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THE STORM TRACK OVER SOUTH AMERICA: A COMPARISON BETWEEN THE CMIP5 HADGEM2-ES HISTORICAL SIMULATION AND THE ERA-INTERIM REANALYSIS FOR THE RECENT PAST CLIMATE

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1.INTRODUCTION

Cyclones play an important role in the energy transfer between the equator and polar regions. Preferred regions of cyclones propagation are called Storm Tracks (ST). The ST are important in modulating weather and climate in South America (SA), some recent studies have shown that they may be being affected by climate change [1]. This study aims to evaluate the ability of the Hadley Centre Global Environment Model version 2, with its Earth system configuration (HadGEM2-ES) [2], in simulating the ST in the recent past climate. HadGEM2-ES was one of the models used to produce climate simulations for the latest report of the Intergovernmental Panel on Climate Change (IPCC-AR5) [3].

2.METODOLOGY

Storm Tracks are studied for the recent past climate, using an objective feature tracking algorithm (Track) [4] applied to extratropical cyclones. The aim is to provide an indication of the reliability of using HadGEM2-ES over South America to investigate future changes in ST. Track was applied to 27 years (1979-2005) of relative vorticity data at 850hPa from the HadGEM2-ES historical experiment and the ERA-Interim reanalysis [5]. Statistical analysis of the track, genesis and lysis densities were explored to identify key patterns and possible trends in the simulations.

3.RESULTS

The track density statistic for the reanalysis data (Fig.1.a, b) shows the main patterns seens in the literature, such as the ST being closer (more distant) to the pole in austral summer (winter). Regions of genesis are found at the southeast of SA (Fig.1.e, f) and regions of lysis to the west of the Andes (not shown). The track (Fig.1.c, d) and genesis (Fig.1.g, h) densities for HadGEM2-ES shows similar patterns to those of the reanalysis, only slightly displaced.

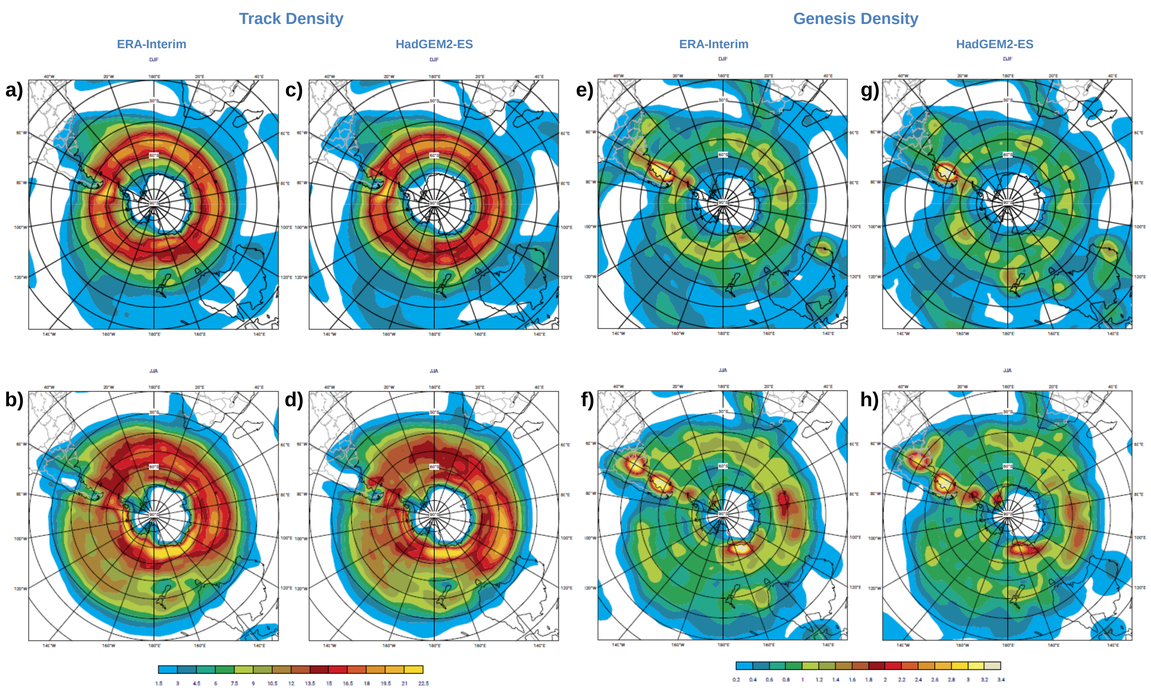

Figure 1. Lower-tropospheric seasonal cycle of the SH storm track based on ξ_{850} track density for ERA-Interim in a) DJF and b) JJA and for HadGEM2-ES in c) DJF and d) JJA. For e), f), g) and h), same as in the track density, but for genesis density.

