

# **CORDEX FPS - LUCAS**

## **The impact of afforestation on the diurnal cycle**

Institute for Meteorology and Climate Research -Troposphere Research

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# LUCAS – Phase 1

## Phase 1 Experiment plan

Experiment name	Tier	Description	LUC forcing	Global forcing	Domain	Resolution	Time period
<b>"FOREST"</b> <b>(maximised forest cover)</b>	1	Reanalysis-driven run with maximized forest cover (according to potential vegetation)	Static map of potential vegetation (break down forest types)	ERA-Interim	EURO-CORDEX	0.44°	1986-2015 (analysis period) <i>individual model spin up e.g. 1979-1985</i>
<b>GRASS</b> <b>(no forest, only grasses)</b>	1	Reanalysis-driven run without forest (maximum deforestation scenario)	Grassland only static map (break down C3/C4 grasses)	ERA-Interim	EURO-CORDEX	0.44°	1986-2015 (analysis period) <i>model spin up</i>

# LUCAS – Vegetation Maps

## FOREST-Map:

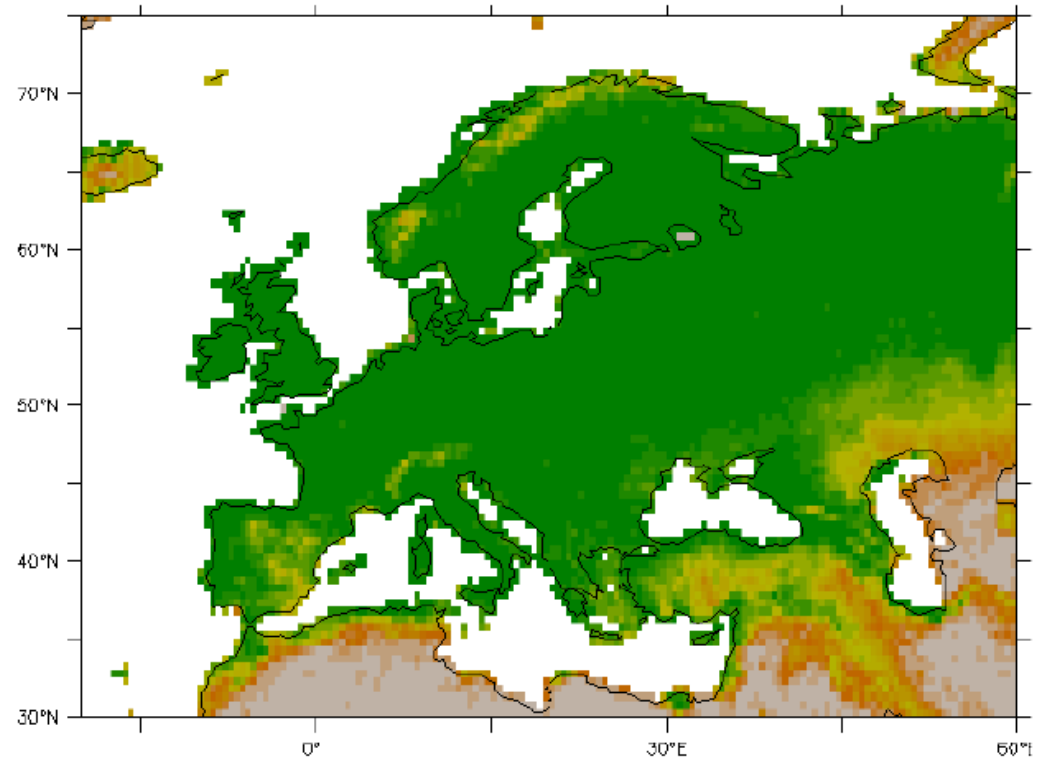
Land use in each grid cell is set to forest, except deserts

