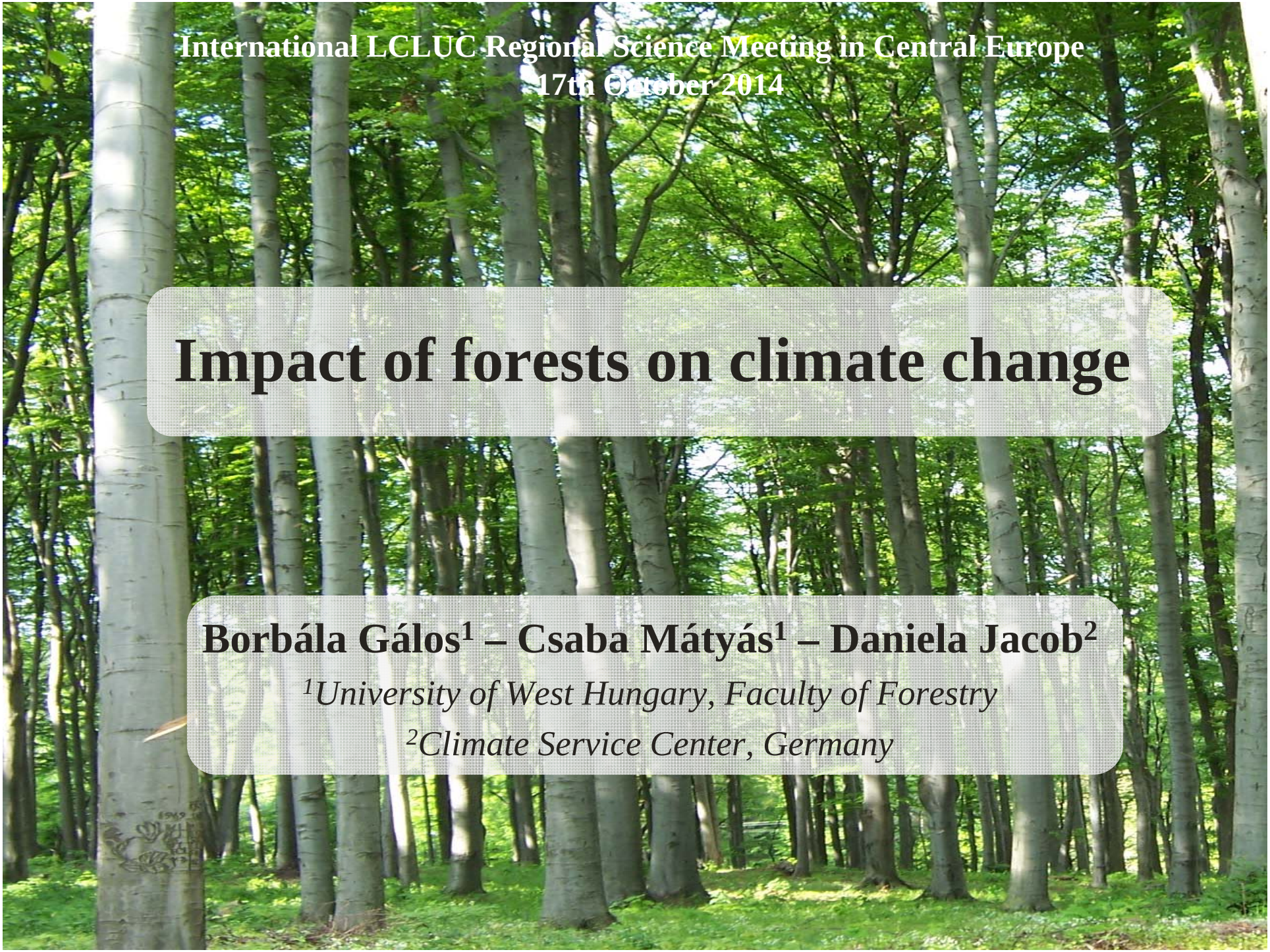


International LCLUC Regional Science Meeting in Central Europe
17th October 2014

Impact of forests on climate change

Borbála Gálos[1] – Csaba Mátyás[1] – Daniela Jacob[2]

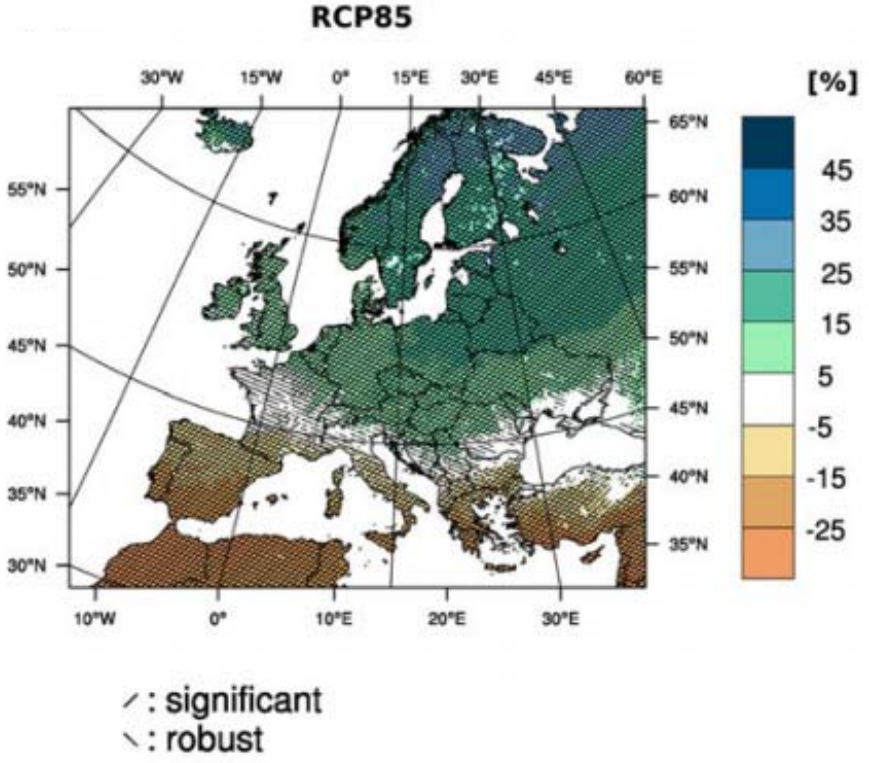
[1]University of West Hungary, Faculty of Forestry

