Long-term variability of heat waves in Argentina and recurrence probability of the severe 2008 heat wave in Buenos Aires

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Motivation

Heat waves are one of the main concerns related to the impacts of climate change and their frequency and severity are projected to increase in a future climate.

The objective of this work is to study the long-term variability in the occurrence of heat waves over Argentina, and to estimate recurrence probability of the most severe heat wave in Buenos Aires (observed in 2008).

HEAT WAVE: we consider spells of >3 days, for the October-March period
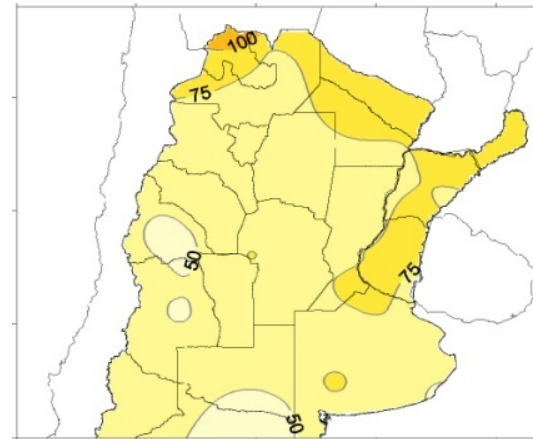
1) with MAXIMUM temperature above the (1961-90) 90th cuantile (MAXTHW),

2) minimum temperature above the 90th cuantile (MinTHW), and

3) both MAXIMUM and minimum temperatures above the corresponding 90th cuantiles (Extreme HeatWave).

