Characterization of thermal seasons and their projections in extratropical northern and southern hemisphere domains through the analysis of annual daily temperatures cycle as seen from regional climate model ensembles

EMS2016-338

Noelia López-Franca(1)*, Enrique Sánchez(2), Claudio G. Menéndez (1,3), Andrea F. Carril (1)

(1) Centro de Investigaciones del Mar y la Atmósfera, Instituto Franco-Argentino para el Estudio del Clima y sus Impactos UMI3351 IFAECI/CNRS-CONICET-UBA. Buenos Aires, Argentina
(2) Universidad de Castilla-La Mancha, Toledo, Spain
(3) Departamento de Ciencias de la Atmósfera y los Océanos (DCAO/FCEN/UBA), Buenos Aires, Argentina

*** noelia.lopezfranca@cima.fcen.uba.ar**

1. OBJECTIVE

Here we present a method to analyse the **four thermal seasons** based on the study of the function of the **annual cycle of mean daily temperature and its first derivative at any extratropical location.** With the aim to demonstrate the global applicability of the proposed method, southern South America and Europe domains are chosen.

2. METHOD

DATABASE: Annual daily temperature (Tmean) cycle of NCEP/NCAR Reanalysis 1 *(Kalnay et al. 1996; Bull. Amer. Meteor. Soc., 77, 437-470*) at 2.5º resolution for the period 1980-2010.

The method was adapted from Buinterwerf et al. 2015 (Nature Clim. Change, vol 5, issue 4, 364-368.).

1 to 2: Spring-to-Summer warming
2 to 3: Summer-to-Autumn cooling
3 to 4: Autumn-to-Winter cooling
4 to 1: Winter-to-Spring warming

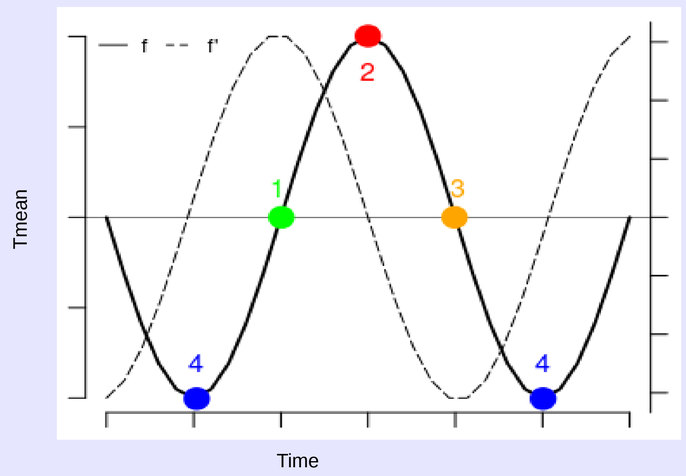

FIG. 1. Theoretical representation of the themal seasons metrics for an idealized cosine-like shape representing the annual cycle of daily temperature (f) and its first derivative (f').

3. RESULTS

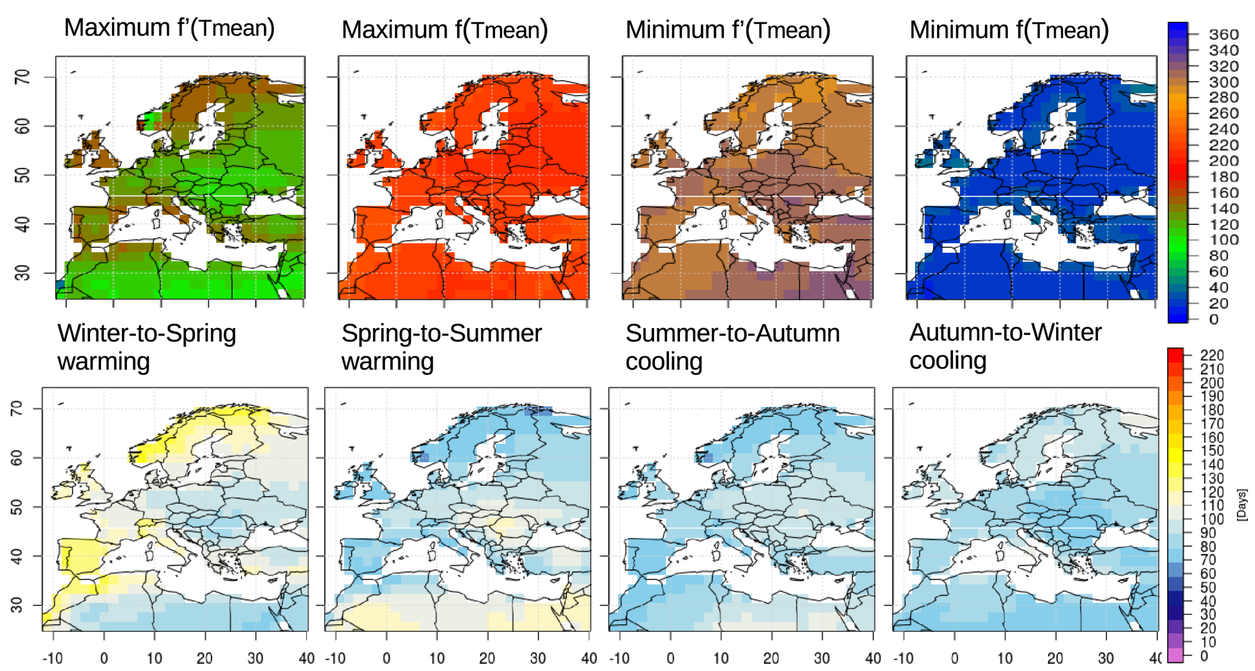

FIG. 2. Thermal seasons metrics (top row) and warming/cooling period of seasons (bottom row) for NCEP-NCAR1 European (EUR) domain at 1980-2010 period.

