DYNAMIC CLIMATOLOGY OF SUBTROPICAL CYCLONES OVER THE SOUTH ATLANTIC: A COMPARISON BETWEEN ERA-INTERIM AND NCEP REANALYSES

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1. Introduction and objectives

Subtropical cyclones are non-frontal systems that present a warm core in low levels of the troposphere and a cold core in upper levels. They can occur as an intermediary phase in tropical/extratropical transitions or as pure subtropical systems formed by dynamic and thermodynamic interactions (relatively high sea surface temperature and weak vertical wind shear).

Here is presented a 10-year climatology of these systems over the South Atlantic Ocean, using reanalysis data from ECMWF ERA-Interim and NCEP Reanalysis 1 (NCEP1). Guishard, Evans and Hart (2009), Braun (2009) and other researchs about subtropical cyclones use high-resolution data; the objective of this work is to compare the climatologies obtained by datasets of different horizontal resolution, in order to determine if NCEP coarse resolution is useful for studying these cyclones.

2. Data and methodology

Fields of mean sea level pressure, zonal and meridional wind and geopotential height, from 1000 to 200 hPa, at 00, 06, 12 e 18 UTC, from the ECMWF ERA-Interim reanalysis (with horizontal resolution of 1.5 x 1.5 degrees) and NCEP Reanalysis 1 (2.5 x 2.5 degrees) were used for this work.

A cyclone tracking algorithm developed by Sinclair (1997) and Sugahara (2000) was used to track all cyclones in an area of 30 degrees of latitude and 55 degrees of longitude (Figure 1), using the 925-hPa relative vorticity field. Regions of $\zeta < 1.5 \times 10^{-5}\ s^{-1}$, with duration of more than 24 hours, were tracked as cyclones.

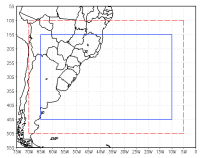


Figure 1: Domain of cyclone tracking (blue rectangle)

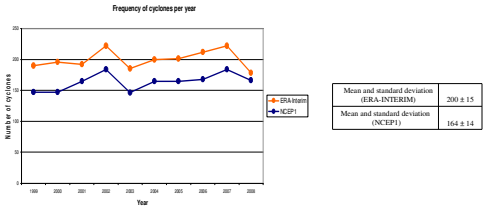
The Cyclone Phase Space algorithm (Hart, 2003) was used to classificate the cyclones, based on their thermal structures. Required characteristics of a subtropical cyclone are:

$-\left|V_T^L\right| > -50$ and $-\left|V_T^U\right| < -10$ for at least 36 hours

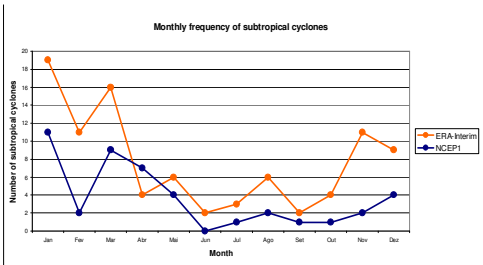
$B < 25$ m

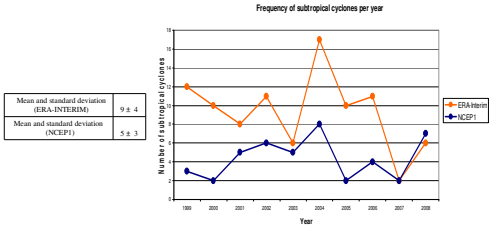
A visual inspection of each system allowed to separate actual subtropical cyclones from extratropical systems in occlusion stage (that presented these values in the end of their life cycles).

3. Results

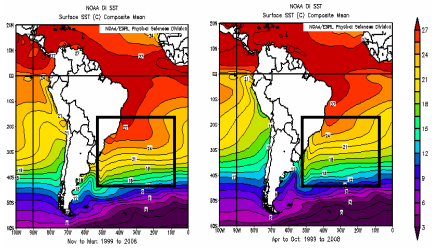


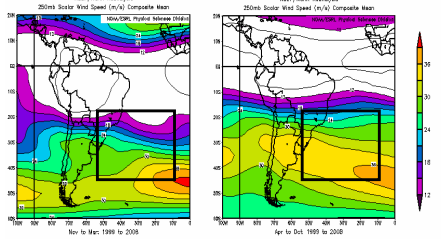
Mean and standard deviation (ERA-INTERIM)	200 ± 15
Mean and standard deviation (NCEP1)	164 ± 14

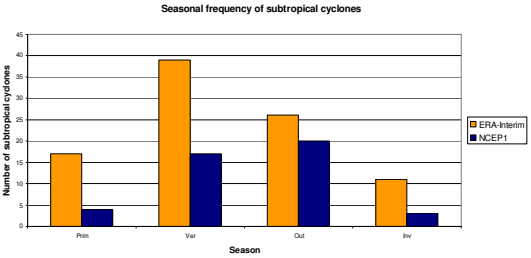


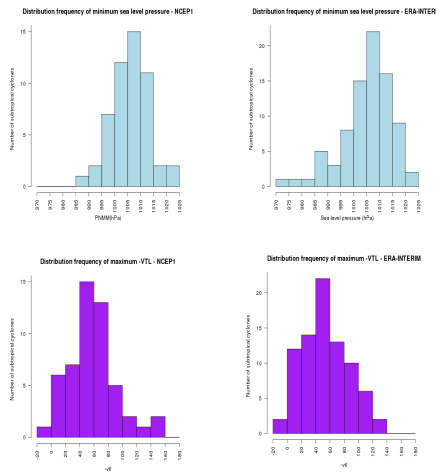


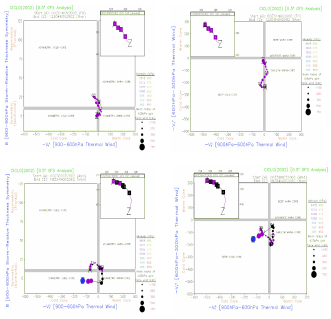
Mean and standard deviation (ERA-INTERIM)	9 ± 4
Mean and standard deviation (NCEP1)	5 ± 3











(a) (b) (c) (d)

Phase diagrams of (b) a subtropical cyclone occurred in November 2002, from:

(a) and (b) NCEP1
(c) and (d) ERA-Interim

4. Conclusions

- The annual variability of total (extratropical+subtropical) and subtropical cyclones in the South Atlantic region, in the period from 1999 to 2008, is similar for NCEP1 and ERA-Interim. The year with more subtropical cyclones for both datasets is 2004.

- Subtropical cyclones are more frequent in the months from November to March, due to a combination of higher SST and weaker vertical wind shear in the preferred region of formation. The monthly variability is the same for both reanalysis.

- NCEP1 and ERA-Interim subtropical cyclones present similar sea level pressure distribution frequencies. The intensity of low-level warm cores are also similar, with slightly stronger intensities in NCEP1.

- By its similarity with a higher resolution reanalysis, NCEP1 seems to be as useful as ERA-Interim for a long term climatology.

5. References

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