ATLANTIC MULTIDECADAL OSCILLATION MODULATION ON TEMPERATURE EXTREMES IN ARGENTINA

Barrucand, M [1,2] ; Rusticucci, M [1,2] ; Collazo, S [1]

[1] Departamento de Ciencias de la Atmósfera y los Océanos – Facultad de Ciencias Exactas y Naturales – Universidad de Buenos Aires (DCAO-FCEN-UBA)
[2] Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)

In this work the influence of AMO over temperature extremes at central Argentina is analyzed. Probability function distribution of TN10 (cold nights), TN90 (warm nights), TX10 (cold days) and TX90 (warm days) are compared for those months affected by El Niño and cold or warm AMO phases among an extended winter season (June to September). The same analysis was performed for La Niña events.

Introduction

- The AMO has affected air temperatures and rainfall over much of the Northern Hemisphere.
- Recent studies show that AMO modifies the ENSO influence on the South American rainfall (Kayano and Capistrano, 2014)
- In this work, this influence is analyzed in relation to temperature extremes in central Argentina.

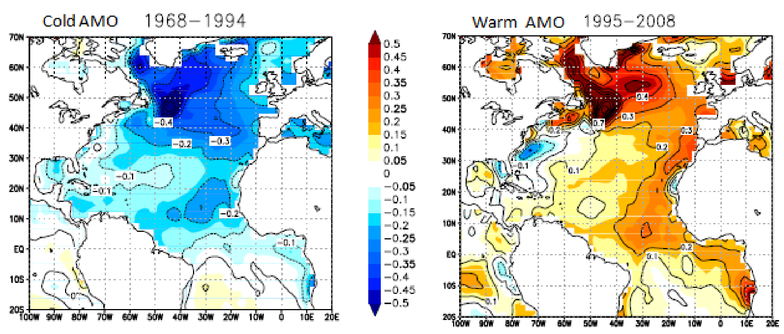

Figure 1: sea surface temperature anomalies for the periods 1968-1994 (cold AMO) and 1995-2008 (warm AMO) (Alexander et al 2013)

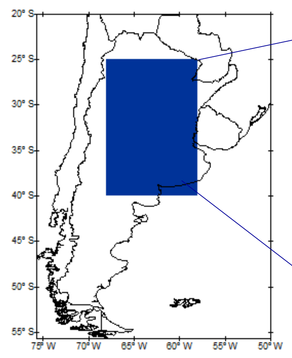

Figure 2: map of the studied area

Data and methodology

- ✓ **Data:** Daily maximum and minimum temperature of 23 stations located at the Central Region of Argentina
- ✓ **Source:** Servicio Meteorológico Nacional (SMN) and Instituto Nacional de Tecnología Agropecuaria (INTA).
- ✓ **Period:** 1979-2010

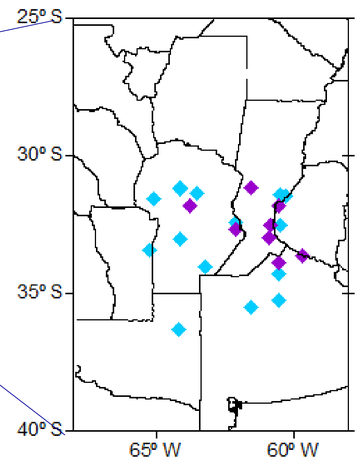

Figure 3: stations analyzed. SMN (light blue) and INTA (violet) stations.

- ✓ Four temperature extreme indices

TN 10 (Cold Nights) TN 90 (Warm Nights)
TX10 (Cold Days) TX 90 (Warm Days)

were calculated for a 1981-2010 base period

- ✓ Those year under EL Niño / La Niña conditions and cold and warm AMO phases were selected.

Table I: Onset years of the ENSO extrmes stratified according to the AMO phases.

	El Niño	La Niña
Warm AMO	2002, 2003, 2004	1999
Cold AMO	1982, 1986, 1991	1984, 1988

Results

El Niño

Under El Niño conditions…

- In general, all months show **lower (higher) frequency of cold nights, under cold (warm) AMO conditions**, except August.
- Note that under warm AMO phase, large differences are observed in June in relation with the expected climatological values.
- With respect to warm nights, **higher (lower) frequencies are observed under the cold (warm) AMO phase in June and September.**

Regarding the frequencies of cold and warm days, TX 10 and TX90 **don't exhibit significant differences considering both phases of AMO.**

In the case of TX 10, opposite behaviour is observed in August and September: more cold days are observed during the warm (cold) phase of the AMO in August (September).

