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# Update on COSMO-CLM²

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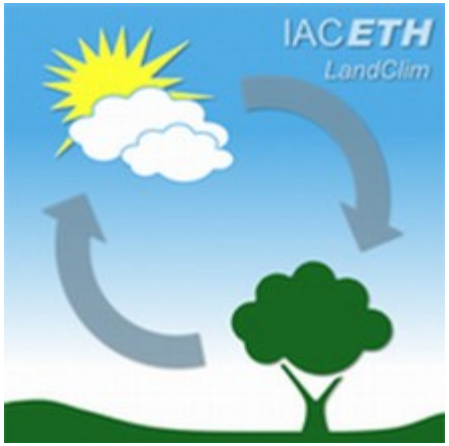
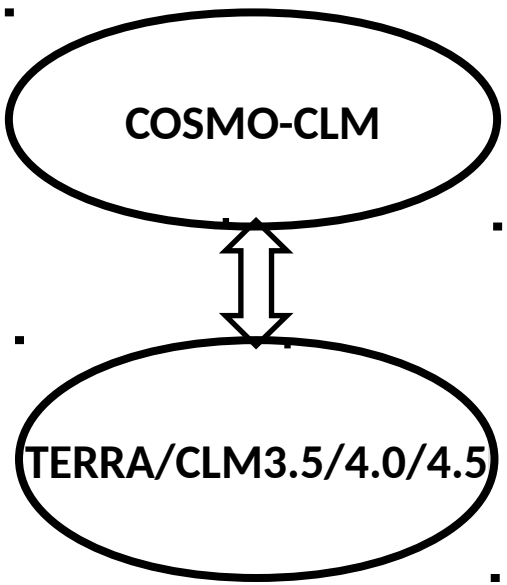


# COSMO-CLM² developments

- **Subroutine coupling with CLM3.5**
  - Evaluation: *Davin et al., Clim. Dyn. [2011]; Davin and Seneviratne, Biogeosciences [2012]; Lorenz et al., [2012]*

- **Coupling with OASIS3-MCT**
  - Well established and supported external coupler
  - More flexibility (different grids, time stepping, versions upgrade easier)
  - Better CPU performance
  - Unified interface for land, ocean, 2-way nesting → OASIS Project Group




- **Upgrade to CLM4.0/4.5** (cesm1_2_0)
- Land-atmosphere $CO_2$ coupling added (S. Ruedisuehli)
- Annual tutorial during the COSMO training course (next: 30-31 Mar. 2015)

# Evaluated configurations and setup

- EU-CORDEX-0.44 setup: historical ERAinterim-driven simulations
- COSMO4.8-CLM19 with official EU-CORDEX settings
- No tuning for COSMO

- **CORDEX-TERRA** (official CORDEX run from ESGF-archive; evaluated in Kotlarski et al., GMD, 2014)

- **CORDEX-CLM3.5**
- **CORDEX-CLM4.0**
- **CORDEX-CLM4.0_tun** (soil hydrology tuned to make it consistent with CLM3.5)
- CORDEX-CLM4.5 (not shown but very similar to CLM4.0 results)

