# Climate services for energy production: are regional climate models reliable for future solar power generation scenarios?



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No

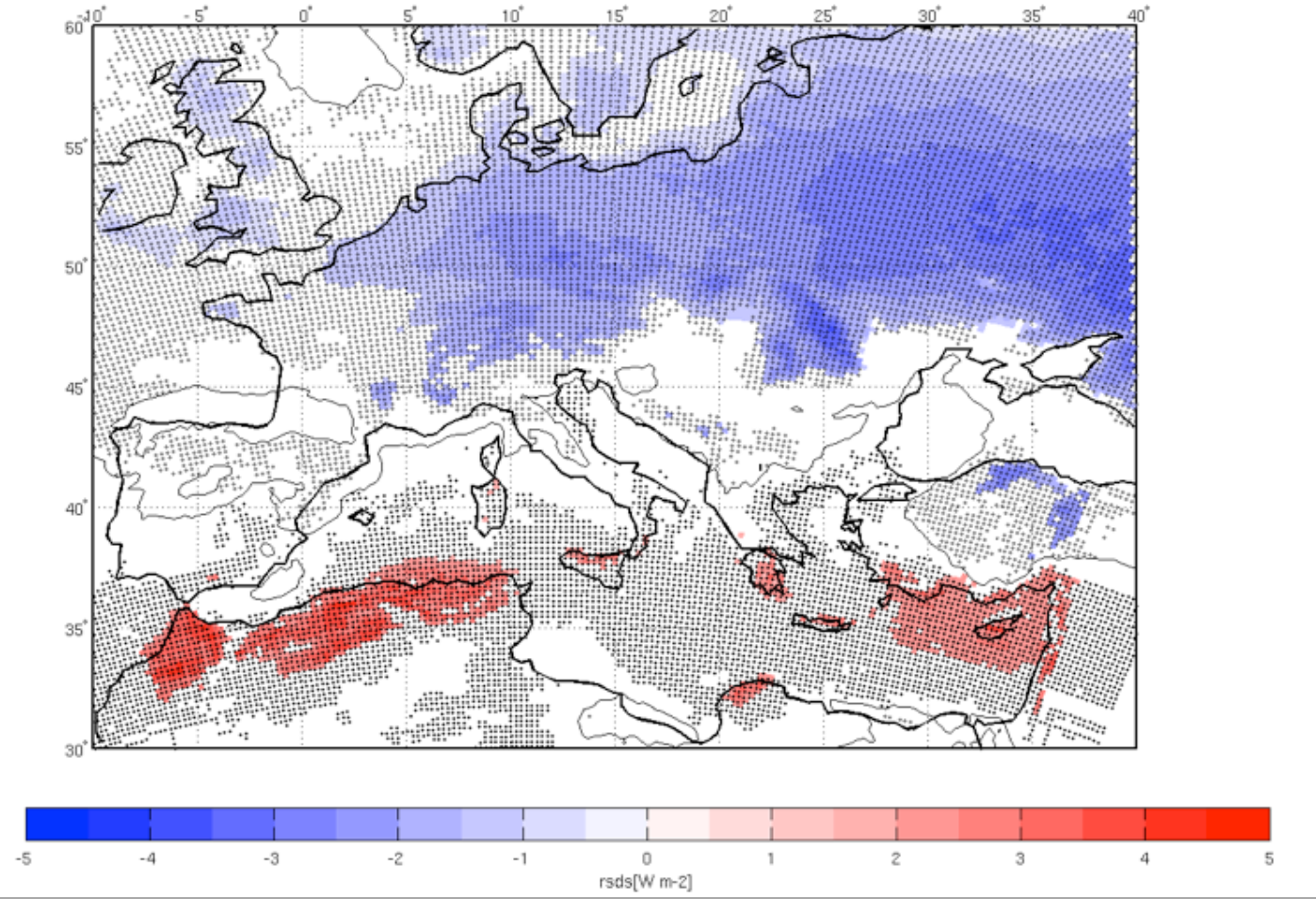
# Solar radiation data for users

- Energy production and energy efficency
- Agricolture planning
- Urban heat Island
- Hydrology
- Surface Energy Budget
- Climate

