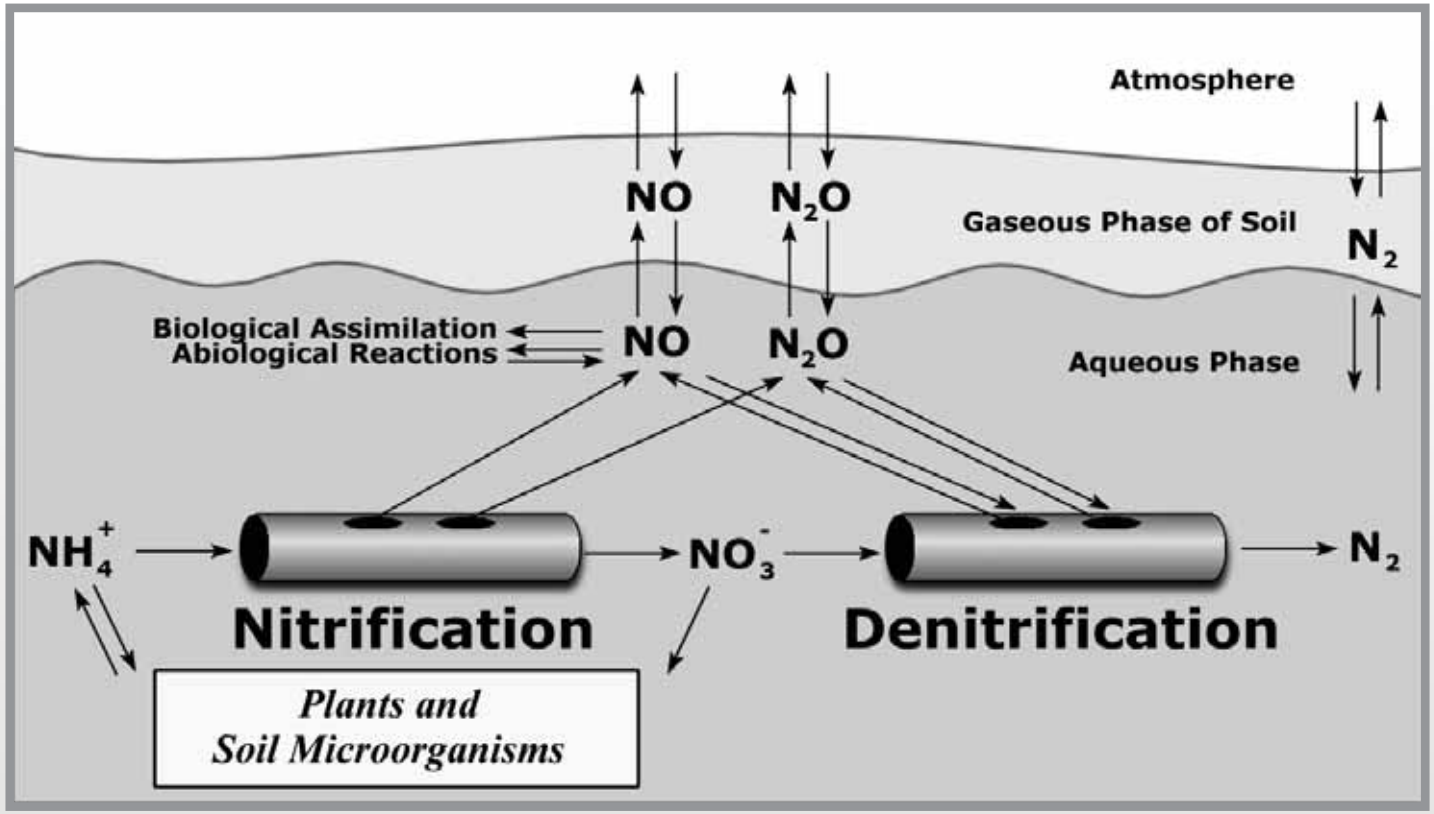
Why focus on N_2O? Because it is a greenhouse gas?

"An error in the system" that reacts sensitive to changes (land use)



The "hole-in-the-pipe" conceptual model [*Davidson et al.*, 2000].

Why focus on N_2O?

Because a lot is already known about it!

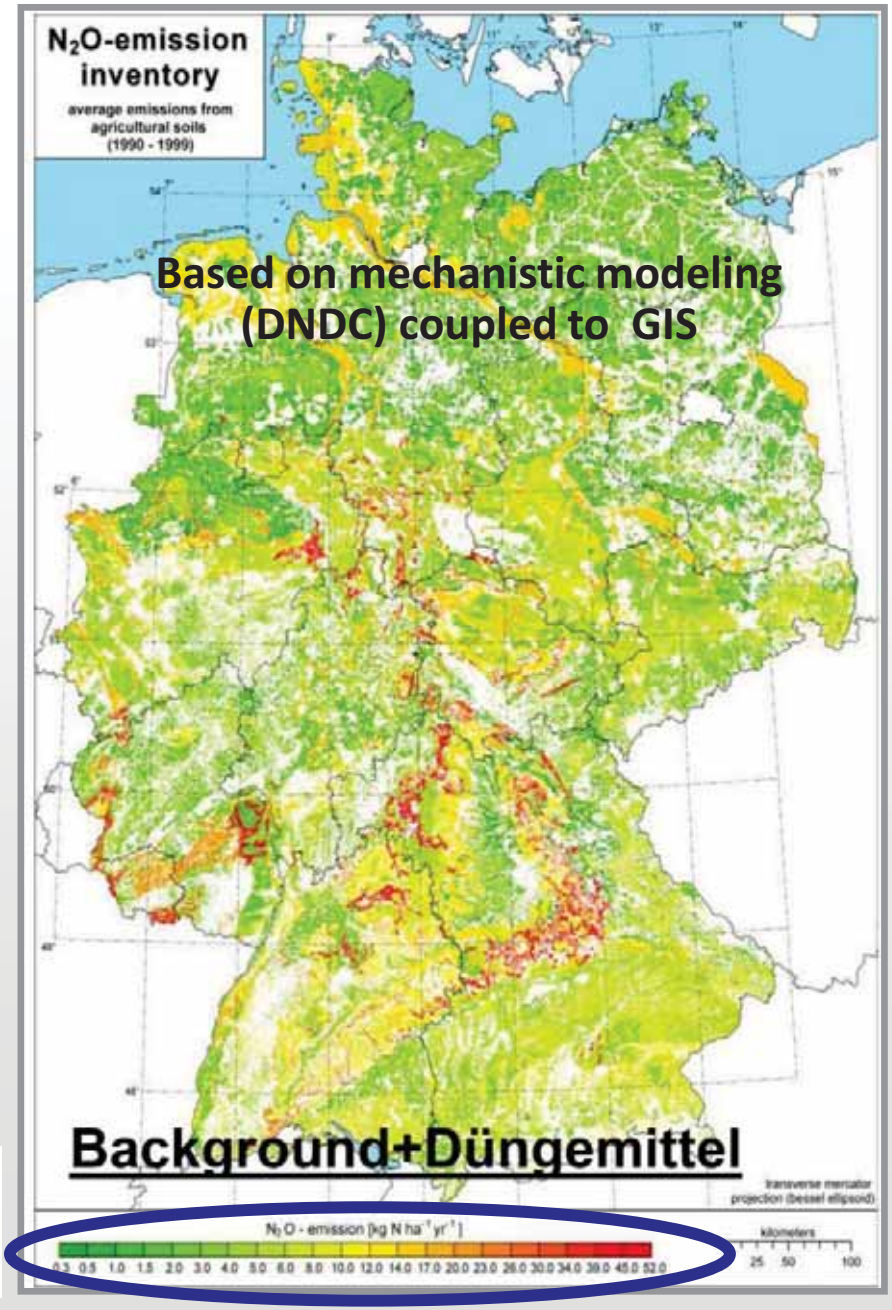
Through field measurements, experiments and models

and

Process-oriented models have been coupled with national datasets and GIS!

Talk by R. Dechow

Butterbach-Bahl et al., 2005 UBA



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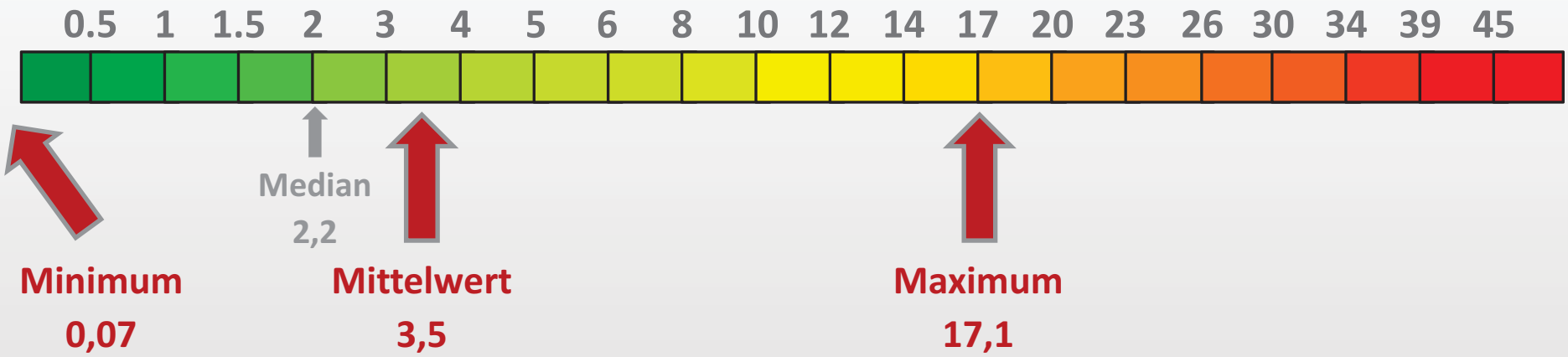
N_2O Emissions [kg N ha^{-1} yr^{-1}]
modeled for agricultural soils in Germany

