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C2SM
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Effects of alternative external fields for TERRA on temperature for climate applications.

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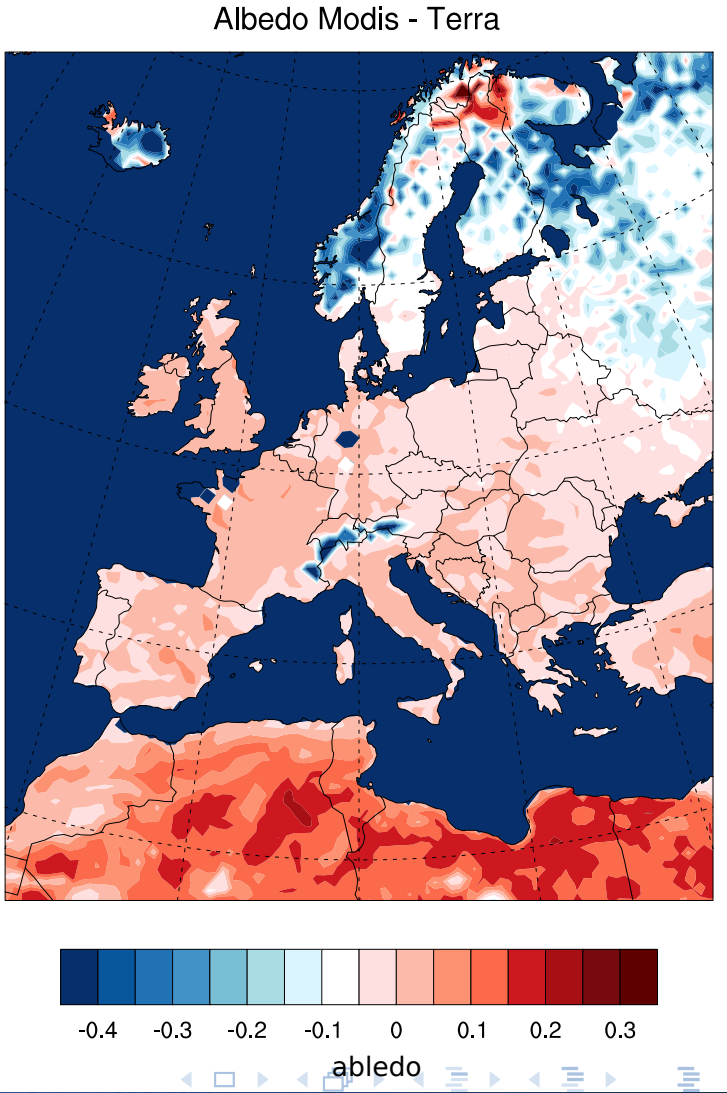
Problem Albedo