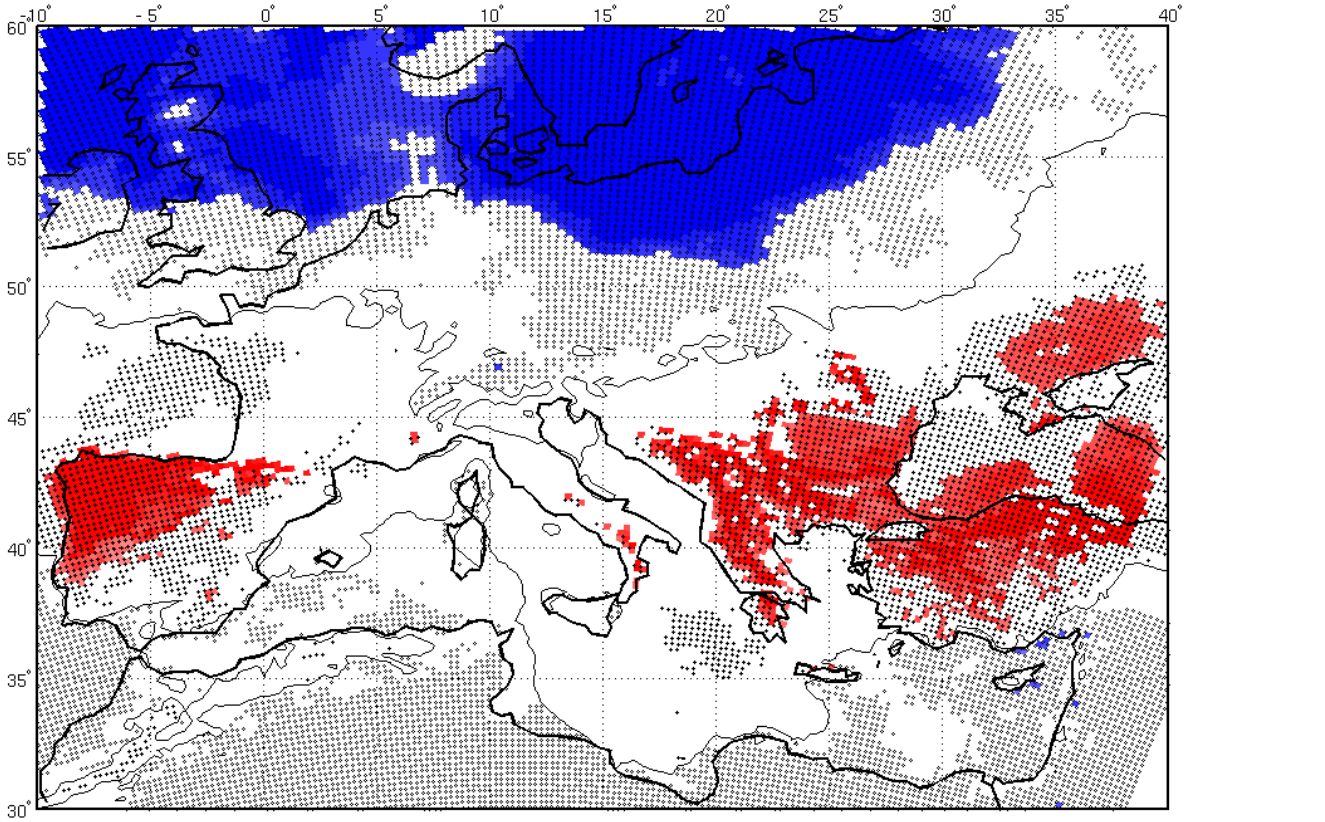
# ENSEMBLES RCMs details

| Institute | Model | # Lev | H. Res | Solar Const. | Aerosols |
|---|---|---|---|---|---|
| C4I | RCA3 | 31 | 25km | 1365 W/m$^2$ | Equivalent CO2 |
| CHMI | Aladin CY28t3 | 27 | 50km | Constant | Equivalent CO2 |
| CRNM | Aladin 4.5 | 31 | 50km | Standard | Tegen et al. 1977 |
| CRCM | OURANOS 4.2.3 | 29 | 50km-25 km | 1365 W/m$^2$ | Boucher, M. Pham (2002), JGR |
| DMI | n.a. | n.a. | 25km | n.a. | n.a. |
| ETHZ | CLM 2.4.6 | 32 | 25km | 1368 W/m$^2$ | J.F. Geleyn, ECMWF, 4.11.1982 |
| GKSS | CLM 2.4.6 | 32 | 50km | 1368 W/m$^2$ | J.F. Geleyn, ECMWF, 4.11.1982 |
| HC | HadRM3.0 | 19 | 50km 25km | 1365 W/m$^2$ | SO2 and DMS: Stott et al 2006 Oxidants: Johns et al 2003 |
| ICTP | RegCM3 | 19 | 25km | 1365 W/m$^2$ | Briegleb 1992 (JGR) |
| INM | RCA3 | 31 | | 1365 W/m$^2$ | Equivalent CO2 |
| KNMI | RACMO2.1 | 40 | 25km 50km | 1370 W/m$^2$ | four types of aerosols according to Tanré (1984) |
| MET.NO | HIRHAM2 | 31 | 25km | 1376 W/m$^2$ | aerosols from ECHAM4 (constant during 1960-2000) |
| SMHI | RCA3 | 24 | 25km 50km | 1370 W/m$^2$ | Constant |
| UCLM | PROMES | 28 | 50km | 1395.6 W/m$^2$ | Not Considered |