→ max. theoretical forest cover

## GRASS-Map:

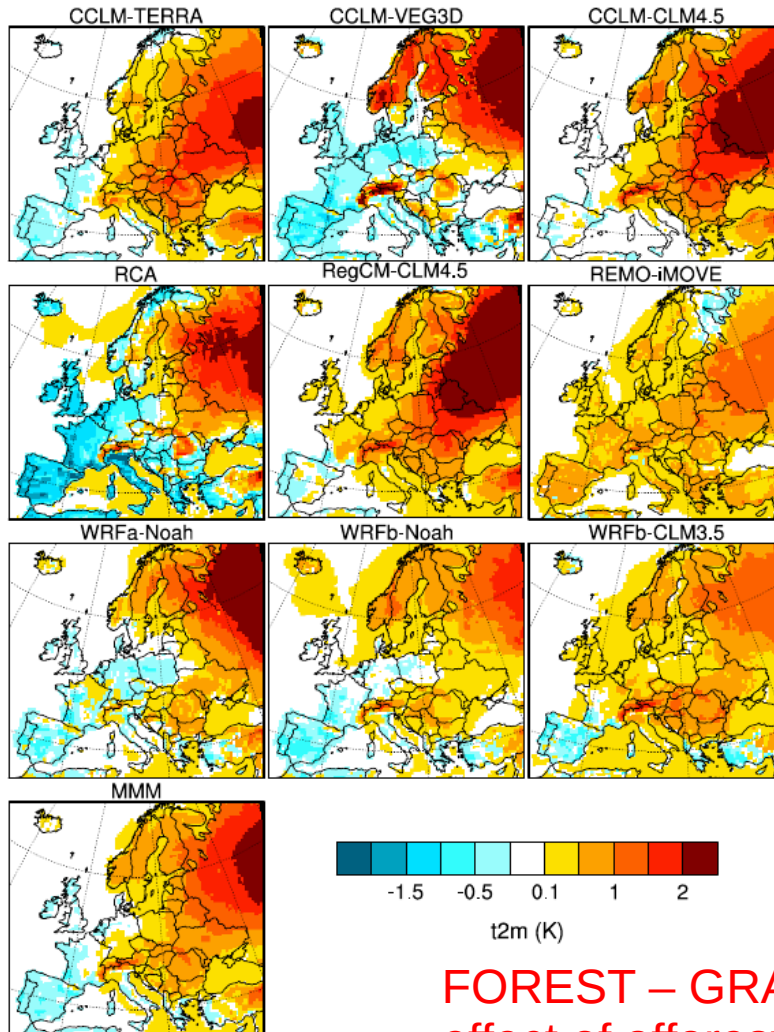
Forest is replaced by grassland

## Forest cover



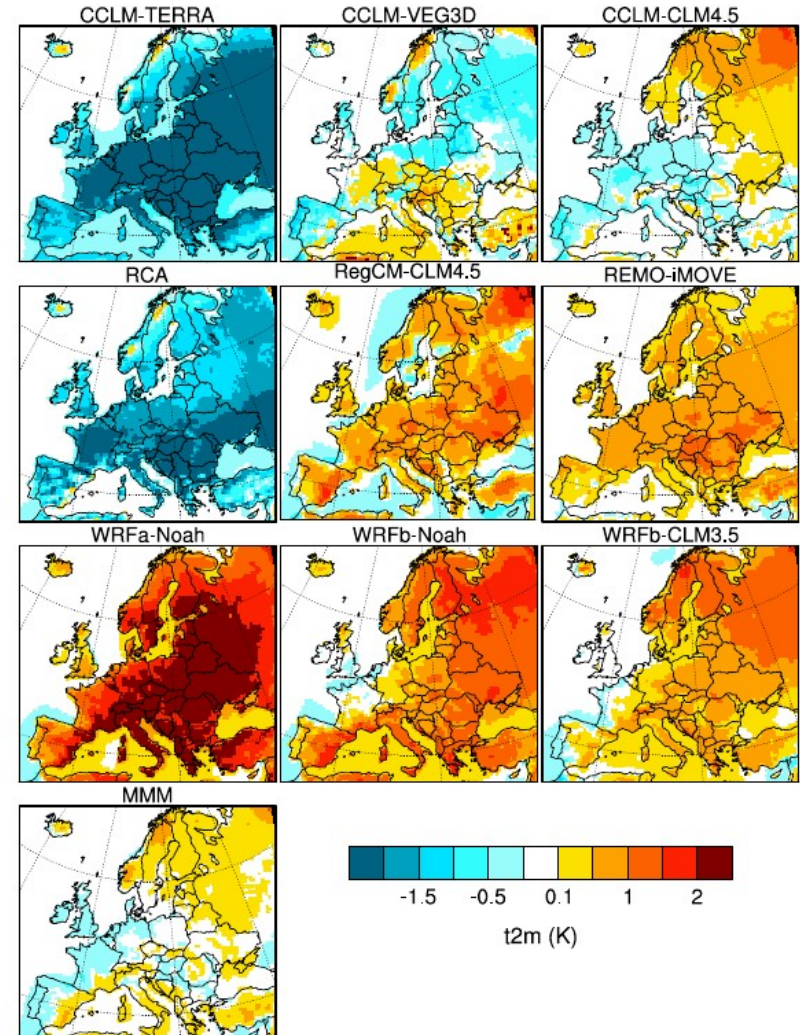
# LUCAS – First results

DJF



**FOREST – GRASS =  
effect of afforestation**

JJA

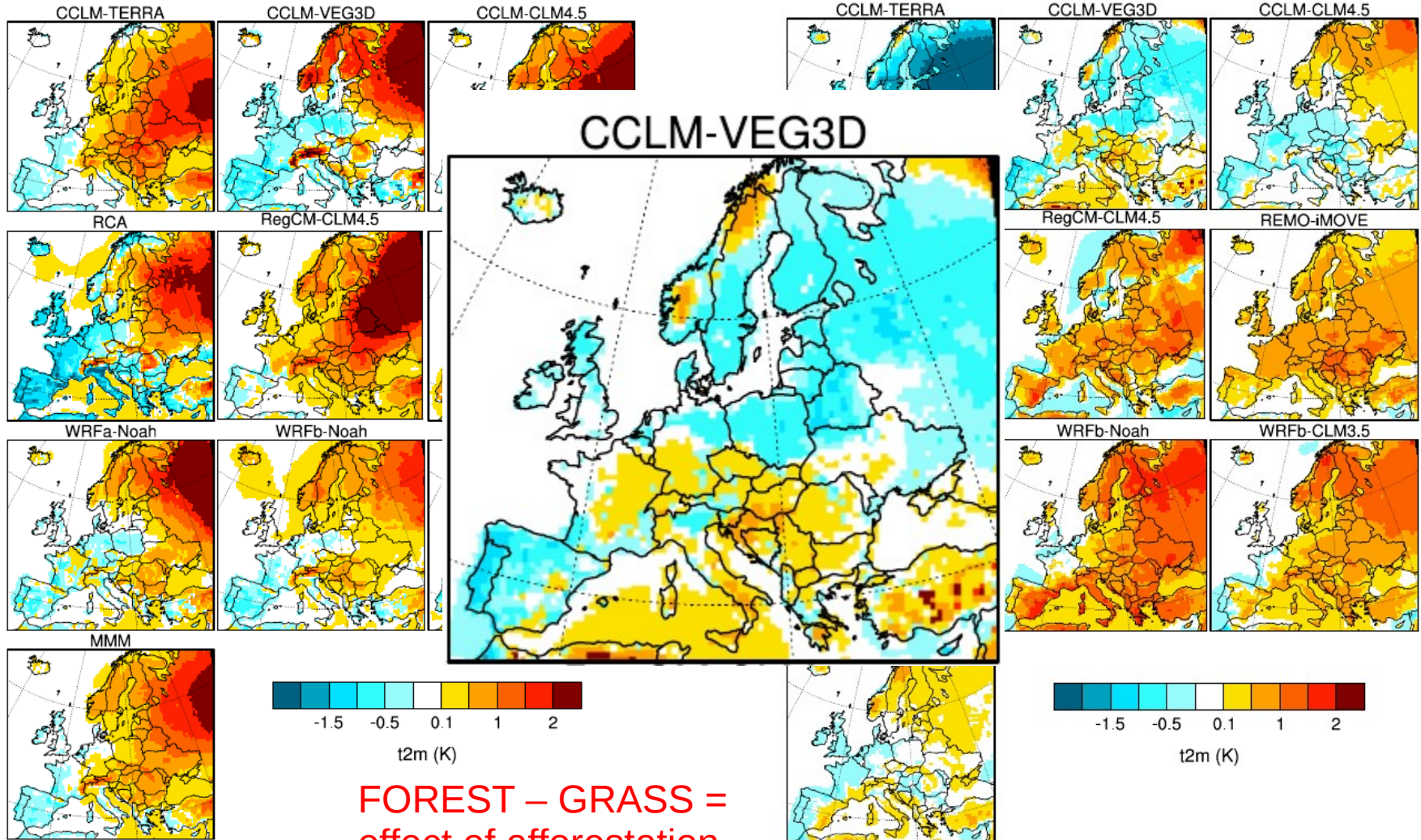




# LUCAS – First results

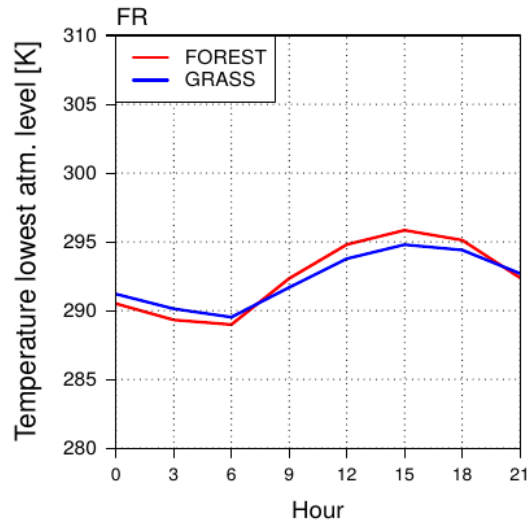
DJF

JJA

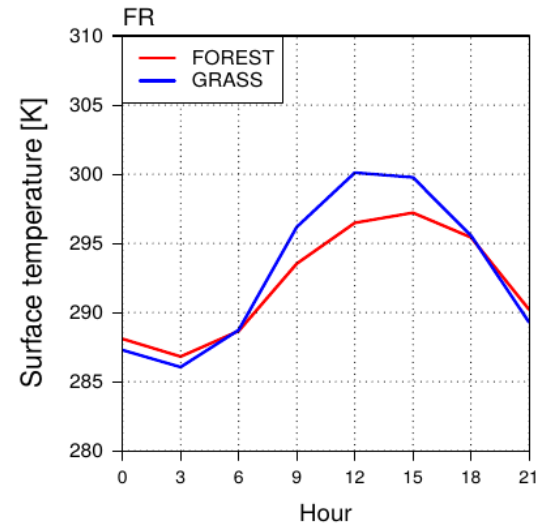


# Diurnal Cycle of CCLM-VEG3D

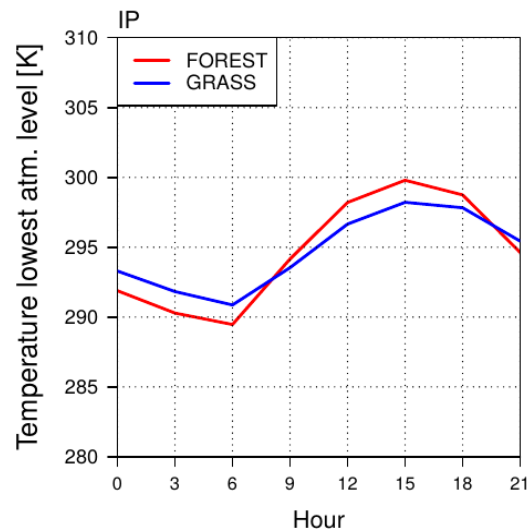
Lowest level  