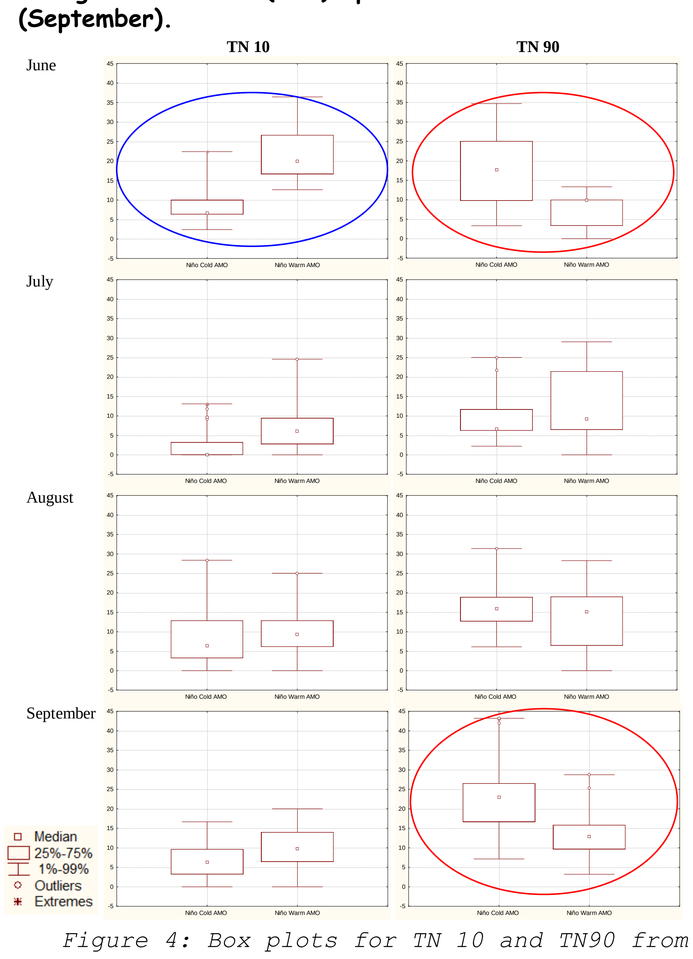

Figure 4: Box plots for TN 10 and TN90 from June to September under El Niño conditions

La Niña

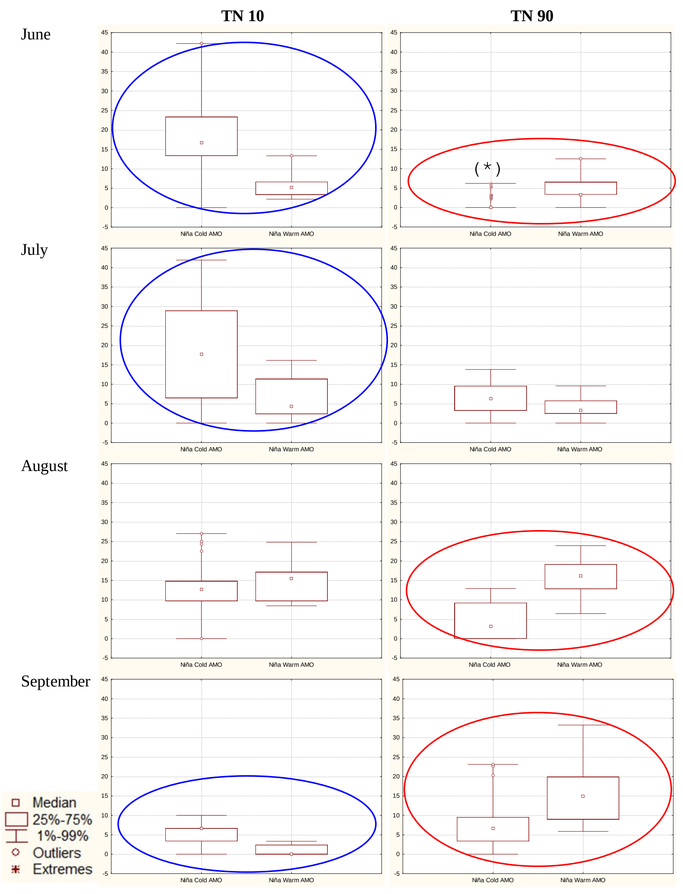

Figure 5: Idem fig. 4, but for La Niña conditions

(*) 78% of cases are null

Under La Niña conditions…

Cold nights appear to be **diminished under warm AMO,** except for August, which exhibits similar conditions at both phases.