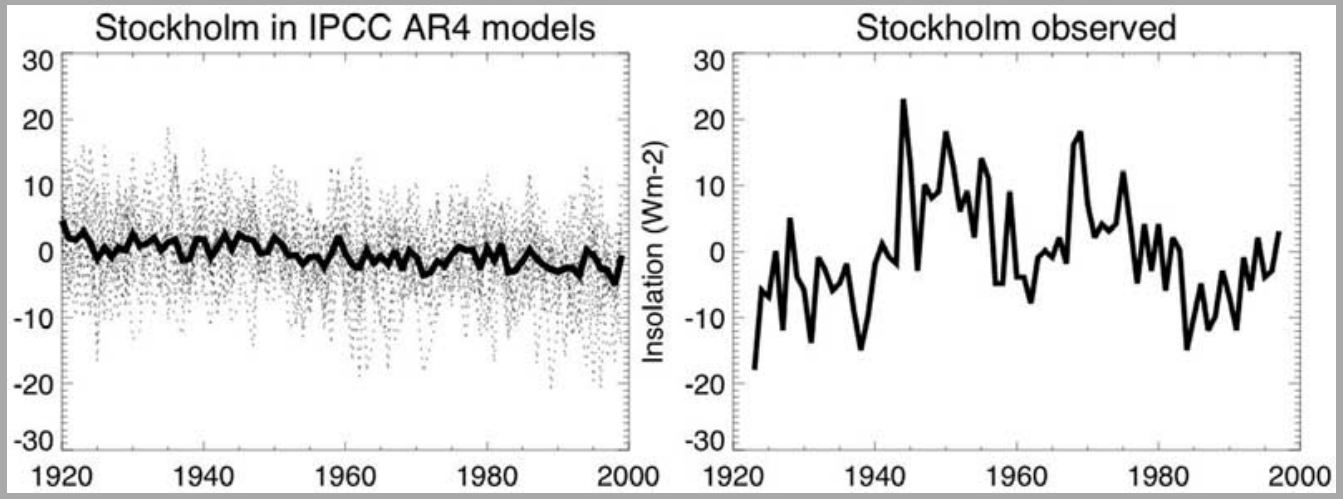
# Ensembles A1B
# DJF (2021-2050) vs (1961-1990)



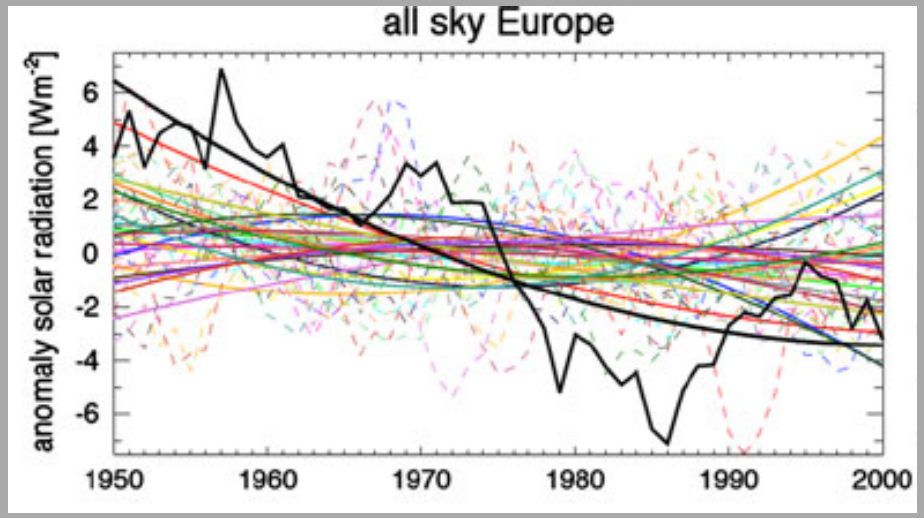
# Ensembles A1B
# JJA (2021-2050) vs (1961-1990)