[2]Climate Service Center, Germany

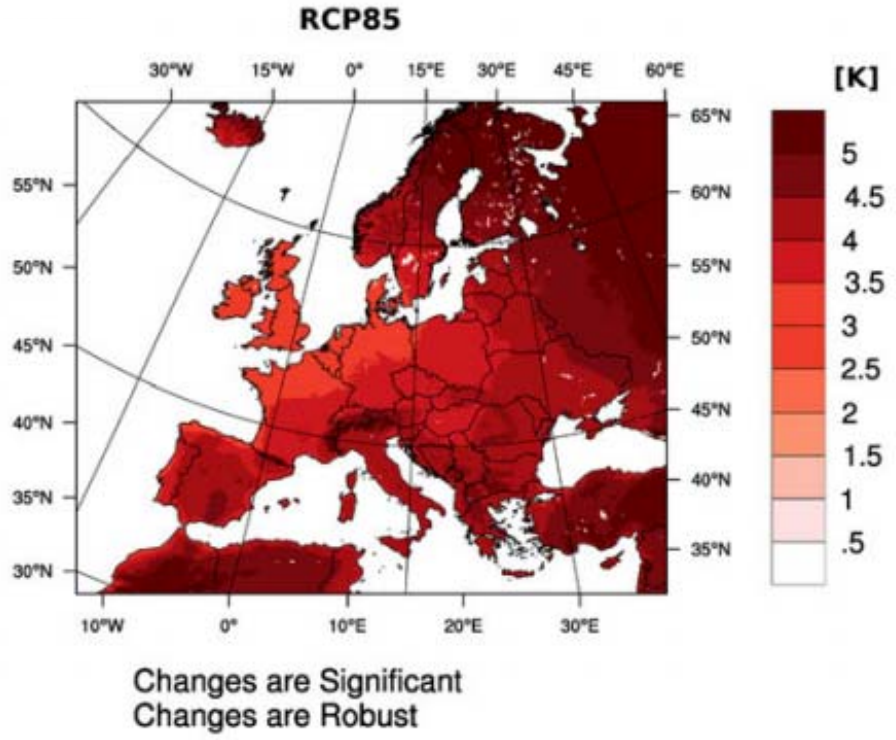
1. Motivation and scientific questions

Projected climate change 2071-2100 vs. 1971-2000

yearly precipitation sum



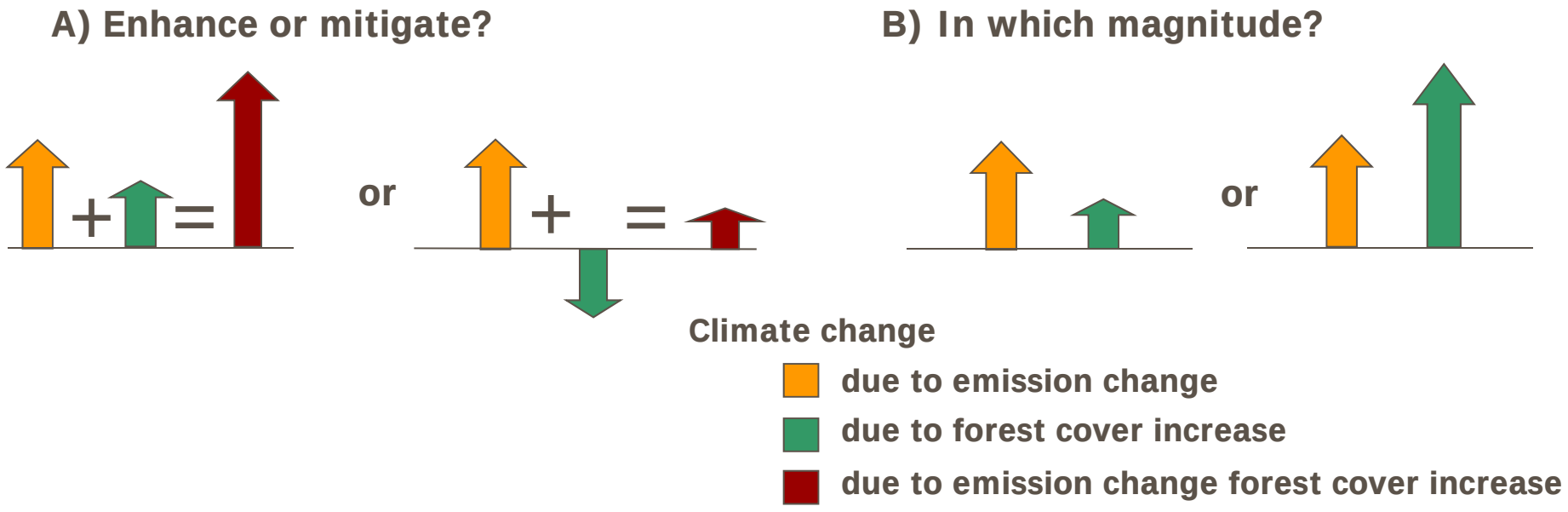
yearly temperature mean



(IPCC AR5, Jacob et al. 2013)

1. Motivation and scientific questions

Can forest cover increase influence the projected climate change signal?



only biogeophysical aspects!

EC-FP7 project CC-TAME *(Climate Change – Terrestrial Adaptation and Mitigation in Europe)*

2.1 Experiment set-up

2 case studies:

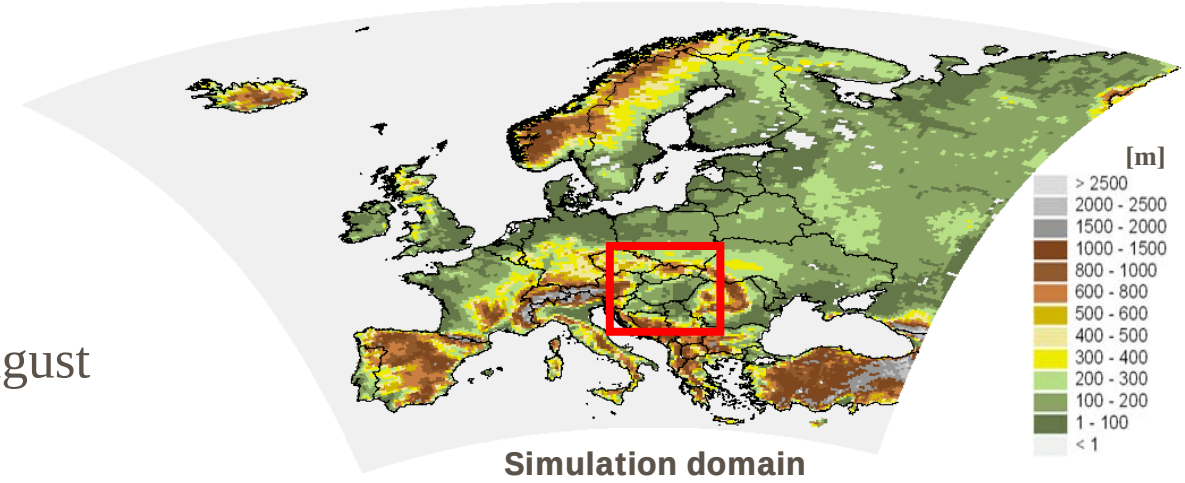
for Hungary and for Europe

Regional climate model REMO

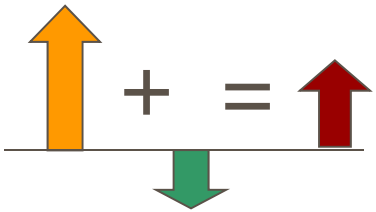
(*Jacob* et al. 2007)