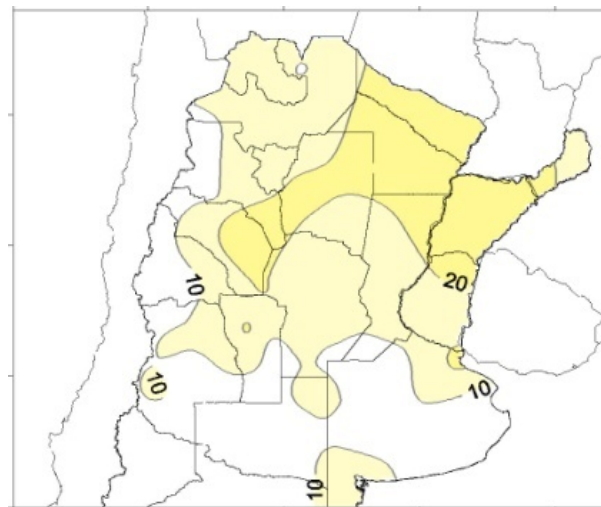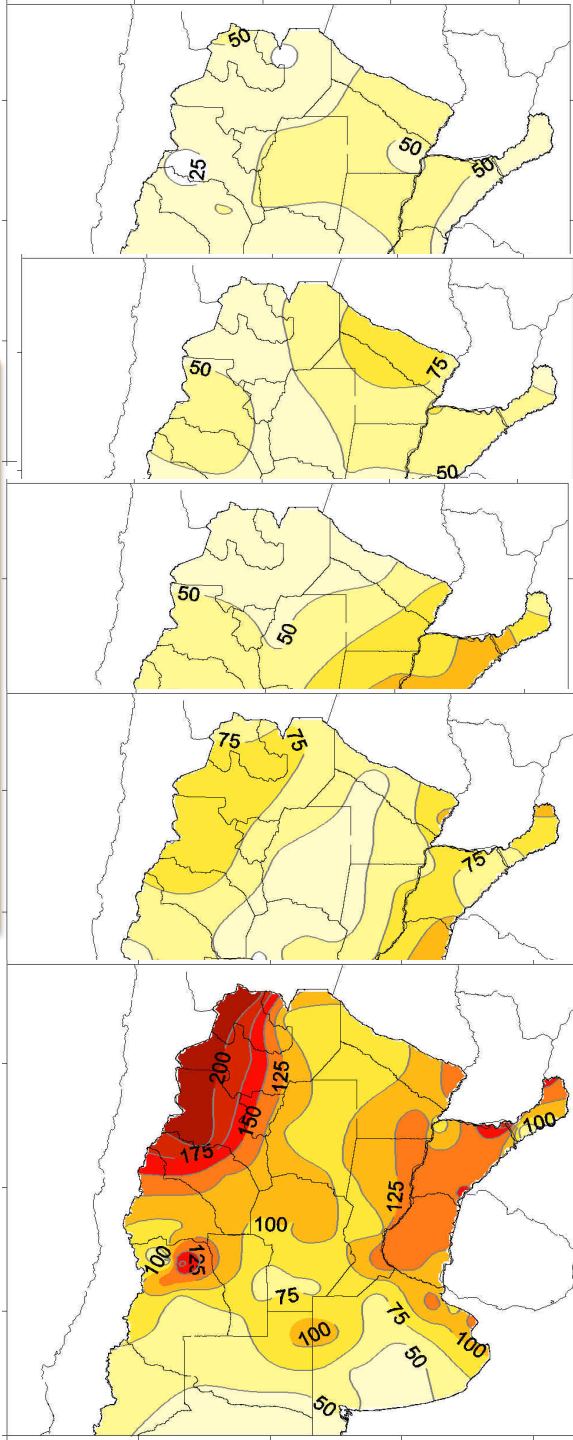# Mean number of days under a heat wave per decade
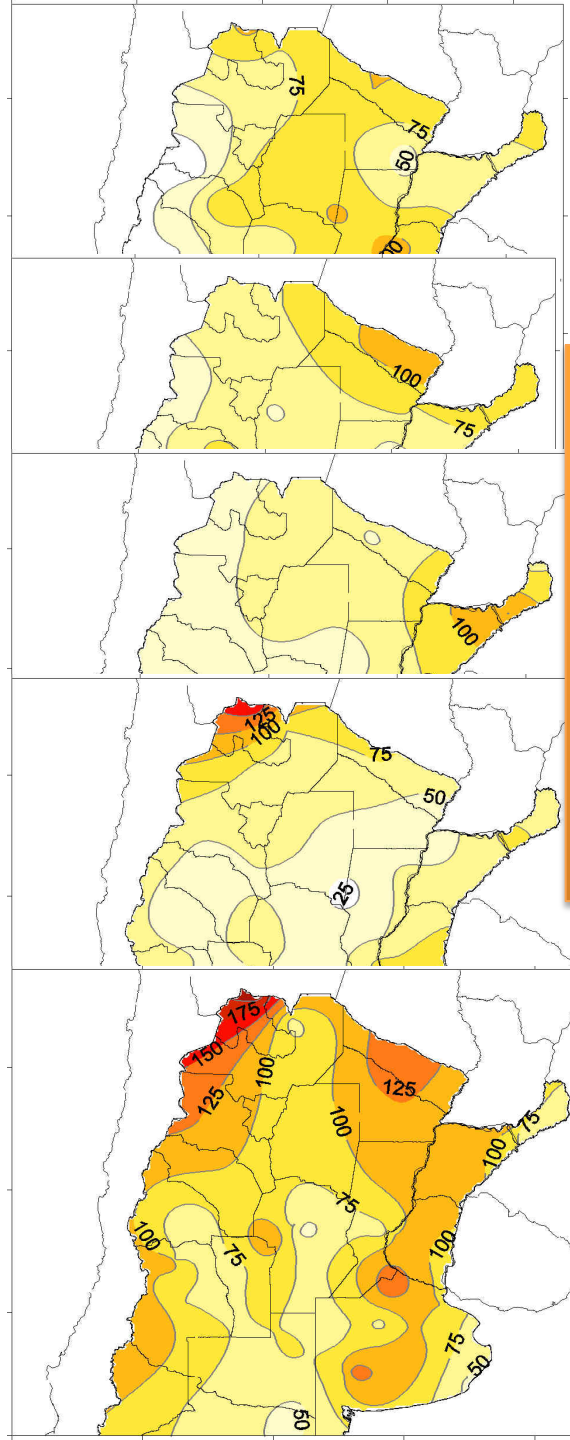

