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CESR Center for Environmental Systems Research

The role of different land cover input data on local climate and its extremes

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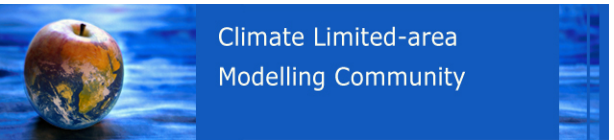
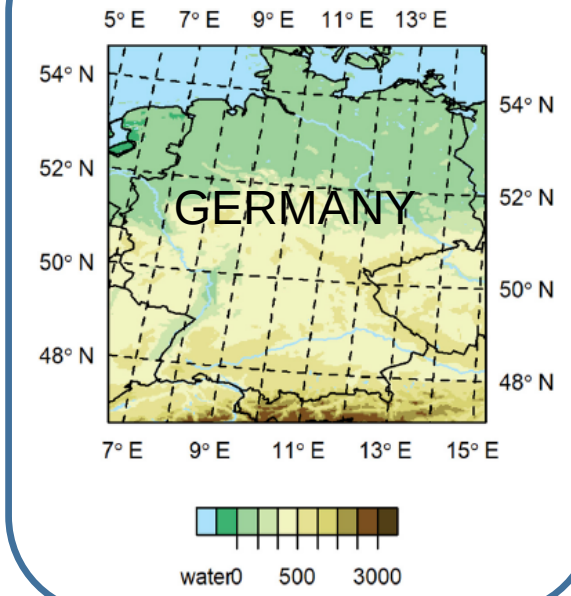


AXIS JPI Climate

MAPPY

Impact of different land cover maps on climate

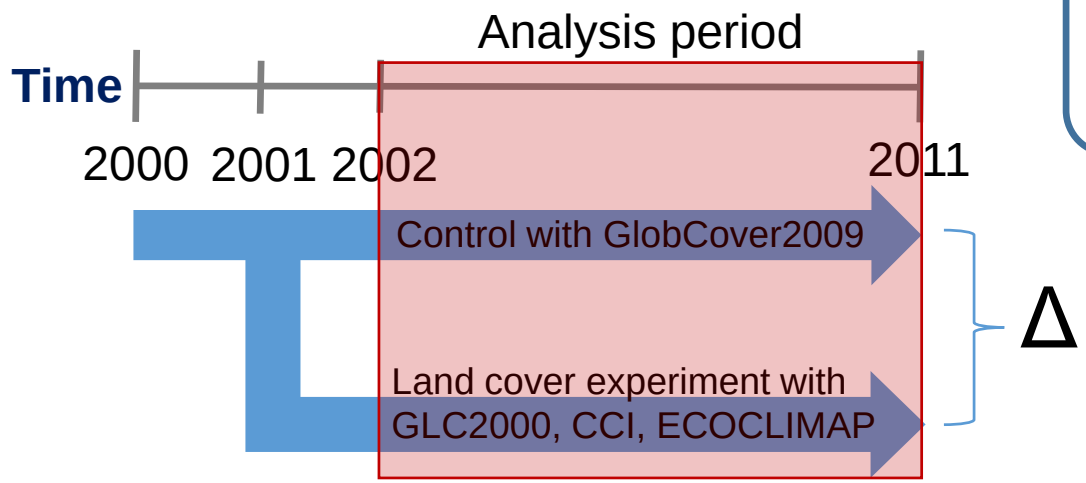
Model domain



Regional climate model

- Convection-permitting simulatios at 3 km with COSMO-CLM (v5.16, Rockel et al. 2004)
- Driving data: ERA5 reanalysis from 2000 to 2011