Temperature



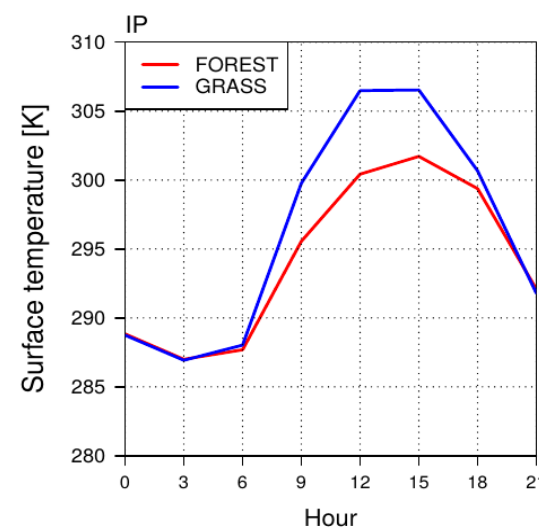
Skin  
Temperature



Lowest level  
Temperature

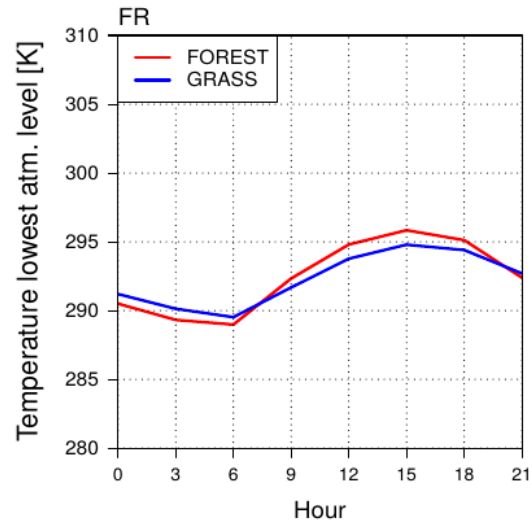


Skin  
Temperature

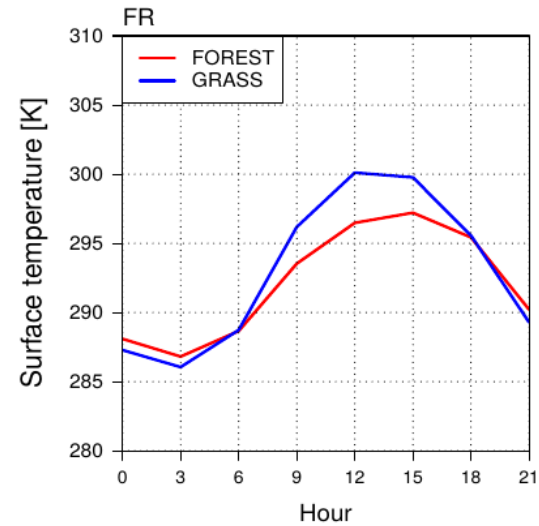


# Diurnal Cycle of CCLM-VEG3D - FR

Lowest level  
Temperature

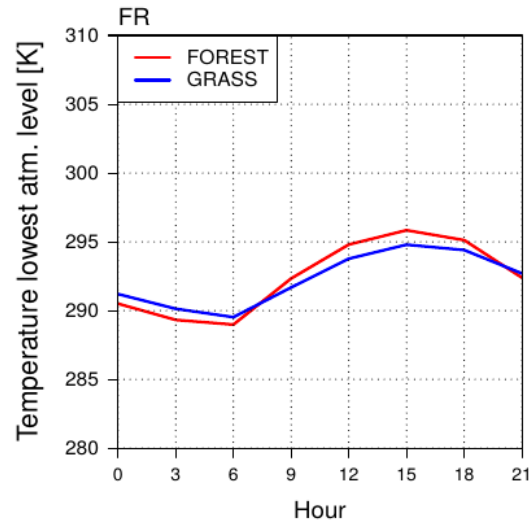


Skin  
Temperature

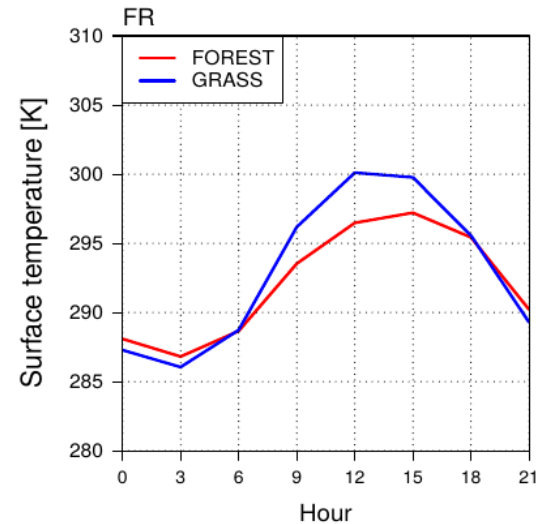


# Diurnal Cycle of CCLM-VEG3D - FR

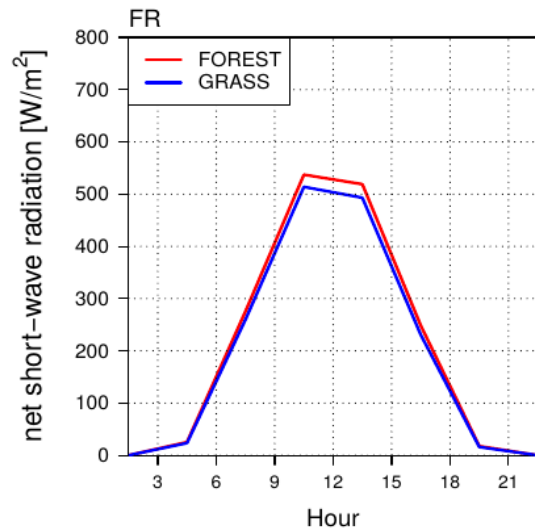
Lowest level  
Temperature



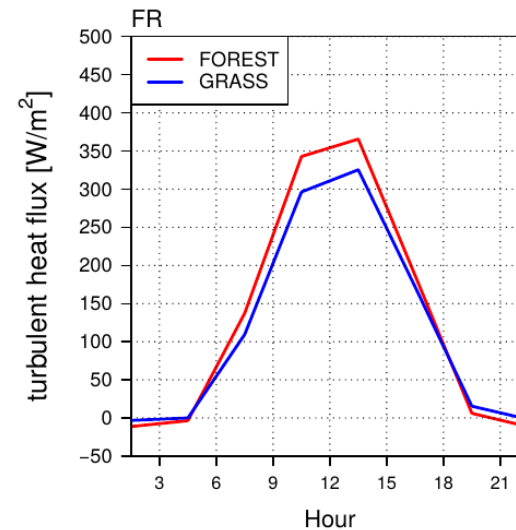