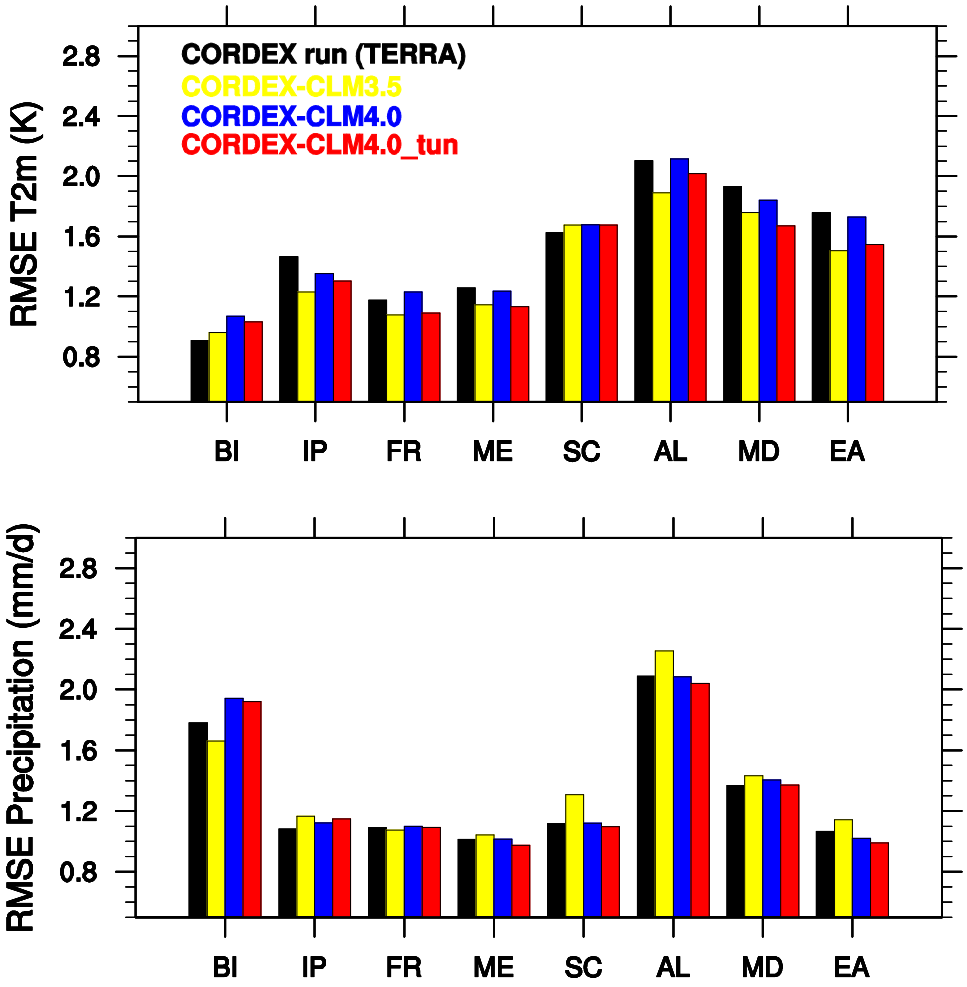
# T2m/Precip scores

- Scores as in *Davin and Seneviratne, 2012*
- Reference dataset: CRU
- RMSE applied spatially and temporally based on monthly means

- More effect on T than on P

- Coupled system has a tendency to slightly outperform official CORDEX run

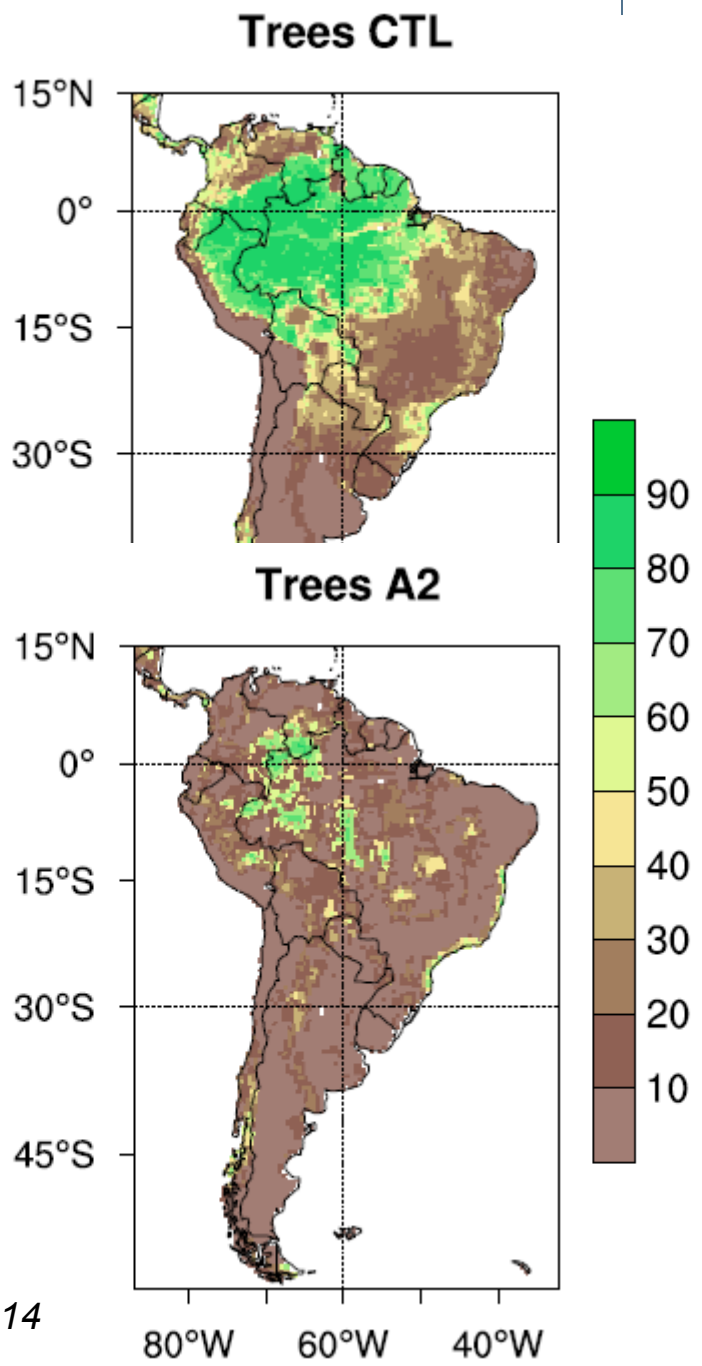
- With appropriate tuning (soil hydrology) CLM3.5 performance can be reproduced with CLM4.0