Butterbach-Bahl et al. (2005) UBA



measured at agricultural sites in Germany

N = 101 of 27 sites

Jungkunst et al. (2006) JPNSS

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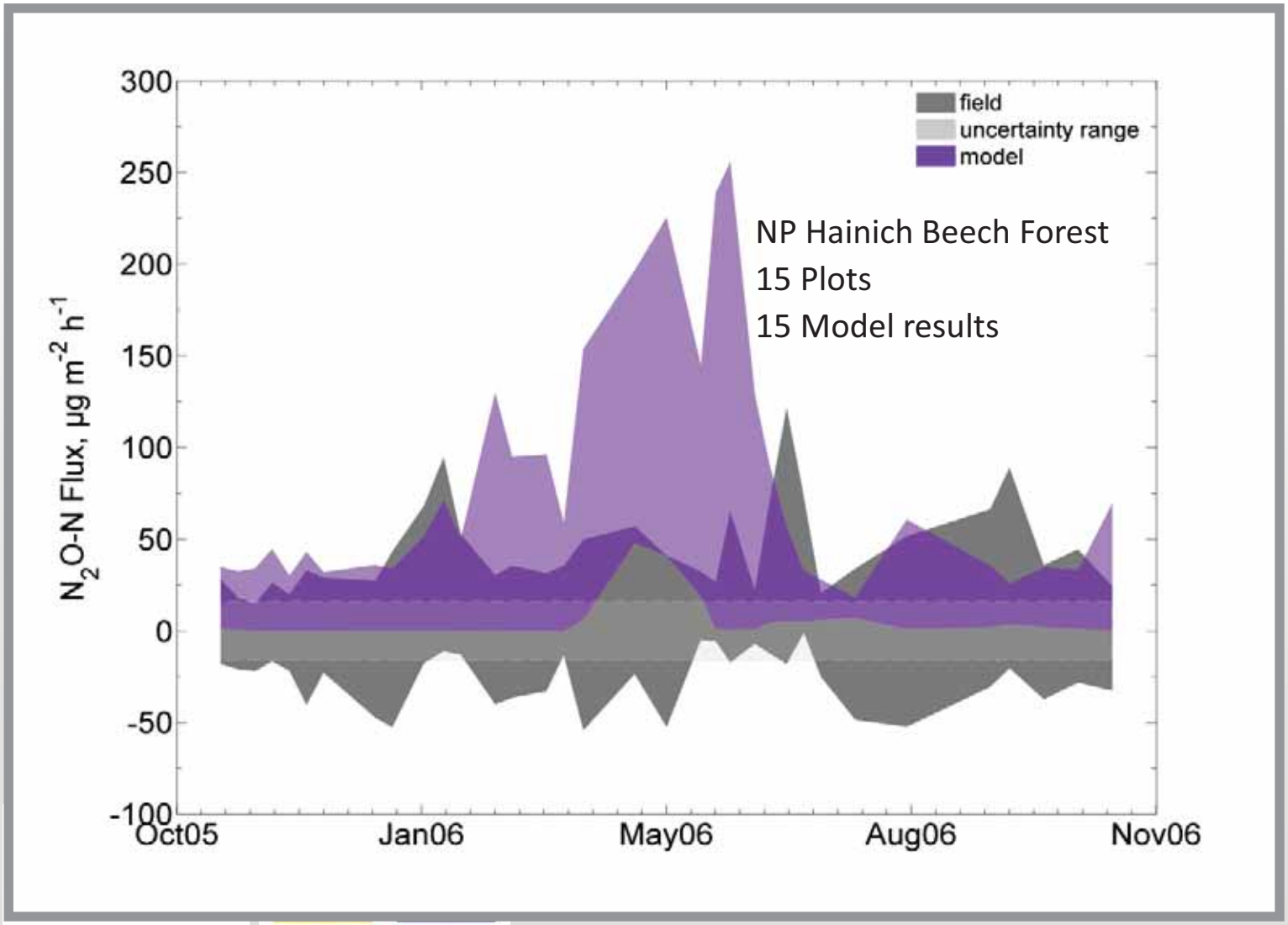
… Temporal and Spatial Variability (talk by S.Koch)

– Models frequently show even higher sensitivity.



Jungkunst et al. (2012) JPNSS

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Despite of high knowledge big differences remain between models and measurements!

Why?

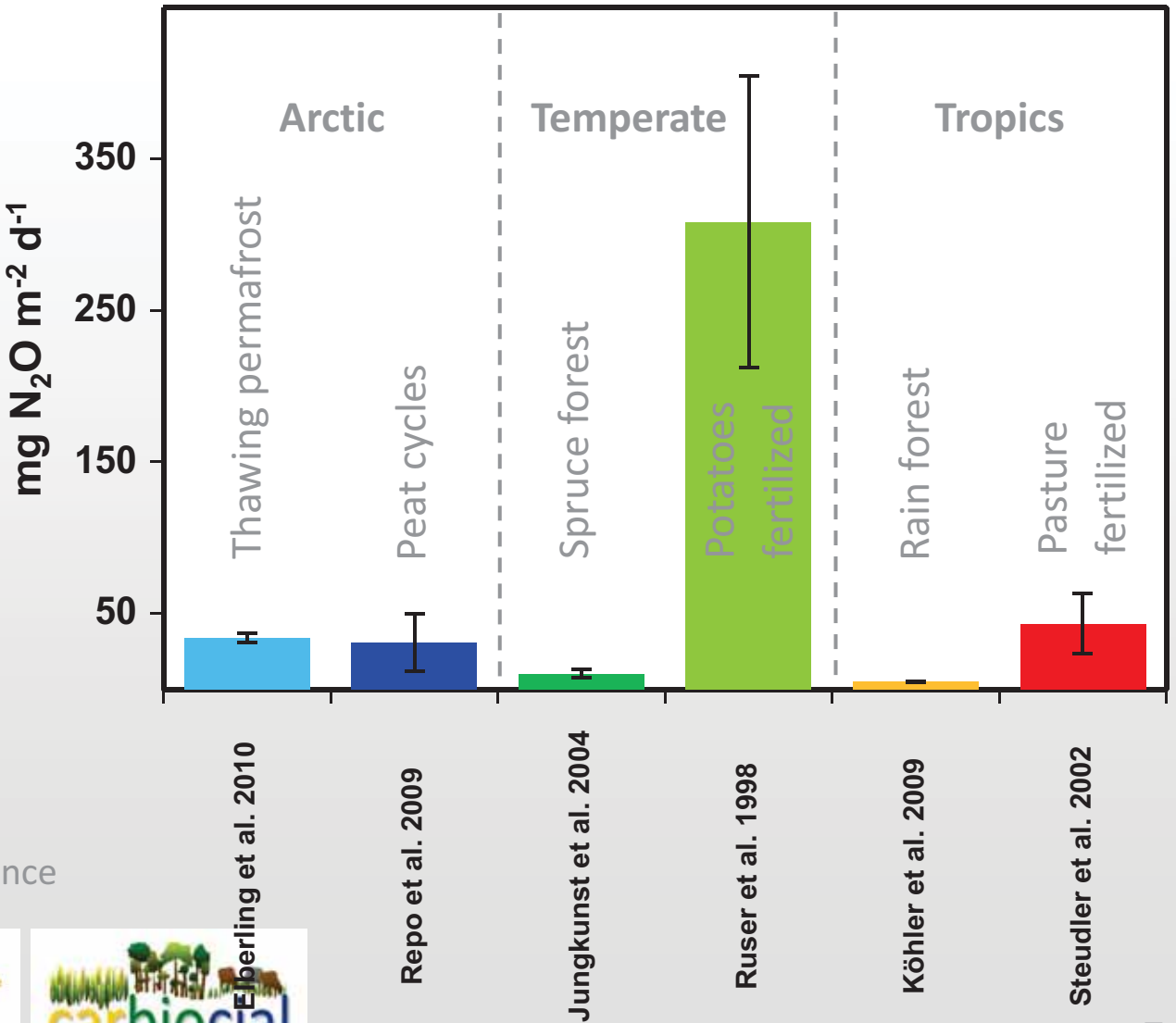
Four Hypotheses

1. **faster, louder, harder…**
2. too simple (C and N cycles separated)
3. underestimated biotic impacts
4. **“Lego” brick principles (Modules), i.e. interface biogeochemistry is ignored**

Mainly high values are published!