Skin  
Temperature



short-wave  
radiation



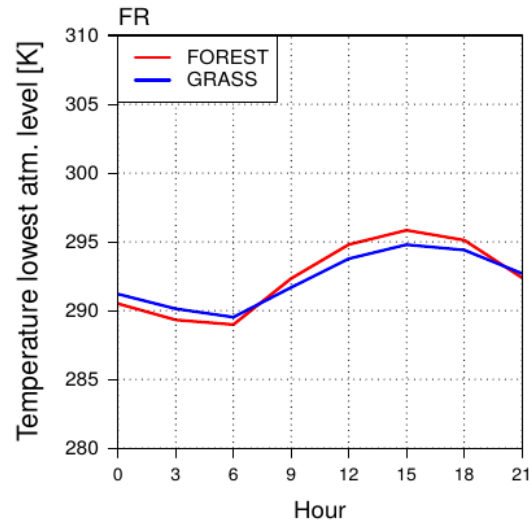
turbulent  
heat flux



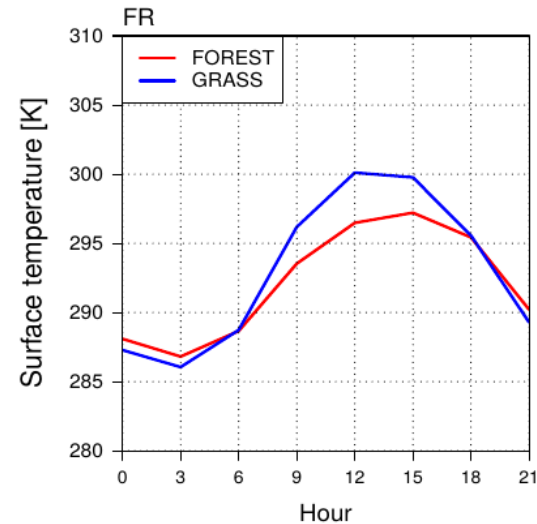


# Diurnal Cycle of CCLM-VEG3D - FR

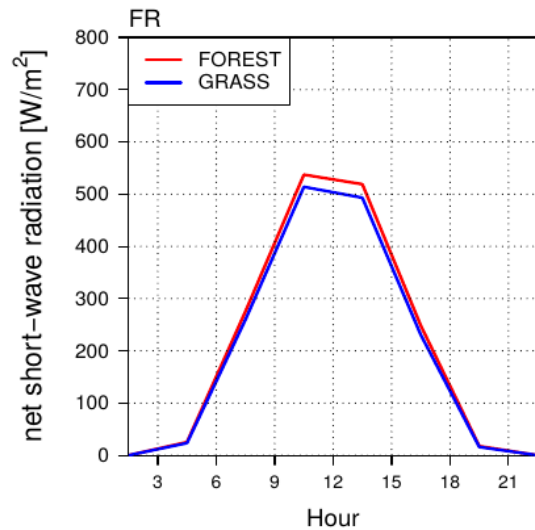
Lowest level  
Temperature



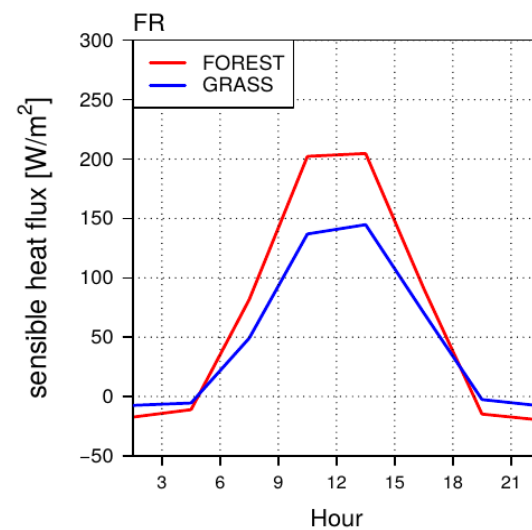
Skin  
Temperature



short-wave  
radiation

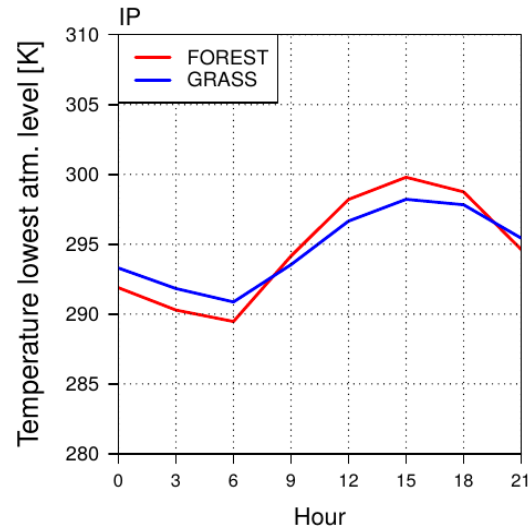


sensible  
heat

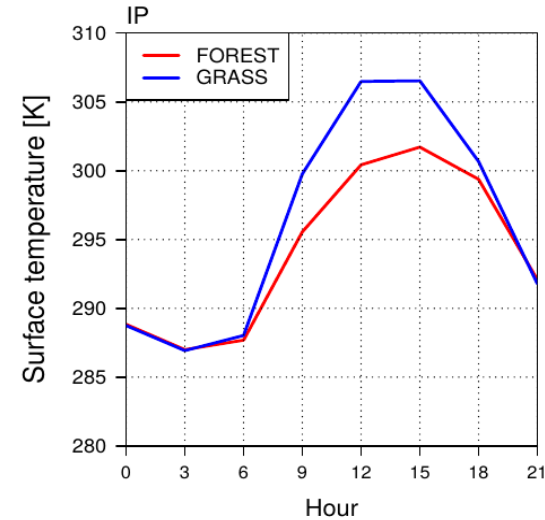


# Diurnal Cycle of CCLM-VEG3D - IP

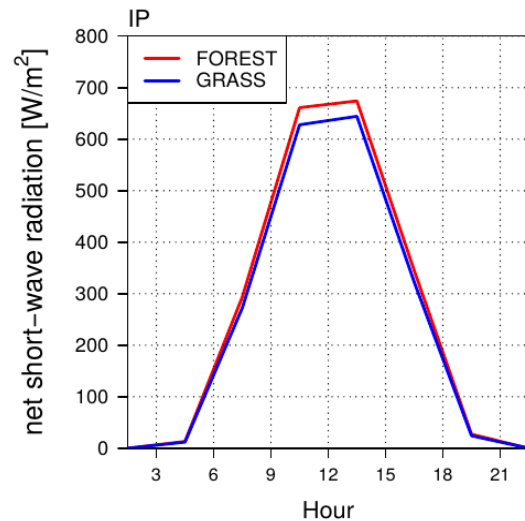