# Examples of two recent applications

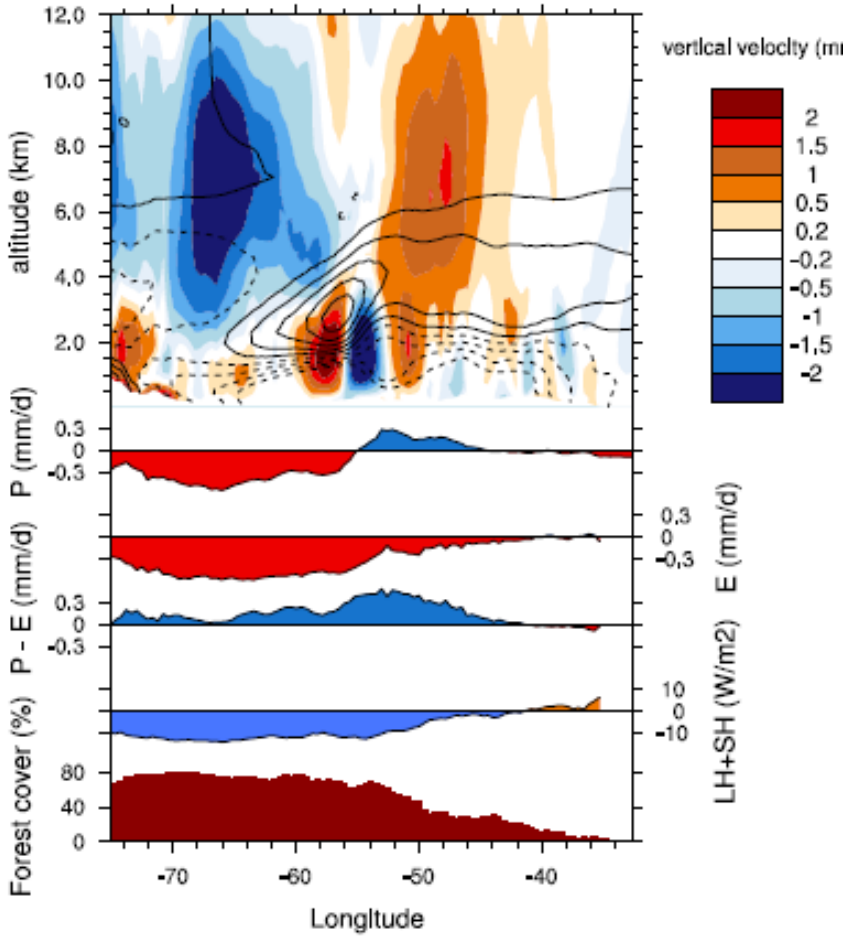
# Future Amazon deforestation

- Amazon holds 40% of the world rainforest
- Deforestation rates are currently higher than in most other regions
- Most pessimistic scenarios project an almost complete loss of the rainforest by the end of the century (e.g. A2 scenario)