MinTHW,
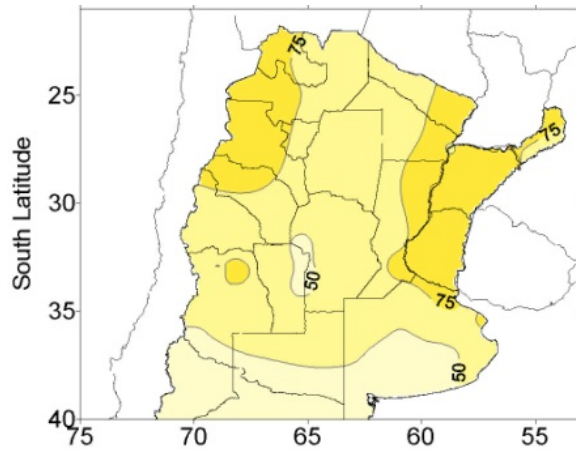
MaxTHW
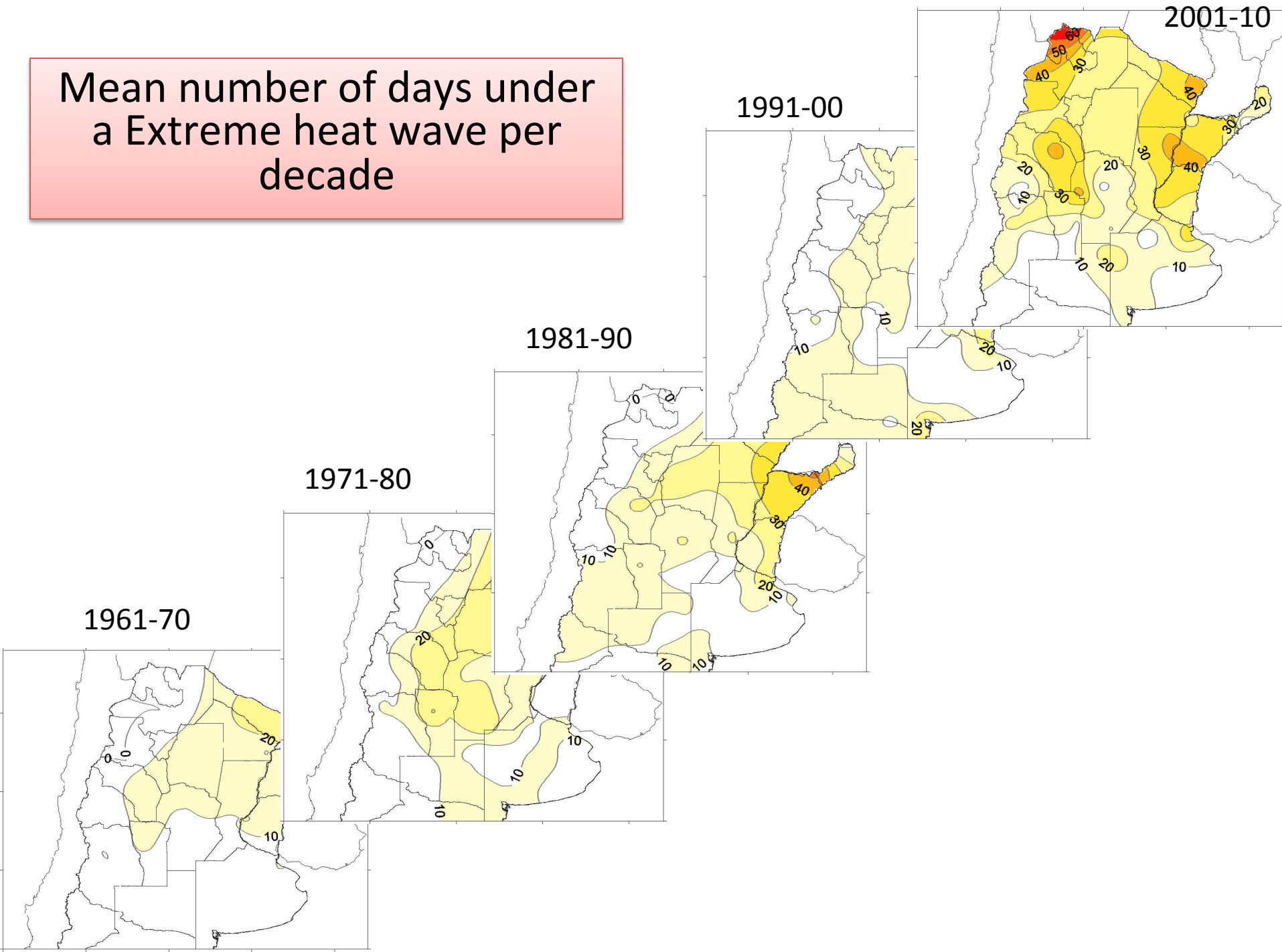