Lowest level  
Temperature



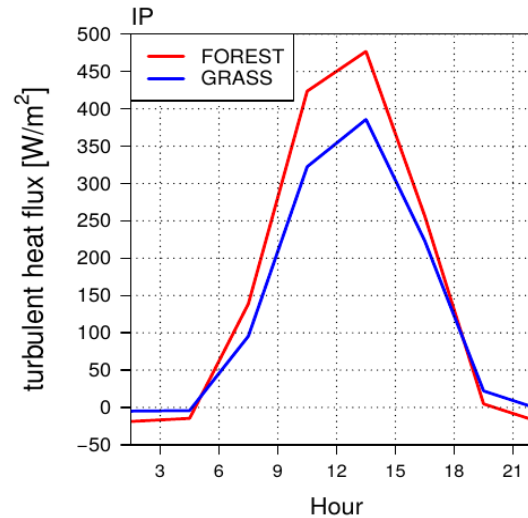
Skin  
Temperature



short-wave  
radiation

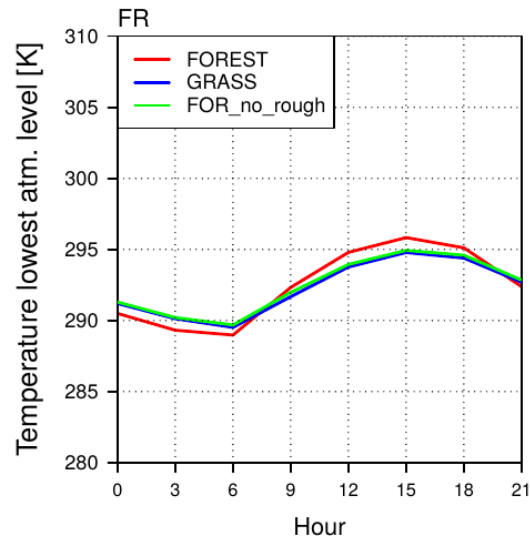


turbulent  
heat flux

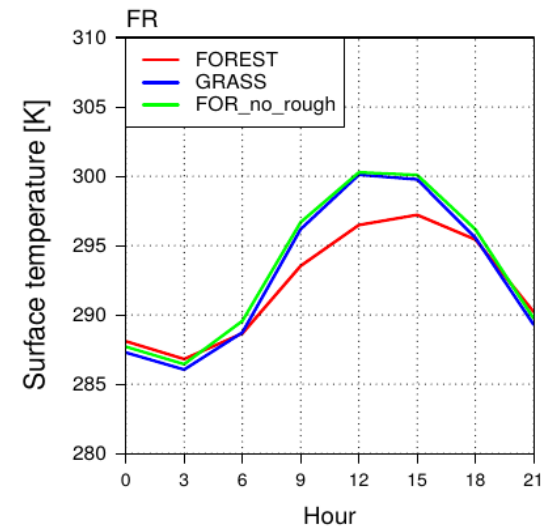


# FOREST run with reduced surface roughness

Lowest level  
Temperature

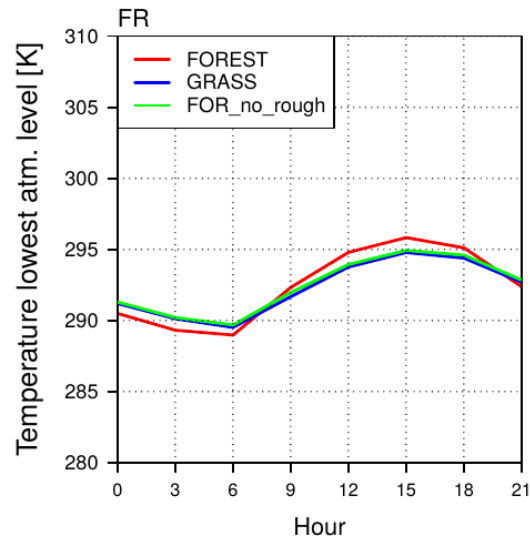


Skin  
Temperature

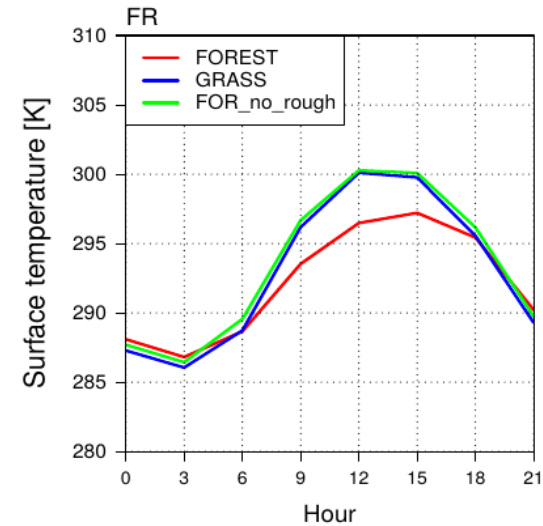


# FOREST run with reduced surface roughness

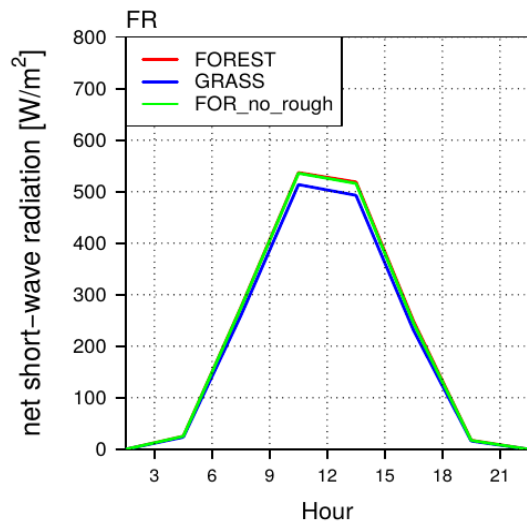
Lowest level  