# Dimming and Brightening



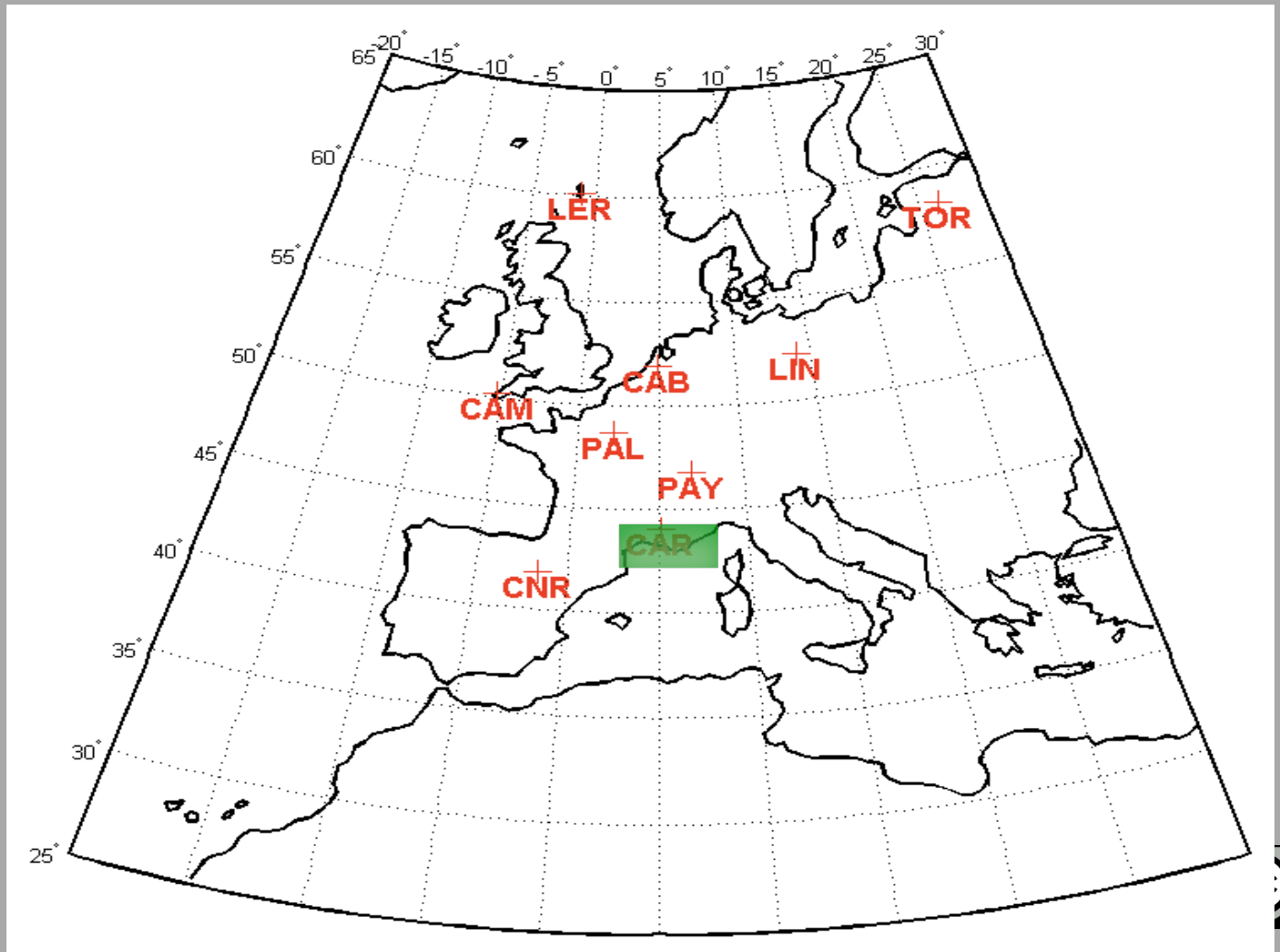

Wild, 2009: Journal Of Geophysical Research, Vol. 114, D00d11



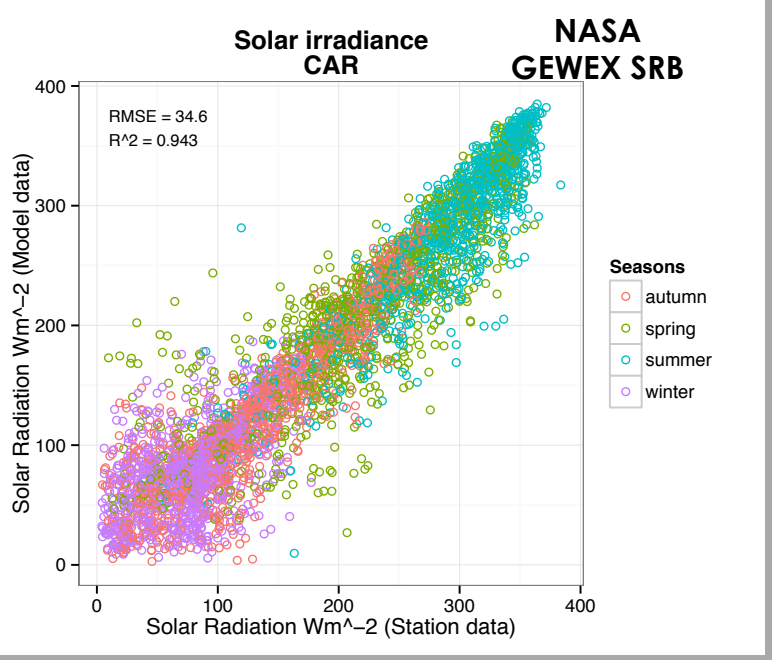

- No trends (inhability in reproduce global dimming and brighetning)
- No decadal variations