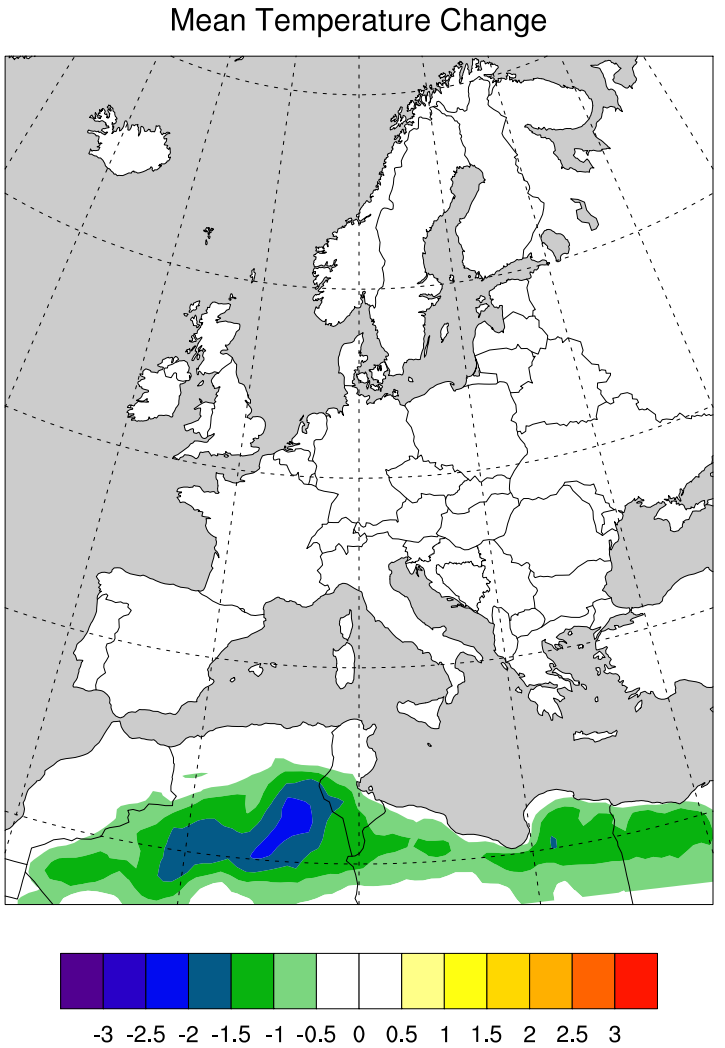
- TERRA Soil albedo is bound to soil type
- TERRA Soil is too dark in North Africa
- COSMO-CLM has a strong hot bias over North Africa

Use MODIS soil color and look-up tables of CLM to prescribe COSMO albedo.



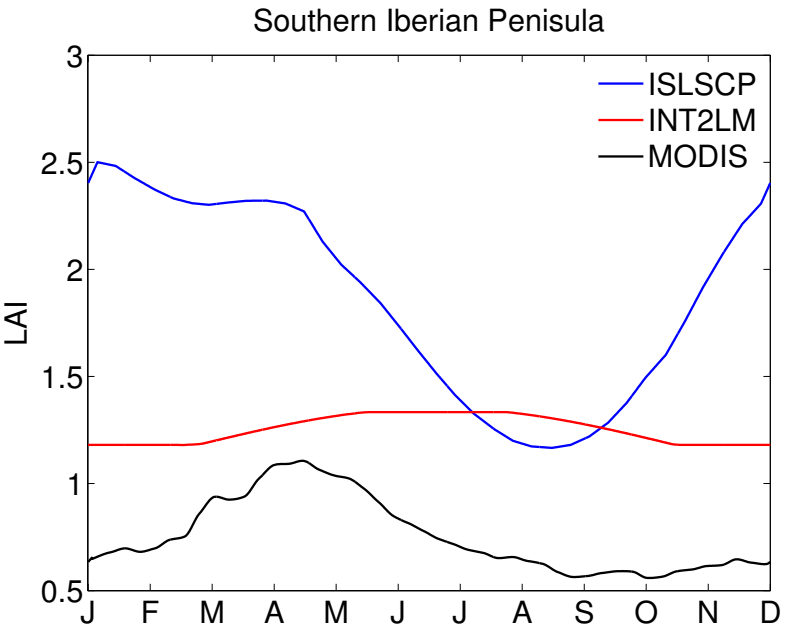
Effect of new albedo

- Effects strongly confied to North Africa
- Strong cooling because of higher albedo
- Improvement of bias. But a warm bias remains
- Temperature change in North Africa has no effect on Europe for climate mode



Problem LAI

- LAI has a predefined annual cycle in int2lm
- Annual peak of LAI not necessaraly in June (Spain,Scandinavia)
- Satellite LAI is much higher and has a different spatial structure