Temperature



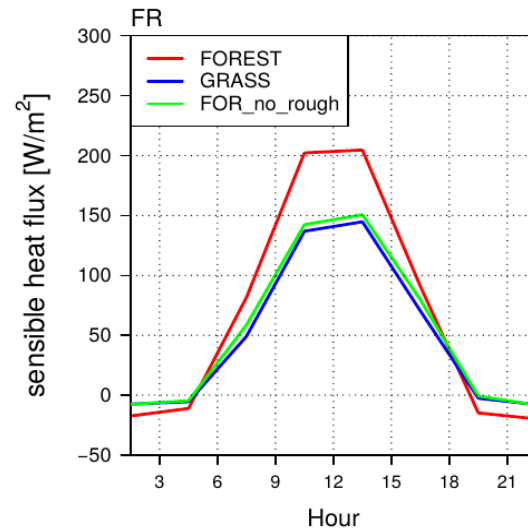
Skin  
Temperature



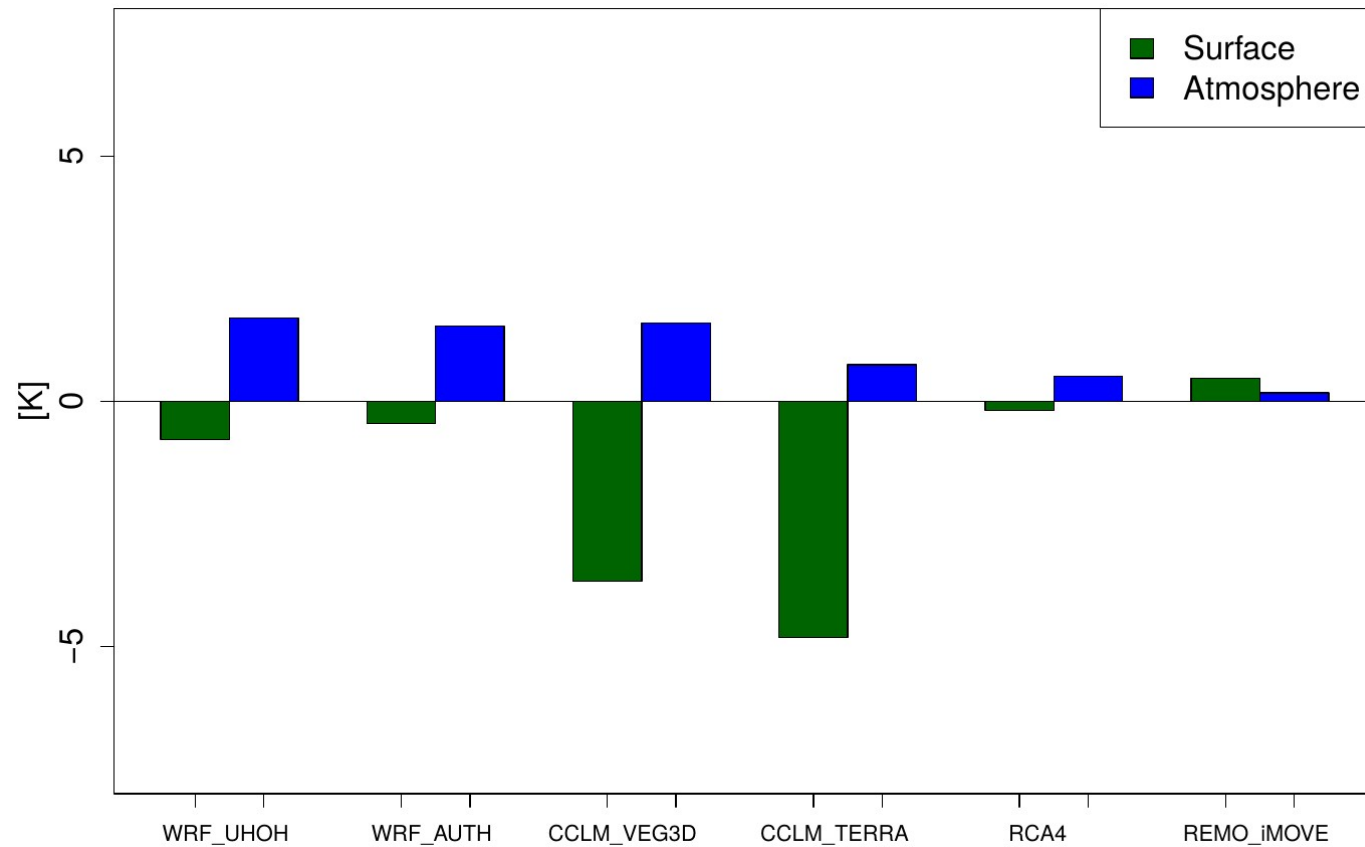
short-wave  
radiation



sensible  
heat

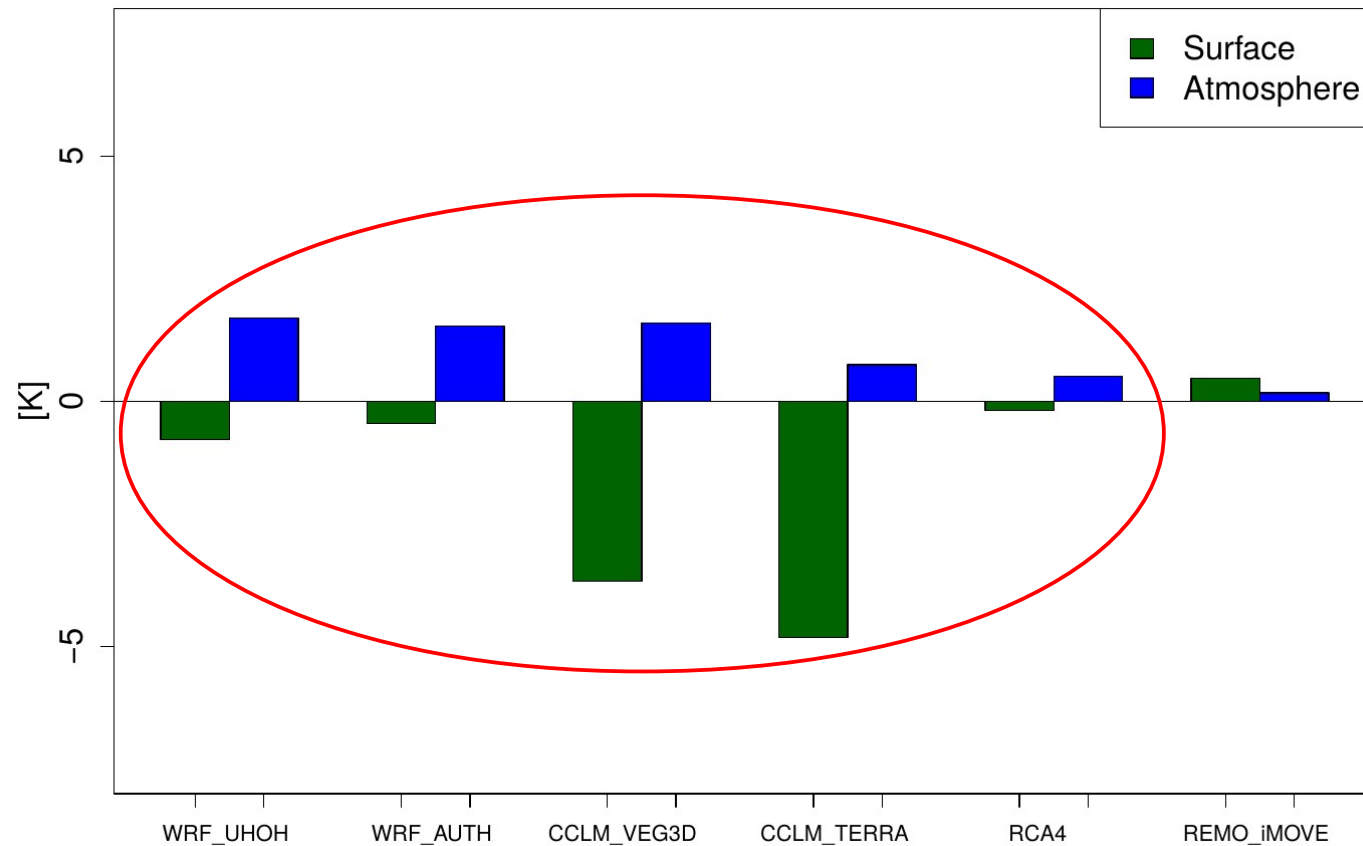


# Results from the other RCMs

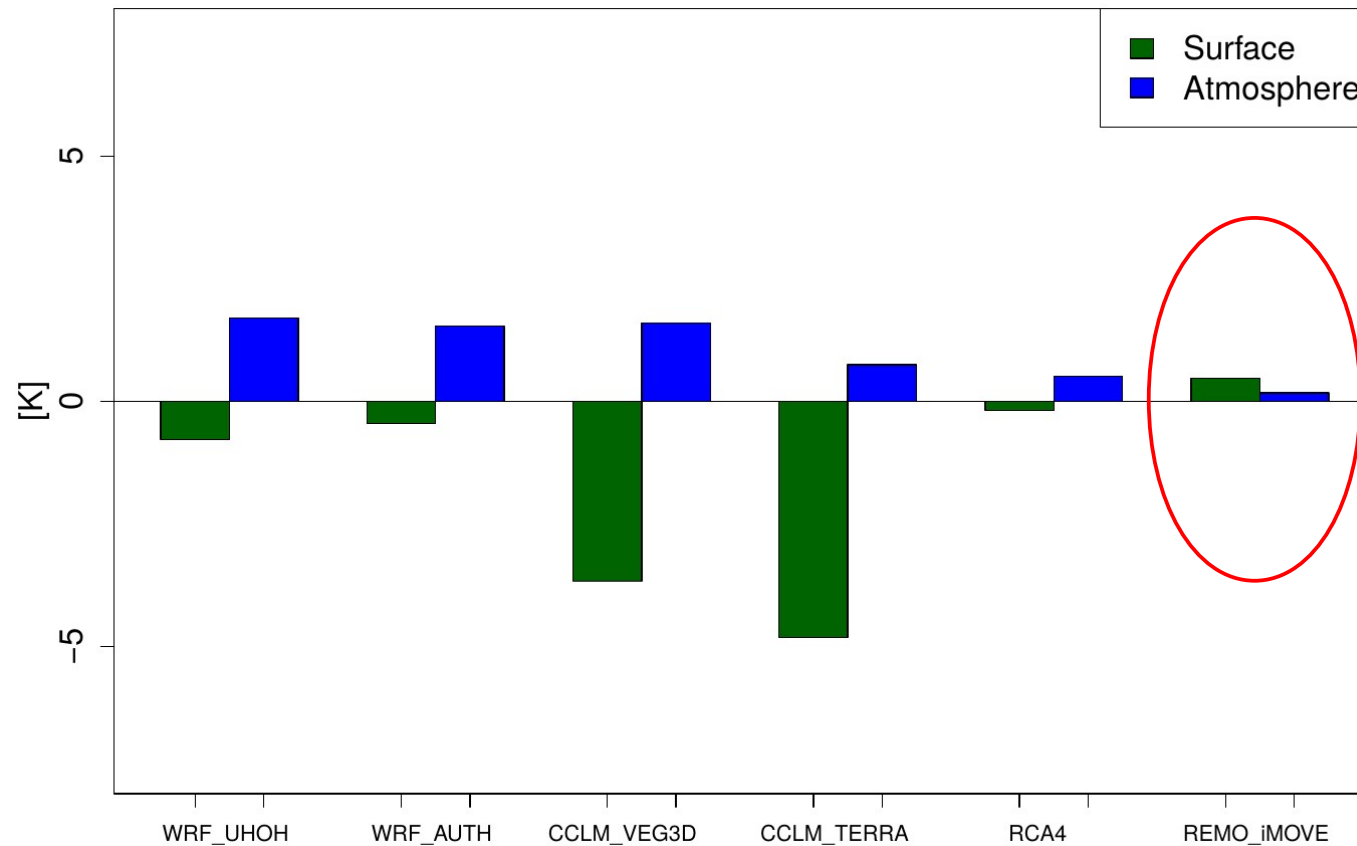




# Results from the other RCMs

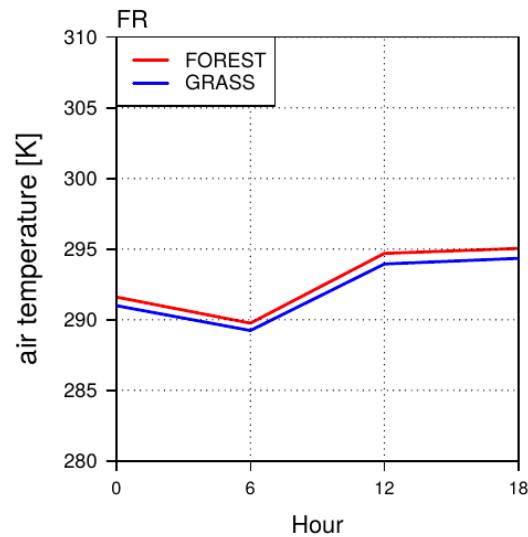


# Results from the other RCMs

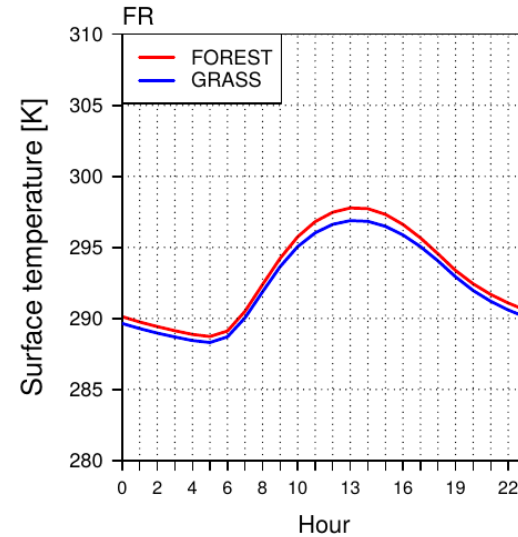


# REMO\_iMOVE

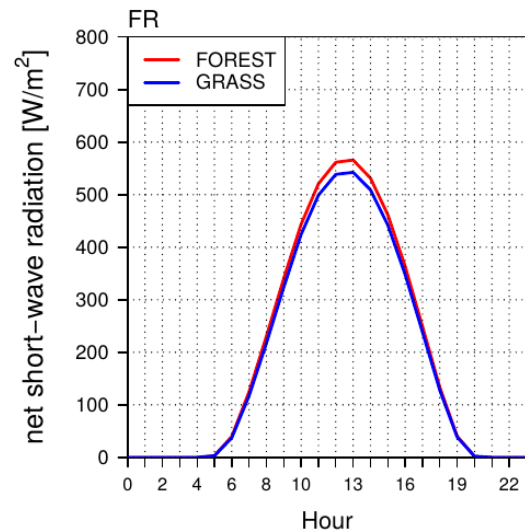
Lowest level  
Temperature