„ But science is not an Olympic sport, where faster, higher and longer are the only results that count “

selected „Highest Values“ of daily N_2O emissions of different Ecozones



Jungkunst (2010) Nature Geoscience

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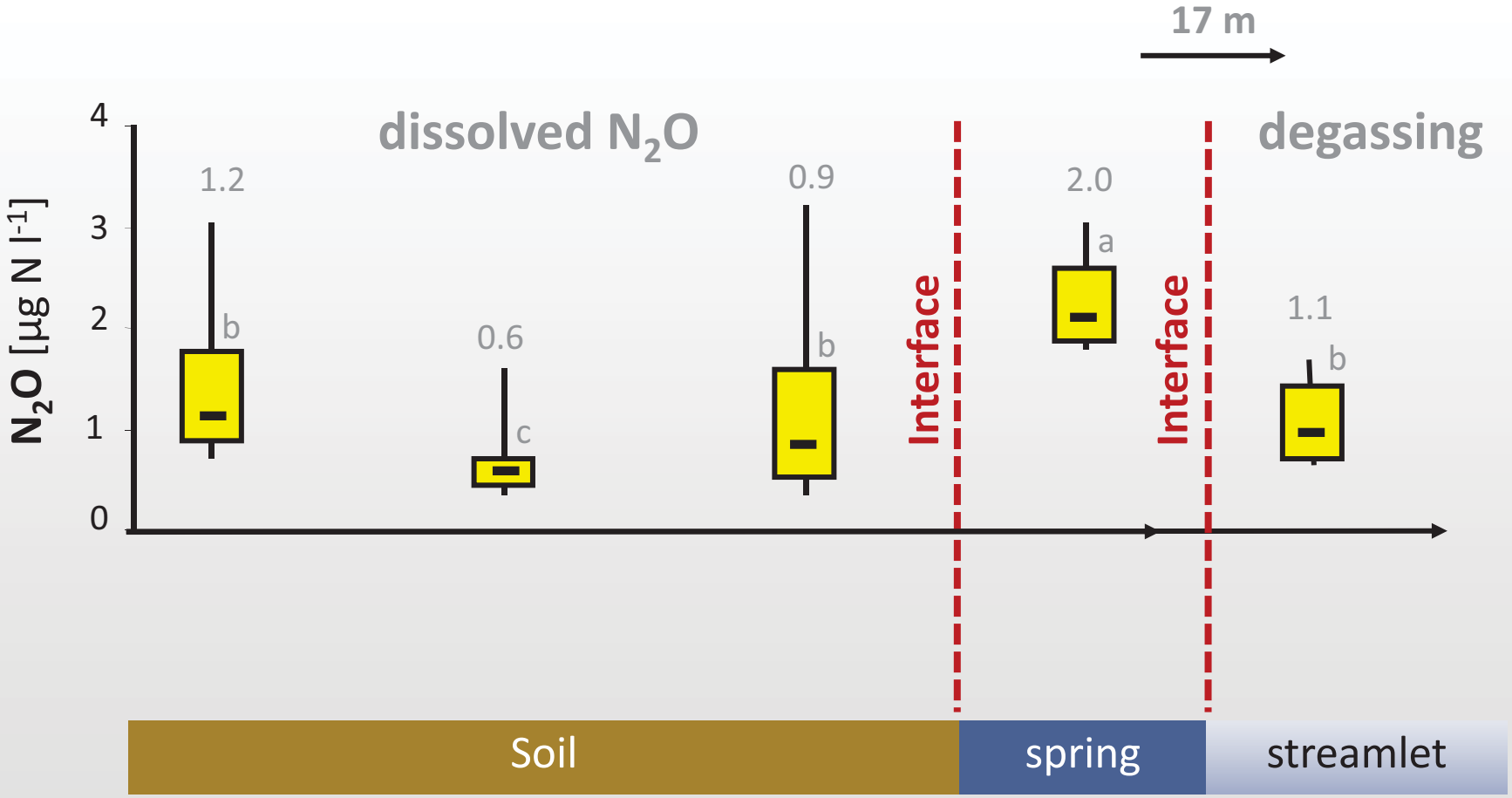
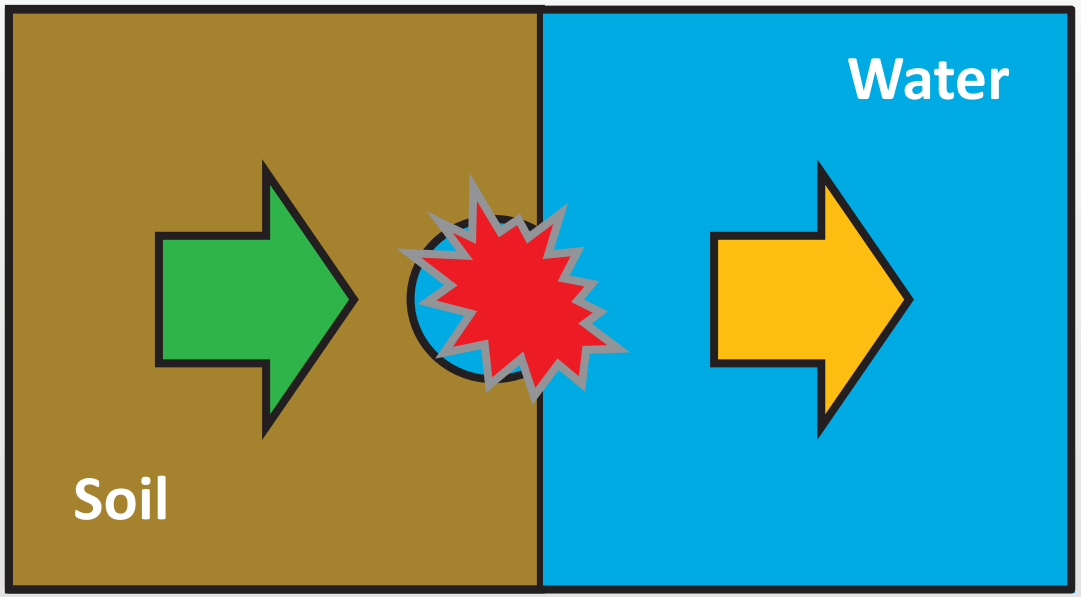
High uncertainties, if measurements are not made directly at the interface (spring)



(P< 0.01)

Höll et al. (2005) AE (Diplom Thesis)

Biogeochemical fluxes at the landscape scale are highly controlled by interface biogeochemistry



Hence biogeochemical fluxes

at the landscape ecosystem scale are determined by small scale processes

These need to be identified by large scale thinking!

Four Hypotheses

Rainforest high N_2O
Agriculture low N_2O

1. faster, louder, harder…

we need more low and "regular" values published!

2. too simple (C and N cycles separated)

we need more C and N coupling

3. underestimated biotic impacts

we need more experiments on plant-soil interactions

4. "Lego" brick principles (Modules), i.e. interface biogeochemistry is ignored

we need interface biogeochemistry integrated in models & measurements

Region-specific solutions !!!
not one fits all
(talk R. Seppelt)