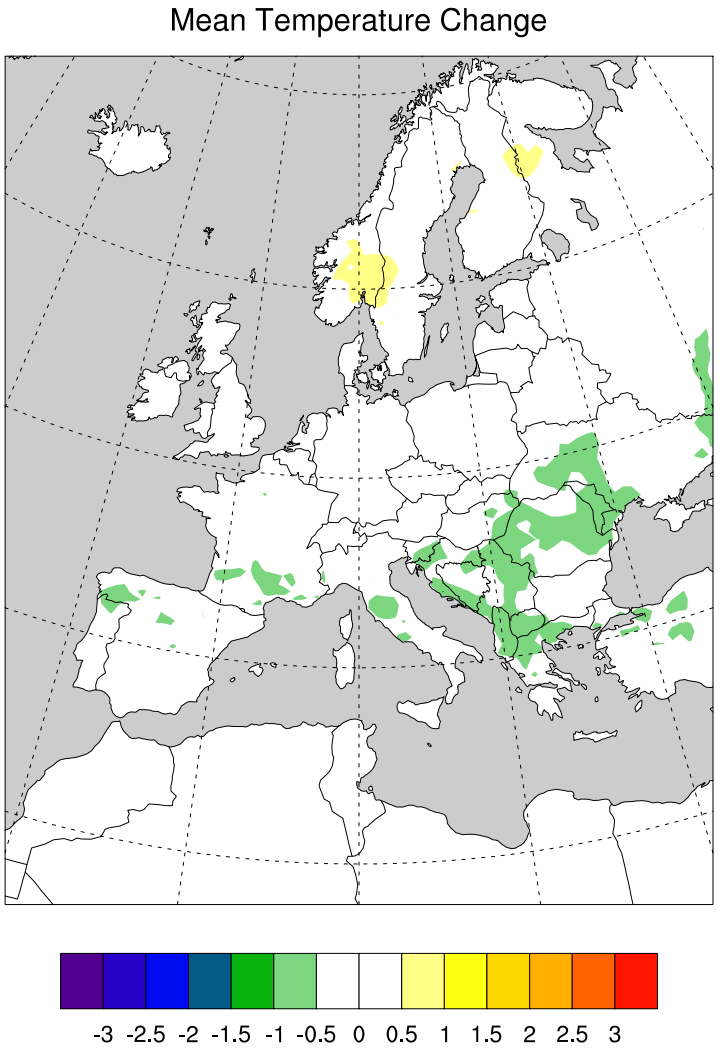


Use ISLSCP II data as driving LAI.

Effect new LAI

- Only weak effect on temperature, also on annual cycle.

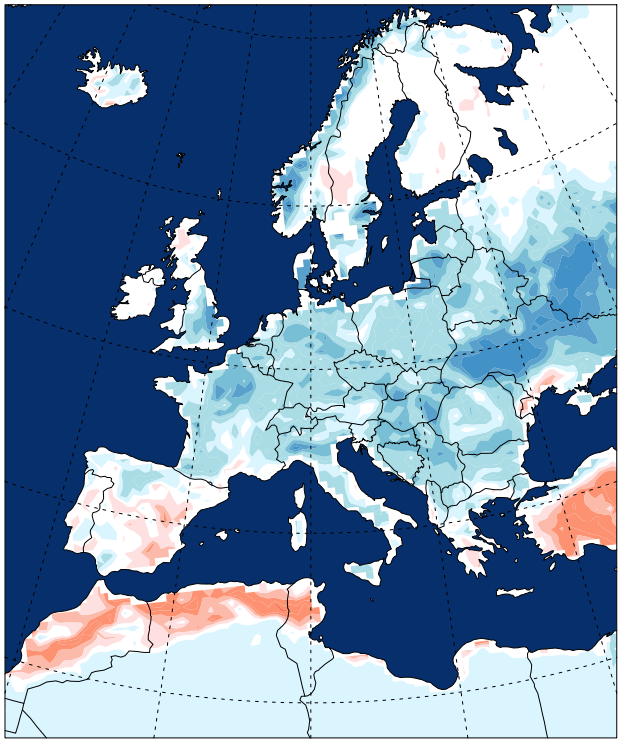
Other important external fields for Terra are plant cover (PLCOV) and root depth (ROOTDP). ISLSCPII provides alternative fields to int2lm.