*Lejeune et al., Clim. Dyn., 2014*

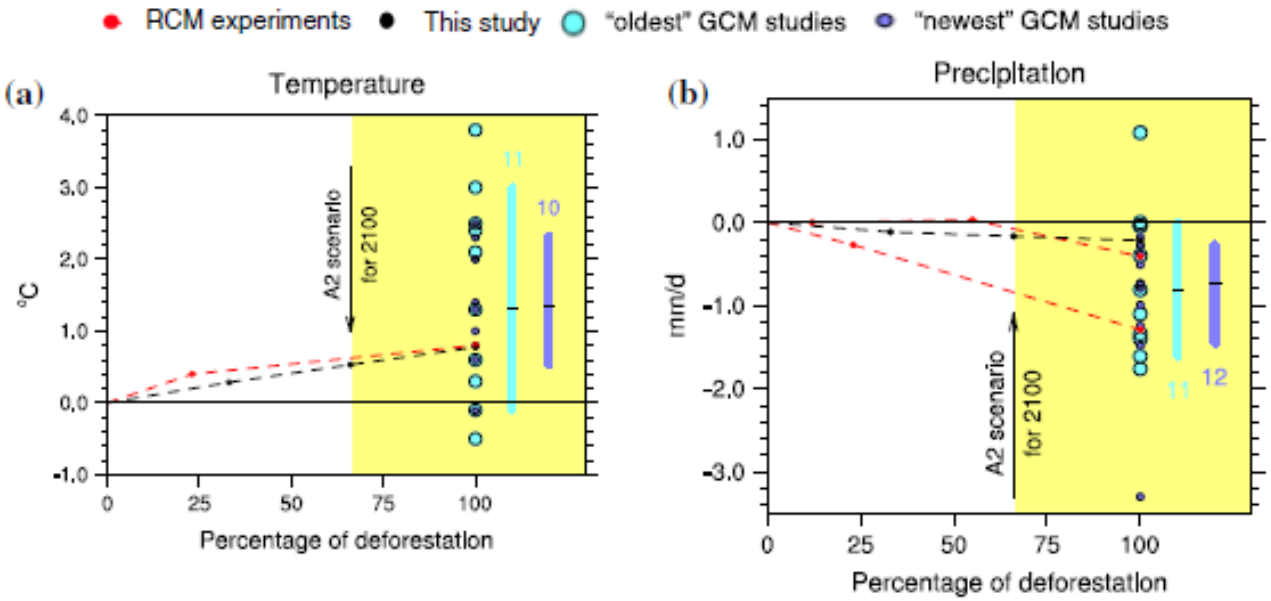
# Impact on the regional climate




*Lejeune et al., Clim. Dyn., 2014*

# Comparison with GCMs

- Large spread in modelling results
- Most models agree on the sign of change: increase in temperature and decrease in precipitation due to lower evapotranspiration




*Lejeune et al., Clim. Dyn., 2014*

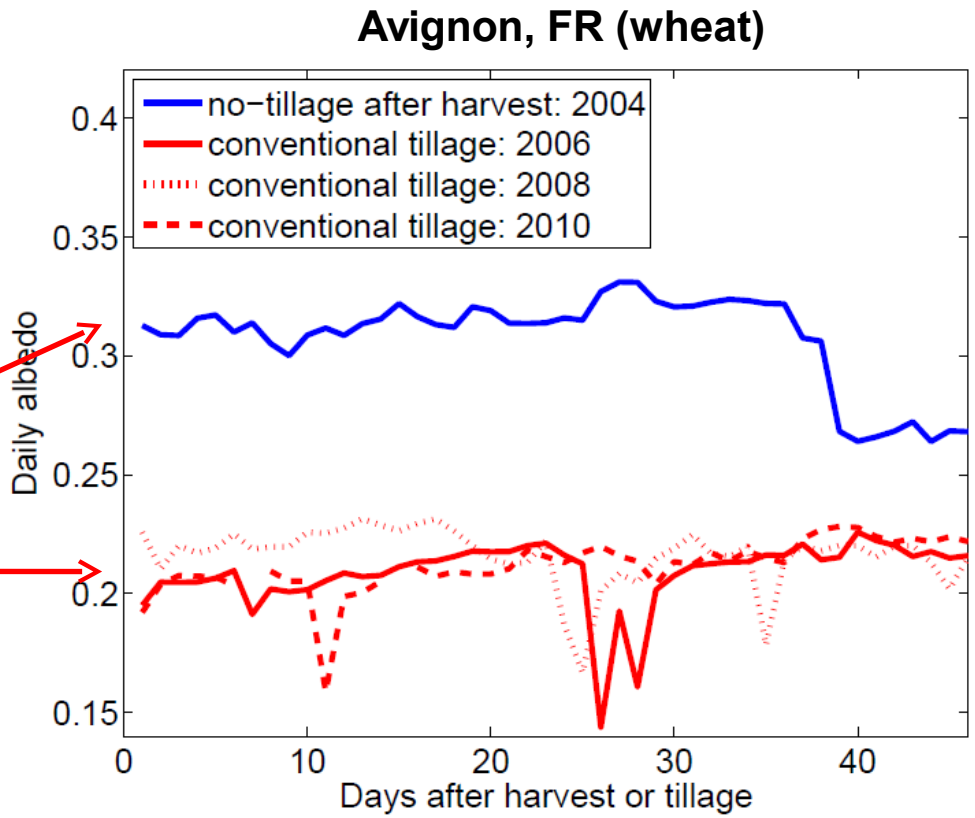
# Beyond deforestation: The importance of management