Simulation experiments

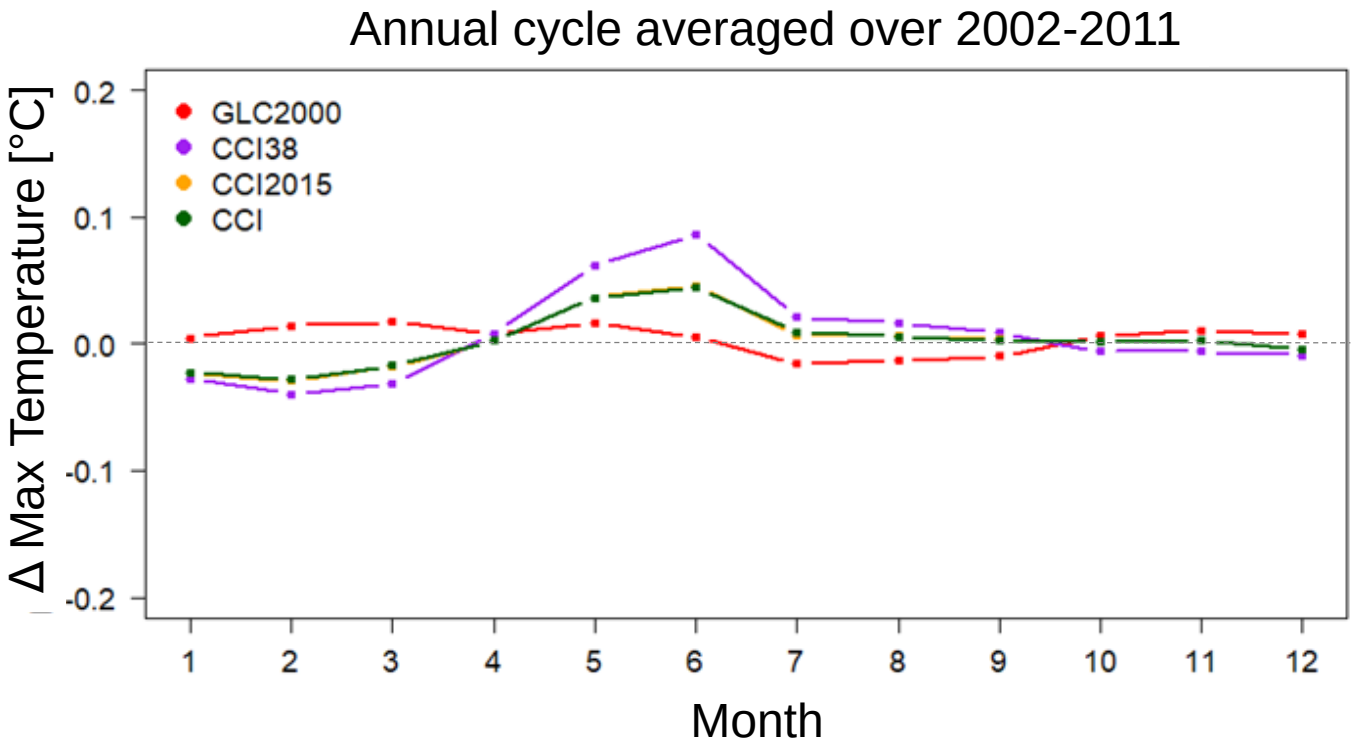


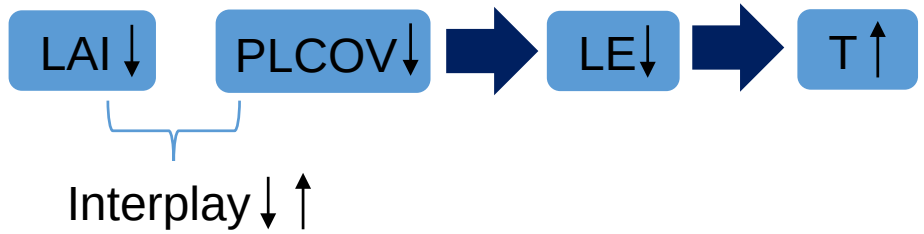
Simulation experiment	Land cover map &resolution	Year	Reference	No. Land cover classes
Control GC	GlobCover2009 300 m	2009	Arino et al. (2008)	22
GLC	GLC2000 1 km	2000	Bartholomé et al. (2005)	22
CCI	CCI 300 m	2000	Poulter et al. (2015)	22 as GLC2000
CCI2015	CCI 300 m	2015	" "	22 as GLC2000
CCI38	CCI 300 m	2015	" "	38
ECO	ECOCLIMAP 1 km	2000	Champeaux et al. (2005)	243