The difference between the track densities provided by HadGEM2-ES and ERA-Interim reanalysis (Fig.2.a, b) indicates a positive bias in an area extending from Paraguay and its neighborhood to the southwest of the state of Minas Gerais and another one in an area to the east of the province of Santa Cruz in Argentina. On the other hand, negative biases are observed in the vicinity of Buenos Aires and also at the southern end of the SA. Hence, the analysis shows a zonal bias, positive/negative in similar positions for all seasons, extending from the southeastern Brazil to the south of SA (~ 50°S).

In the Antarctic Peninsula region the bias is negative in the austral summer/winter and positive in the austral fall/spring (not shown), which shows that the model has difficulties in representing the ST here.

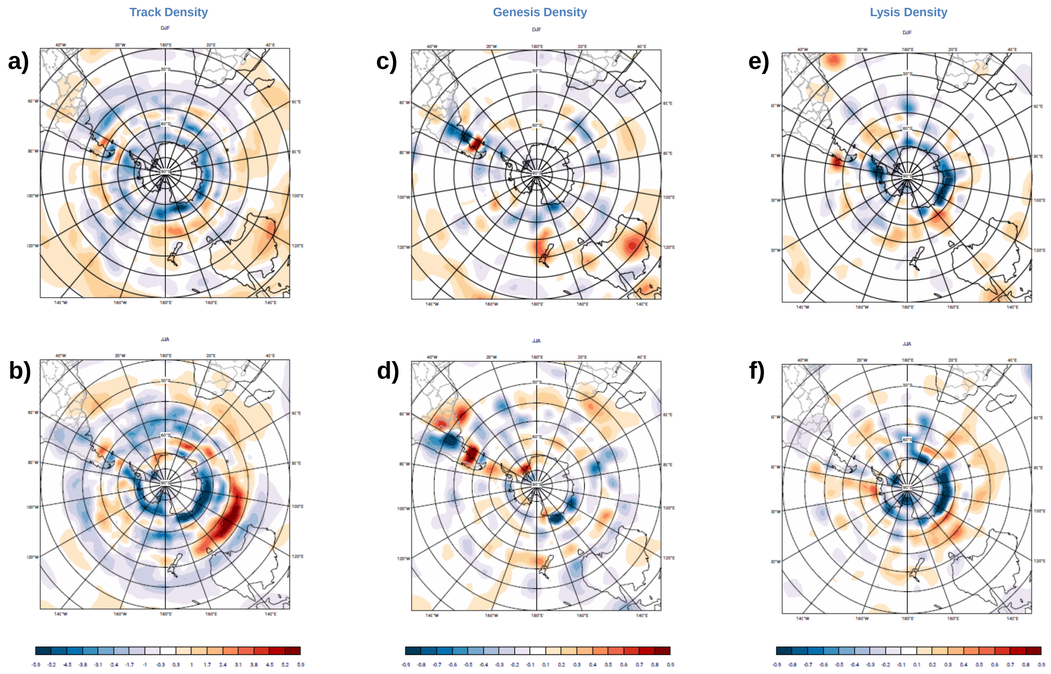

Figure 2 – Lower-tropospheric biases (HadGEM2-ES vs. ERA-Interim) of the SH storm track based on ξ_{850} for track density in a) DJF and b) JJA, genesis density in c) DJF and d) JJA and lysis density in e) DJF and f) JJA.

The genesis density (Fig.2.c, d) is well simulated by the model when compared with the reanalysis, especially for the area of cyclogenesis to the east of southeastern Brazil during the summer. However, the model tends to displace the genesis slightly to the north, which explains the zonal bias observed in all seasons. Also, the model underestimates cyclogenesis in the region to the east of northern Argentina, especially in DJF. Finally, the model represents the lysis density (Fig.2.e, f) similarly to the reanalysis, especially in the most important region to the west of the Andes. However, the model tends to overestimate the values and displaces the lysis areas slightly to the north, except in the austral winter.

4.CONCLUSION

Overall, results show SA cyclones correspond well between the HadGEM2-ES and the ERA-Interim reanalysis, with some regions slightly displaced in the variables analyzed. However, a zonal bias is observed in the track density around the pole associated with a underestimation of the cyclones by HadGEM2-ES.

5.REFERENCES

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