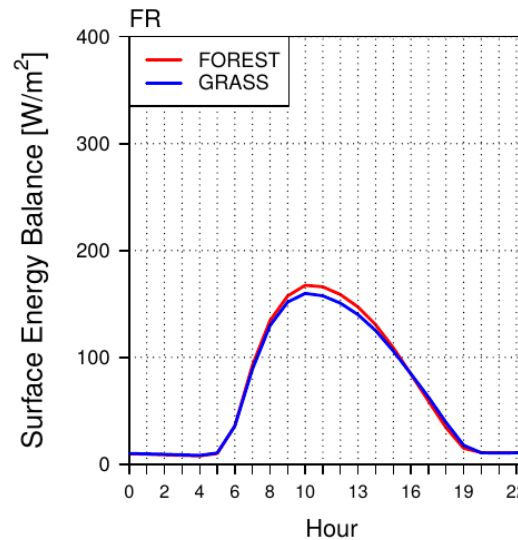
Skin  
Temperature



short-wave  
radiation

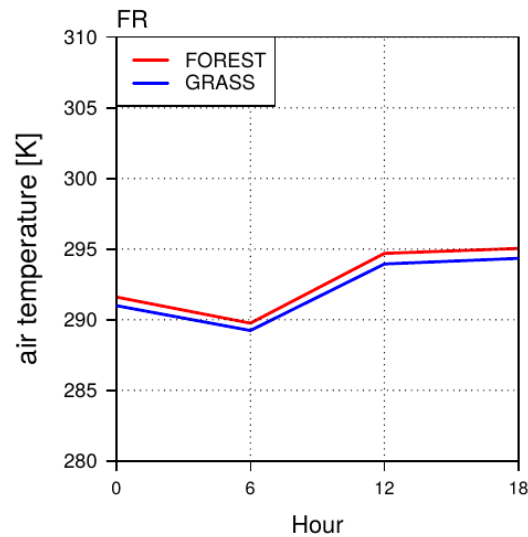


Energy  
balance

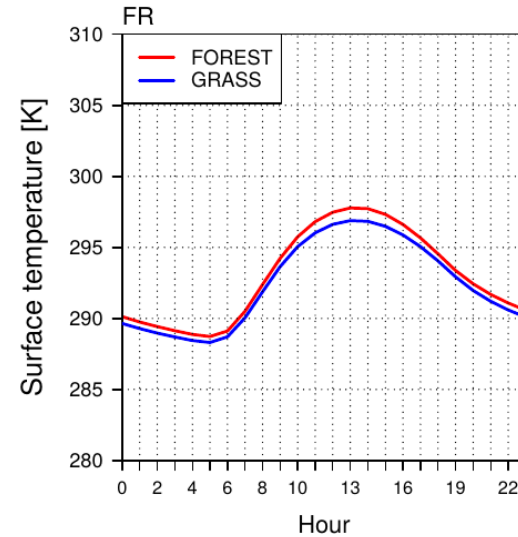


# REMO\_iMOVE

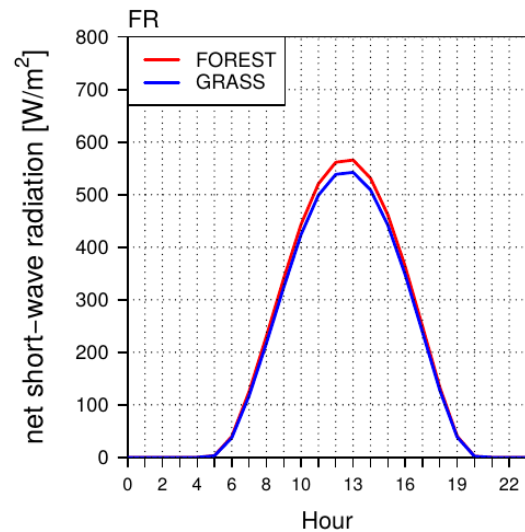
Lowest level  
Temperature



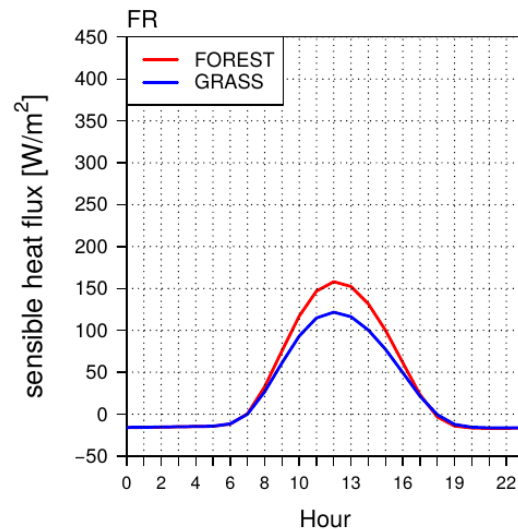
Skin  
Temperature



short-wave  
radiation



sensible  
heat



# Conclusions

- **Consistent model behavior for the diurnal temperature cycles, which is not reflected in the mean 2m temperatures**