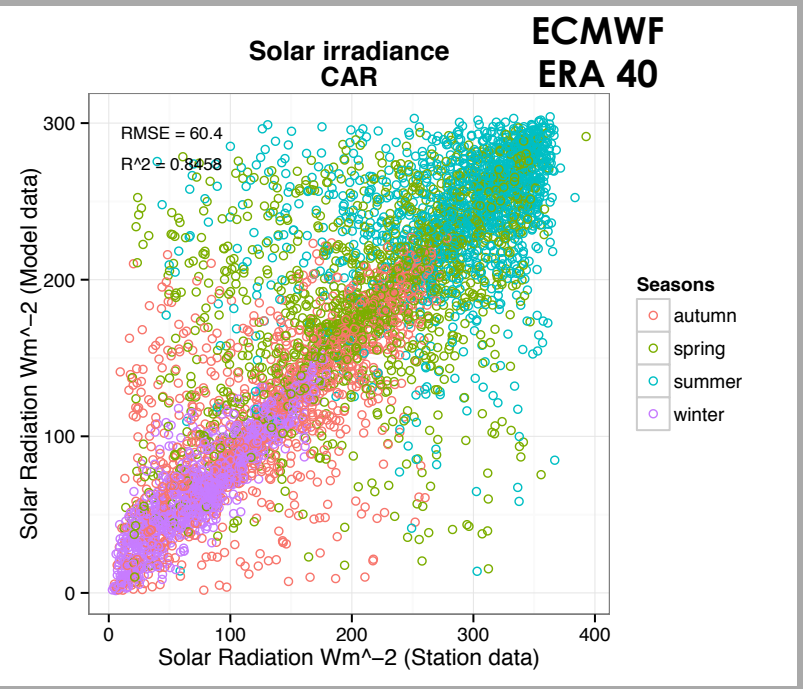
Wild et al., 2010: Clim. Dyn.