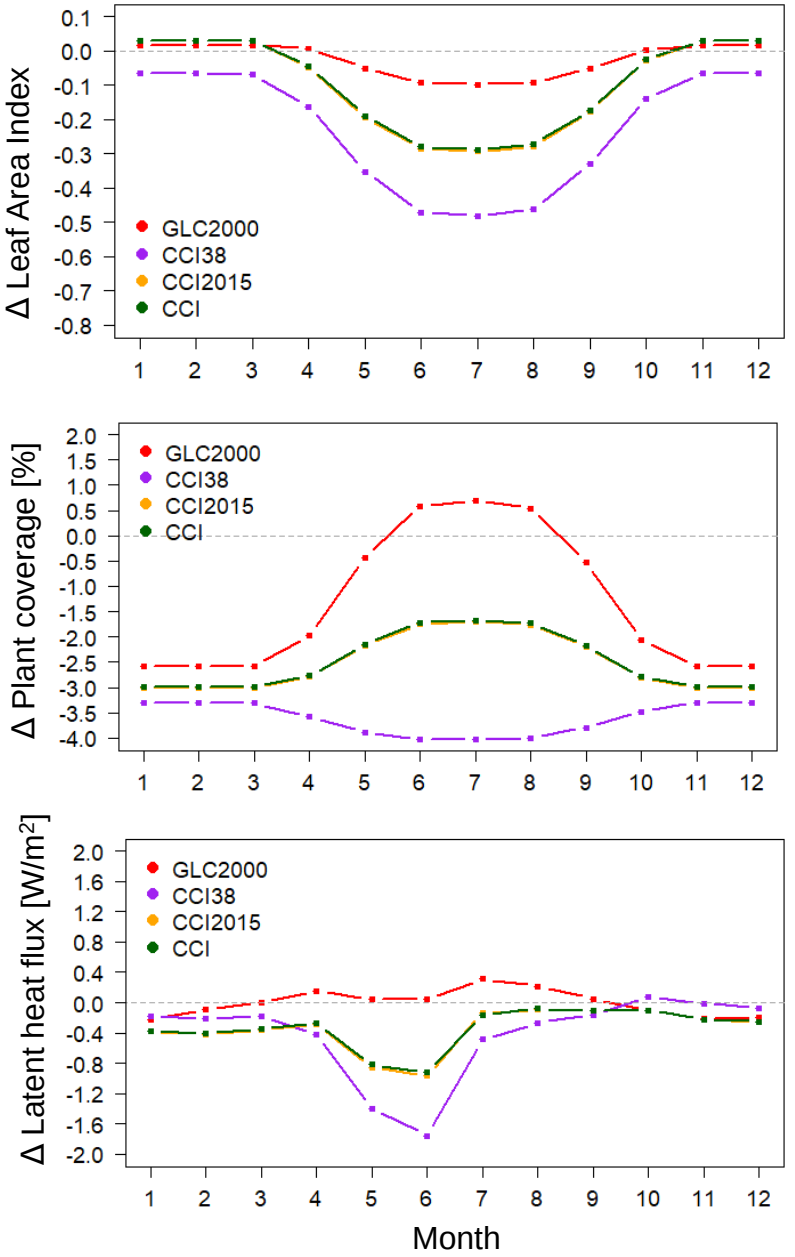
Investigate the **influence of surface parameters** due to different land cover maps on **temperature and moisture fluxes**

- Control simulation from 2000 to 2011 with GlobCover2009
- Simulation with alternative land cover maps from 2001 to 2011 as restart from control simulation
- Lateral boundary conditions are not varied and experiments started with balanced soil moisture conditions from the reference simulation, simulated changes can be explained by alternative land cover maps
- **Difference** Δ (experiment minus control) **of daily values** is analysed over the period **2002** to **2011** (10 years)

Temperature sensitivity to land cover input data







- Differences in land cover classes in a grid cell due to different land cover maps results in differences in surface parameters (e.g., LAI) and finally latent heat fluxes and temperature

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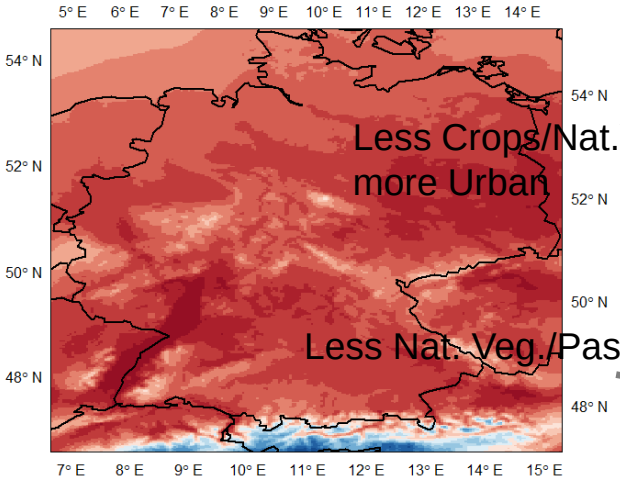
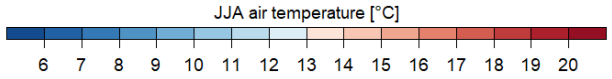
Differences in summer air temperature distribution

