# Uncertainties of input parameters an their impact on CLM simulations

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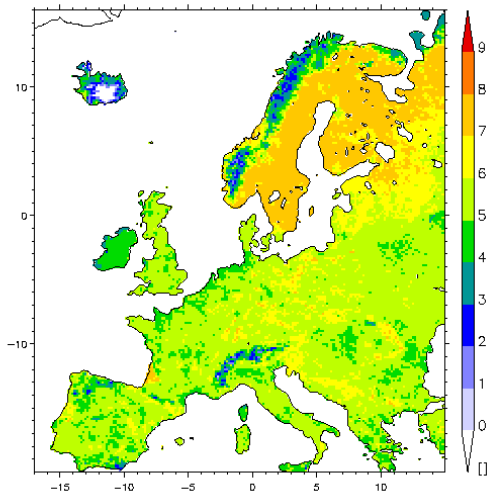
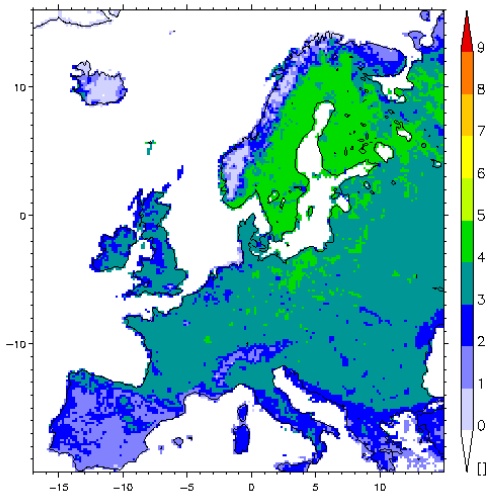
# Motivation

Maximum LAI

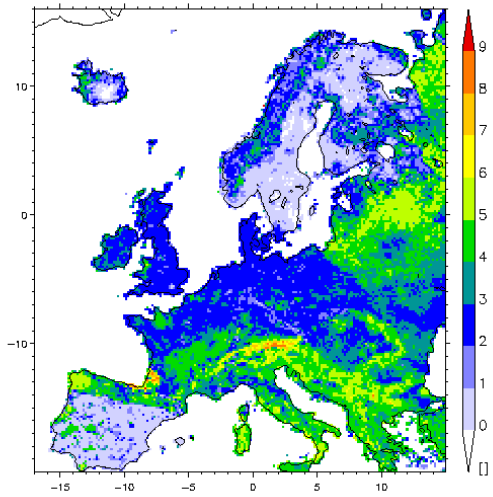
DWD

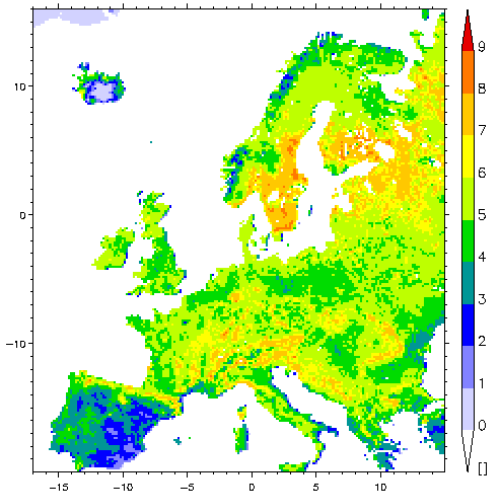



ECOCLIMAP

GKSS



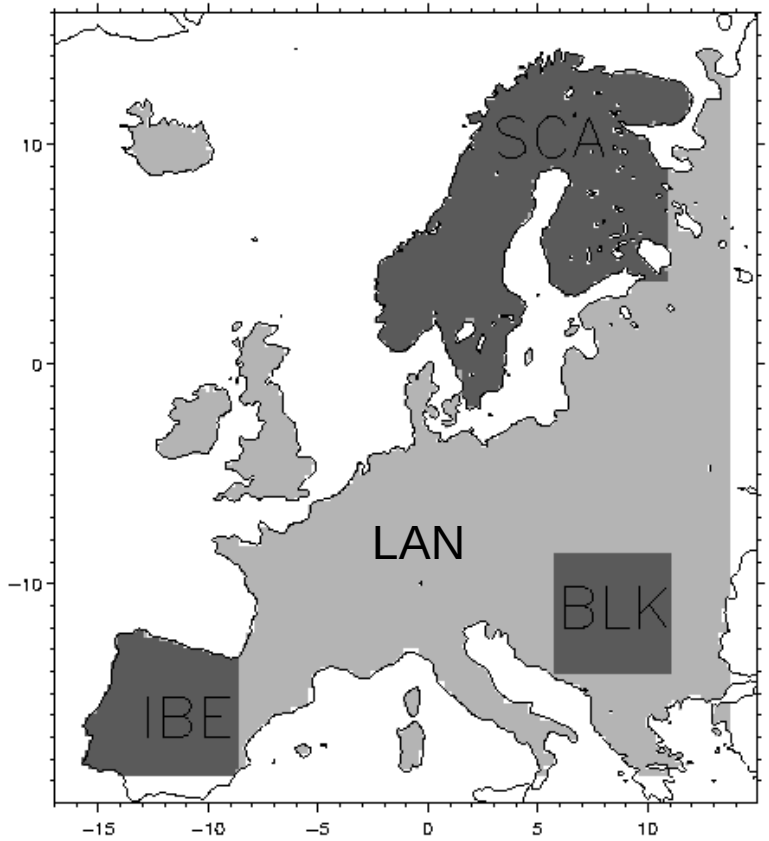

EFAI

# Simulations

- LAI30: Leaf area index (LAI-LAI*0.3)
- LAIECO: Leaf area index (ECOCLIMAP)
- PLCOV: Plant cover (ECOCLIMAP)
- ROOTDP: Root depth (ECOCLIMAP)
- ALBVEG: Vegetation Albedo (ECOCLIMAP)
- TC: Thermal Conductivity dependent on water content
- RS: Stomata resistance
- ST: Soil type parameters
- GKSS: Plant cover, LAI, soil type
- ECO: Plant cover, LAI, vegetation Albedo, root depth