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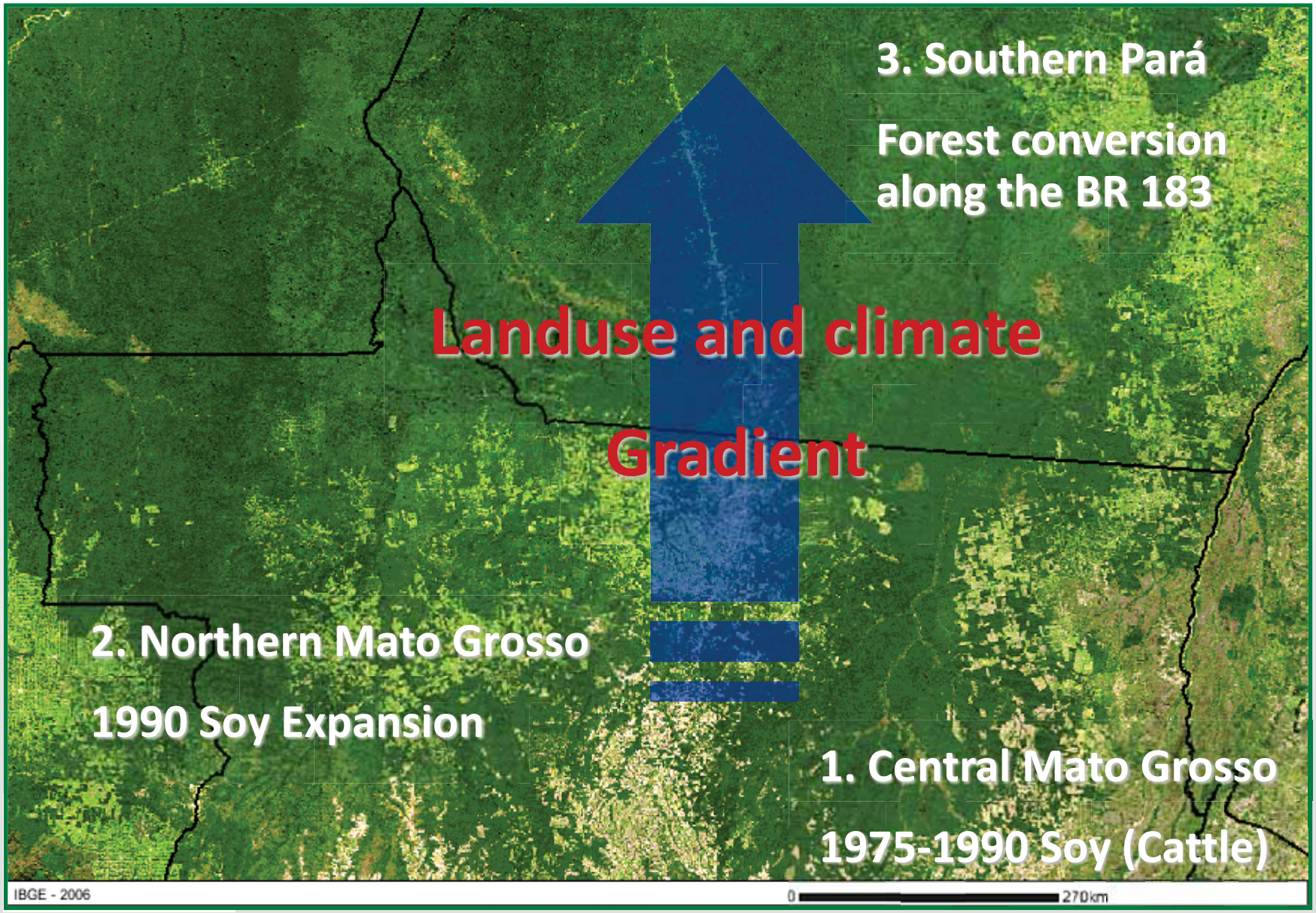
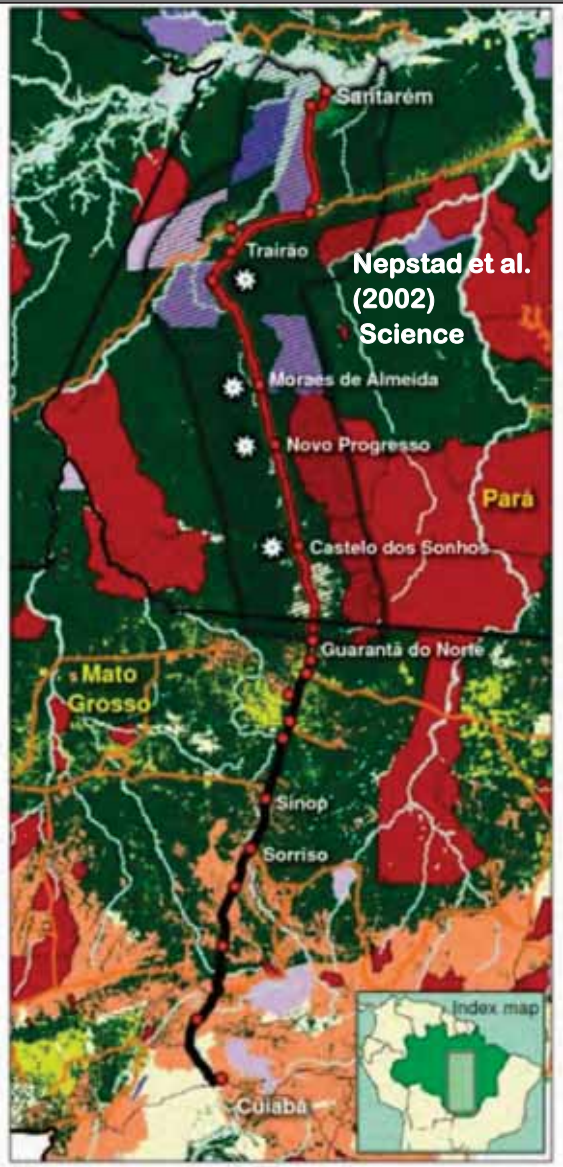
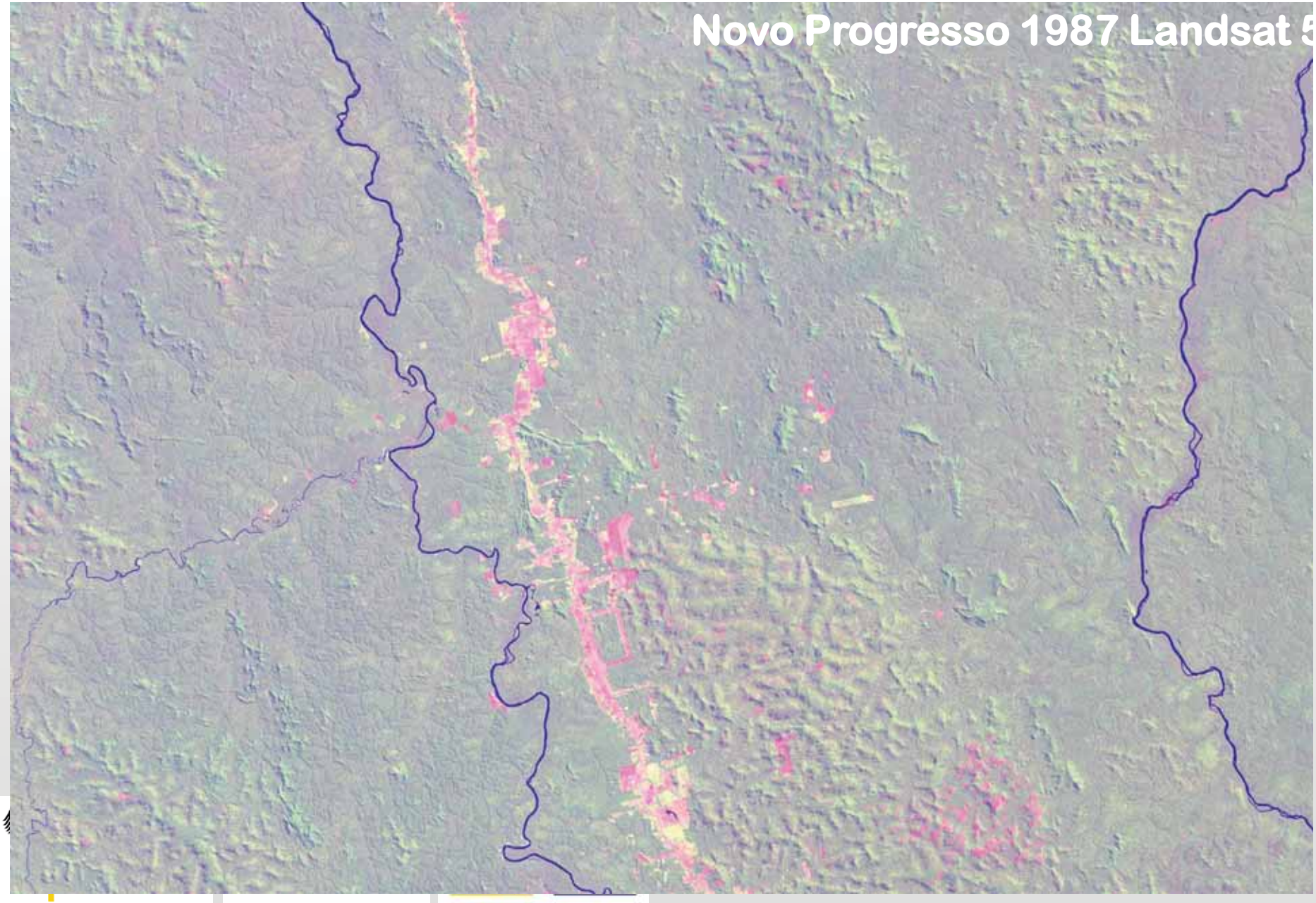
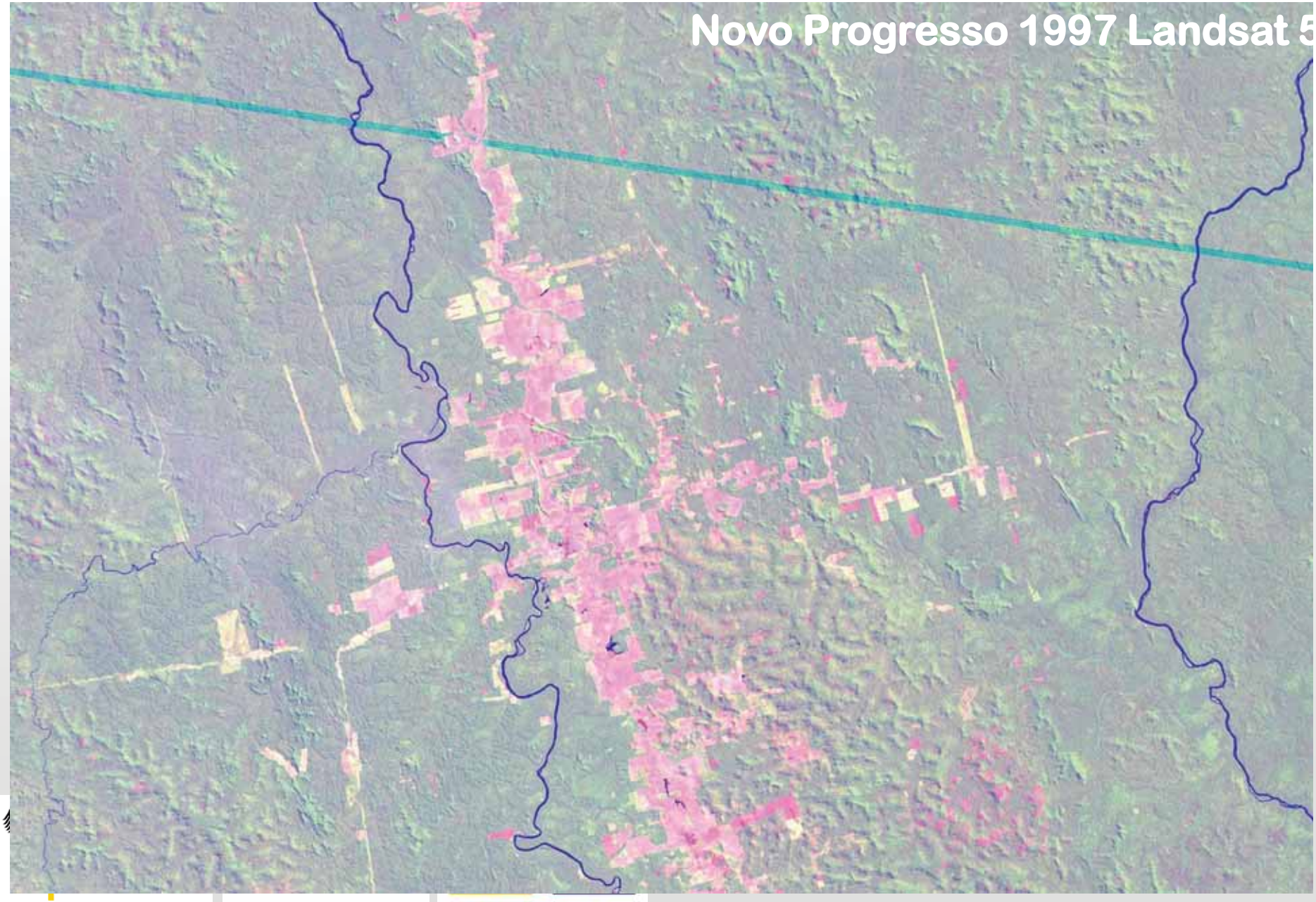
Three research regions (space for time)