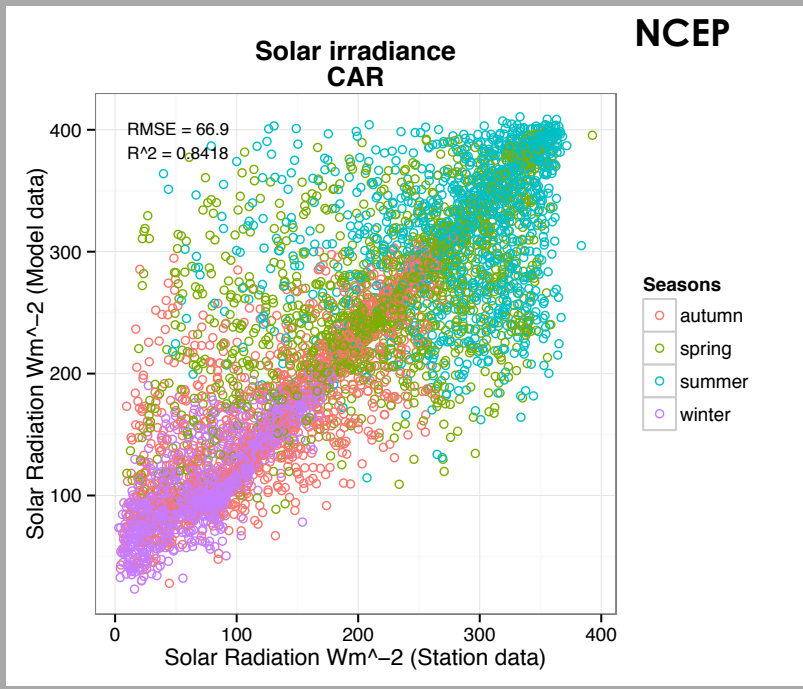
# BSRN stations used for validation



# Validation for Carpentras Station (France)



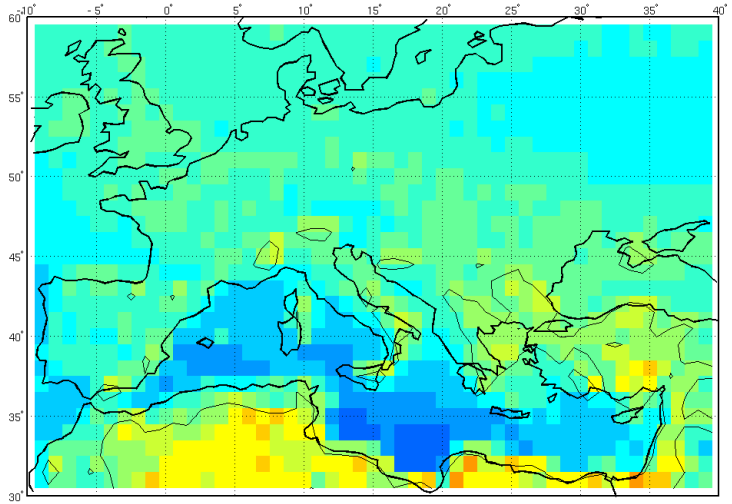



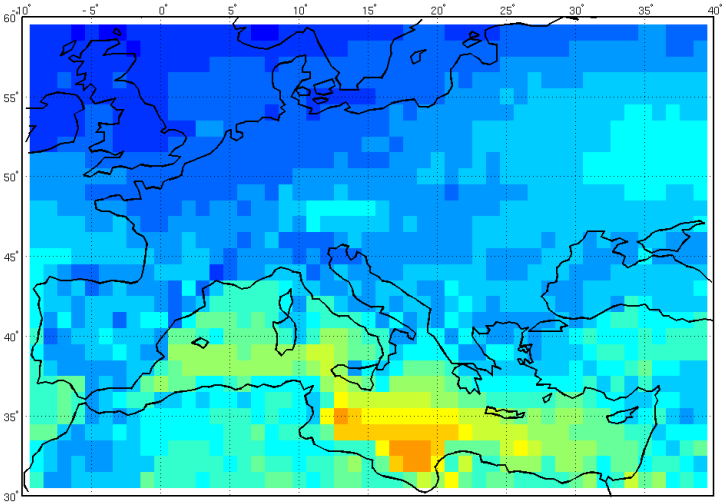
# RCMs ERA40 simulations vs NASA



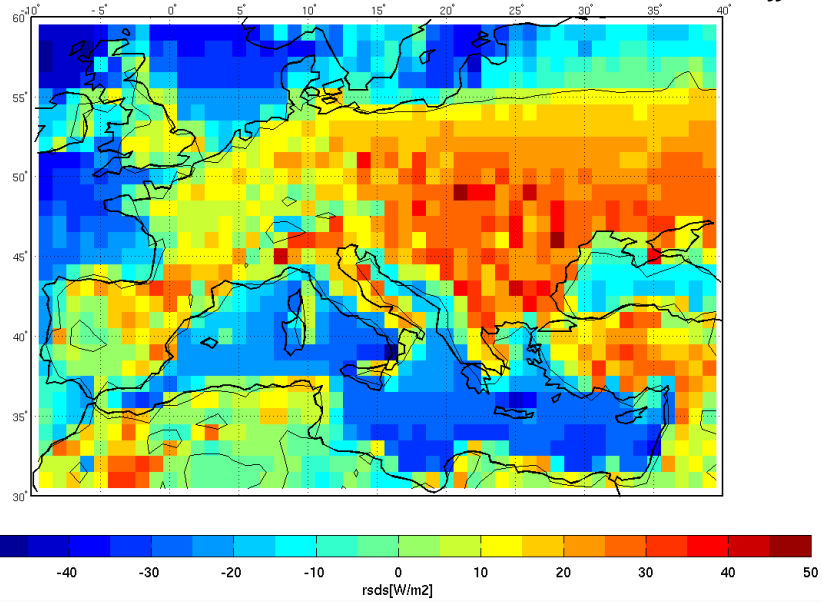
Bias ENSEMBLES RCMs ERA40 vs NASA Solar RAD; rsds DJF



RMSE ENSEMBLES RCMs ERA40 vs NASA Solar RAD; rsds DJF



Bias ENSEMBLES RCMs ERA40 vs NASA Solar RAD; rsds JJA

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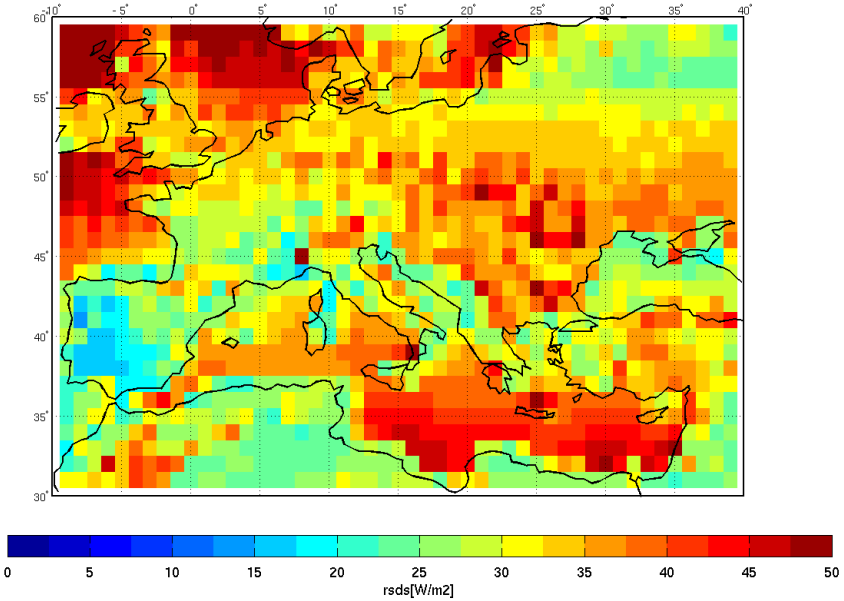