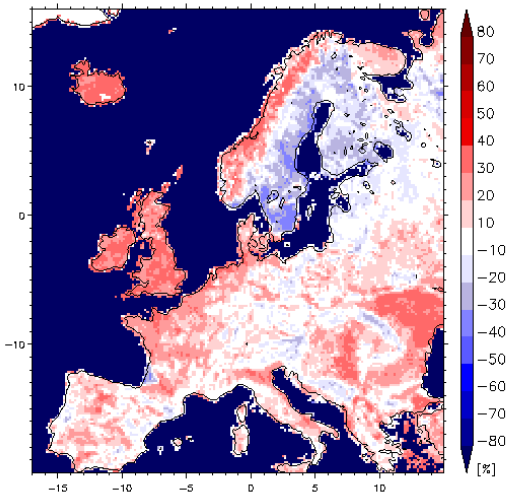
# Model setup

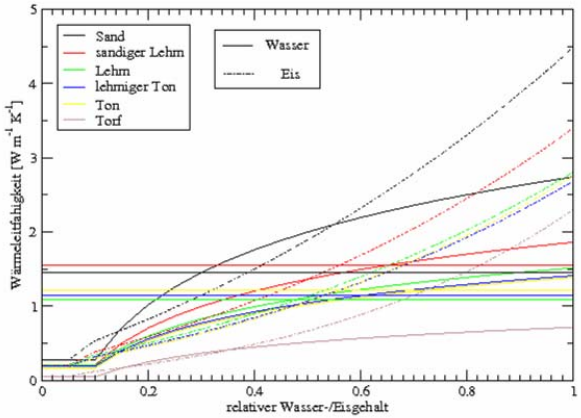
- Version LM3.19
- ERA40 boundary data
- 1 year (1987)
- 1/6°, 193x217 GP, 20 vertical levels
- 10 soil levels
- dt=90s