Horizontal resolution: 0.22°

Analyzed months: June-July-August



Simulation domain



1961-1990	2071-2100	
Control simulation without land cover change	Emission scenario simulations - greenhouse gas forcings A1B, A2 -	
	without land cover change	with potential afforestation

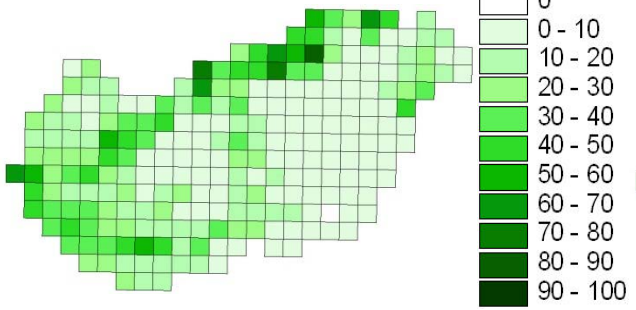
Climate change due to emission

Climate change due to forest cover increase

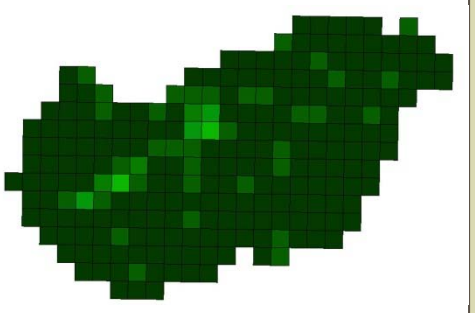
Climate change due to emission and forest cover change