Deforestation
(land conversion)

# Example: tillage


*Photograph by Jim Richardson (National Geographic)*

# Example: tillage

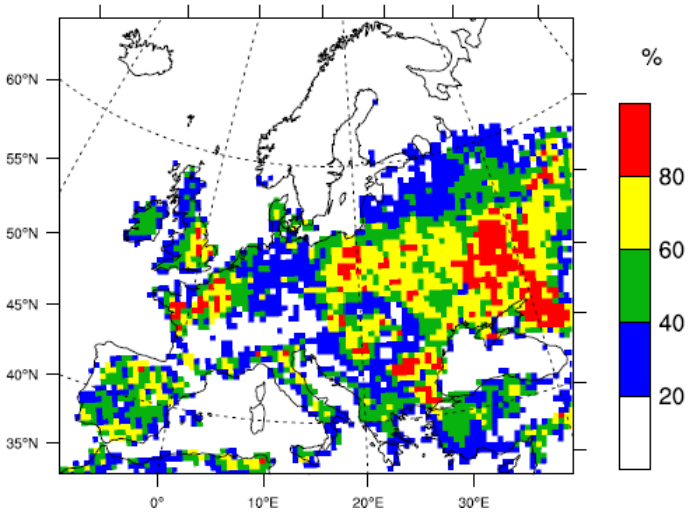



*Photograph by Jim Richardson (National Geographic)*

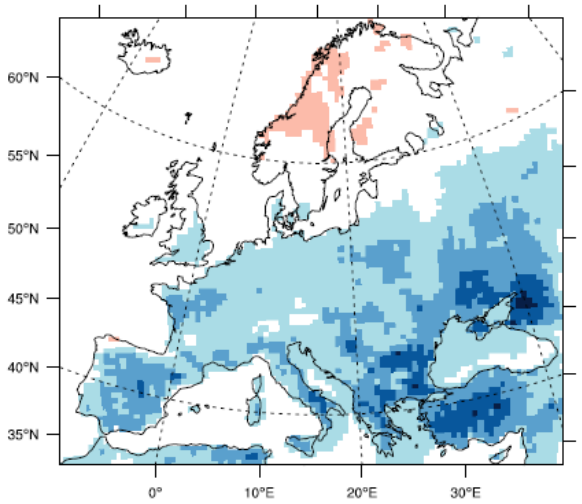
*Davin et al., PNAS, 2014*

# T2m summer mean change

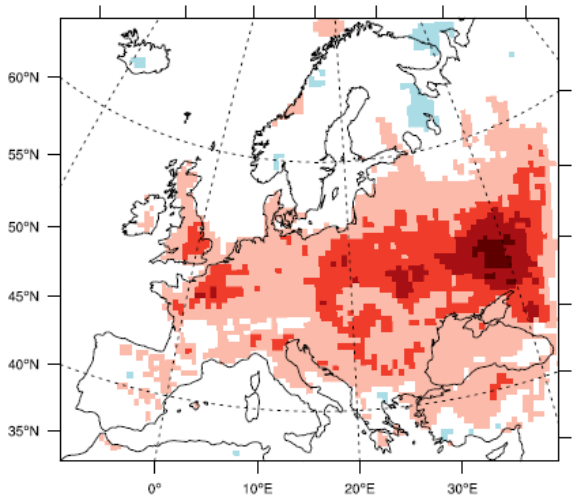
Crop distribution (%)