# Uncertainties

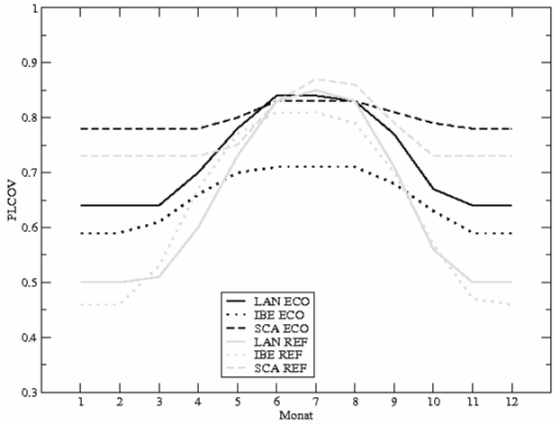
ALBVEG

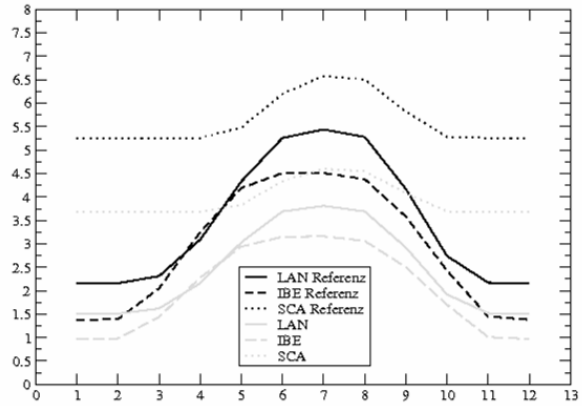



TC

PLCOV



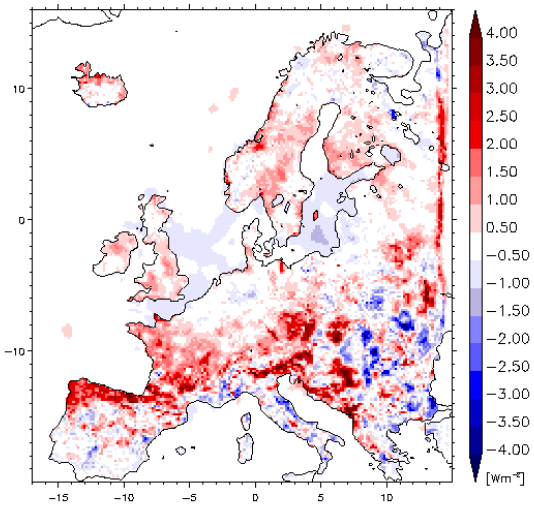

LAI30

Uncertainty soil type parameters (ST): +/- 20%

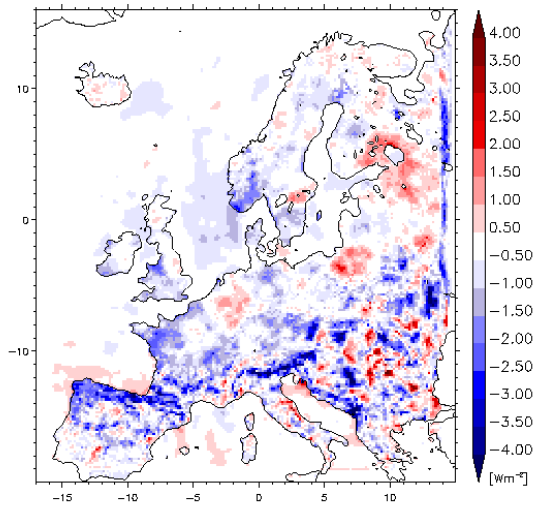
# Diff: yearly average

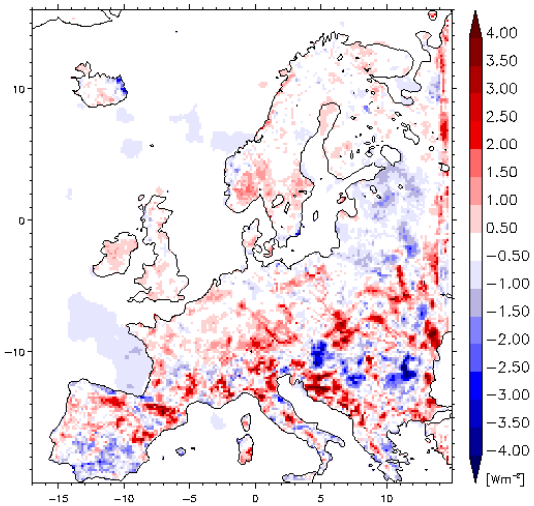
H

E

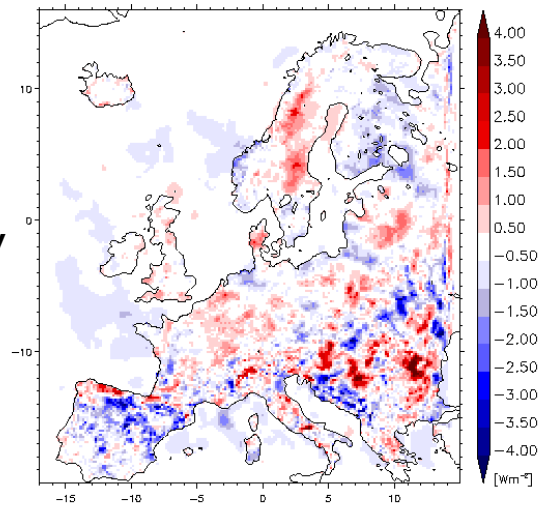



LAI30



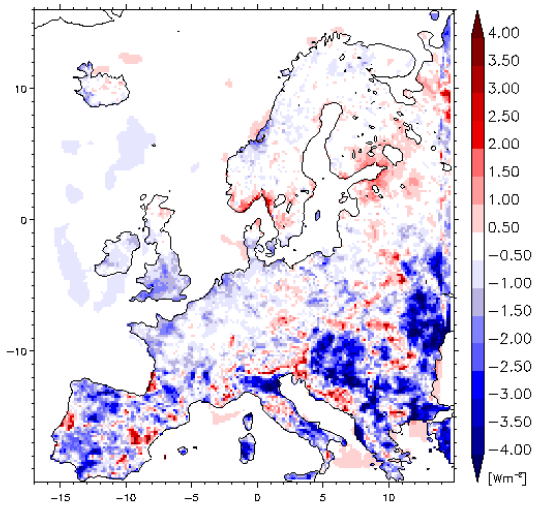

PLCOV



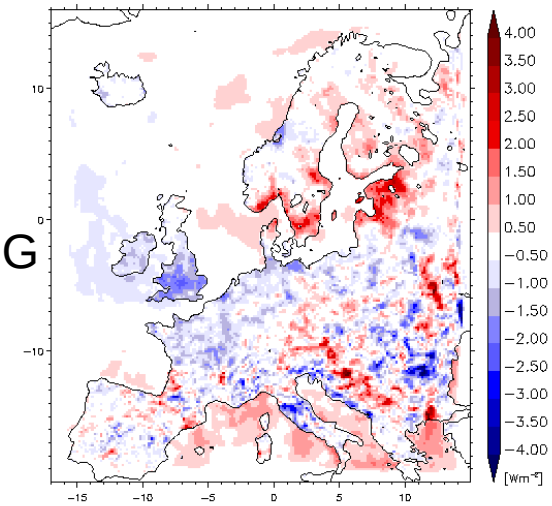
# Diff: yearly average

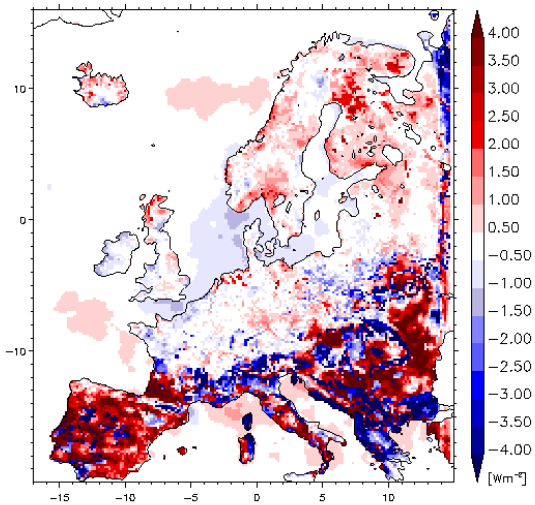
H

E