(A) GlobCover2009

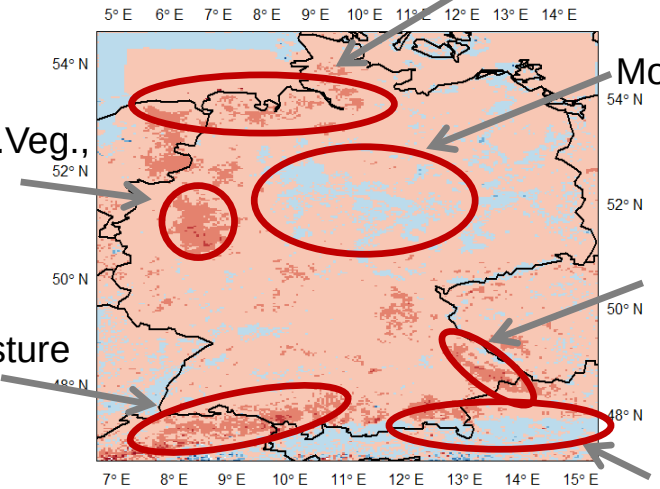


Less Crops/Nat.Veg., more Urban

Less Nat. Veg./Pasture



(B) CCI2015

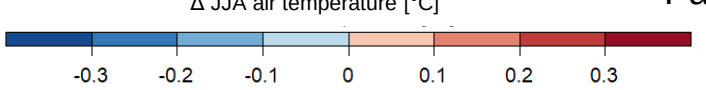


Less Nat. Veg. than in GlobCover2009

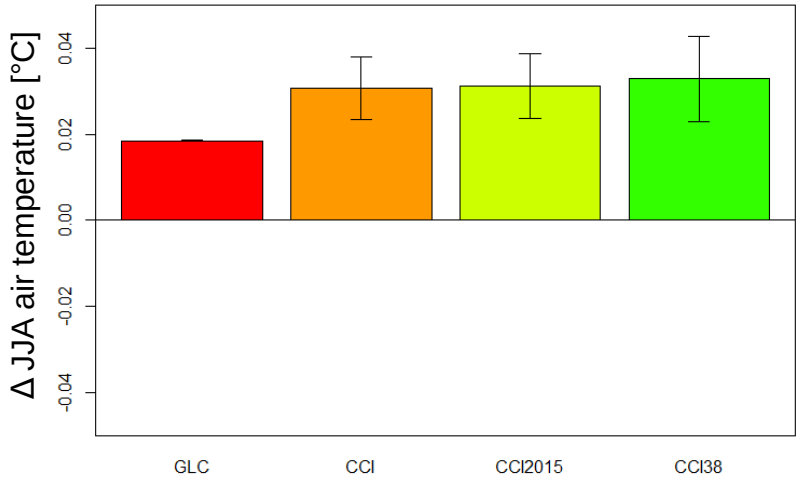
More Pasture

Less Nat. Veg.

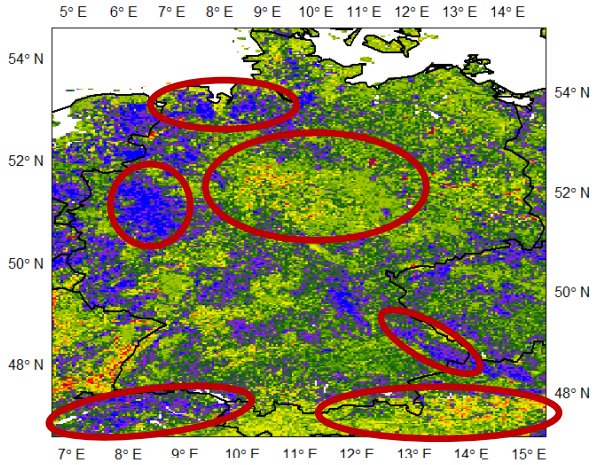
More Nat. Veg./ Pasture, less crops



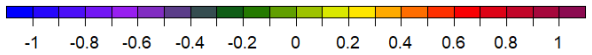
(C)