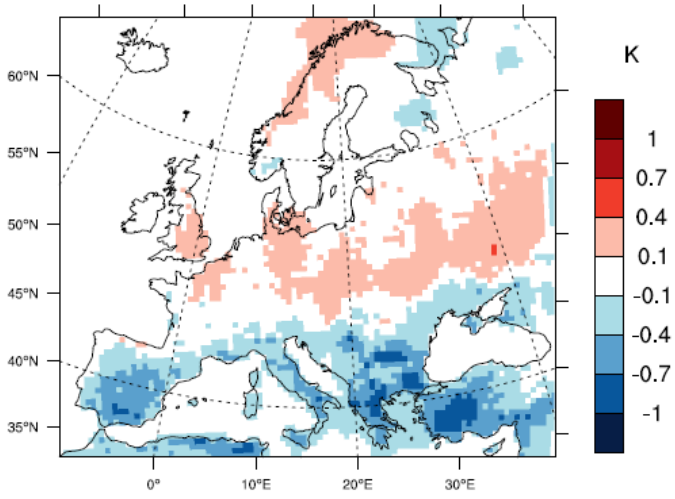

ALB - CTL




EVA - CTL

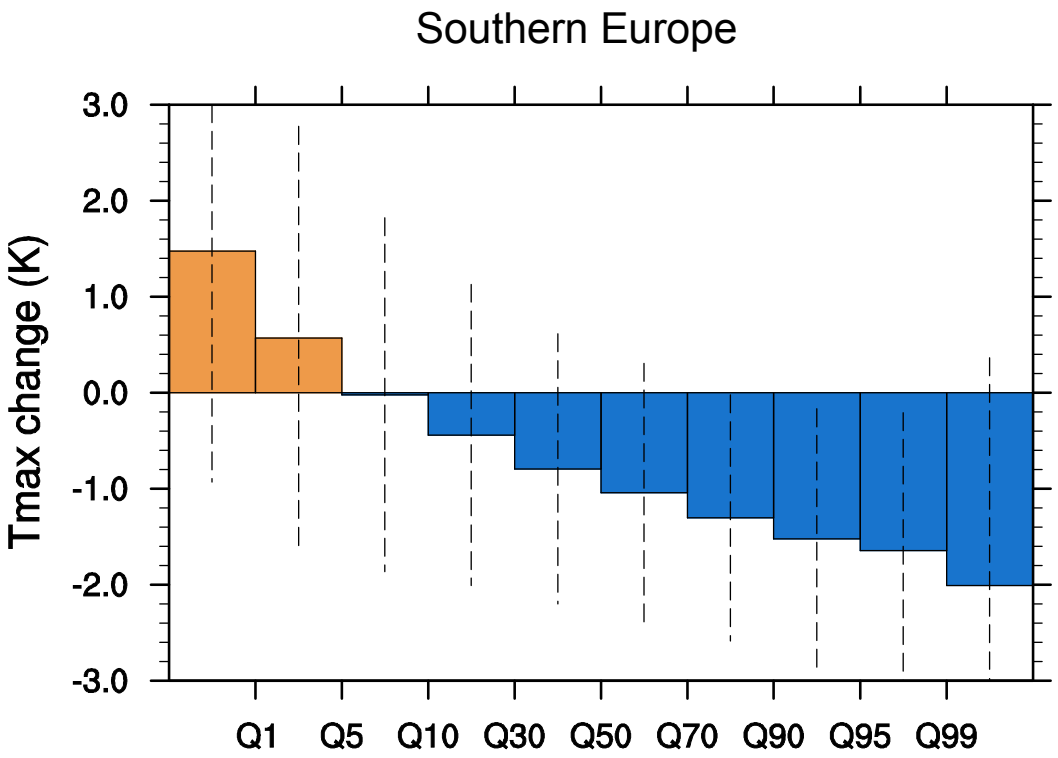



NOTILL - CTL




*Davin et al., PNAS, 2014*

# Asymmetric effect on temperature distribution




*Davin et al., PNAS, 2014*