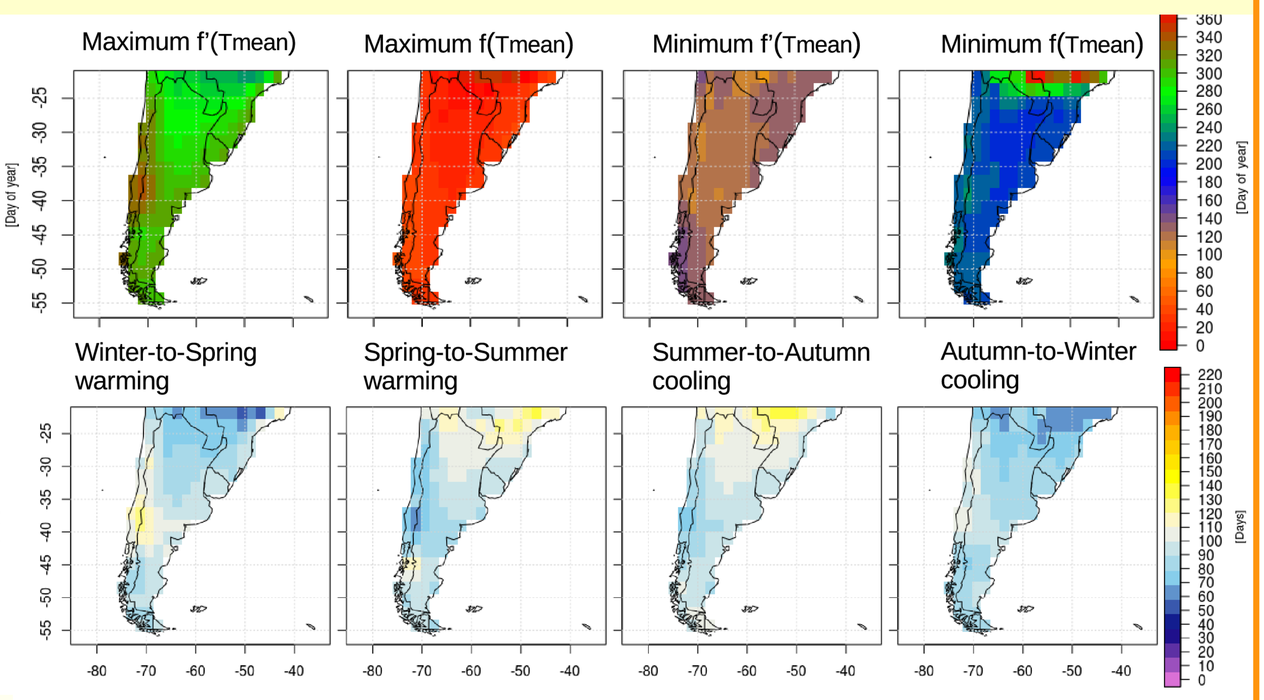

FIG. 3. As Fig. 1 but for southern of South America (SSA) domain.

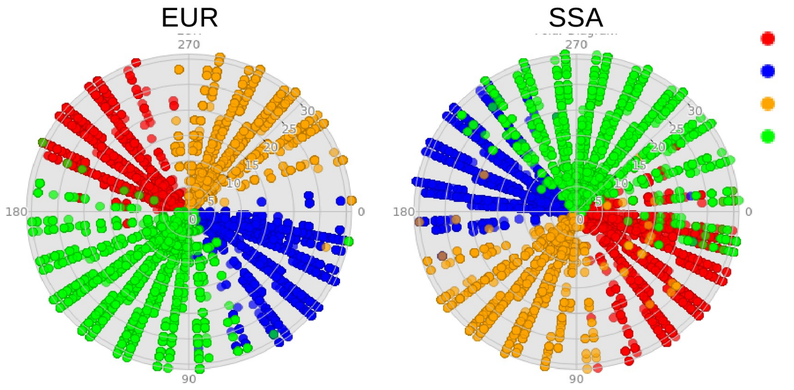

FIG. 4. Polar diagrams for European and southern of South America domains (right and left) representing the thermal seasons metrics for each grid point (colored points). The radial distance is the year and the azimuthal angle describes the day of the year of each metric.

- **The proposed method seems to be suitable for different extratropical regions and quite robust for a very large domain on both hemispheres, despite the large differences in absolute values of temperature and ranges present on those regions.**
- **The four warming/cooling periods of thermal seasons are clearly distinguisable along the year lasting around 90 days.**
- **The spatial patterns of the days of occurrence of maximum and minimum of f'(Tmean) are more homogeneus than the metrics related with intermediate thermal seasons (FIG. 2 & 3). This fact also can be extracted from the grouping of points in the polar diagrams (FIG. 4). These results are in agreement with *López-Franca et al. (2013; Theor. Appl. Climatol., 114(3-4), 635-642.)* for Iberian Peninsula where a method based on local percentile thresholds of temperature was proposed.**

4. CURRENT ONGOING WORK

- The proposed methodology will be applied to ensembles of RCMs. This would allow us to see their capability to reproduce the observational behaviour obtained by the reanalysis. Then, the projected changes of these models on regional scales for future climate conditions seem to be another challenging focus of this work.

- Among the many features that could be studied based on the proposed method, one quite interesting could be the temporal trends. It would allow to identify how climate change could to modify subperiods on the thermal annual cycle in a homegeneous or heterogeneous way in time and space.

- As the proposed method is based on *Buinterwerf et al. 2015,* who determines the growing season from satellite data, the study of relation with phenological features is also another promising future focus of this work.