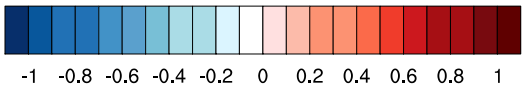


ISLSCPII PLCOV and ROOTDP

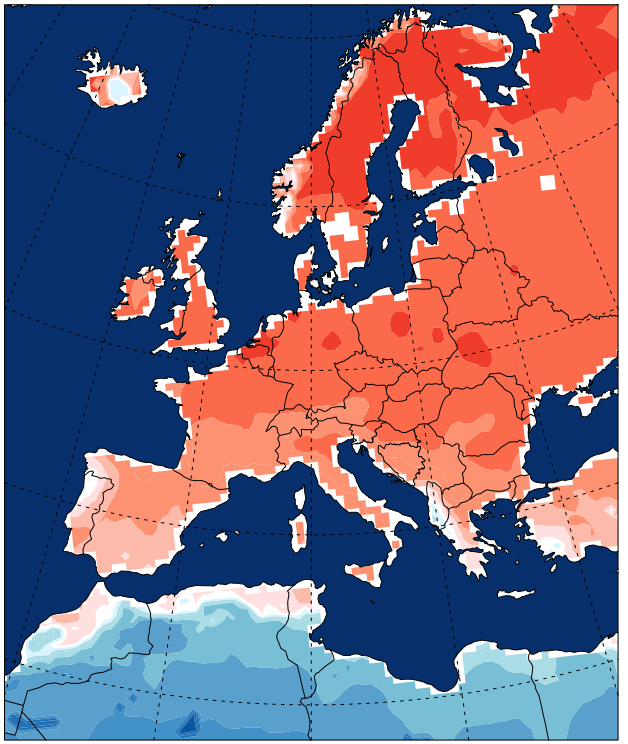
- Relevant differences between two fields.