Extreme HW

Min T Heat Waves

MAXT Heat Waves

1961-70

1971-80

1981-90

1991-00

2001-10

Mean number of days under a Extreme heat wave per decade
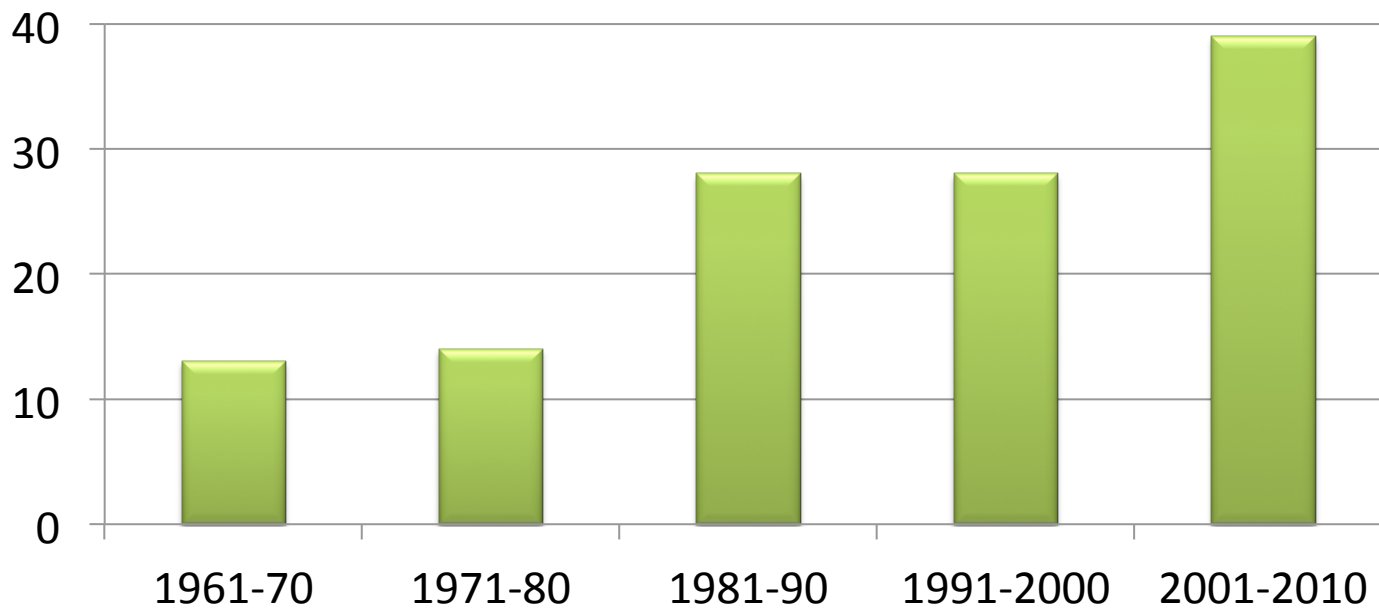
1961-70