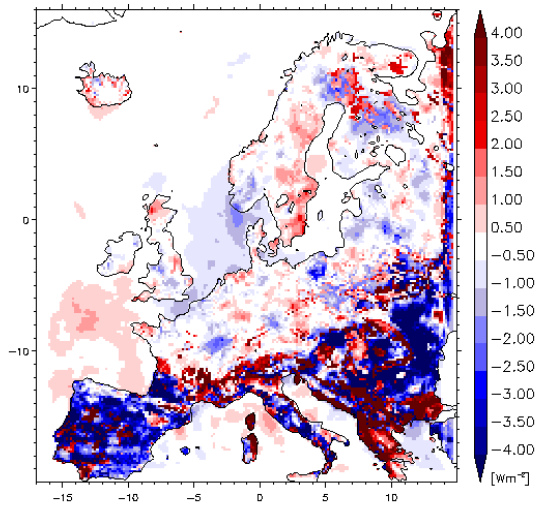



ALBVEG



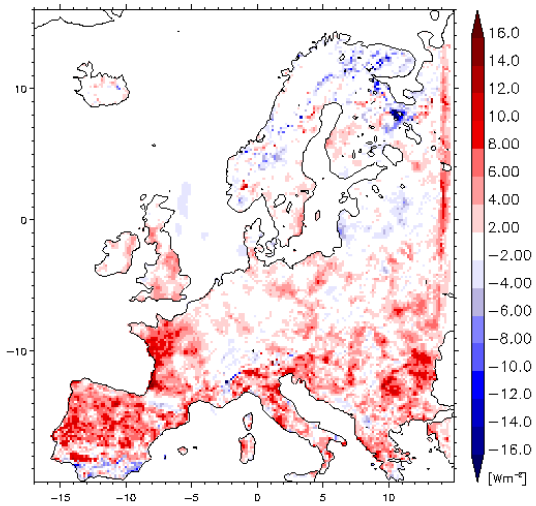

TC



# Diff: monthly average

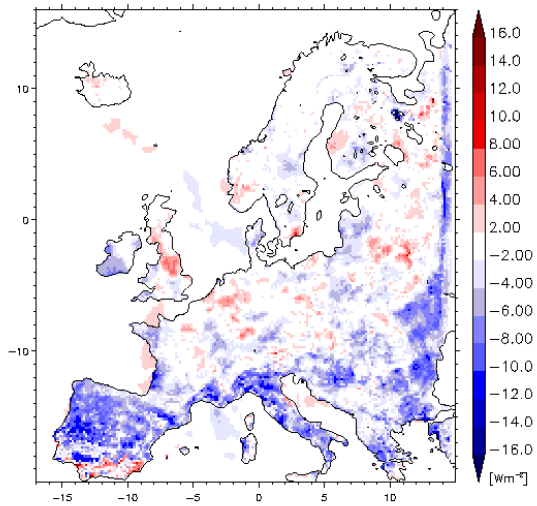
H

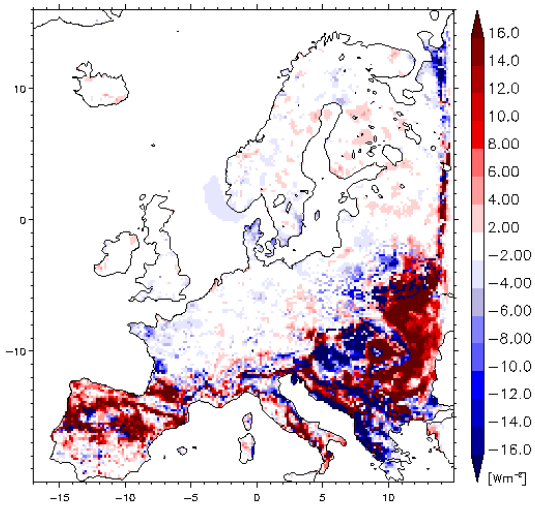
E




LAI30

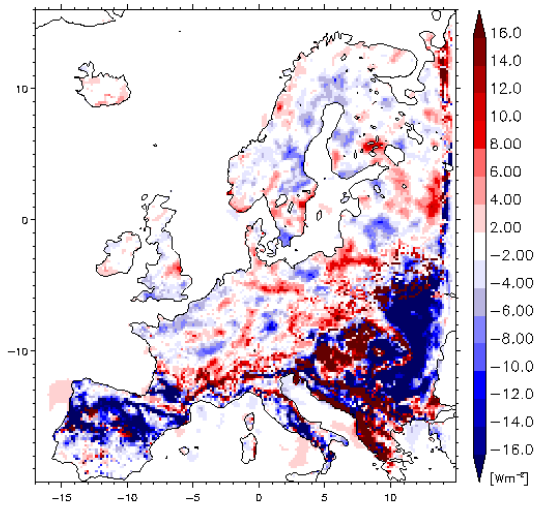
May



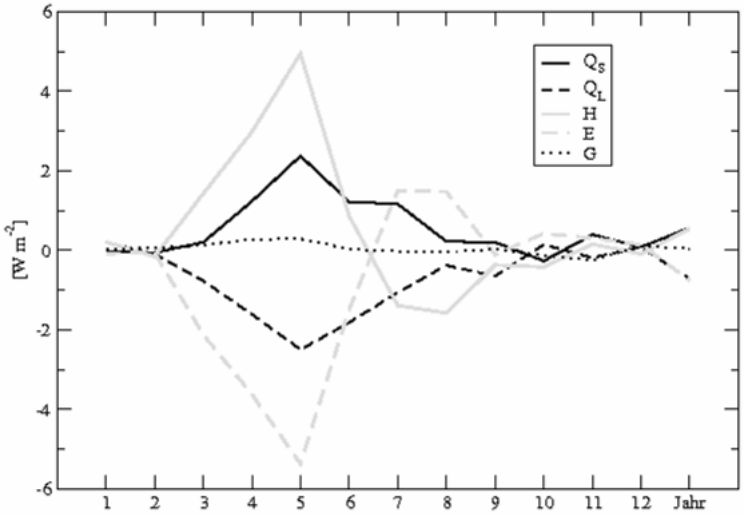

ST

July

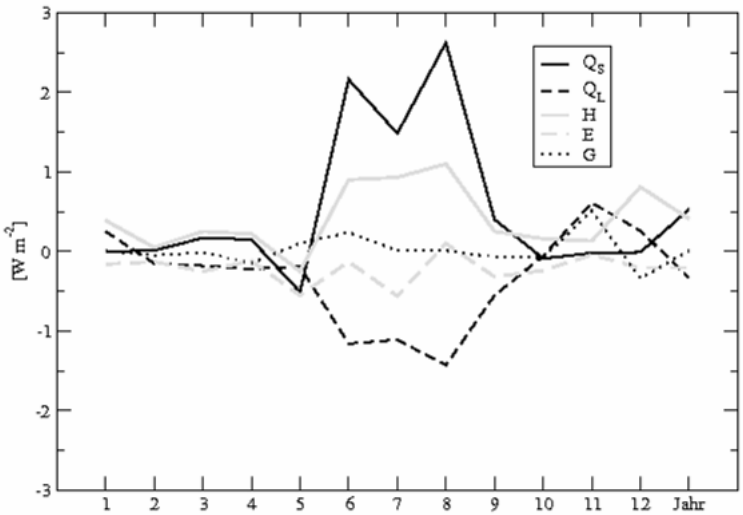


# Area mean differences

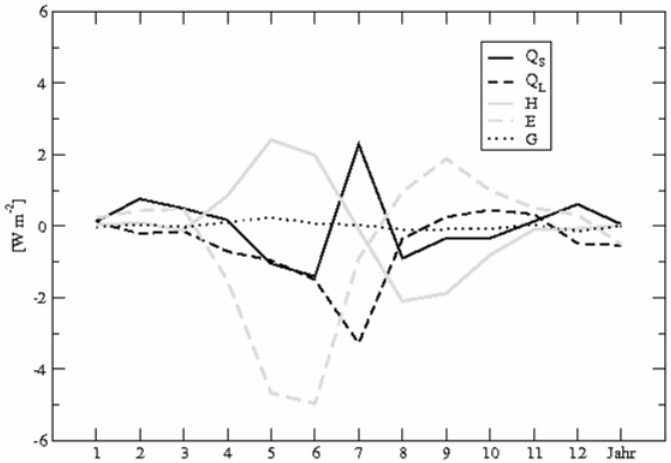
IBE (LAI30)



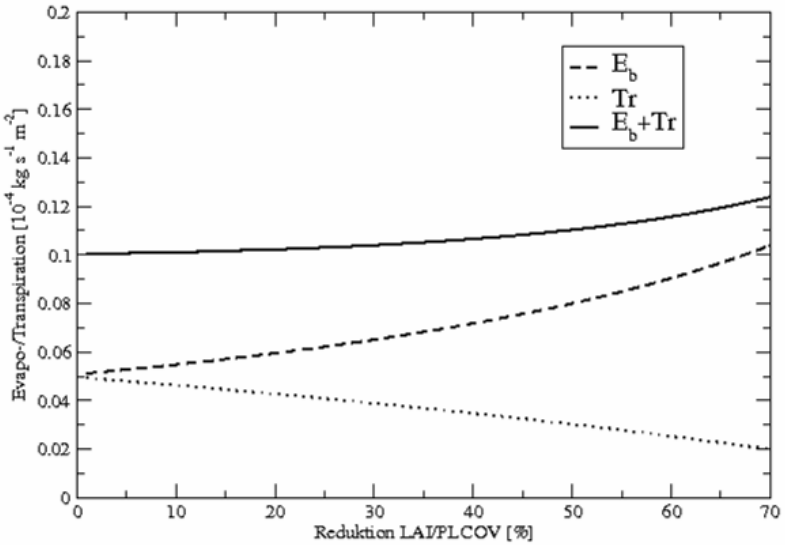

SCA (LAI30)

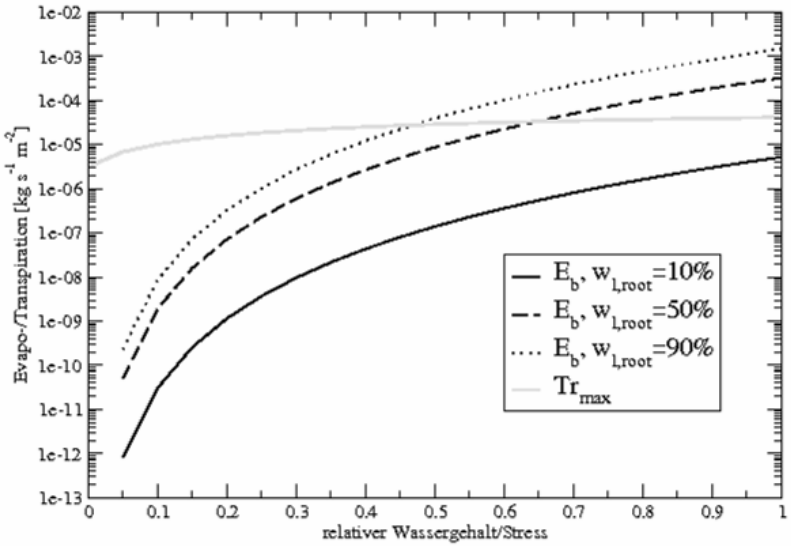



IBE (PLCOV)



