

A study about the linearity of trends between extreme and mean temperatures in Argentina

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Objective

Evaluate and quantify the quarters with the greatest relationship between extreme and mean temperature.

Introduction

- Global mean temperature has increased 0.85°C from 1880 to 2012 (IPCC, 2013).
- In summer (DJF), mean temperature is more sensitive to temperature extremes than in winter (JJA) during 1959 - 2008. Moreover, the increase in mean temperature (in summer) is strongly related to the increase in warm days and nights (more than with the decrease in cold days and nights) during 1959 - 2008 (Rusticucci and Barrucand (2004).

Data

- Daily minimum and maximum temperatures for the 1977–2017 period.
- Two monthly extreme temperature indices were calculated on a monthly basis: **Cold nights (TN10)** and **Warm days (TX90)**.

Methodology

- The relationship between the linear trends of extremes and mean temperature (T) on a seasonal basis (JFM, AMJ, JAS, and OND) was evaluated. (statistical significance → Student's T-test at 5%).

Results

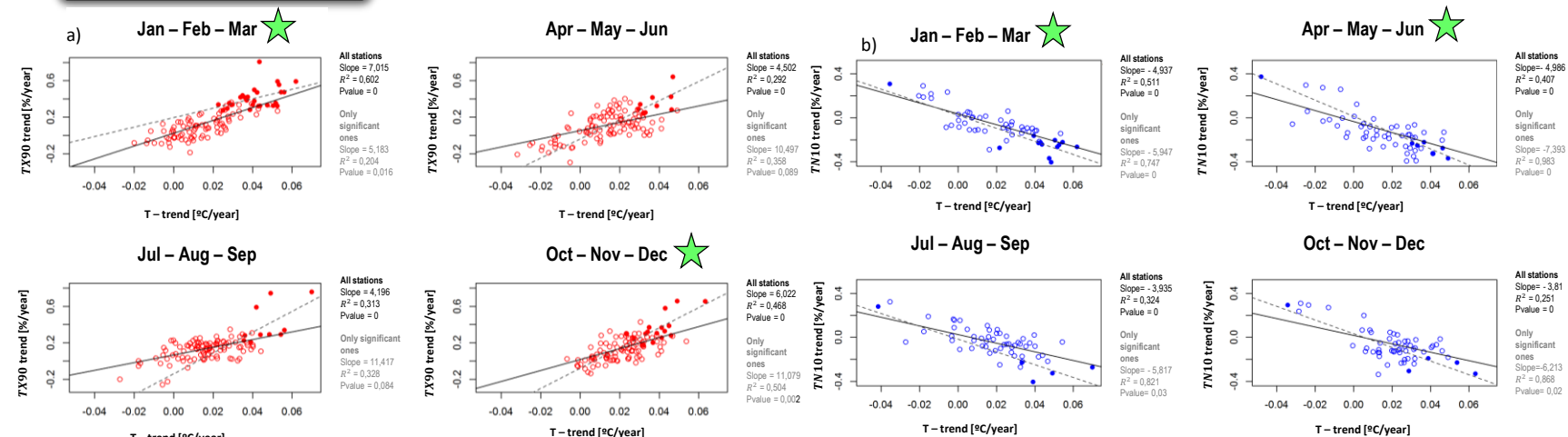


Figure 2: Quarterly scatter plots for the period 1977-2017 between a) TX90 trend and mean temperature trend (T - trend) and b) TN10 and T - trend. The linear regression calculated with all station points (filled line) and the linear regression calculated only with the stations that presented significant trends in both variables (dotted line) with a 95% confidence level are distinguished.

Discussion and conclusions

- ✓ Positive (negative) and significant linear regressions were found between TX90 (TN10) trends and mean temperature trends (T-trend) for the four studied seasons.
- ✓ JFM was the one with the highest coefficient of determination → **60.2% (51.1%)** of the TX90 (TN10) trend could be explained as a function of the T-trend by a linear regression.
- ✓ The warm semester (JFM and OND) presented a **greater linear relationship between TX90 trend and T-trend** during the period 1977 – 2017 than the other ones. → in the JFM (OND) quarter, the TX90 index increased by 7.02 (6.02) % of days each with a 1 °C increase in the mean temperature.
- ✓ The first semester (JFM and AMJ) presented a **greater linear relationship between TN10 trend and T-trend** during the period 1977 – 2017 than the other ones → the TN10 index decreased by 4.94 (and 4.99) % of days from a 1°C increase in the mean temperature for the JFM (AMJ) quarter
- ✓ Uneven behavior between hot and cold extremes and the mean temperature.

References:

- IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
- Rusticucci, M., & Barrucand, M. 2004. Observed trends and changes in temperature extremes over Argentina. Journal of Climate, 17(20), 4099–4107. <https://doi.org/10.1175/1520-0442>

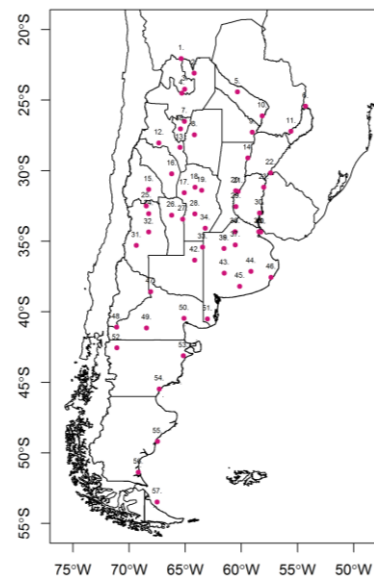


Figure 1: Spatial distribution of the meteorological stations used.