# Conclusions

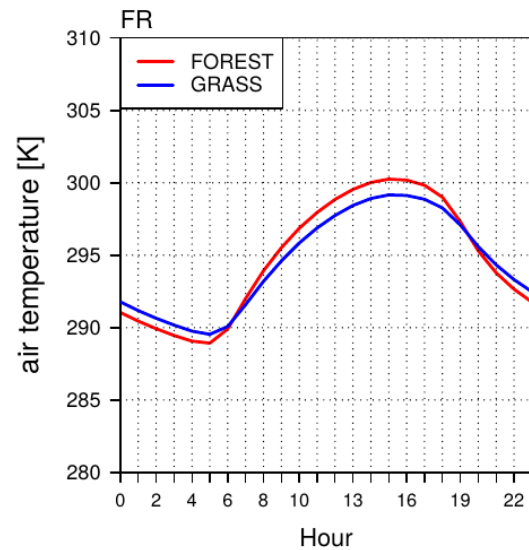
- **Consistent model behavior for the diurnal temperature cycles, which is not reflected in the mean 2m temperatures**
- **Diurnal cycle is reduced at the surface and increased in the atmosphere, due to afforestation**

# Conclusions

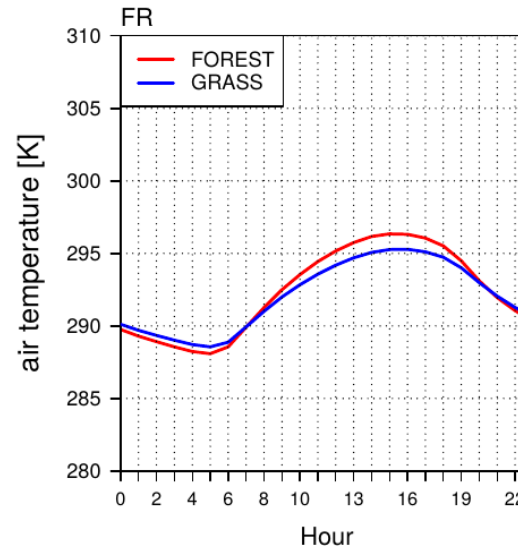
- **Consistent model behavior for the diurnal temperature cycles, which is not reflected in the mean 2m temperatures**
- **Diurnal cycle is reduced at the surface and increased in the atmosphere, due to afforestation**
- **Enhanced turbulent heat exchange, due to higher surface roughness of forest**

# Results from the other RCMs

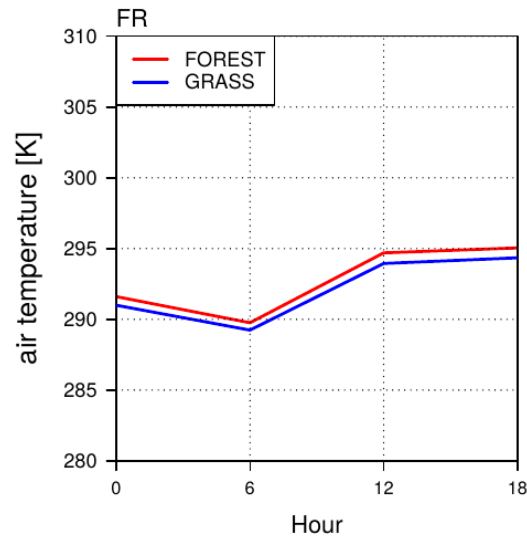
WRF-UHOH



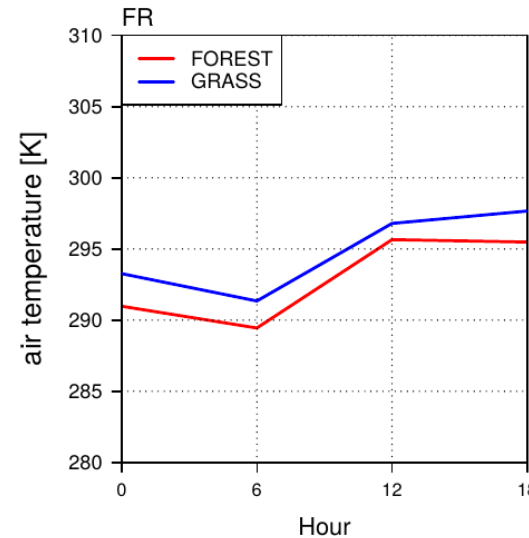
WRF-AUTH



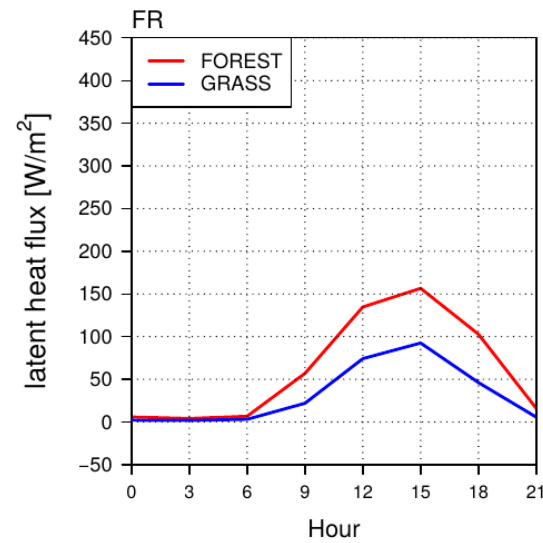
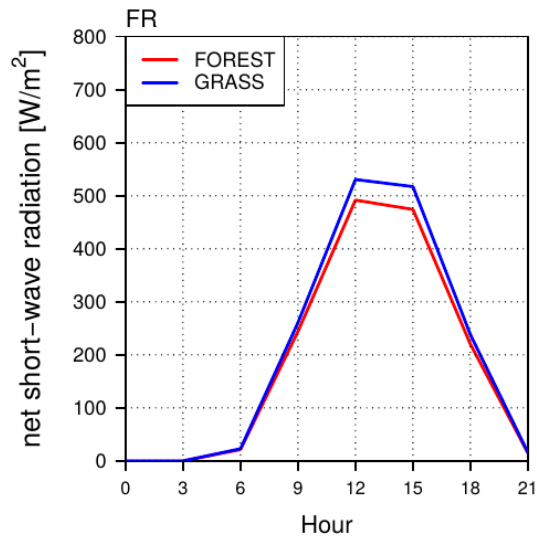
REMO\_iMOVE



CCLM-TERRA

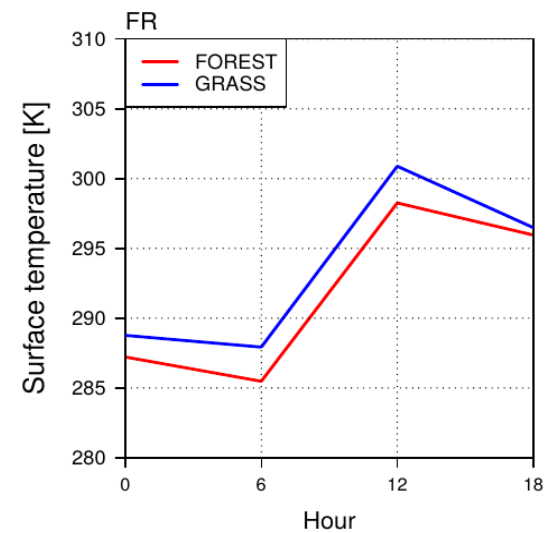
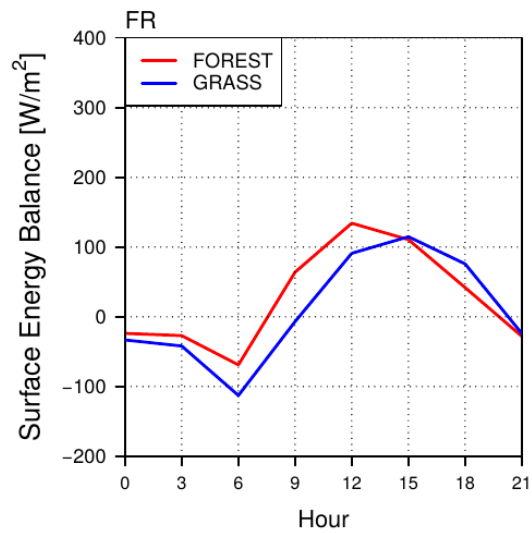


short-wave  
radiation



latent  
heat

Energy  
balance



Skin  
Temperature