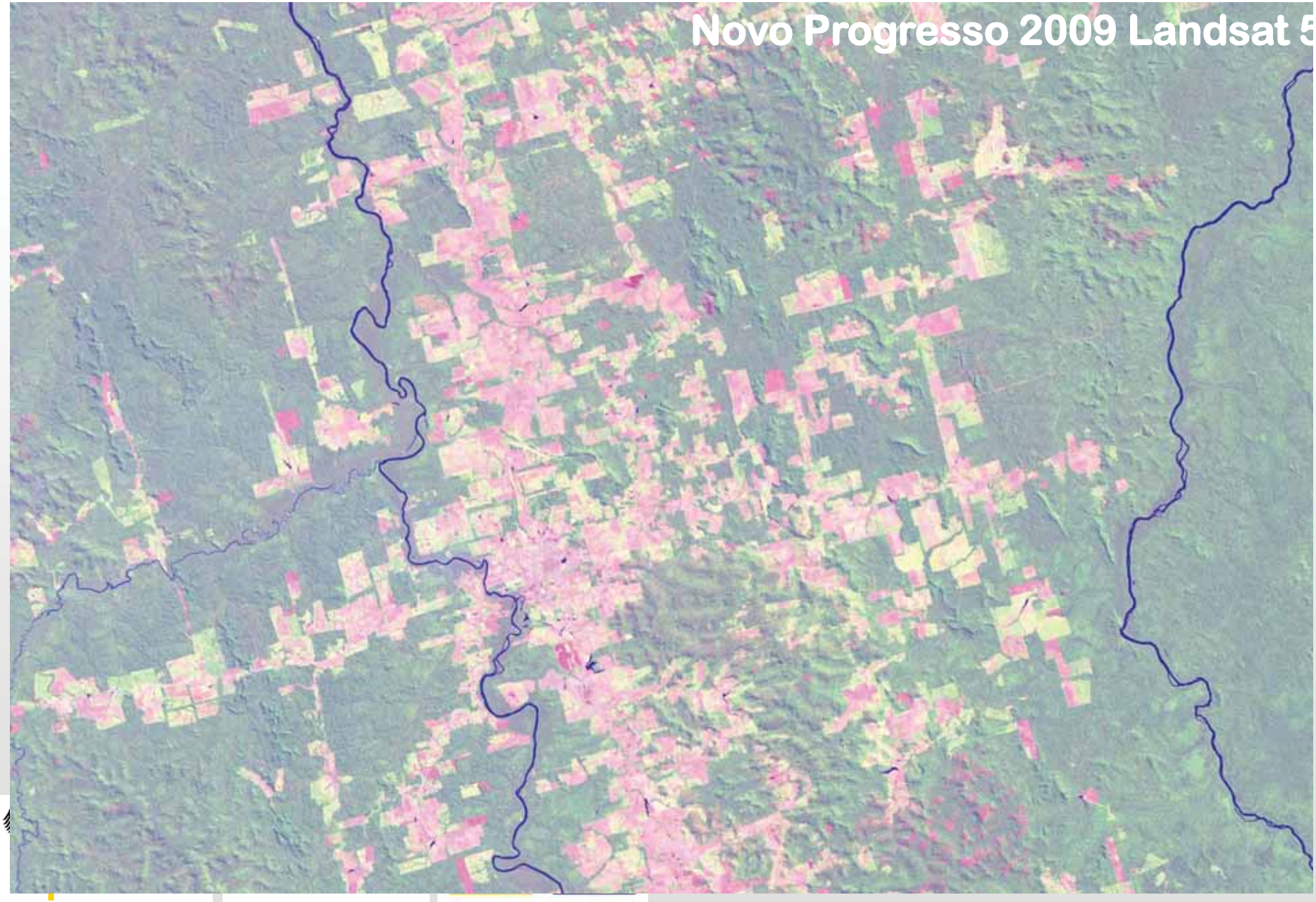


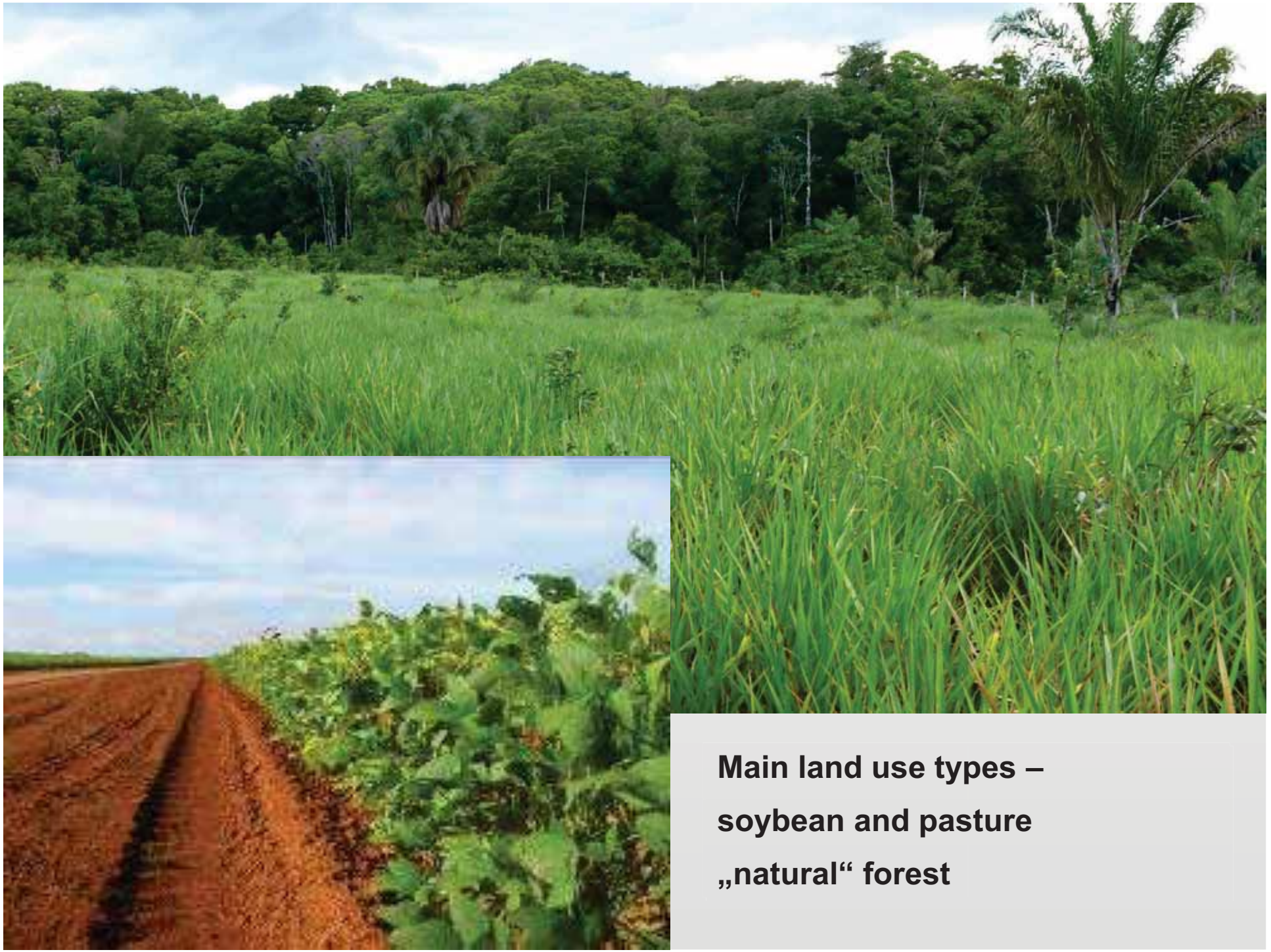
Biogeochemical model contributions Carbiocial




