

A detailed painting of a rural landscape. In the foreground, a large, leafy tree stands on the right. A group of people, including men, women, and children, are gathered around the base of the tree, some sitting on the ground. One man is lying down, resting against the tree. In the middle ground, several people are working in a field, possibly harvesting or tending to crops. The background shows rolling hills and a distant town or village with a church spire. The overall scene is a depiction of rural life and agriculture.

Usages des sols & climat

**Qu'avons-nous appris de LUCID & CMIP5,
Comment faire mieux la prochaine fois ?**

LUCID « Land-Use and Climate: IDentification of robust impacts »

■ Ensemble simulations (with & without land-use changes).

Exp. design		veg. cover	
		1870	1992
SST & GHG	1870	PI	PIv
	1992	PDv	PD

> LCC-induced changes : {PD-PDv, PIV-PI}

➤ SST: 31 years of interannually varying SSTs and sea-ice, for each time period.
CO2SST-induced changes = {PD-PIv, PIV-PD}

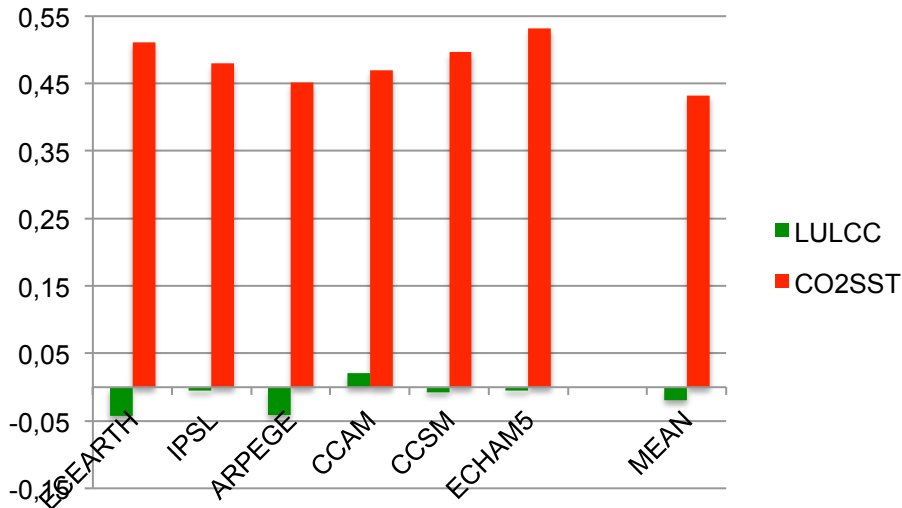
■ **7 groups have run the snapshot experiments**

(5 members per ensemble)

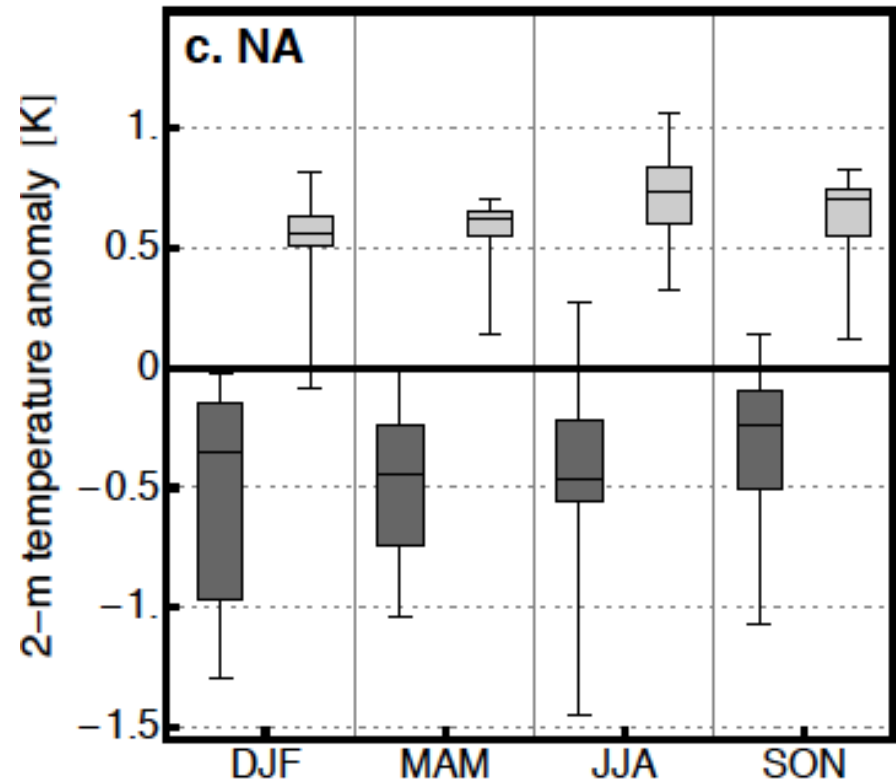
Name of Climate Model	Name of Land-surface Model
ARPEGE	ISBA
CCAM	CABLE
CCSM	CLM
ECearth	TESSEL
IPSL	ORCHIDEE
SPEEDY	LPJmL
ECHAM5	JSBACH