When warm nights are analyzed, higher (lower) frequencies are observed during warm (cold) AMO phase, except for July.

There are not significant differences on cold days frequencies when both AMO phases are analyzed. Only September presents clear differences, with a diminution of TX10 during the warm AMO phase (fig 6).

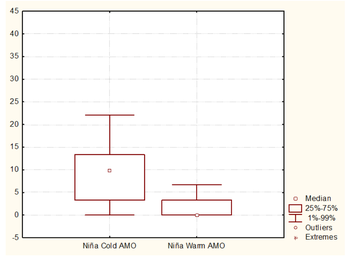

Figure 6: idem fig. 5, but for TX10 (September)

Finally, under La Niña conditions, **lower (higher) frequency of warm days during the cold (warm) AMO phase** can be observed, specially at August and September. The major difference between phases occurs in August as in the case of the warm nights.

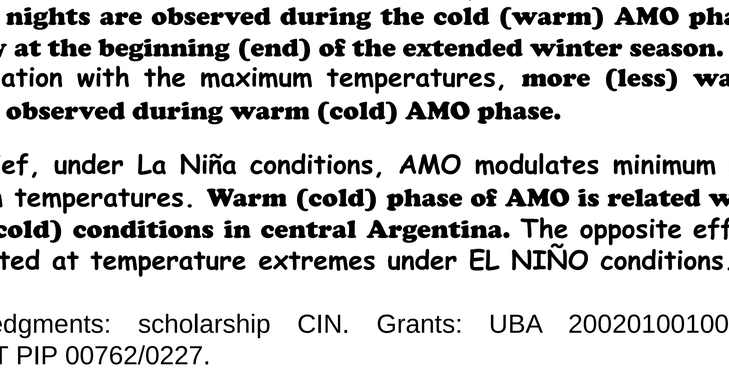

Figure 7: Box plots for TX 90 for August (left) and September (right), under La Niña conditions

Summary and conclusions

- ✓ In this work, the influence of AMO over temperature extremes at central Argentina is analyzed for both ENSO phases
- ✓ During El Niño conditions, AMO modulates temperature indices related with minimum temperatures (TN 10 and TN 90), especially in the beginning and the end of the extended winter season. **More cold (warm) nights are observed during the warm (cold) AMO phase.**
- ✓ During La Niña conditions, AMO modulates temperature indices related with minimum and maximum temperatures. **More cold (warm) nights are observed during the cold (warm) AMO phase, specially at the beginning (end) of the extended winter season.**
- ✓ In relation with the maximum temperatures, **more (less) warm days are observed during warm (cold) AMO phase.**
- ✓ In brief, under La Niña conditions, AMO modulates minimum and maximum temperatures. **Warm (cold) phase of AMO is related with warm (cold) conditions in central Argentina.** The opposite effect is reflected at temperature extremes under EL NIÑO conditions.

Acknowledgments: scholarship CIN. Grants: UBA 20020100100789 CONICET PIP 00762/0227.

References

Alexander, M.A., et al., Climate variability during warm and cold phases of the Atlantic Multidecadal Oscillation (AMO) 1871–2008, J. Mar. Syst. (2013)

Kayano, MT and Capistrano VB. How the Atlantic multidecadal oscillation (AMO) modifies the ENSO influence on the South American rainfall Int J Clim .Vol 34, Issue 1, January 2014, Pages 162-178

* Correspondence to: Mariana Barrucand, Departamento de Ciencias de la Atmosfera y los Océanos, FCEN, Universidad de Buenos Aires, Buenos Aires, Argentina. E-mail: barrucand@at.fcen.uba.ar