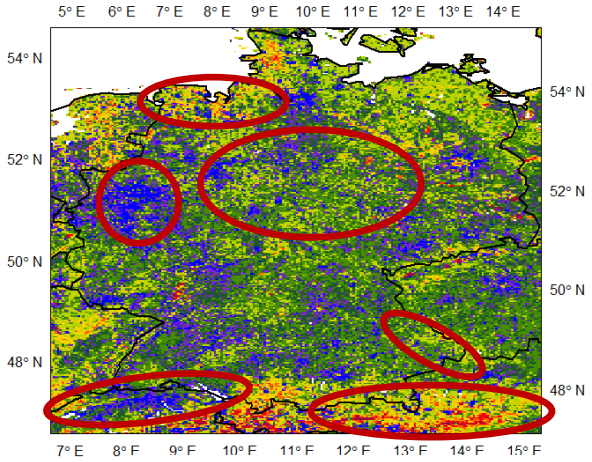


Land cover map

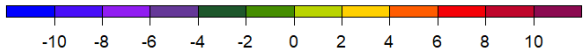


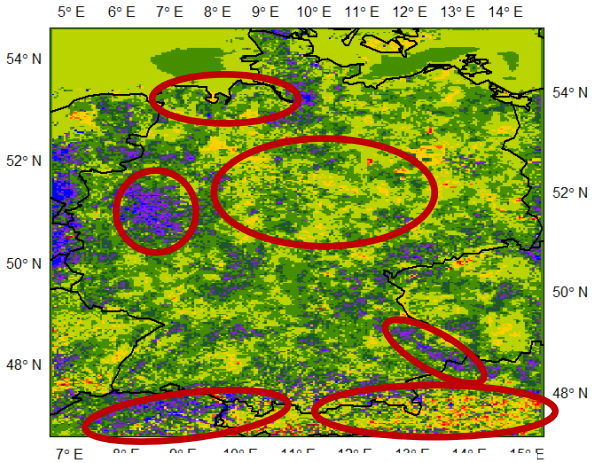
Δ Leaf area index



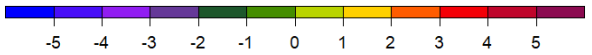


Δ Plant coverage [%]