Impacts of Historical Changes in LULCC on the simulated 2m air temperature

Mean GLOBAL Annual Change



Mean REGIONAL Seasonal Change



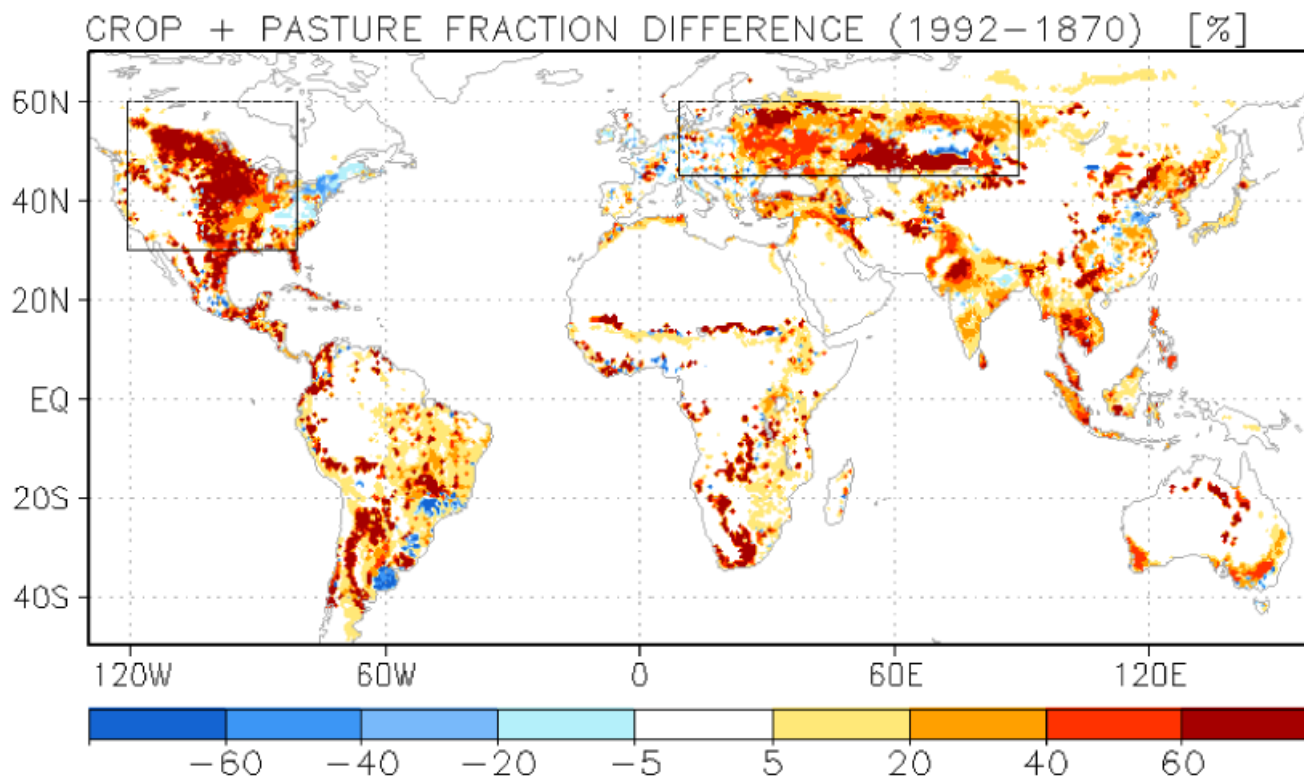
Impact of LCC

Impact of SSTS+SiC+CO₂

LUCID

How has land-use been incorporated into our climate models?