Novo Progresso 1987 Landsat 5


Novo Progresso 1997 Landsat 5


Novo Progresso 2009 Landsat 5



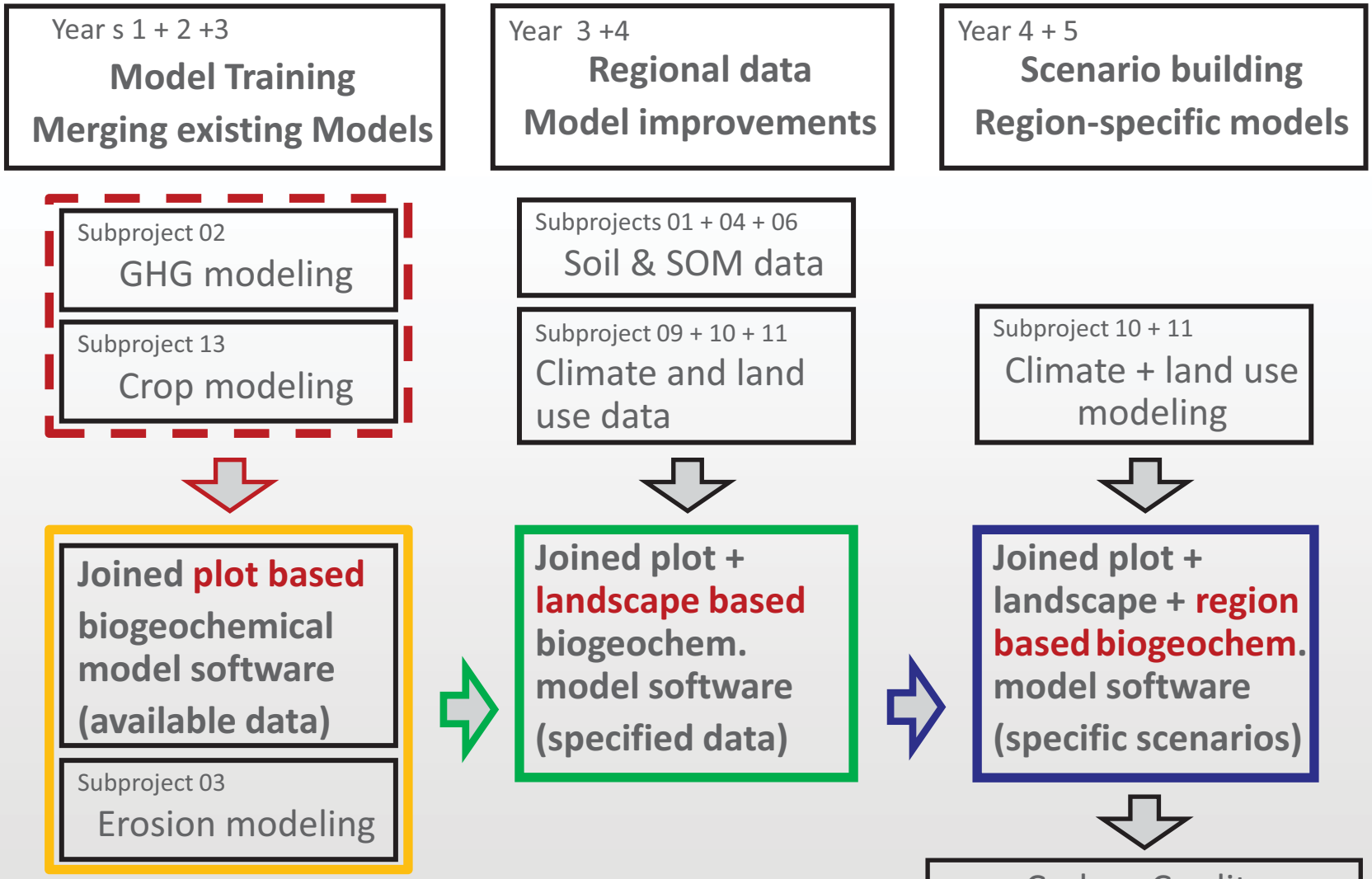
Main land use types –

soybean and pasture

„natural“ forest

Biogeochemical model contributions Carbiocial

Biogeochemical model contributions Carbiocial



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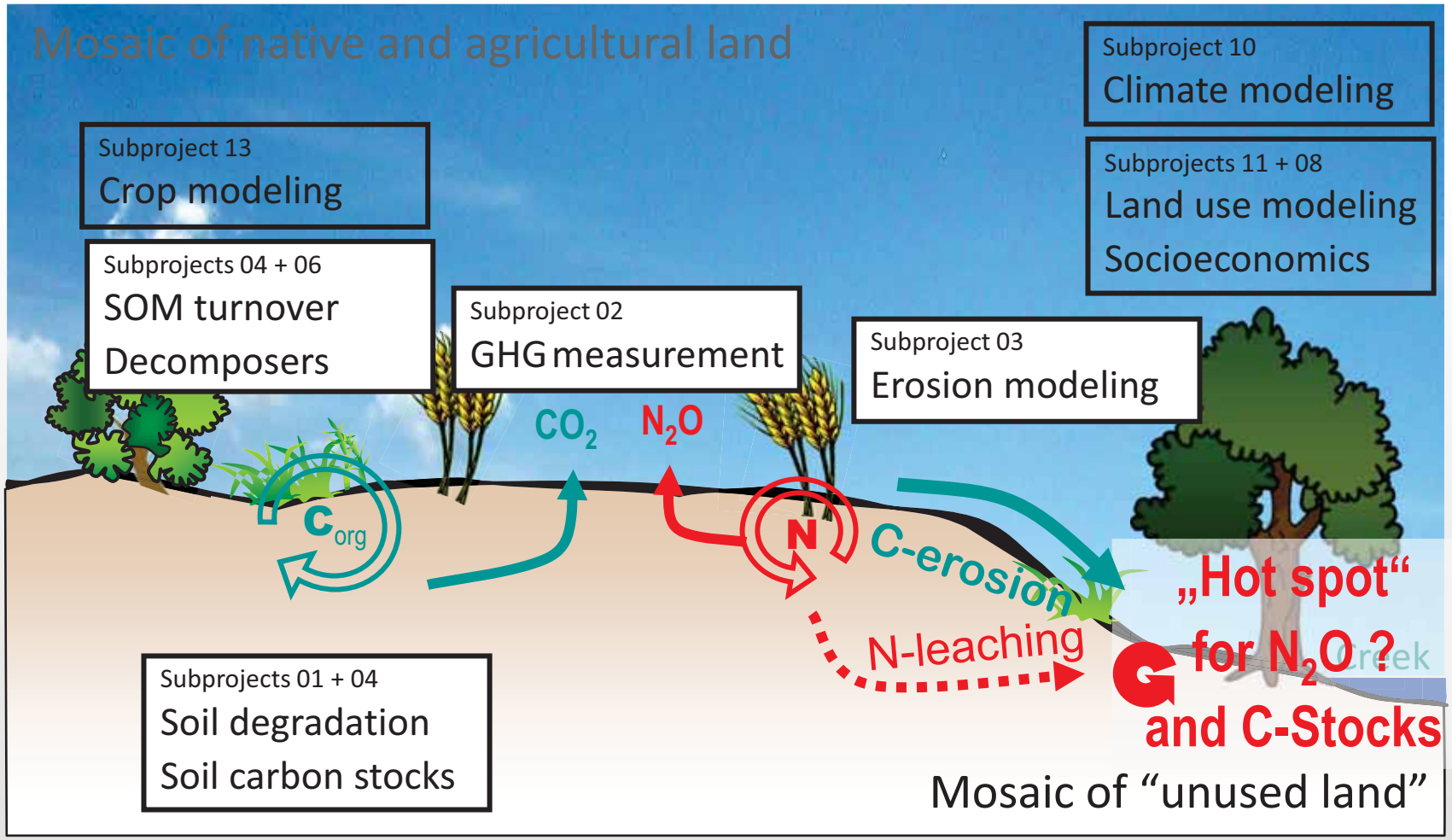

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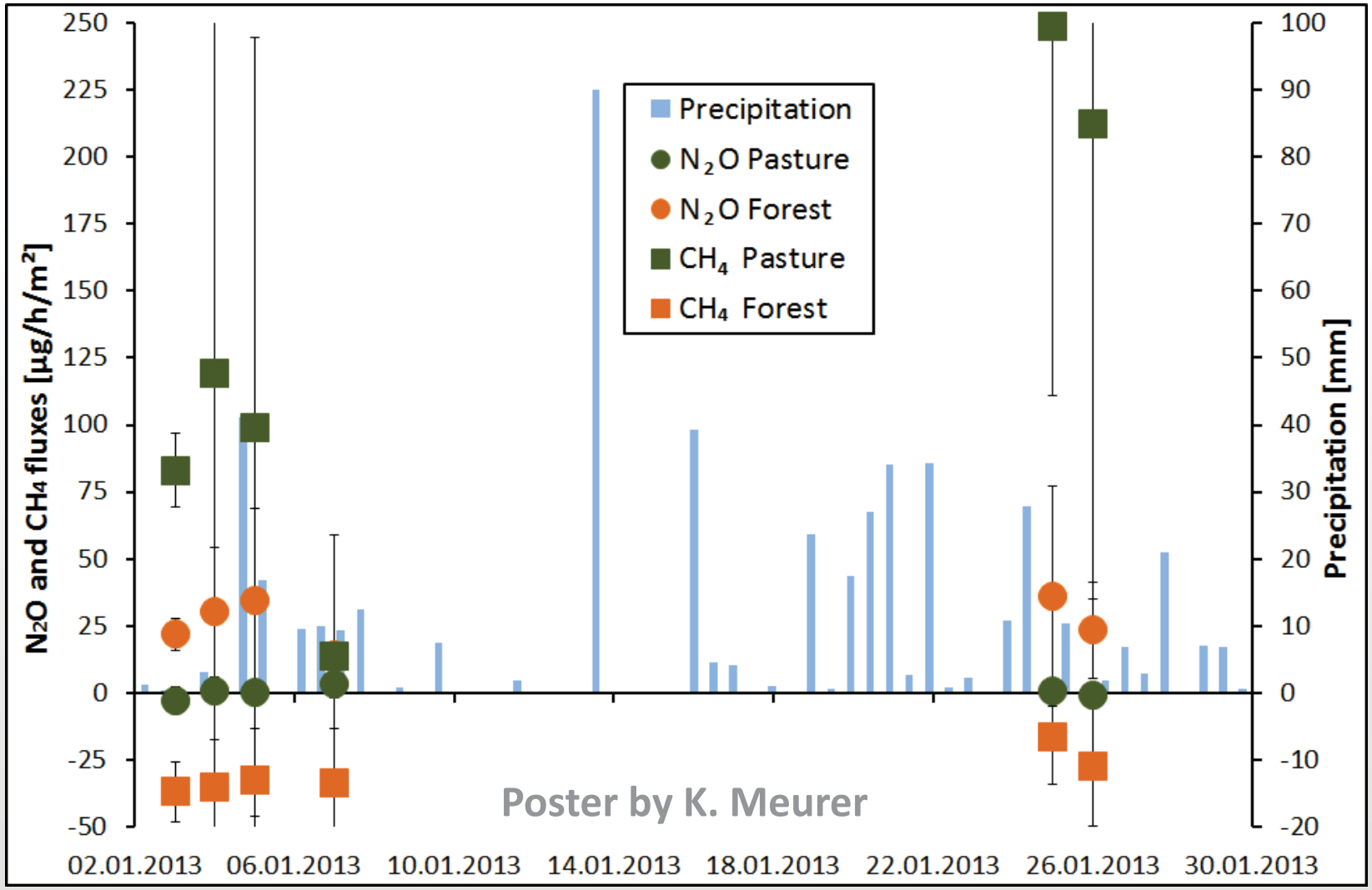
Region-specific (re)calibration of existing mechanistic model

Picking the best for southern Amazonia

For example for GHG:

CANDY, DNDC, DayCent



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Event-based (rainy seson) intensive measurements

Model-based measurement campaigns!