1971-80

1981-90

1991-00

2001-10

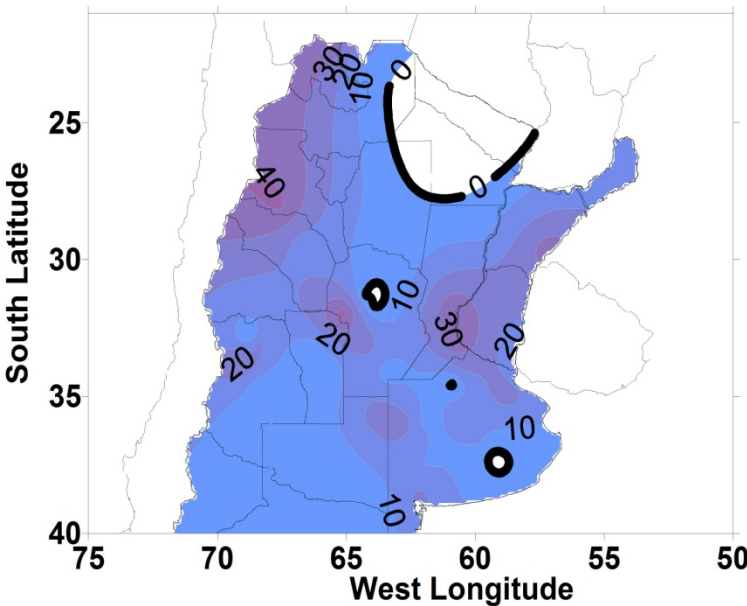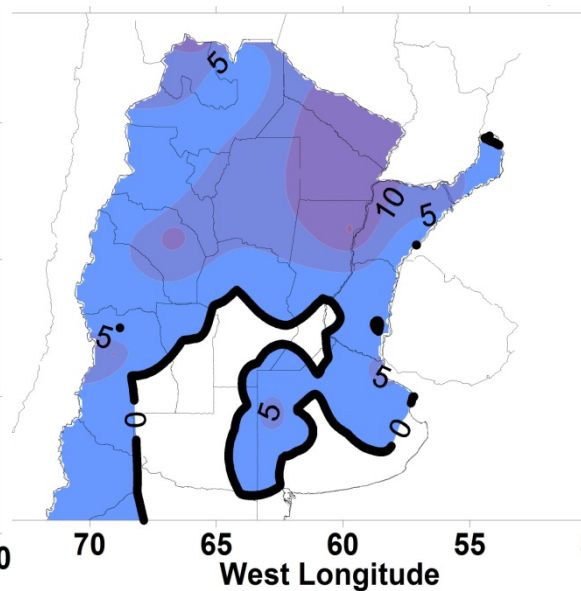**BUENOS AIRES - MinTHW**
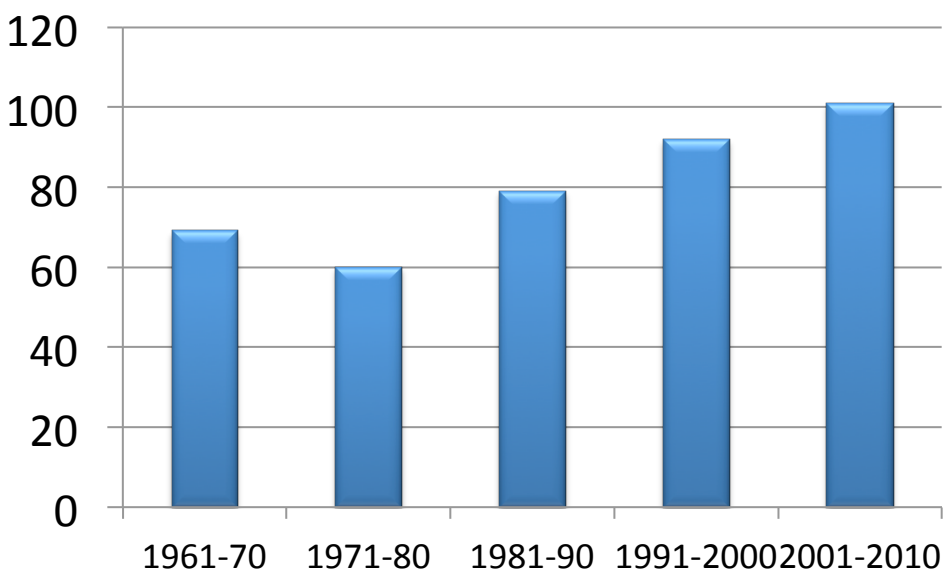
MAXTHW
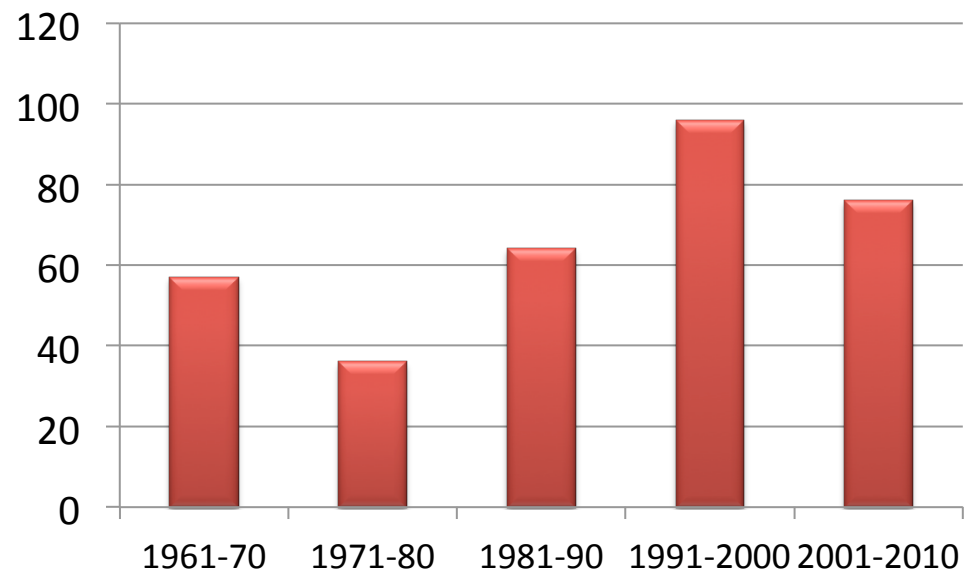
EHW