RCP → sur grille 0.5°*0.5°
fractions couvertes par 1) agriculture, 2) prairies pâturées



À transformer en cartes pour ORCHIDEE

→ Quelle végétation naturelle?

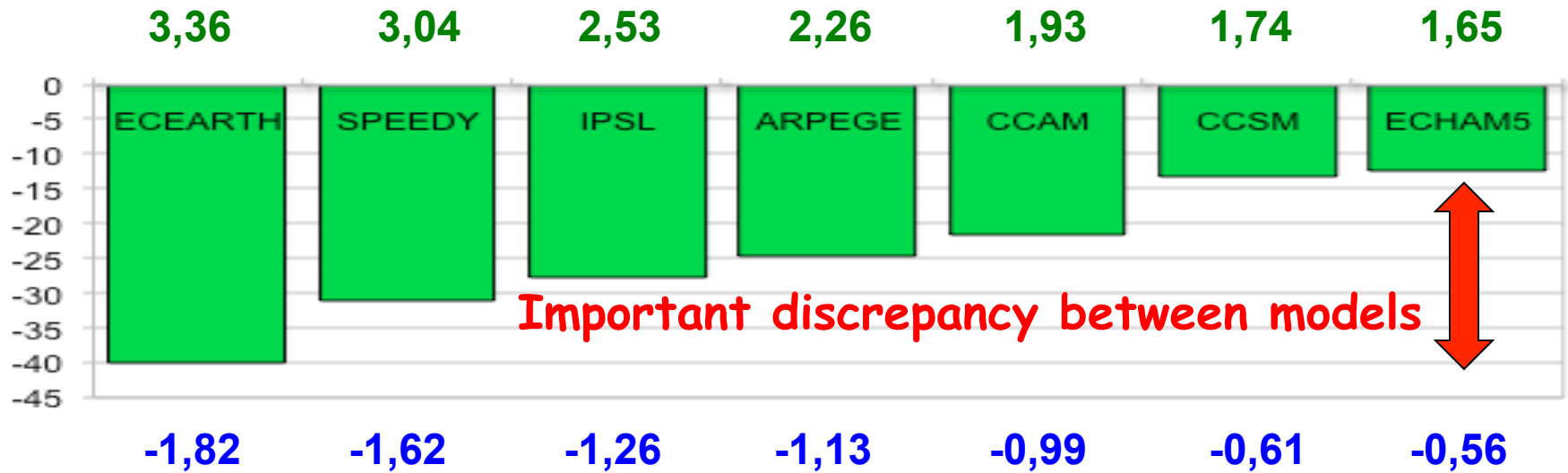
.... Standard (« cartevveg5km »)

→ Quelle stratégie pour les changements d'usages des sols?

Implementation of crop&pasture map onto their own land-cover maps results in:

Increased crop at the expense of forests in many regions

Forest extent in North America (10^6 km^2) in 1870



Important discrepancy between models

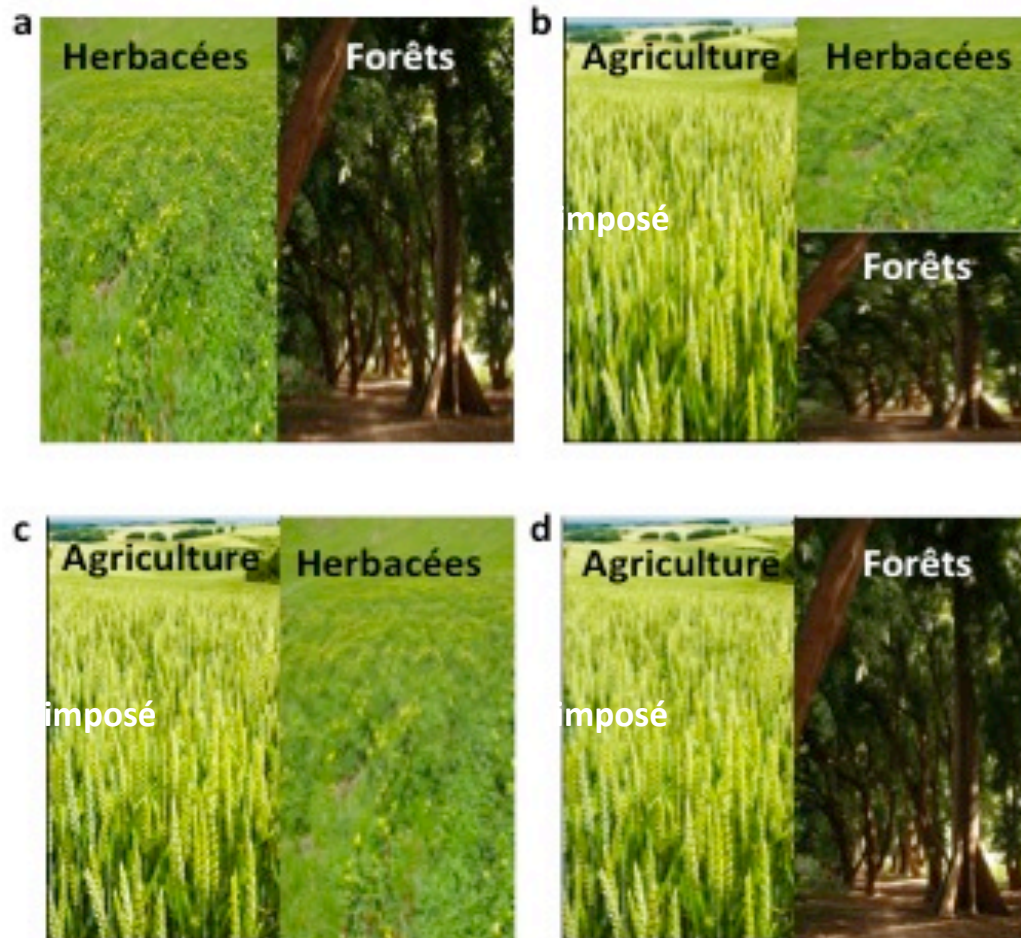
Changes in forest extent in North America