(closed chamber method)

To improve model – data integrations

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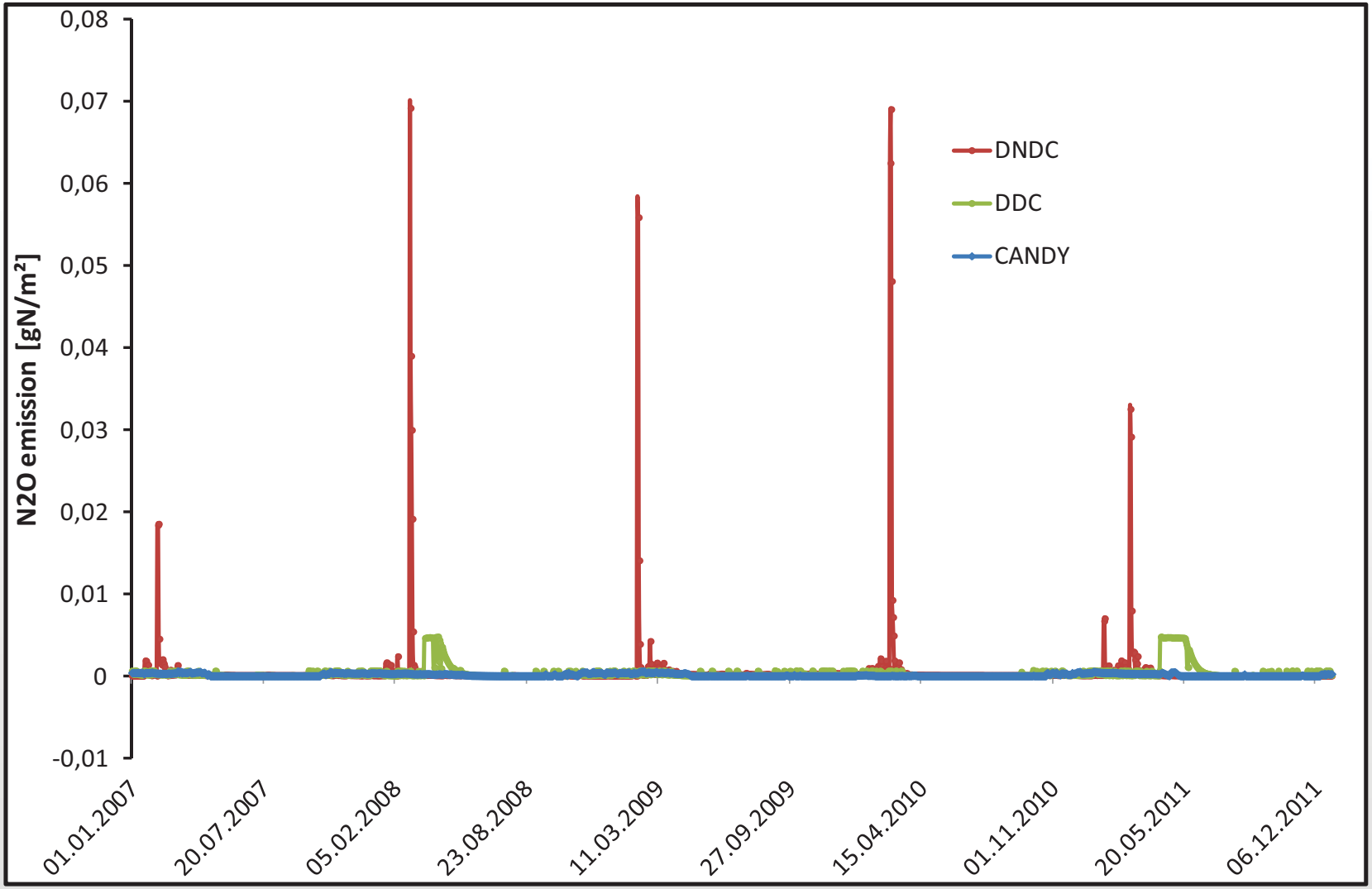

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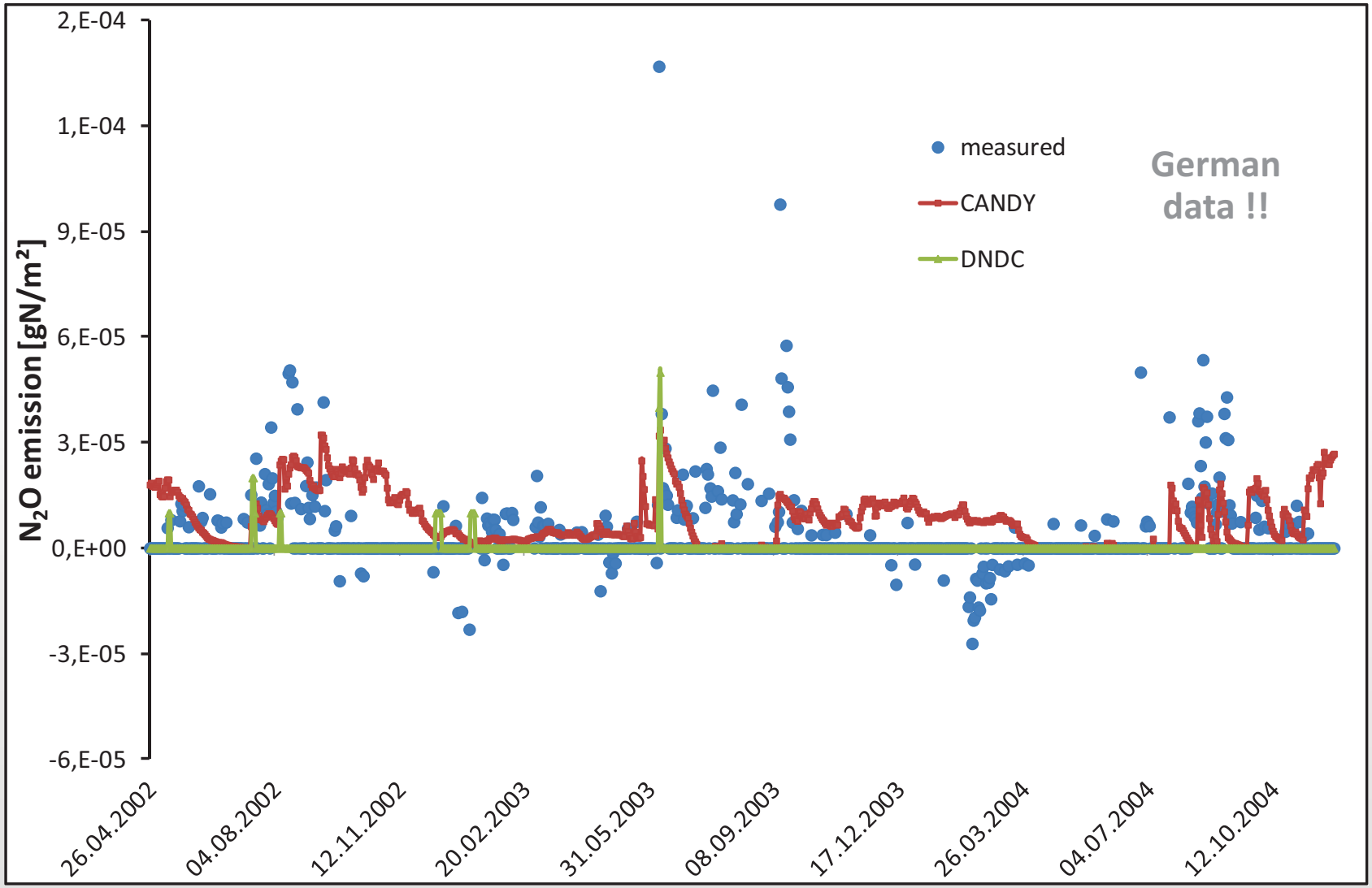

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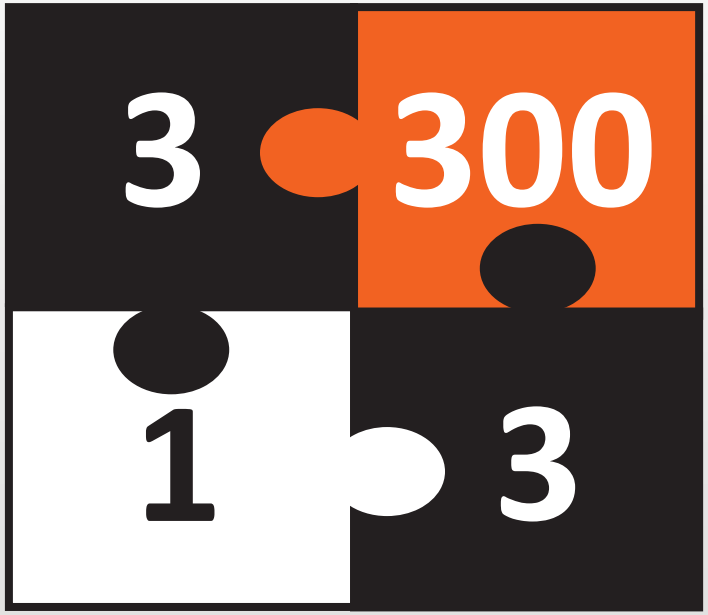
How do we account for interface biogeochemistry?