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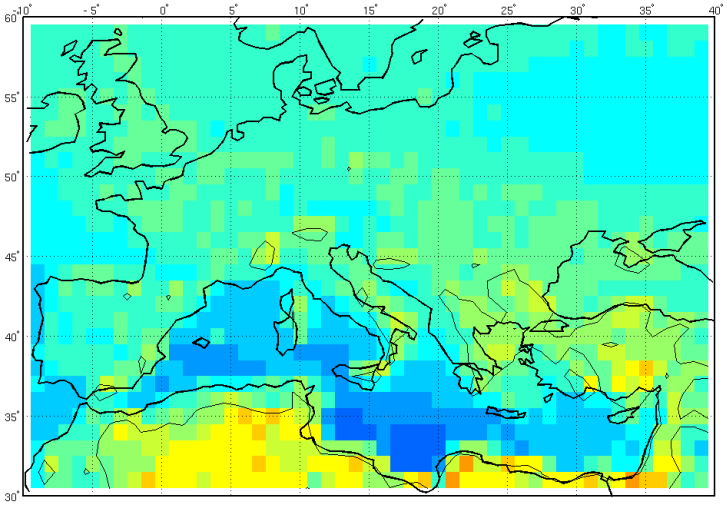

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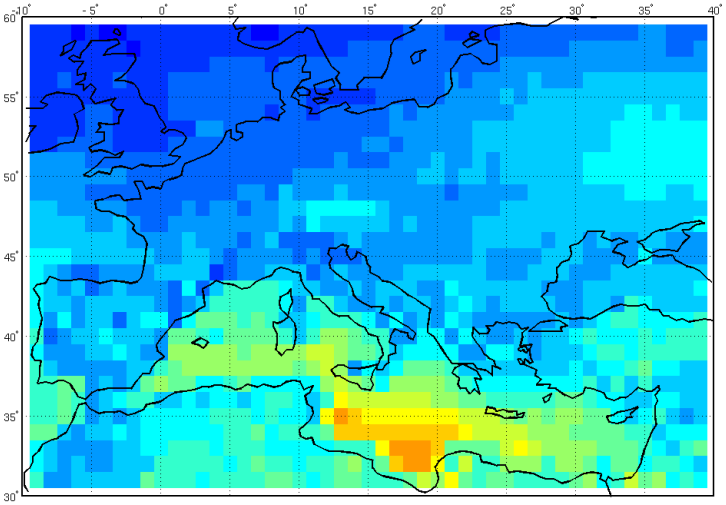

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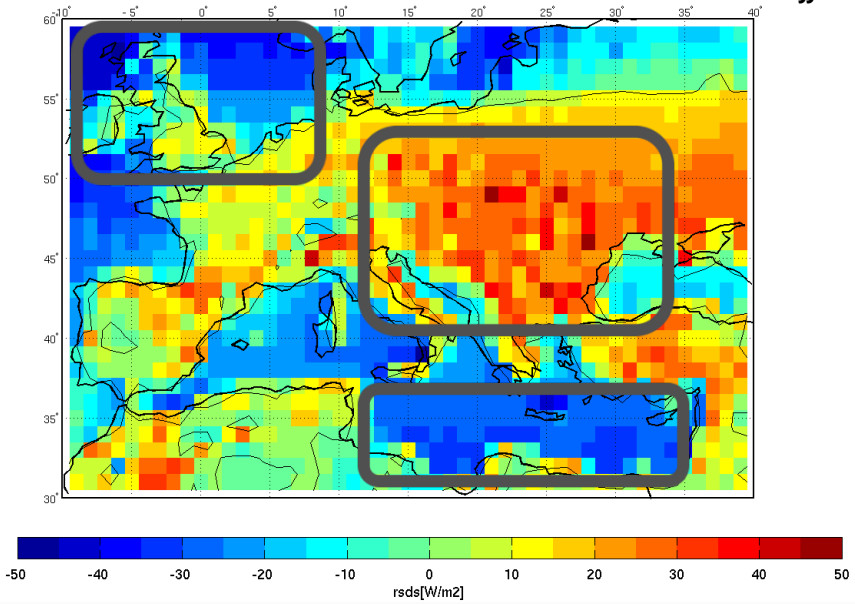