(bars in %, numbers in 10^6 km^2)

Explain $\sim 1/3^{\text{rd}}$ of differences between climatic responses

Where are those differences in land-cover coming from?

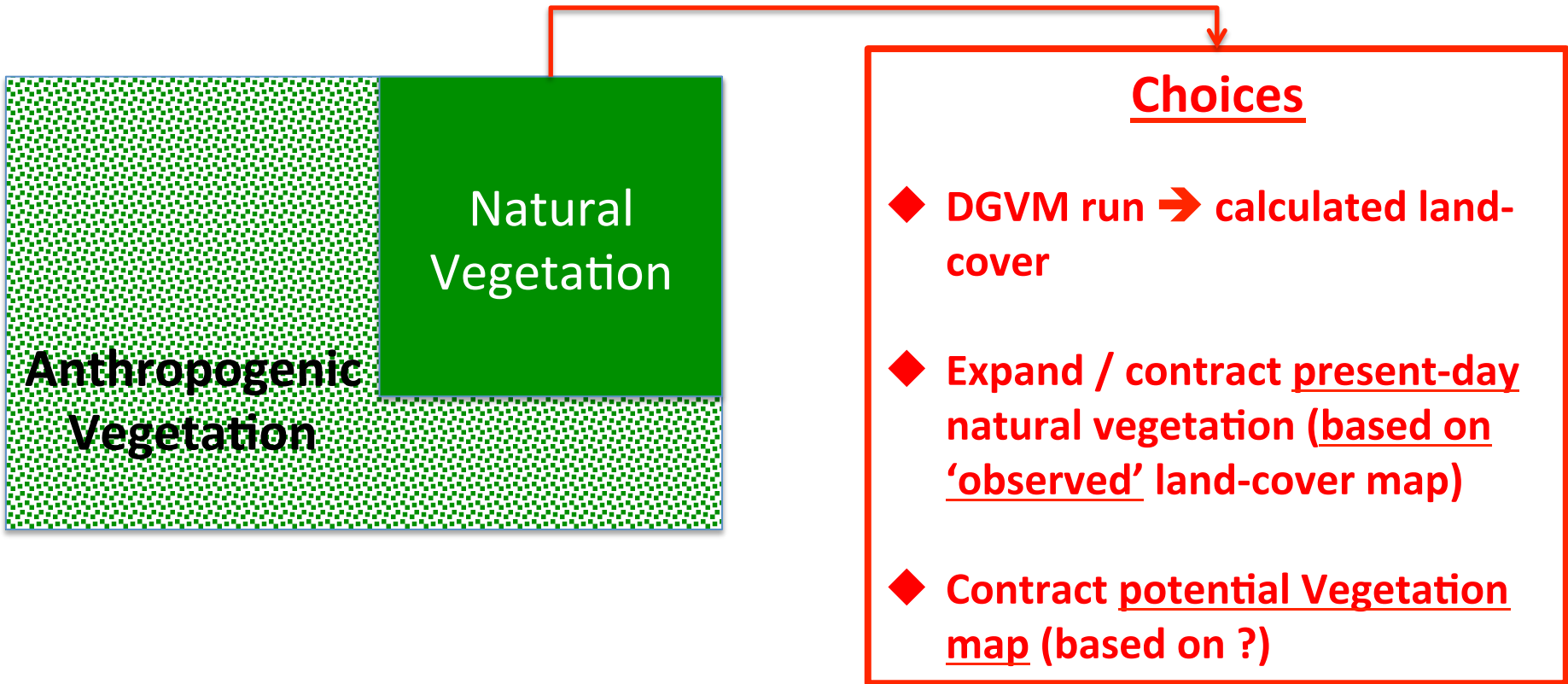
1) Different decisions on land-transitions