2.2 Changes of the land surface characteristics due to maximal afforestation for summer

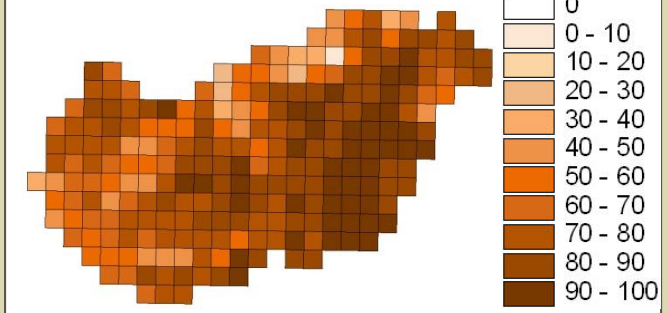
Reference forest cover



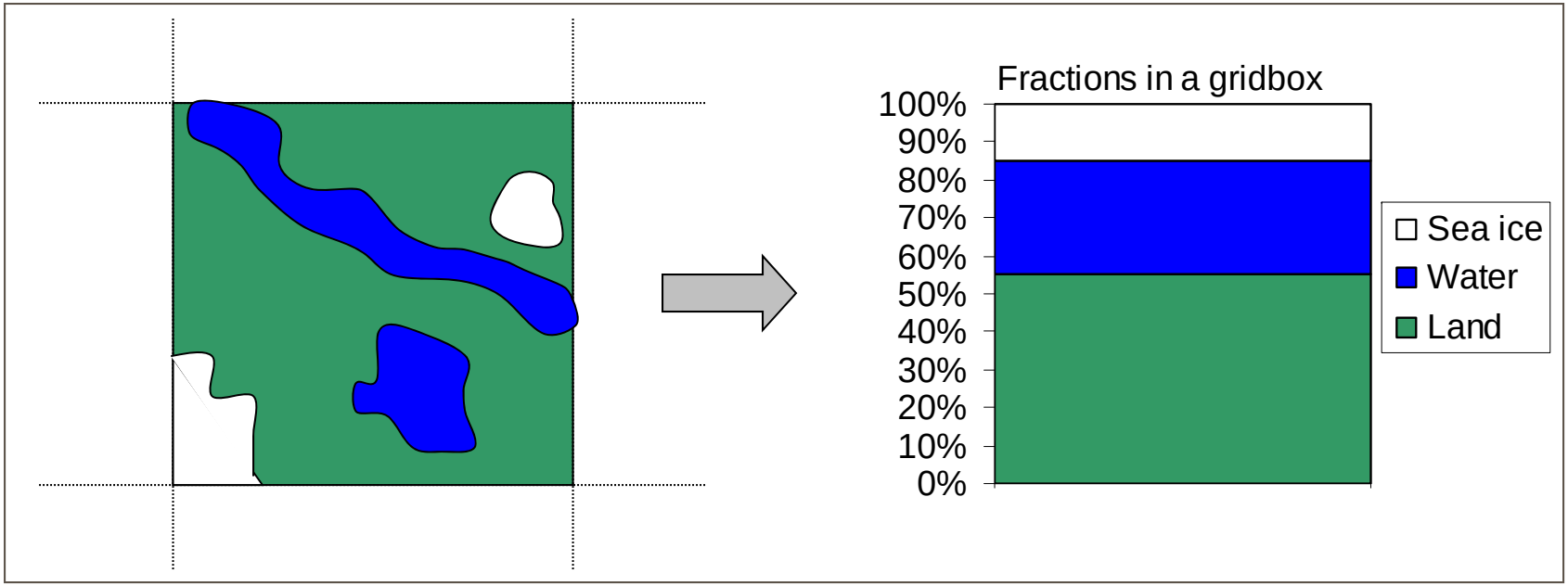
Maximal afforestation

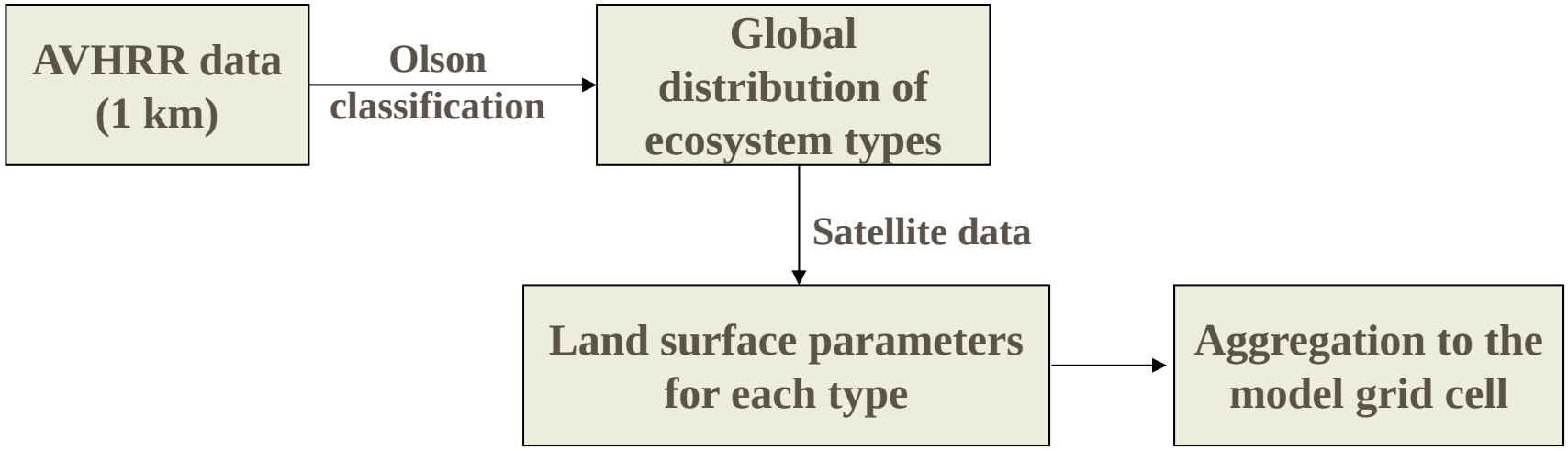


Forest cover change



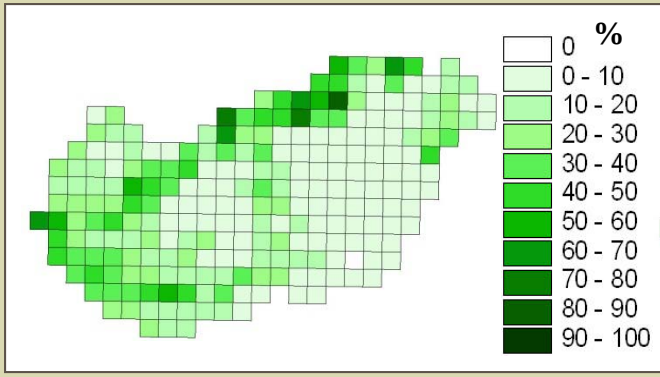
Parameterisation of vegetation in the applied climate model



