Karlsruhe Institute of Technology

Institute of Meteorology and Climate Research
Department Troposphere Research (IMK-TRO)

Baden-Württemberg Stiftung
WIR STIFTEN ZUKUNFT

Analysis of sultriness-triggering parameters using high resolution regional climate simulations

(I) Framework: project room/climate/plaster funded by the Baden-Wuerttemberg (B-W) foundation

Climate
"How is the climate changing in south-west Germany (especially B-W) and how does it impact the indoor climate?"

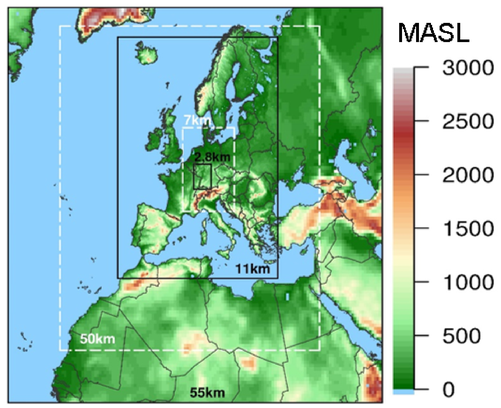
Room
"To what extent can a plaster optimise the room climate and thus avoid sultriness?"

Plaster
"Which characteristics must a plaster have to avoid too sultry indoor conditions?"

(II) Ensemble of regional climate simulations with COSMO-CLM (CCLM)

- Own simulations:

ECHAM6 RCP4.5 RCP8.5
CCLM 55 km
CCLM 11 km
CCLM 2,8 km
CCLM 2,8 km + VEG3D



- Available simulations at IMK-TRO:

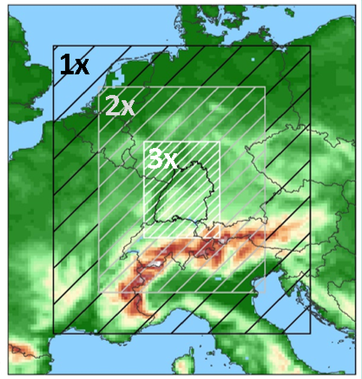
CNRM-CM5 RCP8.5 | HadGEM2-ES RCP8.5 | EC-EARTH RCP8.5 | ECHAM6 RCP8.5
CCLM 50 km
CCLM 7 km

(III.1) Large scale conditions for sultry weather in south-west Germany

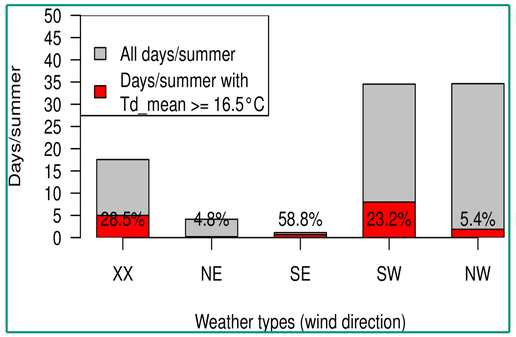
Objective weather type classification from DWD (Bissolli & Dittmann): 40 weather types compounded by:

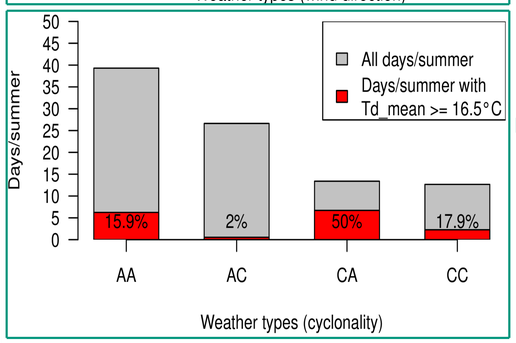
- Main wind direction in 700 hPa → XX,SW,NW,NW,SE → dd
- Cyclonality in 950 hPa and 500 hPa → cyclonal (C) or anticyclonal (A) → $c_{950}c_{500}$
- Precipitable water content between 950 hPa and 300 hPa → wet or dry→ h (not shown here)

➡ $ddc_{950}c_{500}h$



Areas with weighting factors used for the weather type classification.



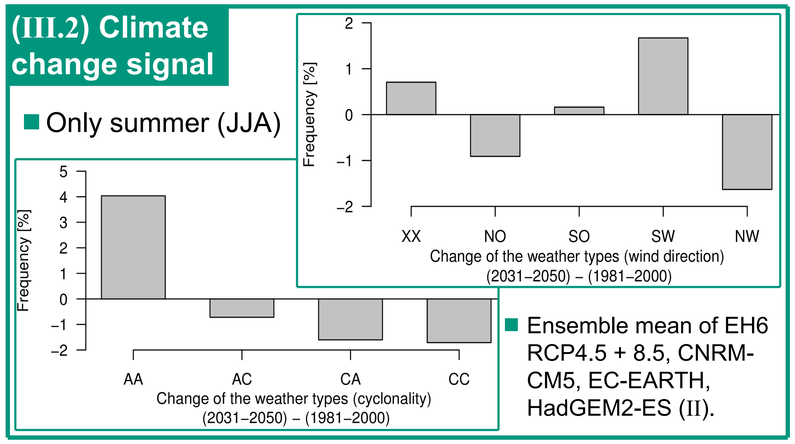


Dependence of sultry conditions in south-west Germany from weather types. CCLM 11 km; 1981-2010; forcing: ERA-Interim

- Sultry conditions are strongly dependent on the large scale flow direction and the cyclonality.
- Sultriest conditions:
  - absolute: advection from SW
  - relative: advection from SE
- Anticyclonity conditions in 500 hPa yields to sultriest conditions, primarily by cyclonality in 950 hPa.

(III.2) Climate change signal

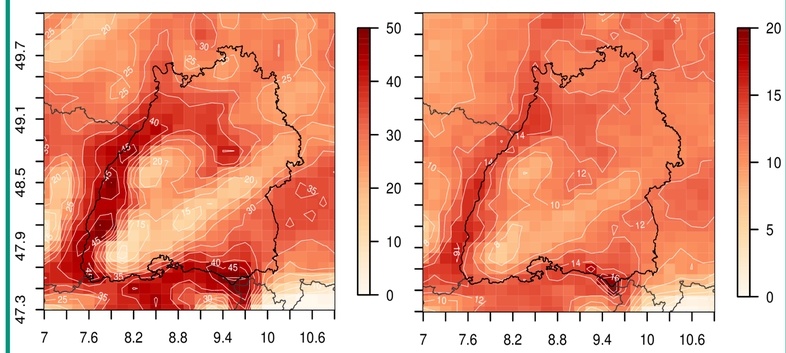
- Only summer (JJA)



- Ensemble mean of EH6 RCP4.5 + 8.5, CNRM-CM5, EC-EARTH, HadGEM2-ES (II).

(IV) Climate signal of the dew point temperature (T_d) for south-west Germany

- T_d assumed here as a proxy for sultry conditions



Left: Days/year with at least 1 hour $T_d \geq 16.5°C$. CCLM 11 km; 1981-2010; forcing: ERA-Interim. Right: The same parameter, but difference between near future (2021-2050) and reference period (1981-2010); CCLM 11km; forcing ECHAM6 RCP8.5.

(V) In progress

- Use complete ensemble instead of one simulation, for example in IV.
- Small scale processes for sultry conditions in south-west Germany (e. g. orography, local wind systems, and landuse).

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