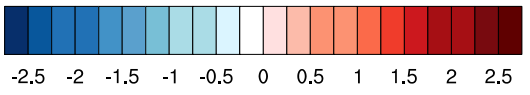
Plant cover INT2LM - ISLSCPII





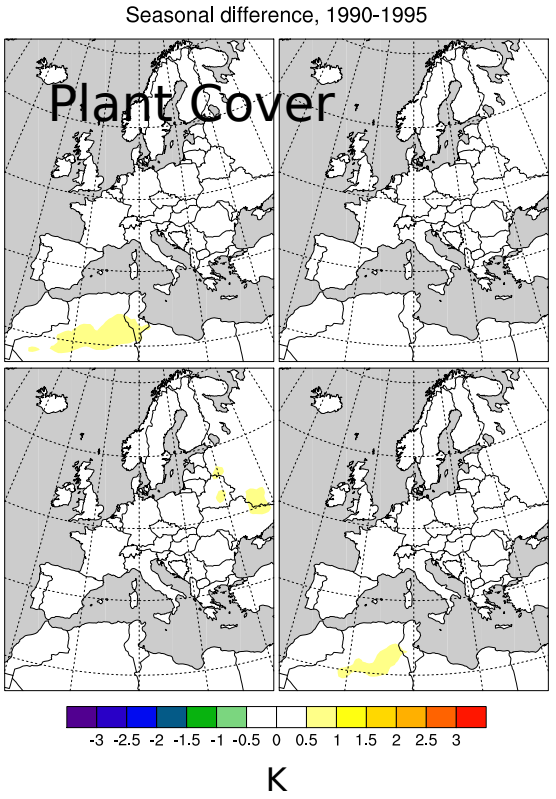
Root depth INT2LM - ISLSCPII

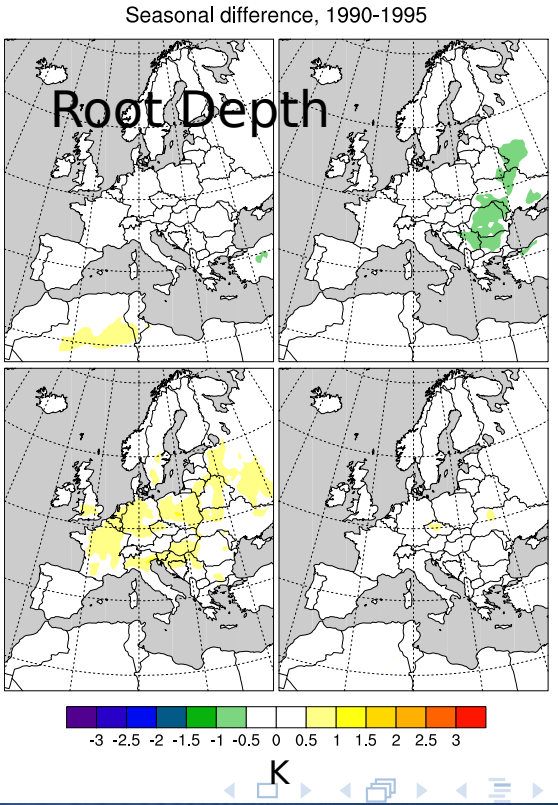




Effects of PLCOV and ROOTDP

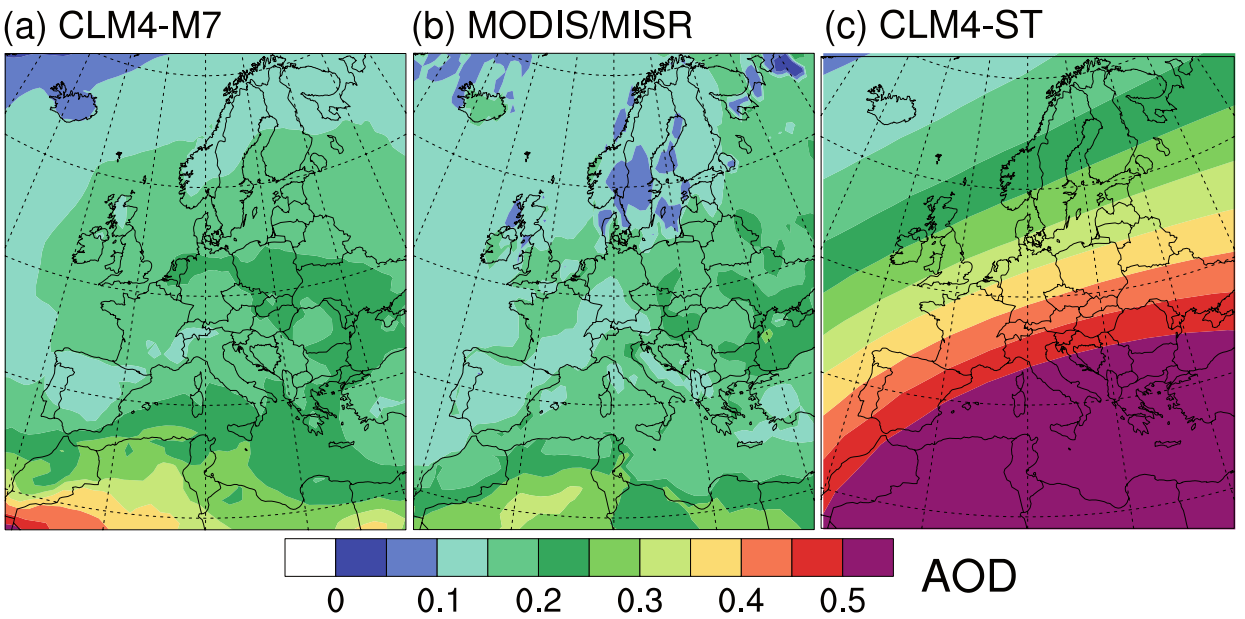
- Changes in PLCOV have a small effect.
- Shorter roots in ISLSCP lead to a warming in summer.
- Less available soil moisture and lower transpiration.