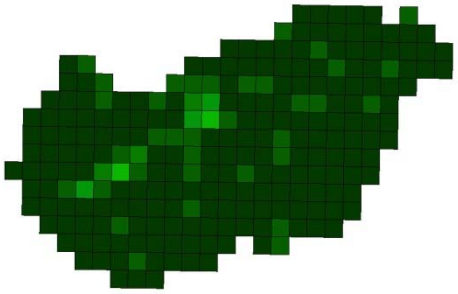


2.3 Changes of the land surface characteristics due to maximal afforestation for summer

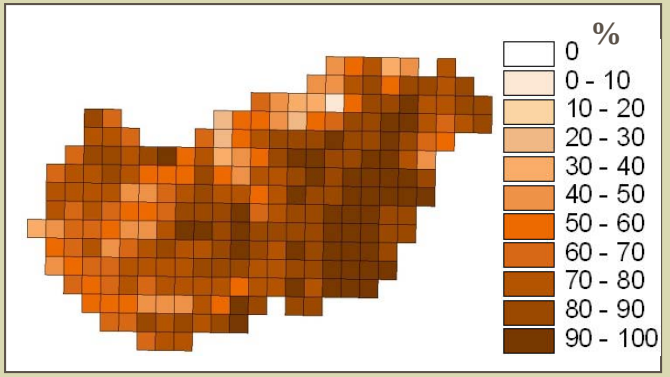
Reference forest cover



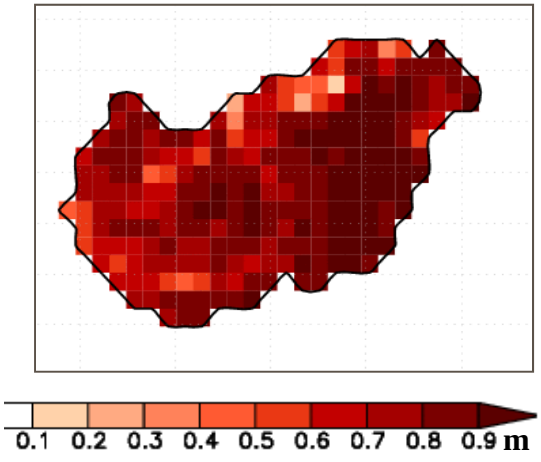
Maximal afforestation



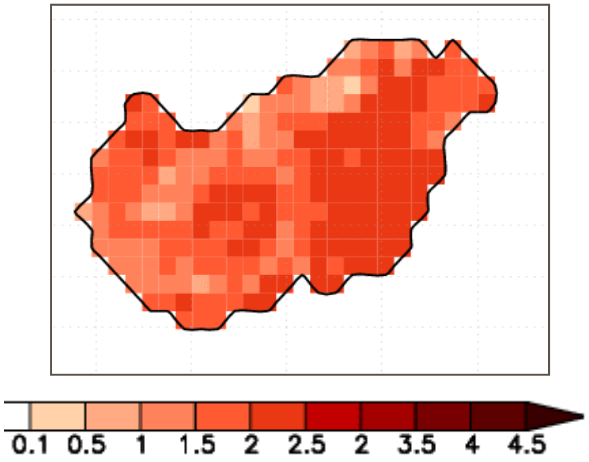
Forest cover change



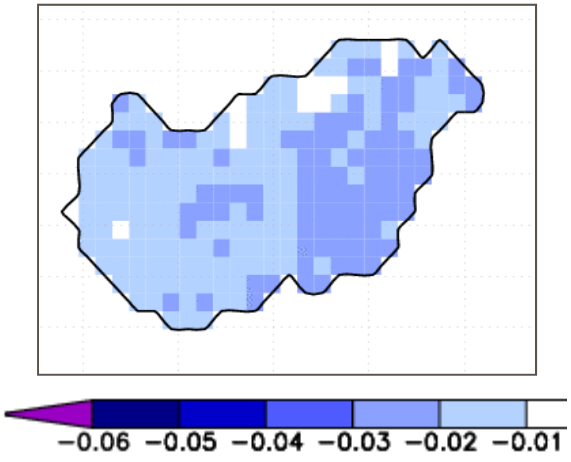
Roughness length: increase



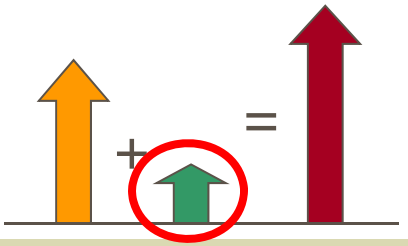
Leaf area index: increase



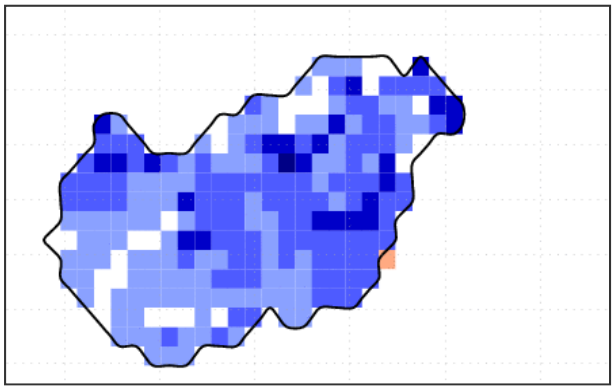
Albedo: decrease



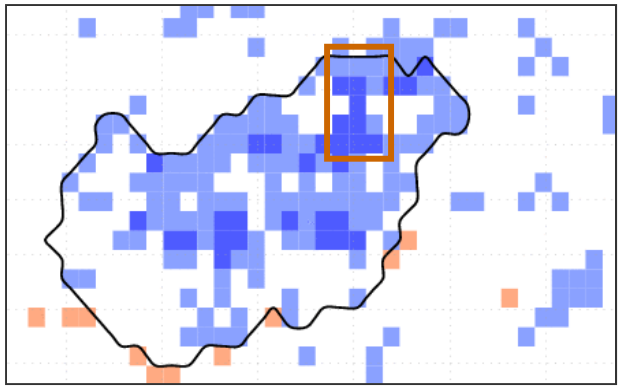
3.1 Climate changes due to maximal afforestation

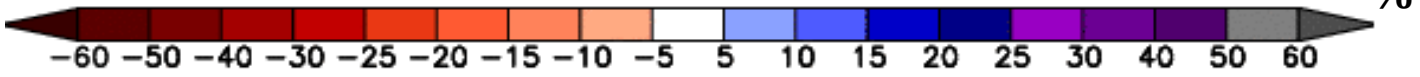


Evapotranspiration: increase

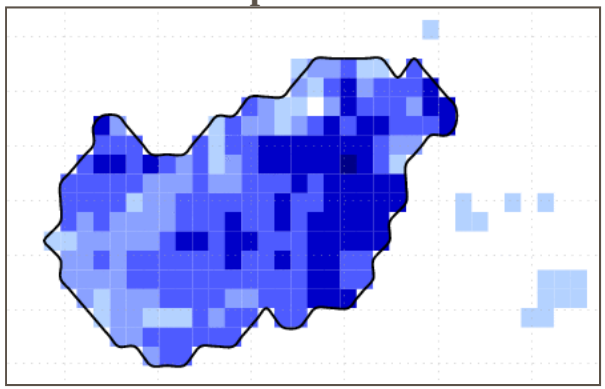


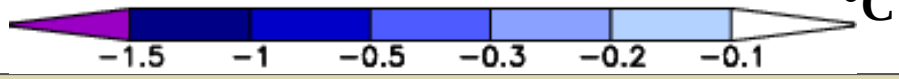
Precipitation: increase





Surface temperature: decrease



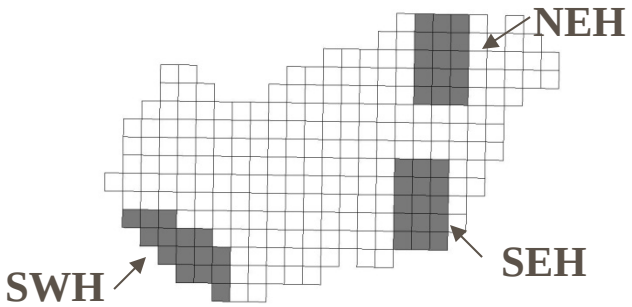


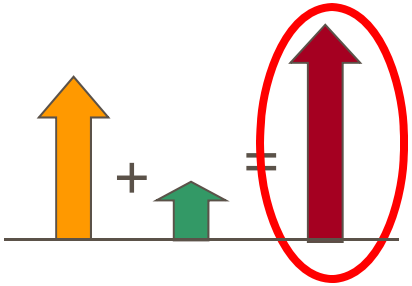
Simulation results for 2071-2100

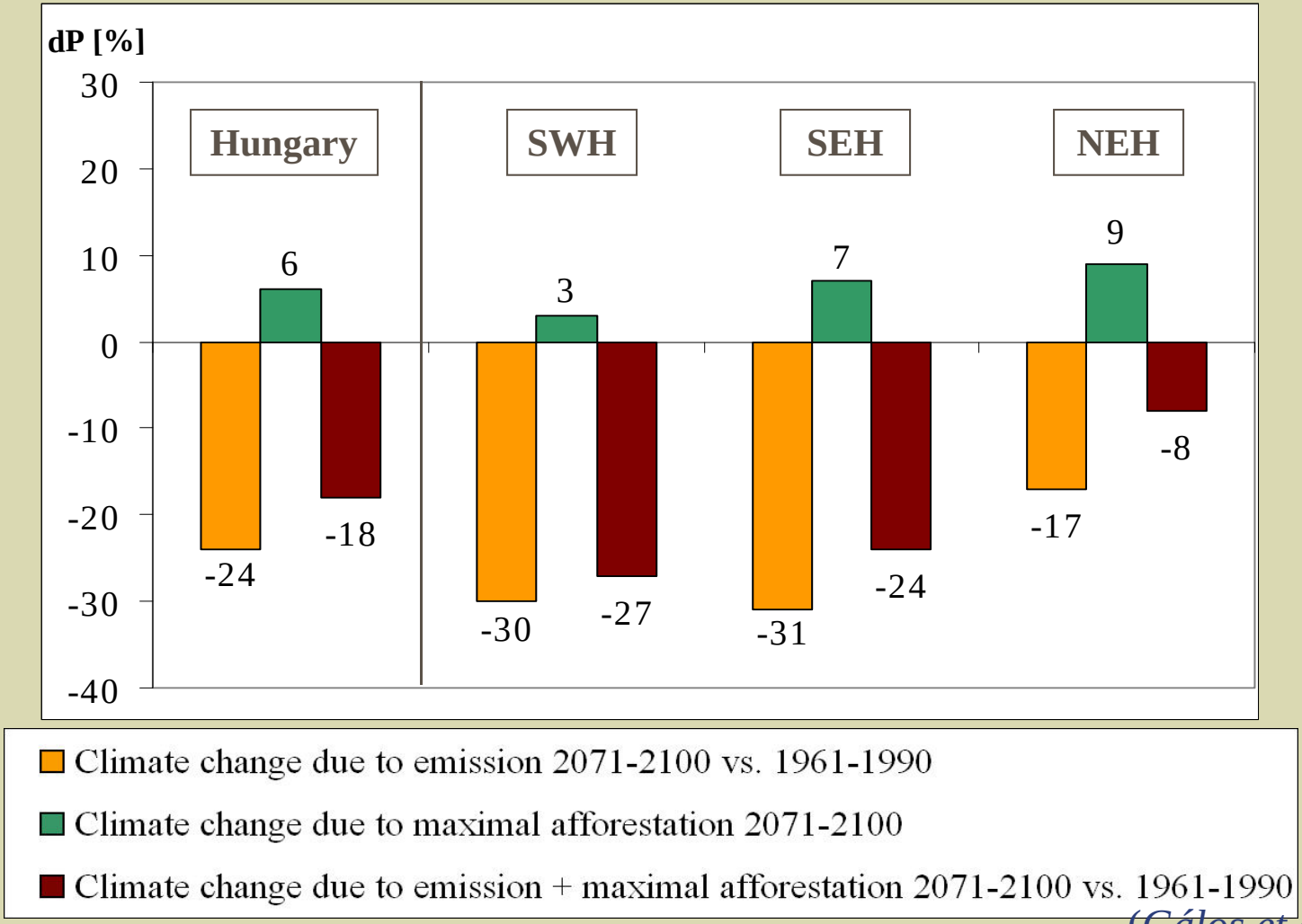
- with- vs. without forest cover change
- summer