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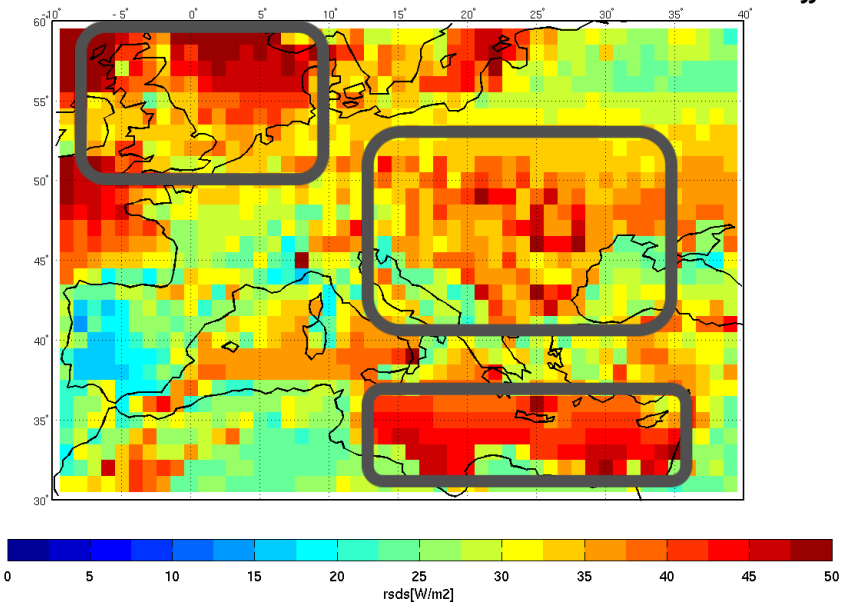
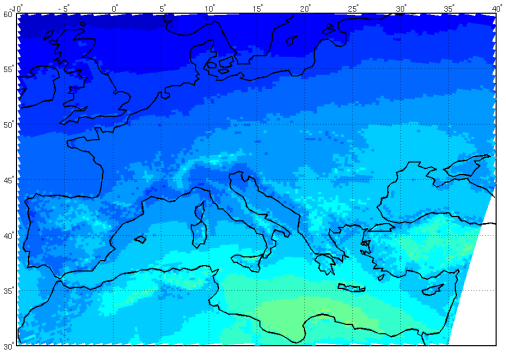


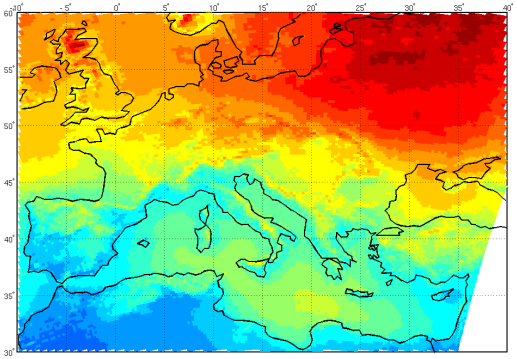
# RCMs ERA40

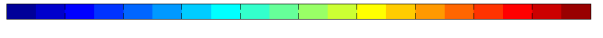


Spread ENSEMBLES model 25km
ERA40 rsds DJF 1961-2000




Relative error ENSEMBLES model
25km ERA40 rsds DJF 1961-2000






Spread ENSEMBLES model 25km
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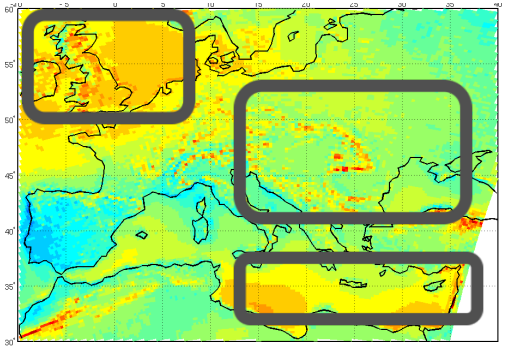


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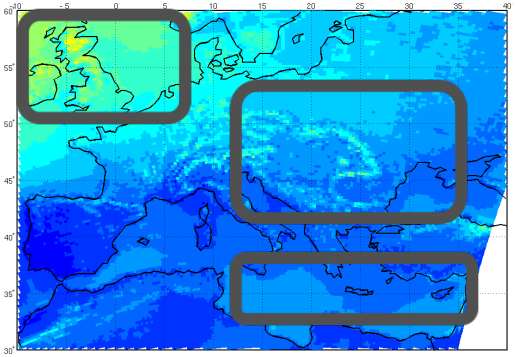

# Conclusions

- Aerosols
  - Aerosols schemes, dynamics and chemistry
  - Aerosols primary and secondary effects
- Clouds
  - Convection schemes
  - Microphysical parameterization
  - Cloud transport from the borders (nesting)

<RCM dependent>

<GCM dependent>

- Looking forward for CORDEX

# acknowledgment

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