Projecting the Regional Climate Change for East-Central France: potential impacts on Burgundy forests

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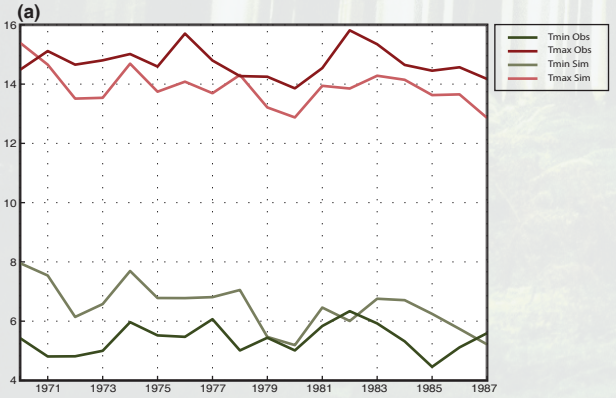
PROBLEMATICS

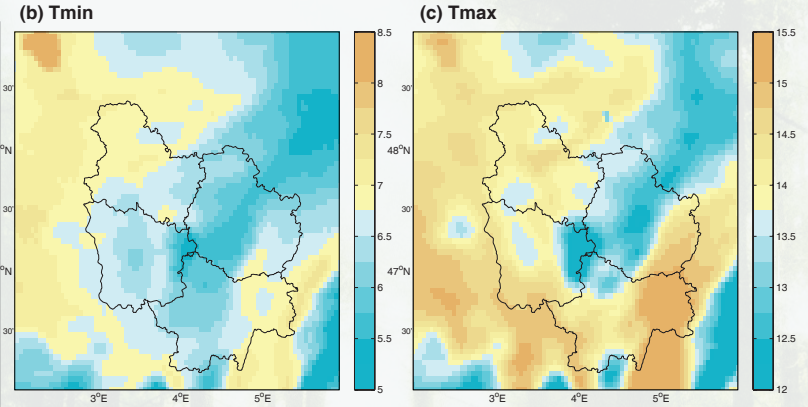
- Assess the capability of a current state-of-the-art RCM (Skamarock et al, 2008) in simulating regional effects of the climate change over Burgundy
- Quantify the performance and the biases related to the numerical downscaling of climate projections
- Asses potential climate impacts on Beech Forest on a simple surface temperature threshold

EXPERIMENTAL SETUP

- **WRF/ARW v3.0.1**, 7km horizontal resolution resampled at 5km, 28 levels, domain (45,89-48,505°N, 2,55-5,65°E)
- **Simulations:** Daily simulations from 1970 to 1987 and 2031 to 2048, after six-month spin-up.
- **Forcing Data:** AOGCM ARPEGE-CM3 simulations for SRES A2 scenario at 2,5° grid resolution, every 12h.
- **Physics parametrization** based on Xu et al. (2012) work: Kain-Fritsch convection, Yonsei Univ. PBL, Lin microphysics, Dudhia SW and RRTM LW radiation, NOAH Land Surface Model and U.S. Geological Survey land-Use/Land-Cover surface data (Loveland and Reed 2000);

MEAN CLIMATE

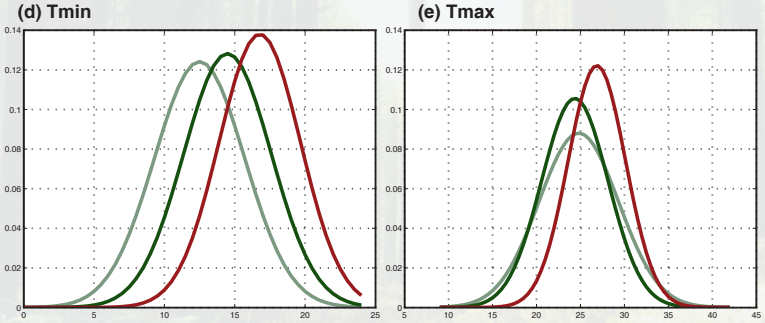




(a) Observed (Meteo-France stations) and simulated surface temperature (°C) interannual variability in regional index. (b) & (c) Simulated spatial surface temperature distribution (i. Tmin & ii. Tmax) over Burgundy.

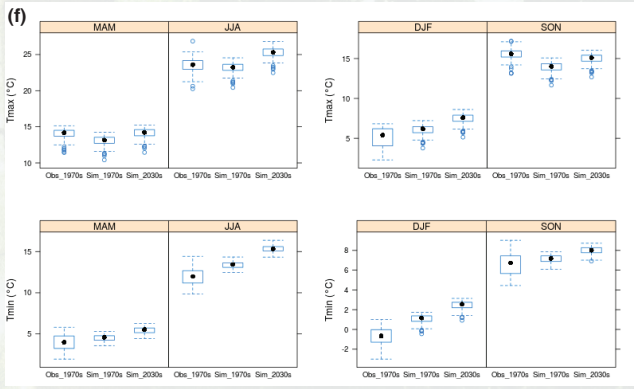
- Weak biases over Burgundy (a). Warm and cold biases beetwen Obs. and Sim. Tmin and Tmax respectively.
- Realistic simulated Tmin and Tmax geography over Burgundy (b) & (c)

CLIMATE EVOLUTION UNDER A2 SCENARIO



(d) & (e) Density of probability for i. Tmin and ii. Tmax temperatures observed (clear green curve), simulated (dark green curve) and projected (red curve).

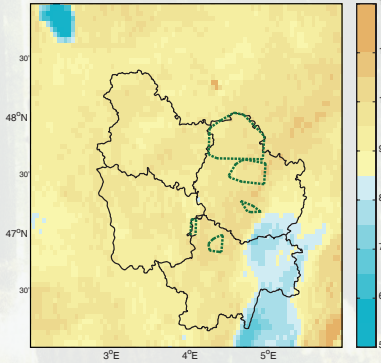
- Tmin annual distribution show a systematic bias.
- For 2030s the increase of mean annual temperature over Burgundy is ~ 2.3°C for Tmin and 2.6°C for Tmax.
- The increase is highest for the high elevations (Morvan, Chatillon's Plateau – results not shown)



(f) Box-and-whisker plots show daily surface temperatures recorded by Meteo-France stations for Obs. and the nearest point for Sim. for each seasons.

- Good reproducibility of seasonal surface temperatures (d).
- The biases are season dependent. Highest warm bias for Tmin are observed for JJA and DJF while for Tmax it is for MAM and SON;
- Increasing projected temperatures for 2031-2048 (Mainly during JJA & DJF).
- Weak predicted temperature increase during MAM and SON.

POTENTIAL EFFECTS ON BEECH FORESTS



(g) Difference between simulated 1970-1987 and projected 2031-2048 passing frequency of days with average temperatures greater than 17°C. The contour lines show the distribution of Beech forests.

- T>17° is a climatic limiting factor for common Beech (Czajkowski 2006).
- Increased of 9-10 days above 17° for the projected period which may affect significatively the potential condition for Beech development
- However such simple index is not sufficient to accurately assess the climate change vulnerability of Beech forest.

CONCLUSIONS

- Current state-of-the-art RCM have good skill in simulating surface temperatures over Burgundy.
- This suggests that ARPEGE-WRF is able to reproduce reasonably well the spatial and temporal distribution pattern of surface temperature representing regional climate trend.
- ARW/WRF is a relevant tool to downscale climate projection. Such approach is promising towards a better estimation of climate change impacts on Burgundy's forest

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