(*Gálos et al. 2012*)

3.2 Changes of the summer precipitation

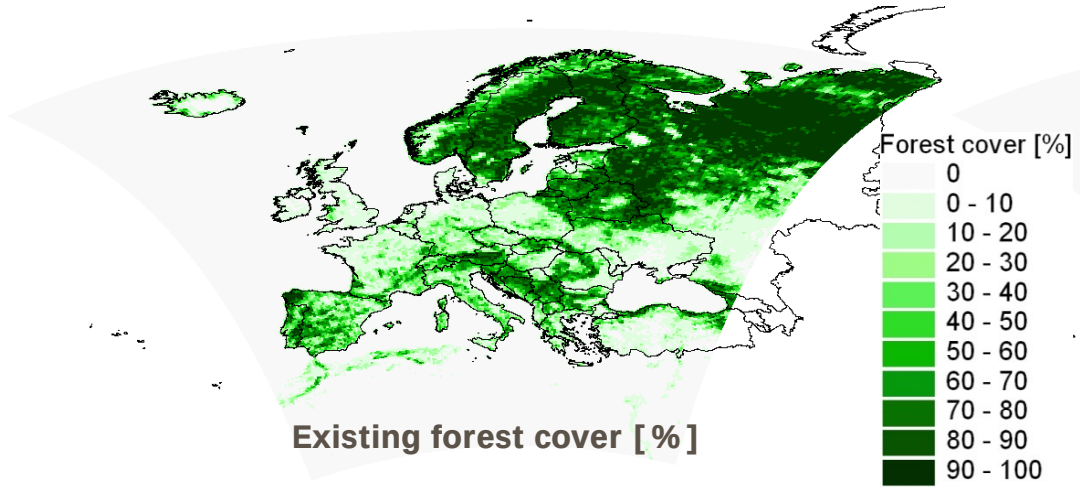




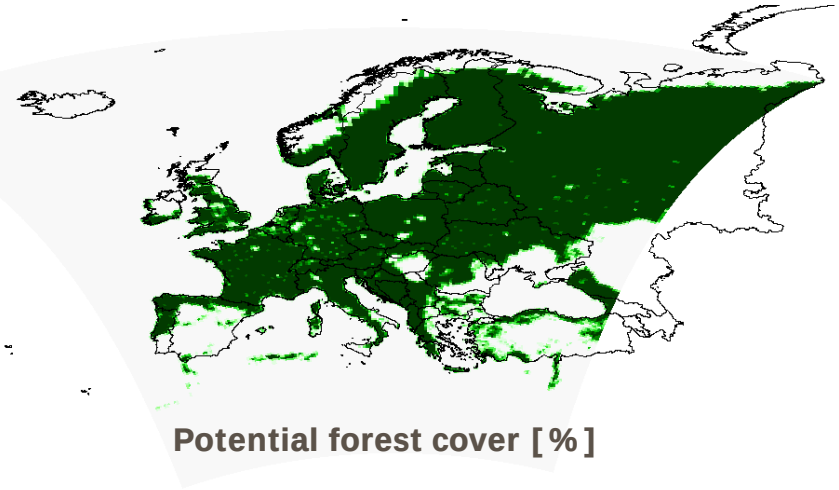


(Gálos et al. 2011)

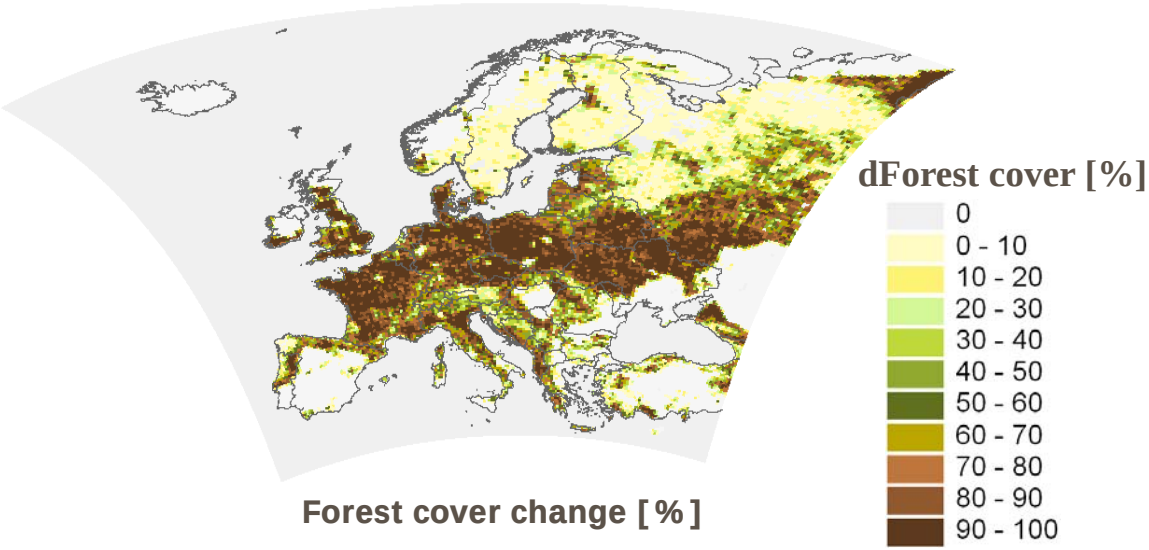
4. Case study for Europe



Existing forest cover [%]



Potential forest cover [%]

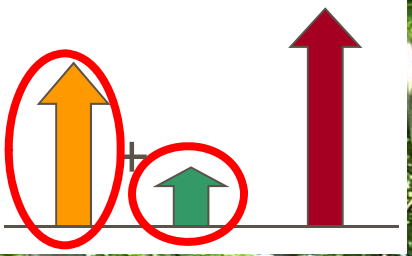


Forest cover change [%]