# Evapotranspiration in Scandinavia



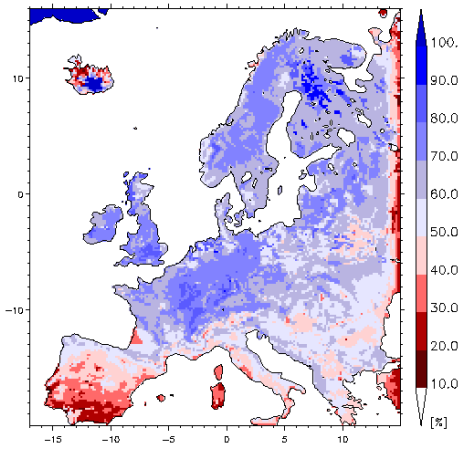




$w_{l,root}$ – water content of rooting zone

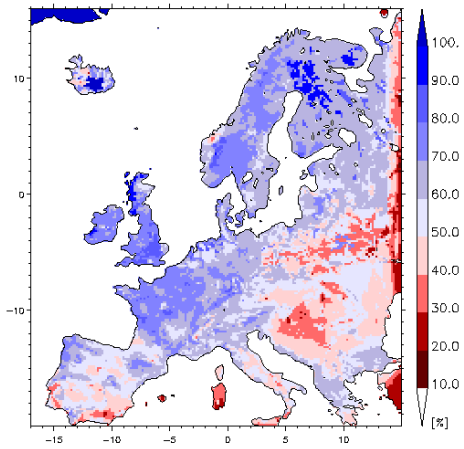
evaporation and transpiration counterbalance each other at soil water contents above 50%