État initial



Where are those differences in land-cover coming from?

2) Choices about Natural Vegetation

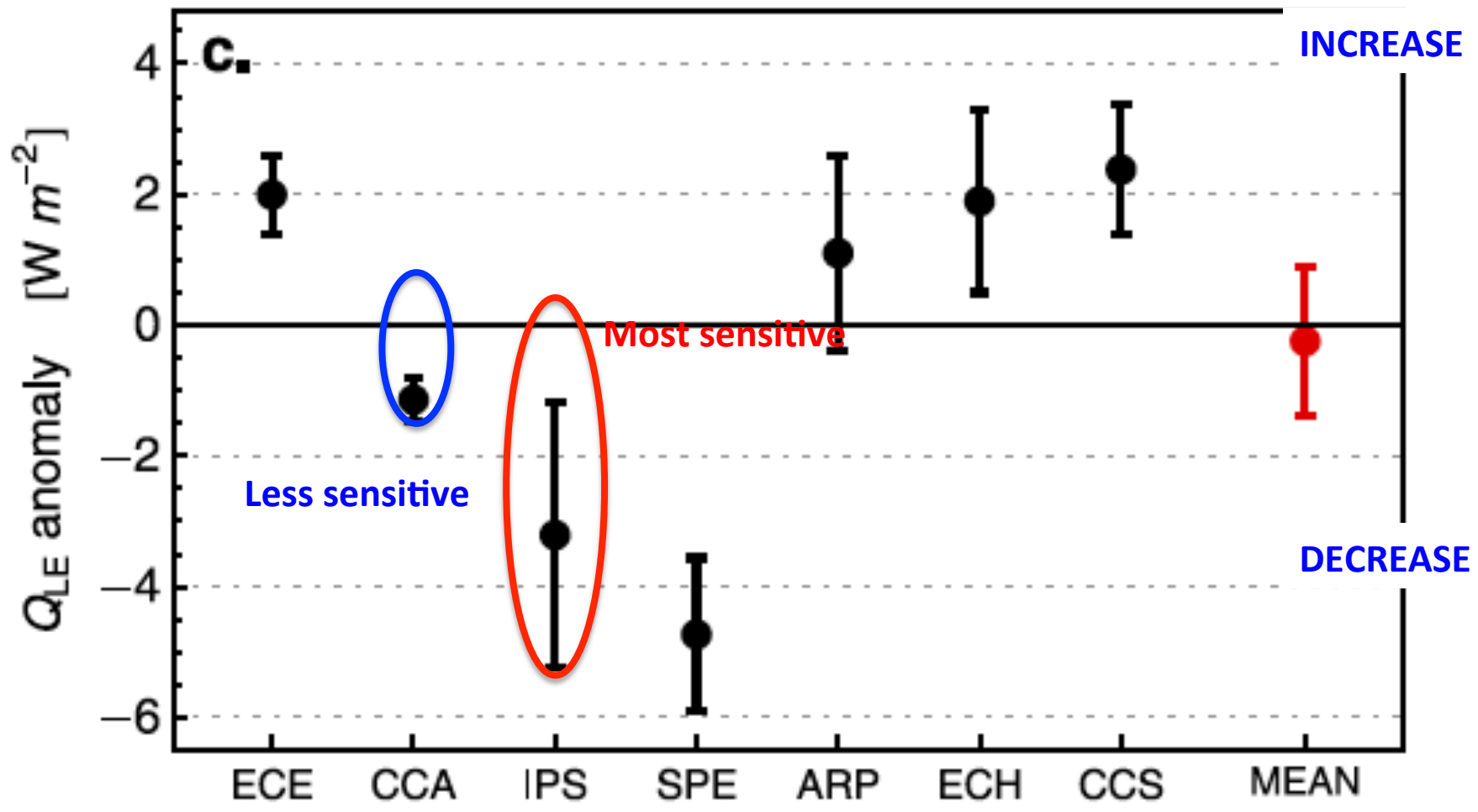


**Where are those differences
in land-cover coming from?**

**3) wether pasture is considered as natural grasses or
are defined as a specific vegetation type**

Differences in Land-Surface Models' parameterizations:

Sensitivity of each DGVM's simulated Latent Heat Flux to the magnitude of LULCC



Boisier et al. (2012)

Explain ~2/3rd of differences between climatic responses

Model-Data Comparisons of the impact of LULCC-induced albedo change as a function of the intensity of the snow pack / LUCID; Boisier et al. (2013)