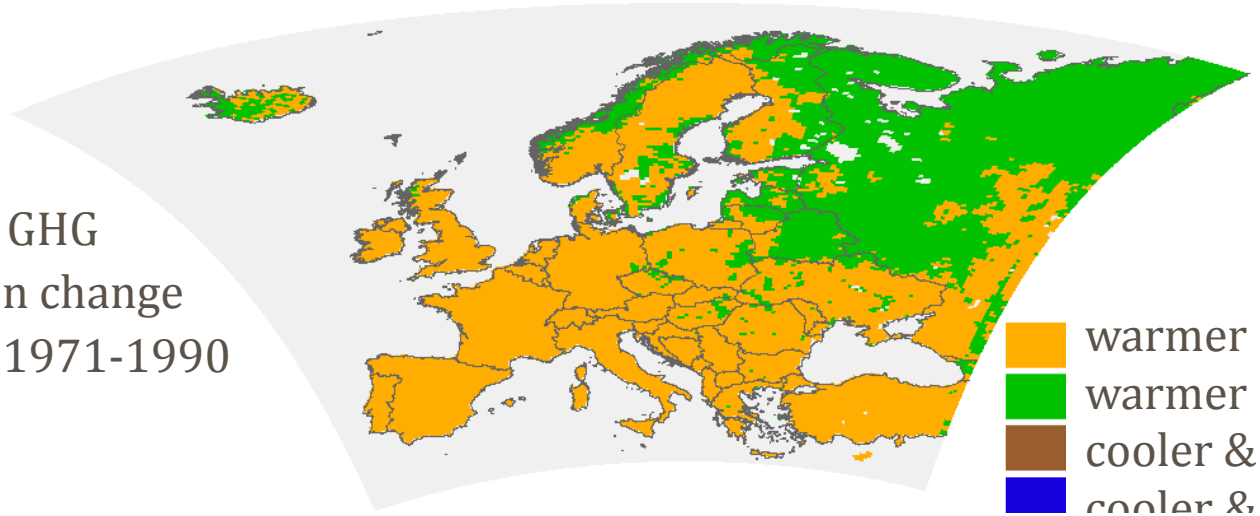
The potential afforestation map is based on the

- net primary production map (derived from MODIS products),
- precipitation and temperature conditions (Wordclim database)
- soil conditions (International Institute for Applied Systems Analysis; *Kindermann* 2011)

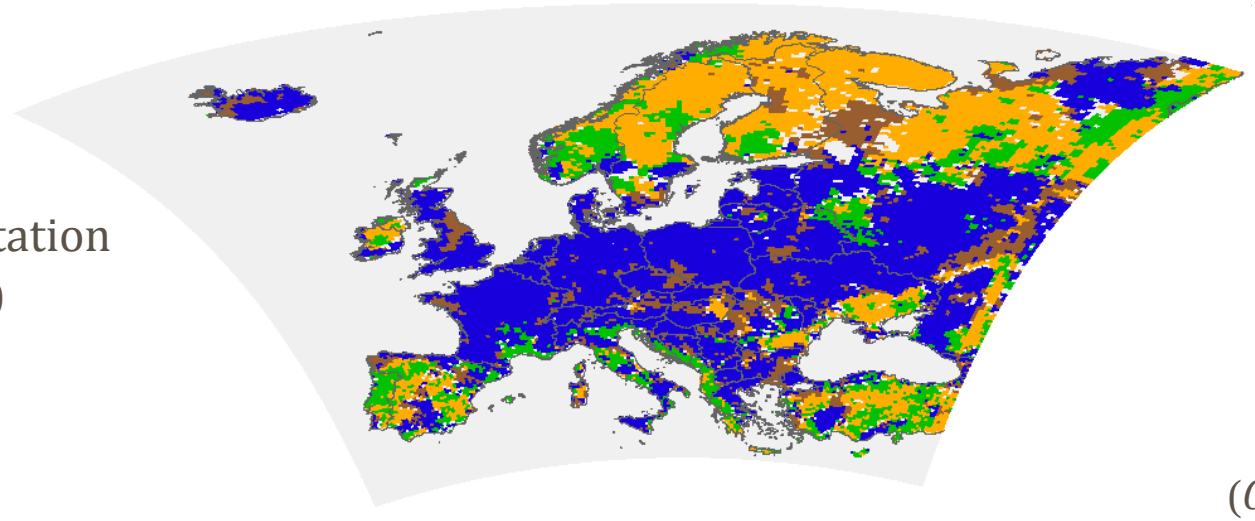
4.1 Effect of afforestation on the summer temperature and precipitation conditions in Europe



Effect of GHG concentration change 2071-2090 vs. 1971-1990



Effect of afforestation 2071-2090



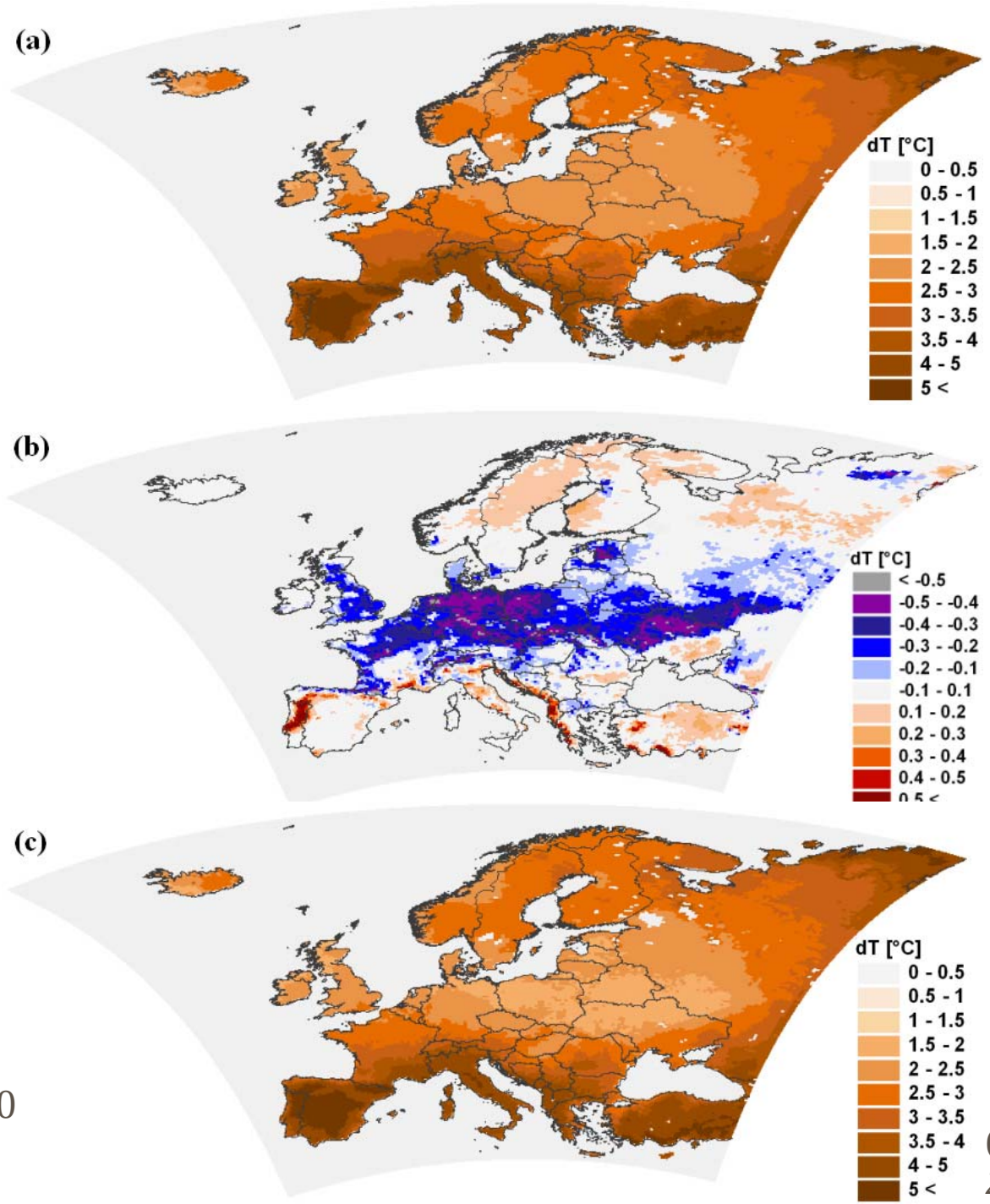
(*Gálos et al. 2013*)