# Relative water content in LAI30

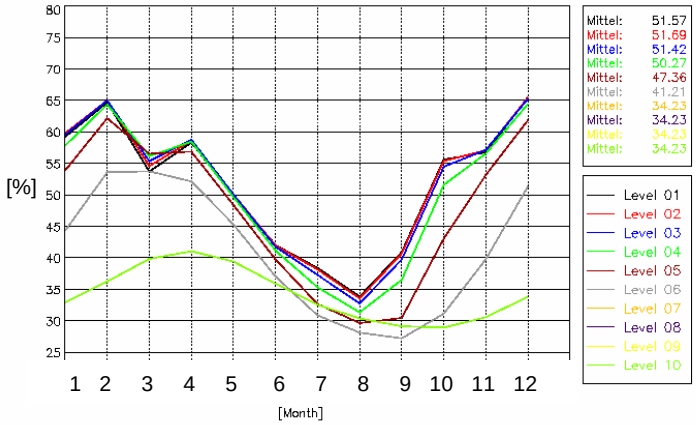
1st level, June



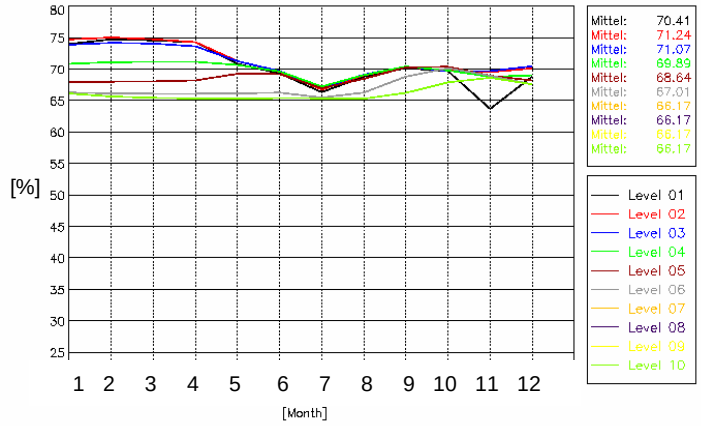

1st level, October




IBE

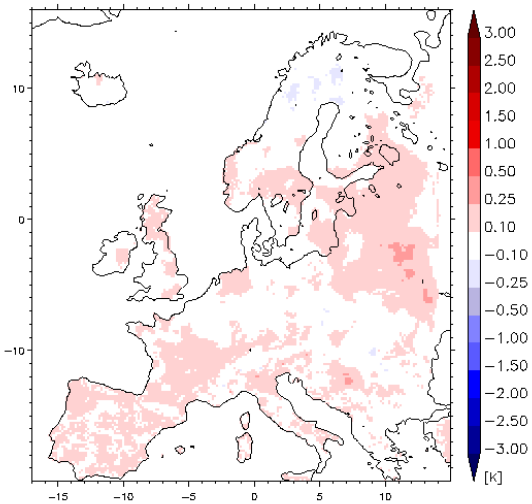



SCA

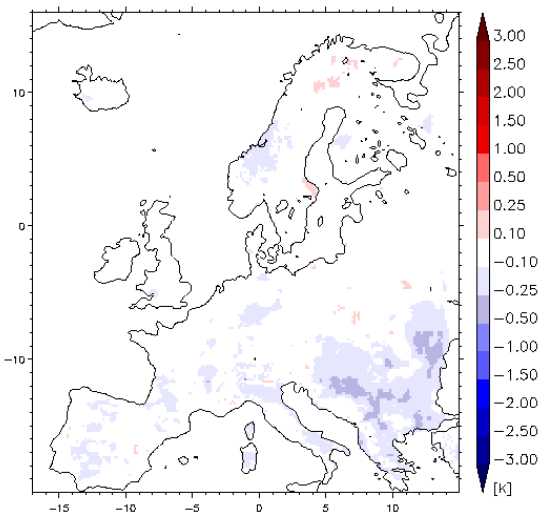


# Diff: $T_{2m}$ yearly average

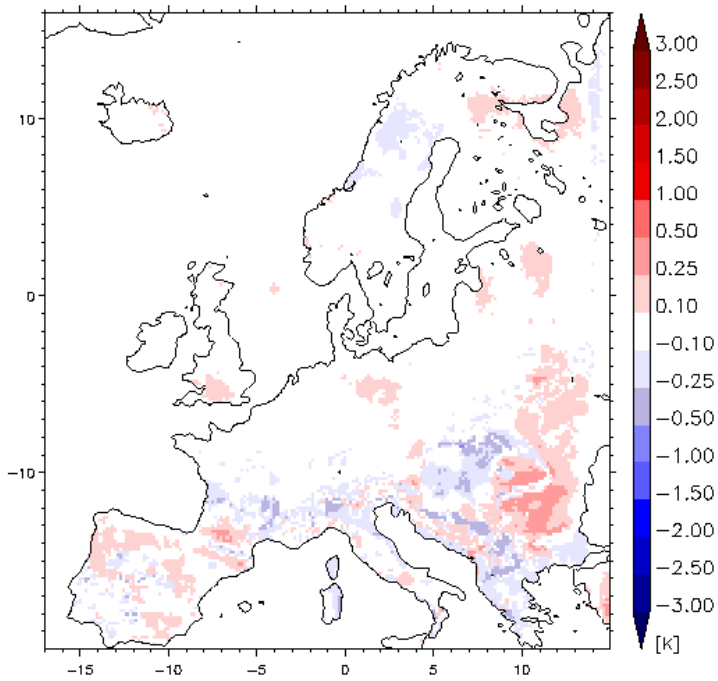
LAI30




ALBVEG



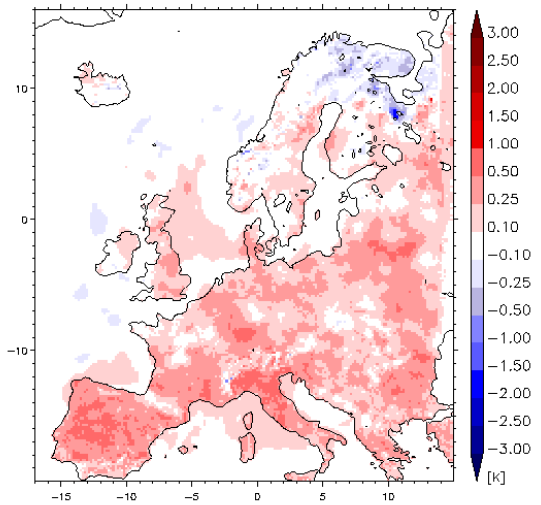

ST



# Diff: $T_{2m}$ monthly average

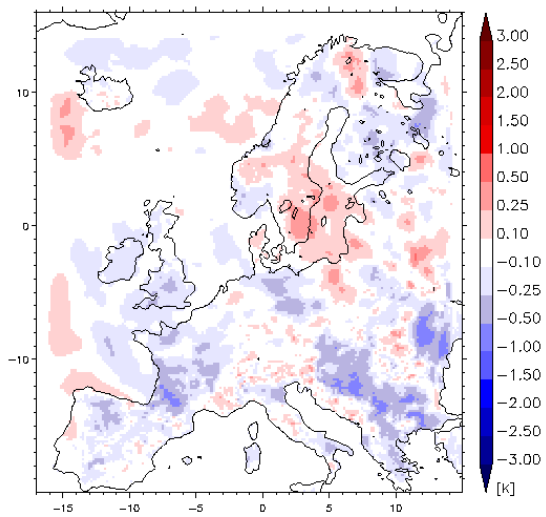
LAI30

May

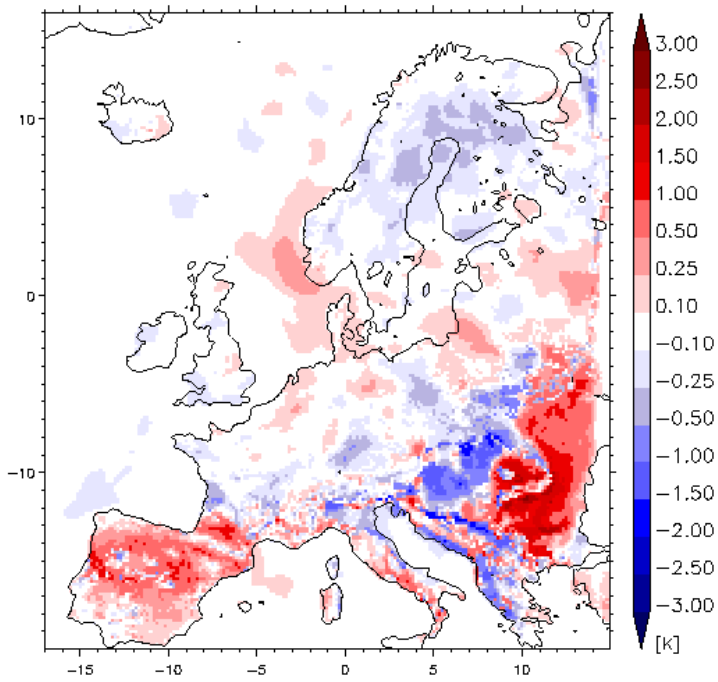



ALBVEG

August




ST July

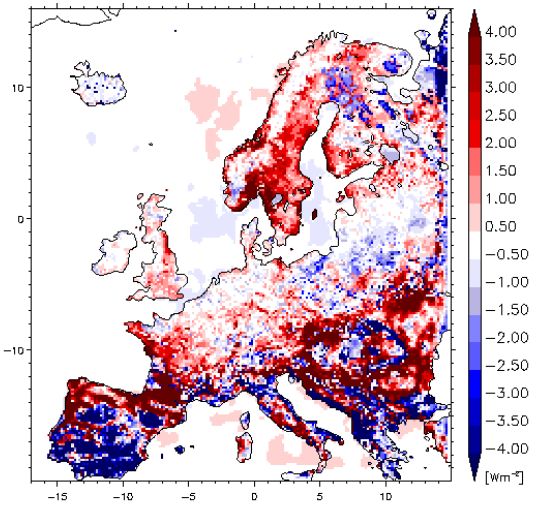


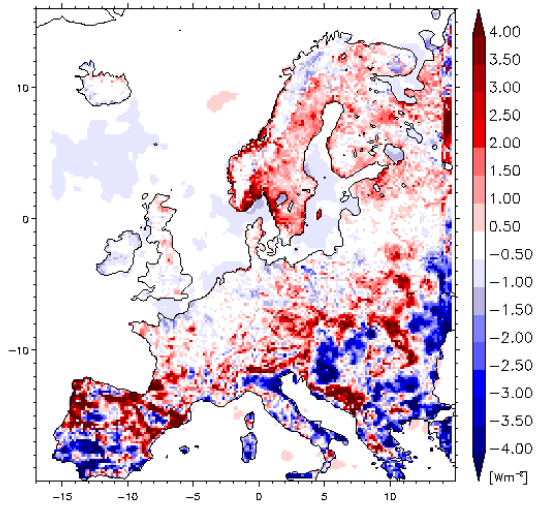
# Diff: yearly average

GKSS

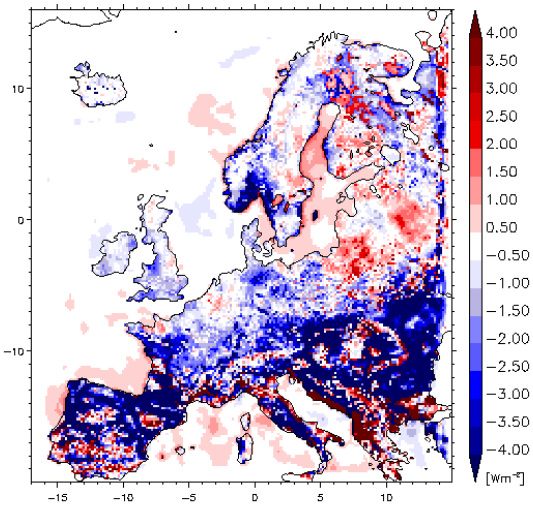
ECOCLIMAP

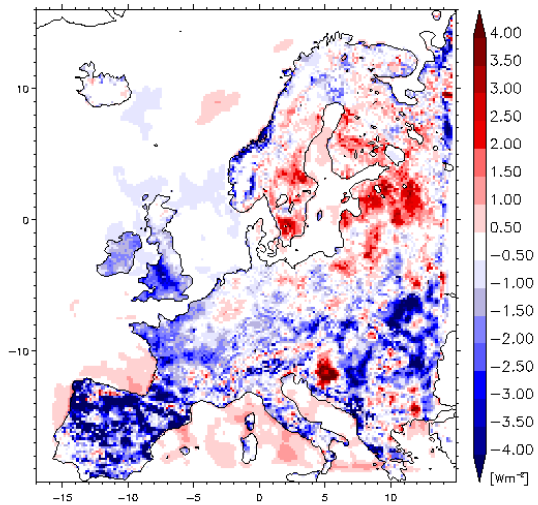