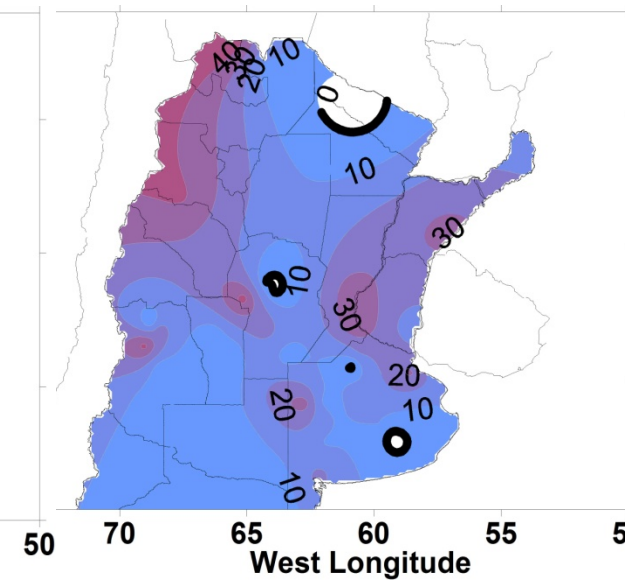# Degree-days: cumulative T excess above the 90% cuantile

short (3-5 days) **long (> 5 days)** **All persistence**

Decadal degree-days <u>differences</u> in ºC between both decades (2001-2010, 1961-70) extreme heat waves. White sectors are negative differences.

Recurrence of the extreme heat wave of November 2008

Over the whole period analysed, the November 2008 was the extreme one, mainly considering Tmax.

So, based on Kysely (2010) we applied the methodology to calculate the recurrence of that kind of heat wave under present and possible future climate.
anomalies from the mean seasonal cycle are modelled by the AR1 process

Severe HWs are considered as follows: (value s for the November 2008 heat wave)

1) cumulative Tmax excess above the 90% quantile (TS) >= 32.6 °C

2) length >= 12 days

3) both conditions 1) and 2) satisfied

in December 2013: considering only Tmin HW it presented a persistence of 16 days and the heat excess was 31.6°C.

Recurrence is for the whole summer period: November-March

Return period [in years] of a heat wave with	Present climate (1961-2010)	Warming +1C	Warming +2 C	Warming +4 C
1) TS >= 32.6	610	95	18	1.3
2) length >= 12 days	3700	380	55	3
3) (TS >= 32.6) and (length >= 12 days)	6250	670	80	3.5

Summary

•Three **heat waves** definitions were used to study their long term change in Argentina from 1961 to 2010. (minT, MAXT, both).

•There is great decadal variability, but generally the **largest number** of heat waves has been observed, in the decade **2001-2010**, surpassing the warm 1981-1990 decade. Most of the stations show a clear **positive trend in heat waves** in the light of **MinT**, and **decadal** variability in the **MaxT**.

•There was a strong **increase** in the **intensity** of heat waves (mainly in short lengths: 3 to 5 days) in the three heat waves definitions.

•The **probability** of such **severe and long heat wave** (Nov08) in Buenos Aires, according to the AR1 model simulations, **increases** by a factor of **6-10** with only a **1 °C** warming; by a factor of ~30-70 with a 2 °C warming; and by a factor of **~500-1000** with a **4 °C** warming