

The climatic importance of South Atlantic hurricane Catarina (2004)

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Sea Surface Temperatures (SSTs) warmer than 26.5°C and Environmental Vertical Wind Shear (EVWS) lower than 8 m/s offer ideal conditions for Tropical Cyclone (TC) development. Thus it has been accepted that hurricanes could not form over the South Atlantic Ocean due to the very intense climatological EVWS and not sufficiently warm SSTs over the basin. This concept is now under review after Catarina hit southern Brazil in March 2004 (figure 1) after undergoing Tropical Transition (TT) over relatively cool waters (figure 2). This was the first documented time when a system reaching a category I hurricane strength (Saffire-Simpson scale) made landfall anywhere in the South Atlantic basin (Pezza and Simmonds 2005). This is not to say that a phenomenon like Catarina had not existed in the past, but there is evidence that at least during the satellite era this is unprecedented.

Catarina generated much discussion and controversy in the community as to how it should be named (which also depends on cultural backgrounds) and as to what its hybrid structure really was. This hurricane represents a mark in Southern Hemisphere meteorology prompting the weather services to improve their forecasting and alert system in a time of climate change. It also draws the attention of the global meteorological community for the increasing need to develop a more modern system of classification of cyclones.

Pezza and Simmonds (2005) proposed a large scale blocking mechanism leading to persistent low EVWS to explain how this extremely rare event was formed, and such ideas have recently received further support in the literature (McTaggart-Cowan et al 2006). A possible hemispheric link with the positive phase of the Southern Annular Mode (SAM) has been found, pointing out to the possibility of more frequent storms if the SAM continues to increase under global warming conditions. We are currently working on further evidence for this association and the new results will be communicated in the peer-reviewed literature. Advances in modeling and the local observing network are expected to throw further light into a possible hurricane climate prediction scheme for the region in the future.

McTaggart-Cowan, R., Bosart, L., Davis, C.A., Atallah, E.H., Gyakum, J.R. and Emanuel, K., 2006: Analysis of hurricane Catarina (2004). *Monthly Weather Review*, **134**, 3029-3053.

Pezza, A.B., and Simmonds, I, 2005: The first South Atlantic hurricane: Unprecedented blocking, low shear and climate change. *Geophysical Res. Letters*, **32**, doi:10.1029/2005GL023390.

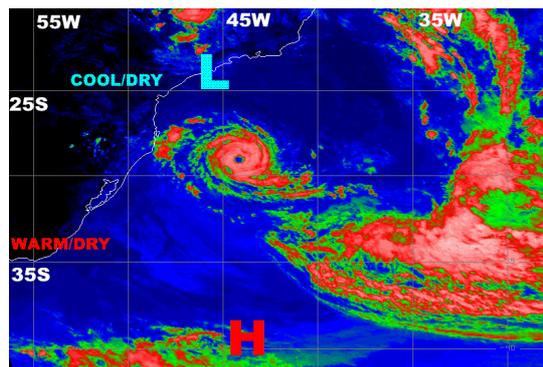


Figure 1: Enhanced satellite image from the GOES-12 Infrared channel at 16:39 UTC 26th March 2004 showing the Tropical Cyclone Catarina approaching the Brazilian coast. The letters H and L indicate the position of the upper level ridge and trough respectively associated with warm/dry and cool/dry surface air over the continent. Estimated minimum central pressure inside the eye of 974 hPa, total cyclone diameter of around 400 Km and eye diameter between 25 and 40 Km, with estimated sustained surface winds with hurricane I force (between 33 m/s and 42 m/s) and translational speed of 11 km/h to the west. Image available for download from the University of Wisconsin – Madison Space Science and Engineering Center (<http://cimss.ssec.wisc.edu>)

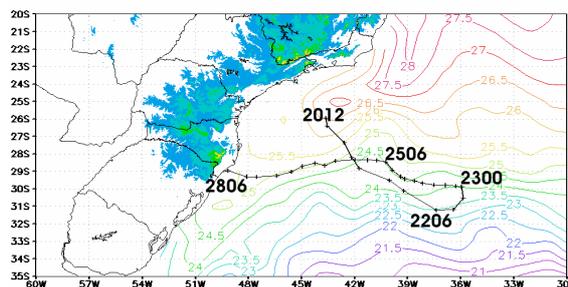


Figure 2: Tropical Cyclone Catarina's trajectory in perspective with the surrounding maximum Sea Surface Temperatures (SSTs). The South American sector is showing: I) 2 km resolution topography plotted for elevations above 500 m, with darker yellow tones indicating elevations above 1500 m; II) Tropical cyclone Catarina's trajectory as derived from the University of Melbourne automatic tracking algorithm showing the central locations every 06 hours and III) Maximum SSTs (°C) for the period between the 20th and the 28th of March. The date and hour (UTC) are indicated next to the trajectory for some selected periods.