4.2 Change of summer temperature mean

due to GHG
concentration change
2071-2090 vs. 1971-1990

due to
potential afforestation
2071-2090

due to GHG emission
+
potential afforestation
2071-2090 vs. 1971-1990



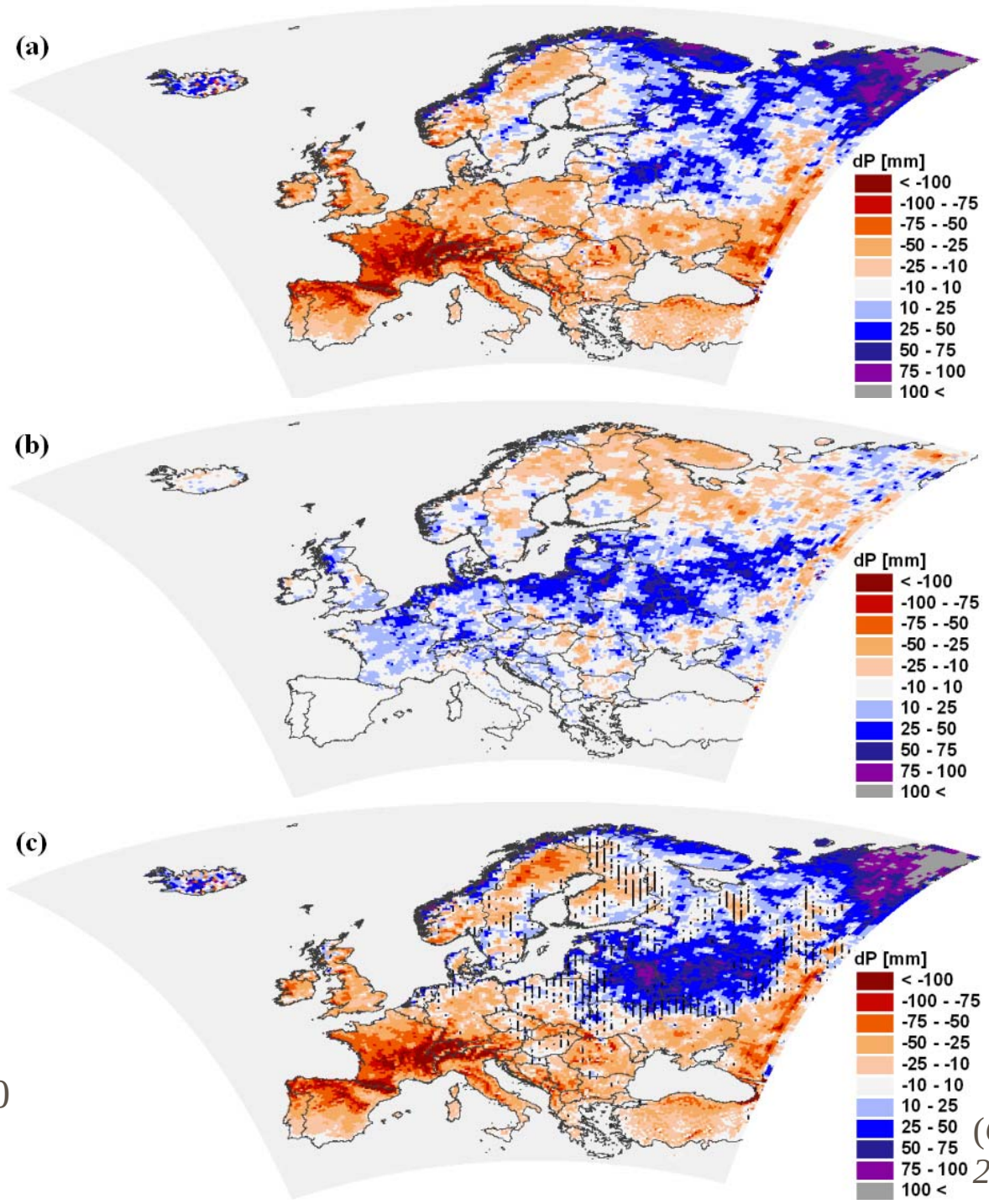
(*Gálos et al. 2012*)

4.3 Change of summer precipitation sum

due to GHG
concentration change
2071-2090 vs. 1961-1990

due to
potential afforestation
2071-2090

due to GHG emission
+
potential afforestation
2071-2090 vs. 1961-1990



(*Gálos et al. 2012*)

5. Conclusions, application of the results

- Afforestation in small forest fragments: slight effects;

  large continuous forest blocks: regional-scale effects

- ***Possible climate change mitigating potential:***
  - cooler and moister conditions in summer
  - reduce the projected tendency of drying, the drought frequency
  - **Both** biogeophysical + biogeochemical feedbacks have to be considered! **& appropriate land surface description**

Practical application

- Assessment of the climatic role of forests
- Identification of areas, where forest cover increase is the most favourable (from climatic point of view)
- With appropriate land use strategy the mitigation costs can be reduced

TALENTUM
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MAGYARORSZÁG MEGÚJUL
A projekt az Európai Unió támogatásával, az Európai Szociális Alap társfinanszírozásával valósul meg.
ÚJ SZÉCHENYI TERV