H




E



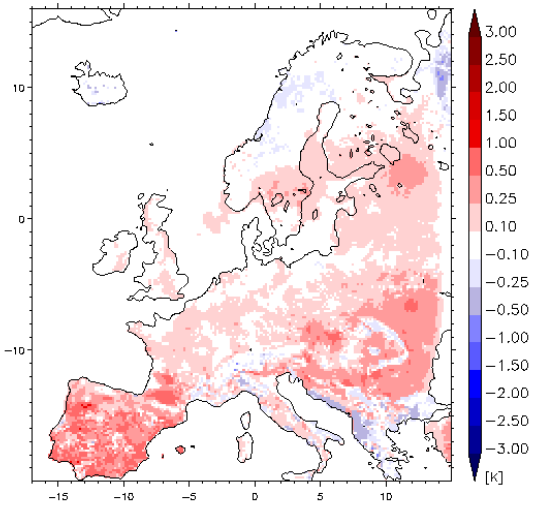



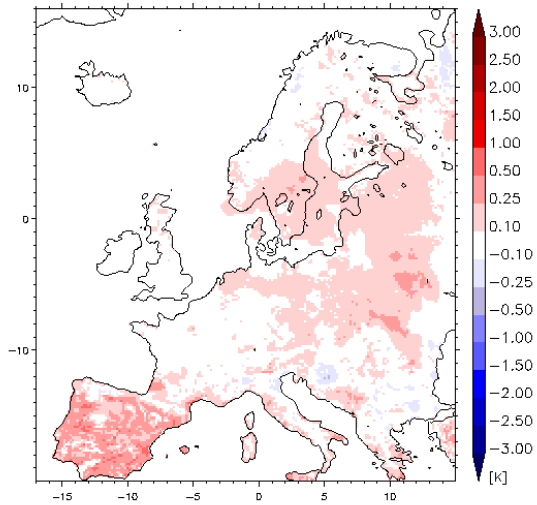
# Diff: $T_{2m}$

GKSS

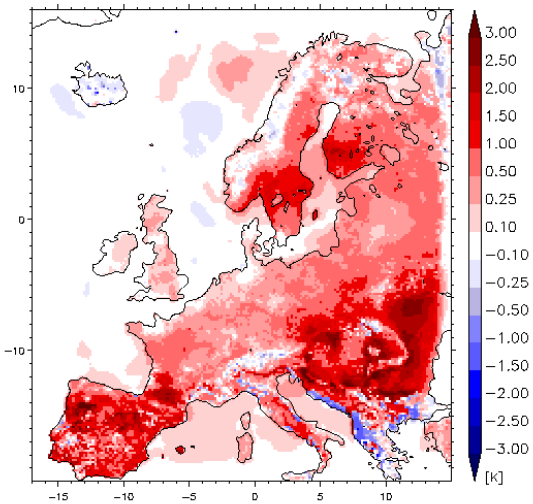
ECOCLIMAP

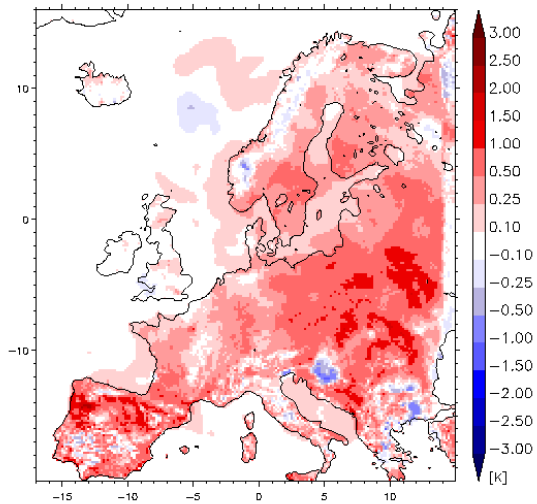
Year



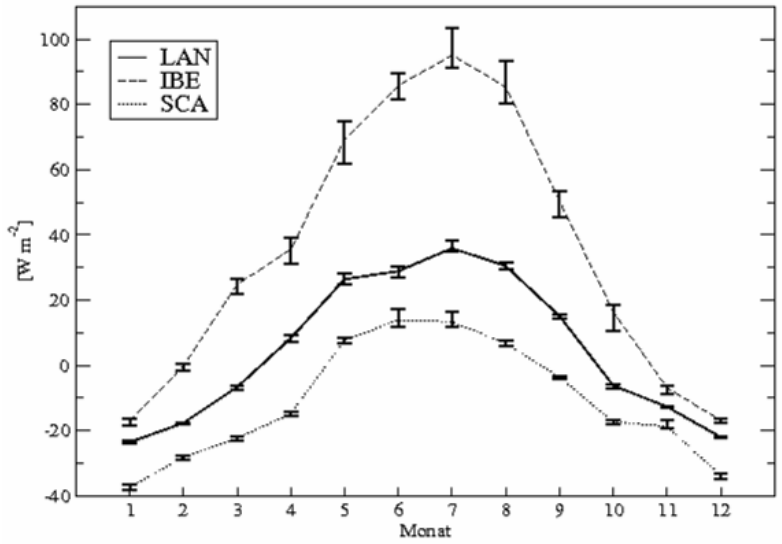

July

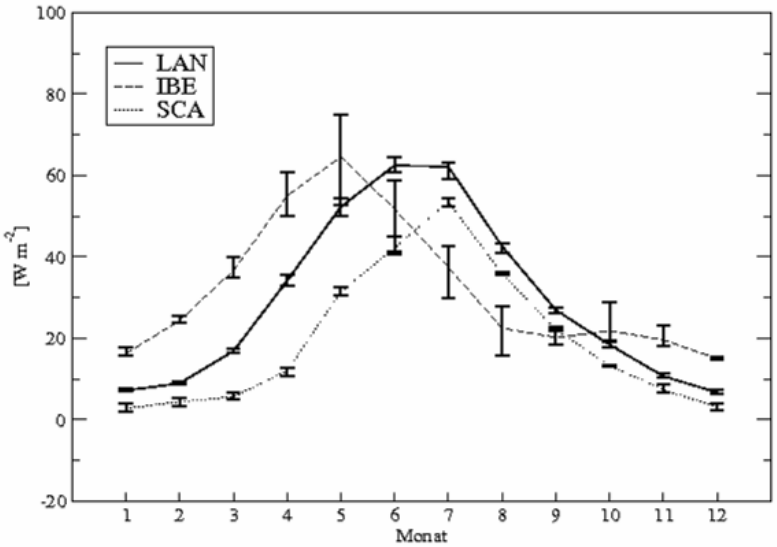


# Uncertainty ranges

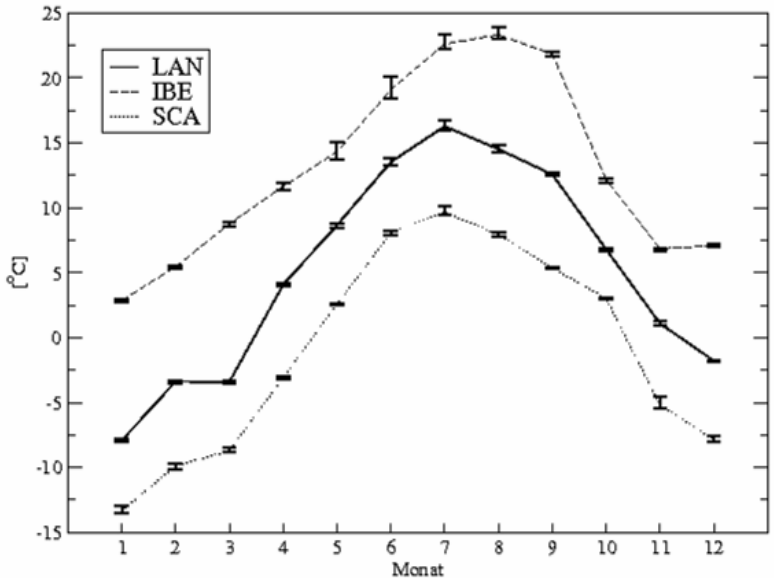
H




E

$T_{2m}$

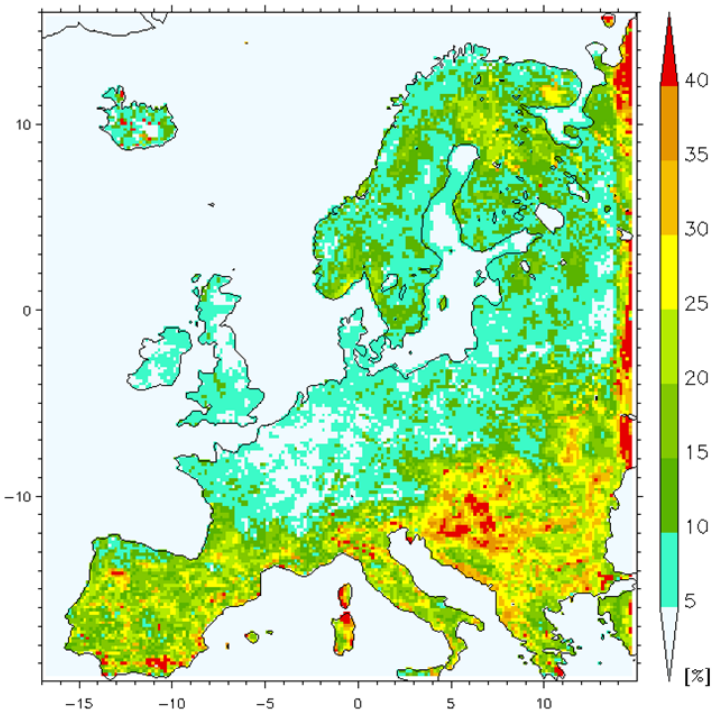



**Yearly average**

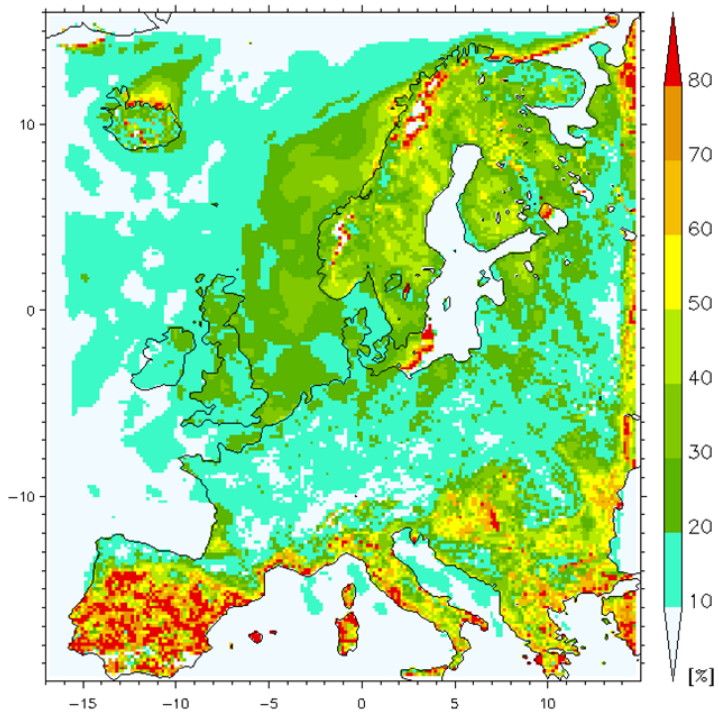
| | LAN | IBE | SCA |
|---|---|---|---|
| **H [W m$^{-2}$]** | 0,8 | 2,6 | 1,1 |
| **E [W m$^{-2}$]** | 1,4 | 3,0 | 0,8 |
| **$Q_S$ [W m$^{-2}$]** | 2,0 | 2,8 | 2,5 |
| **$Q_L$ [W m$^{-2}$]** | 2,0 | 2,0 | 3,1 |
| **$T_{2m}$ [K]** | 0,1 | 0,4 | 0,1 |
| **DTR [K]** | 0,4 | 1,0 | 0,7 |

# Uncertainty ranges

**Latent heat flux, Year**




**Latent heat flux, June**




Percentage of uncertainty range on absolute value

# Conclusions

- Sensitivity of CLM in respect to LAI, plant cover, root depth, vegetation Albedo, soil type parameters in the range of 3/ 20 $Wm^{-2}$ and 0.4/ 1.5 K for yearly/ monthly heat flux and $T_{2m}$ values respectively
- Spatial differences in magnitude
  - Dependence of sensitivity on soil water content for LAI and plant cover
  - Land use change in scenario simulations should be considered
- New input datasets reduce cold bias
- Consideration of spatial variable vegetation Albedo and soil water content dependent thermal conductivity is recommended