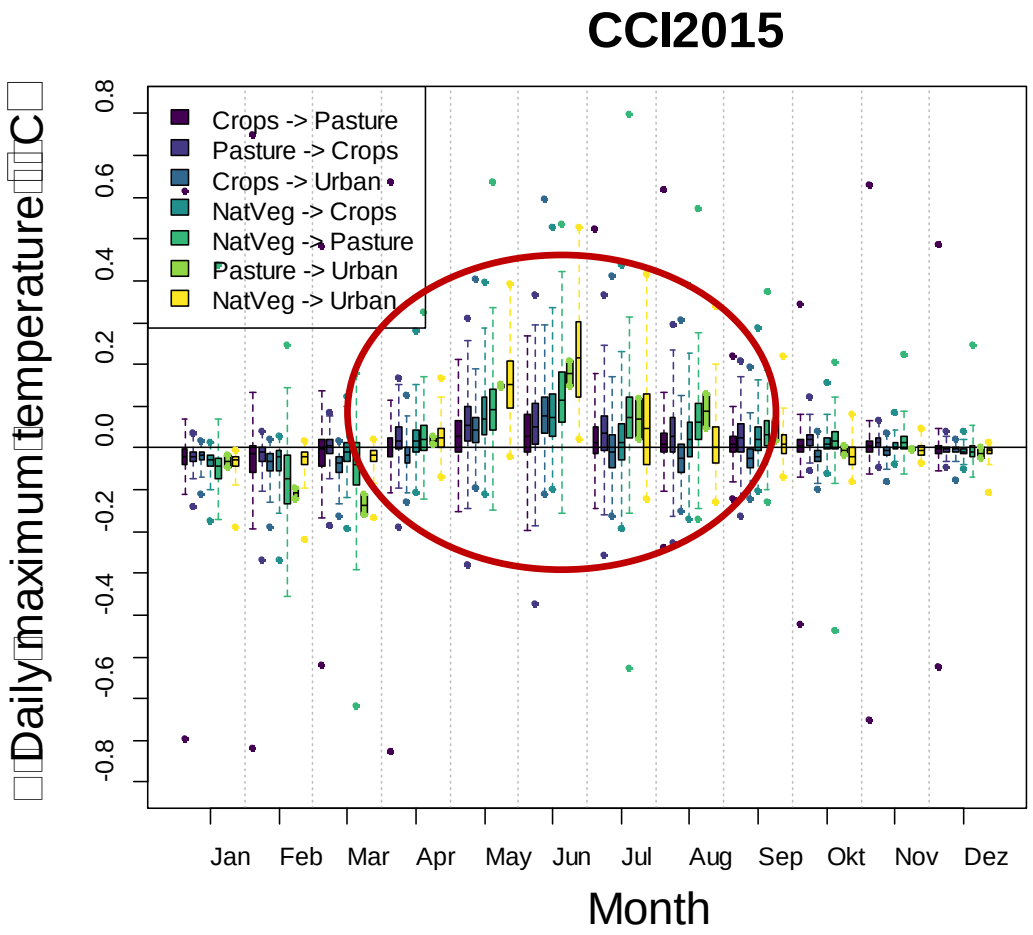


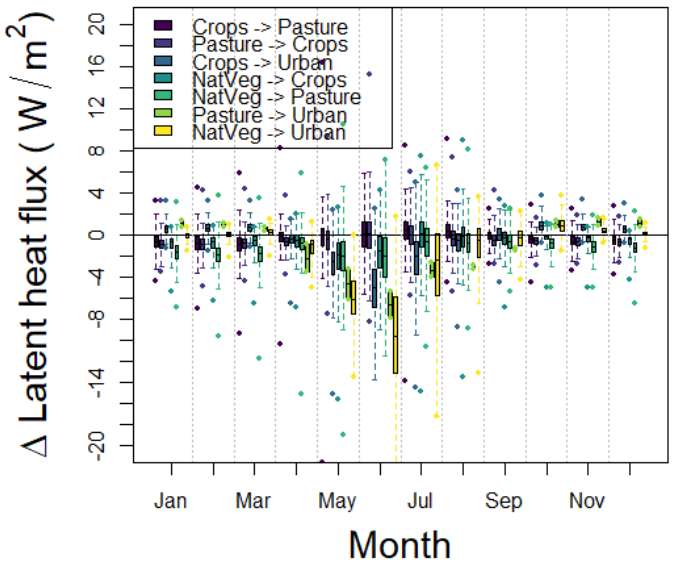


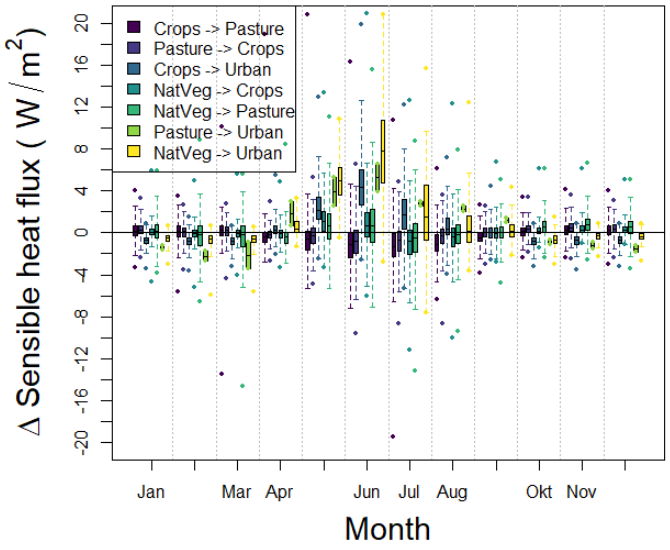
Δ Latent heat flux [W/m^2]



Daily maximum temperature difference due to major land cover change







- Major land cover change: >40% of grid cell
- Change to urban has the strongest impact during vegetation period
- Strongest temperature change due to natural vegetation to urban
- Example: Max. temperature is lower in GlovCover2009 (control) over natural vegetation than in CCI2015 over urban areas resulting in a positive change (warming)

Conclusions

- Land cover class fraction differences result in surface parameter changes (e.g., LAI…)
- Combined changes in land surface parameters determine the differences seen in latent heat fluxes and ultimately the strength of temperature change
- Vegetation parameters are crucial and need validation
- Realistic land cover map especially in mountainous areas is needed for impact studies

Thank you for your attention!

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Supplementary material

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Difference in land cover class fraction