(Lego) merging of model module cannot account for it.

At the end emissions factor (specific) again?

Mean emission rate per land use times its area



Thank you!

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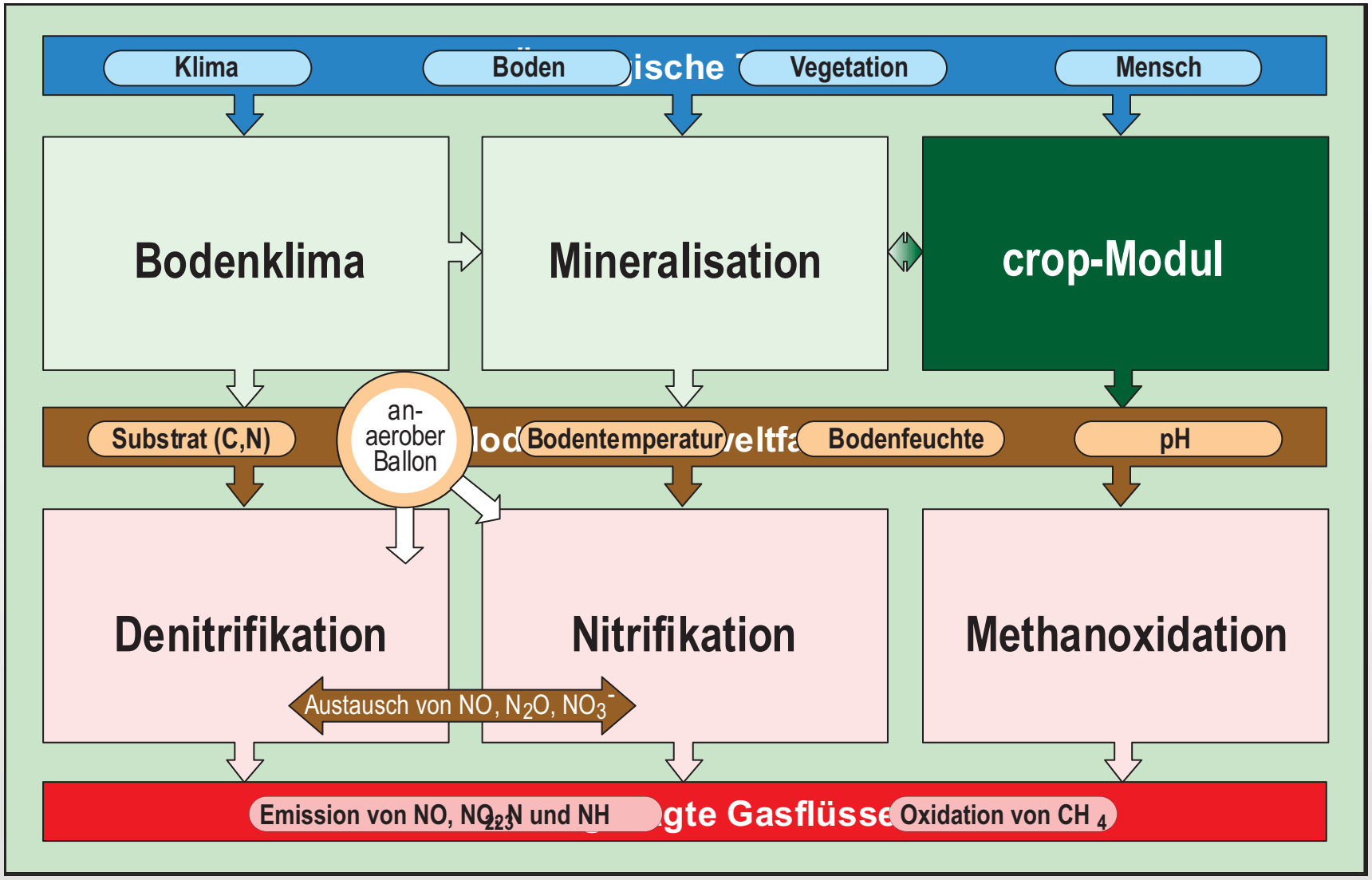
DENITRIFICATION-DECOMPOSITION – DNDC - Modell



Folien von Brigitta Szyska, Gießen

Kleine Flächen große natürliche Methanquellen

Kleine Flächen: dominieren die natürliche Methanbilanz auf der kontinentalen Skala

Atmospheric Environment 51 (2012) 203–211

Contents lists available at SciVerse ScienceDirect

Atmospheric Environment

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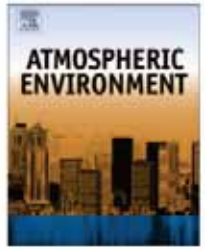


Towards improved bottom-up inventories of methane from the European land surface

Dennis Grunwald [a], Ann-Catrin Fender [b], Stefan Erasmi [c], Hermann F. Jungkunst [a,*]

Grunwald et al. (2012) AE

4.6 bis 6.7 Tg CH_4-C Emissionen pro Jahr

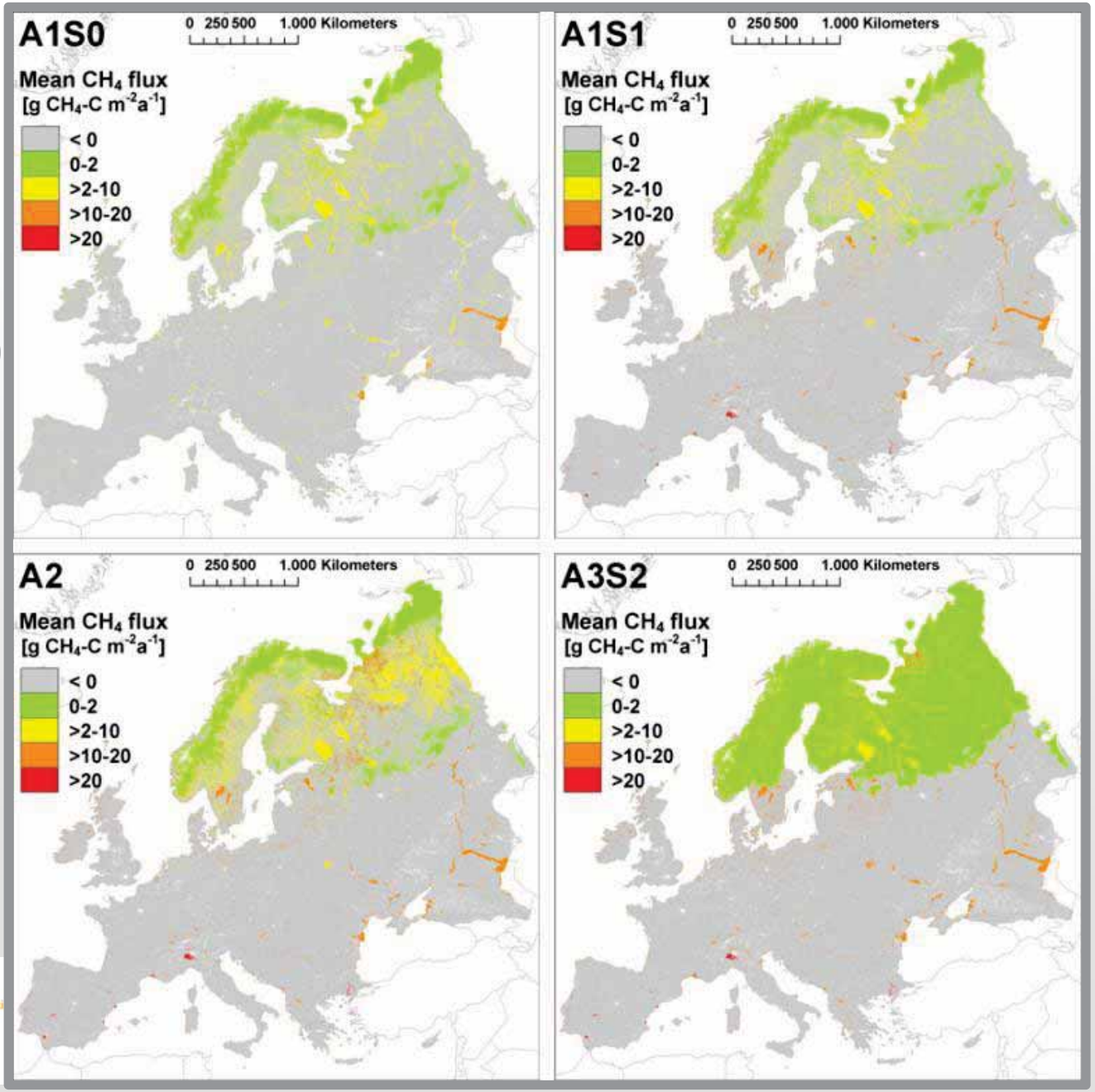
Obwohl methanaufnehmende Böden (graue Flächen)

65% bis 87% der Landfläche Europas ausmachen

Komi besonders wichtig

DFG-Projekt

Julia Schneider



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Demzufolge sind Methanbilanzen von naturnahen Systemen zunächst eher durch genaueres Kartieren nasser Böden zu verbessern, als durch mehr Prozessverständnis.

Mit Hilfe von:

(a) **Fernerkundung** (crowdsourcing)

(b) **Geomorphologie** (Landschaftsentwicklung)

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