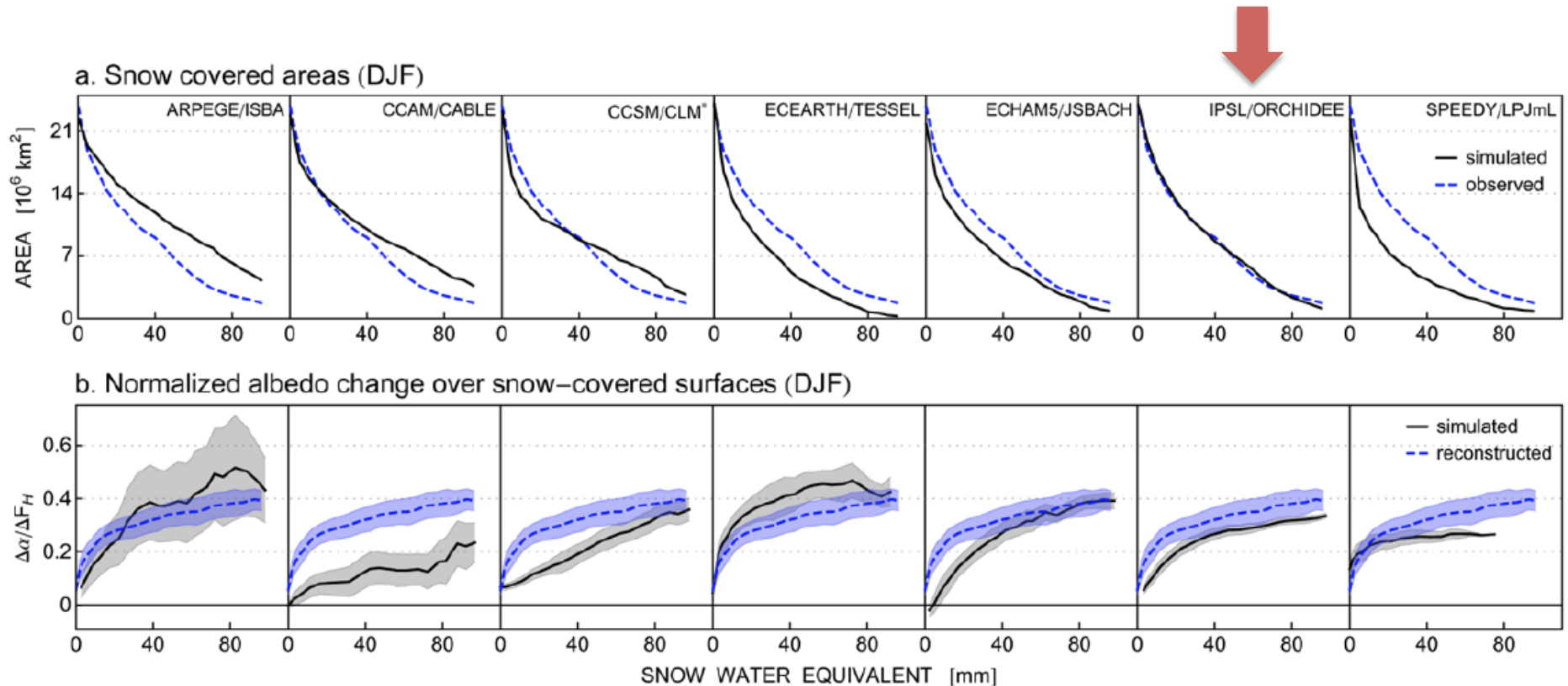
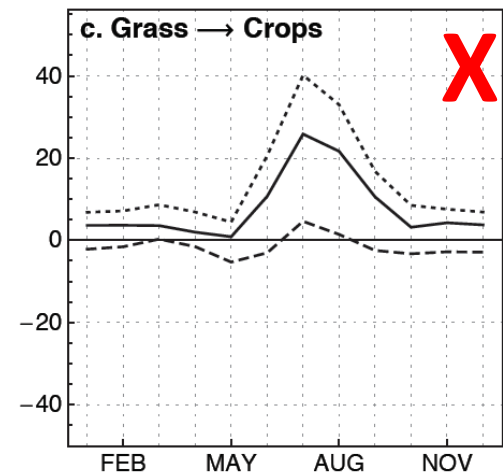
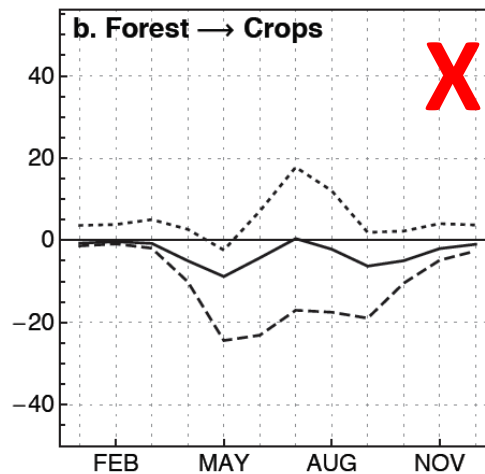
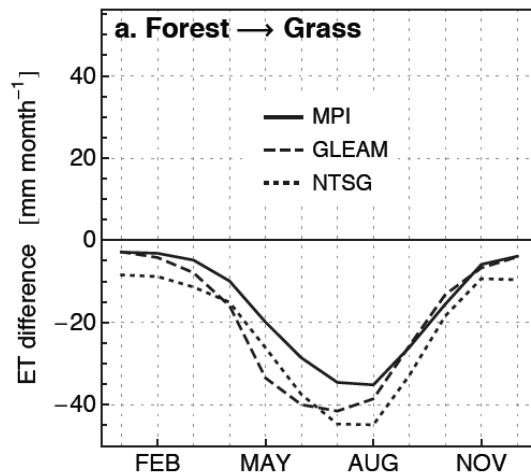
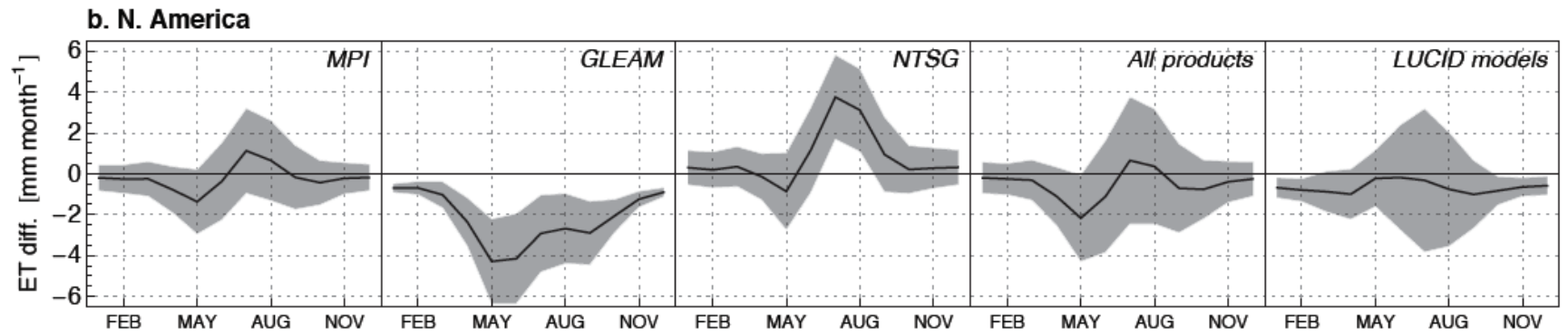
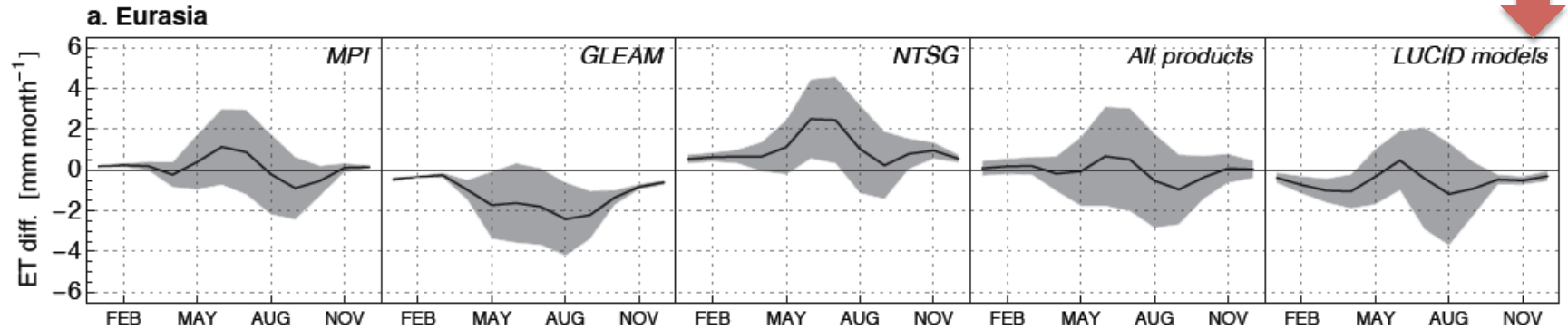


Fig. 8. (a) Total area within the region of study (box in Fig. 5) in DJF with snow water equivalent (SWE) levels higher than the value indicated in the x-axis. Solid and dashed lines illustrate the snow coverage/content relation simulated in LUCID models and obtained from the NISDC dataset, respectively. (b) Normalized surface albedo changes ($\Delta\alpha/\Delta F_H$, see text) averaged over SWE bins of 15 mm around the values indicated in the x-axis. Results from simulations and reconstructions illustrated as solid and dashed lines, respectively. Shaded areas indicate the corresponding ± 1 standard deviation of $\Delta\alpha/\Delta F_H$ calculated within the moving window at each SWE level.

Model-Data Comparisons of the impact of LULCC-induced Evapotranspiration change Through seasons / LUCID; Boisier et al. soumis



Priorities

Revise Strategy to include Land-Uses (*From IAMs to ESMs*)

→ *will be tackled through a European project (LUC4C; 2014-2018) & within the coordinated projects LUCID & LUMIP*

Improve Evaluation of Land-Surface Models:

How do they respond to prescribed changes?

Make sure validation is not only done in 'off-line' mode (i.e. decoupled from climate model)

→ ***Improve representation of managed land?*** (*see Sebastiaann Luyssaert's presentation*)