Problem Aerosol Climatology

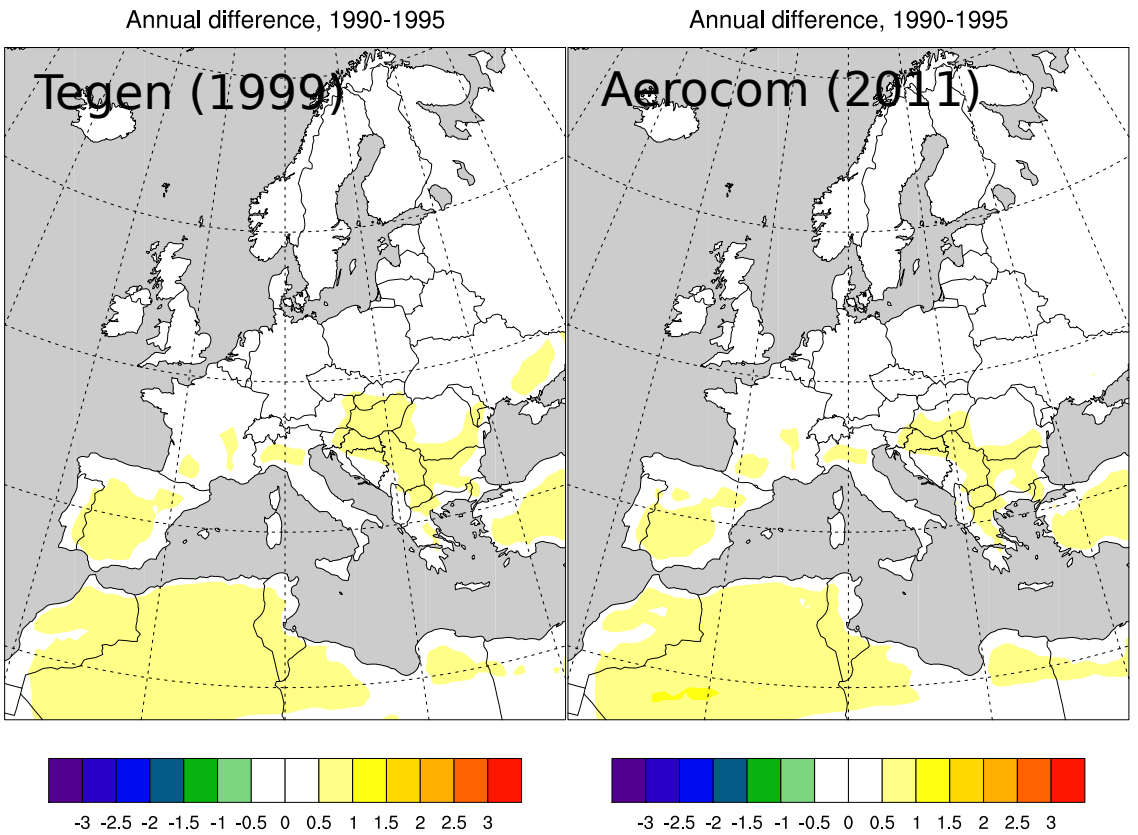
- Current climatology from Tanre (1994) very unrealistic.
- Better datasets Tegen (1999) and Aerocom (2011) available.



Climatology of aerosol optical depth (550 nm)
(a) year 2000 simulated with CLM4 coupled to complex aerosol scheme
(c) previous model version CLM4-ST uses Tanré (1984) climatology

Effect new Aerosol Climatology

- For both datasets warming over Southern Europe
- Changes in direct incoming SW radiation up to 20 W/m^2



Conclusions

- MODIS Albedo stongly improves temperature in North Africa
- Effects in North Africa do not affect European domain
- LAI provided by int2lm can deviate strongly from observations
- Effects of improved LAI from satellite data has only minor effects on temperature
- Root depth and plant cover of ISLSCPII deviate substantially from int2lm.
- Shorter roots in ISLSCPII lead to a warming in summer because of lower transpiration.