



Moisture sources for subtropical cyclogenesis over Southwestern South Atlantic

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Subtropical cyclones are non-frontal low pressure systems that present a hybrid thermal structure, with a low tropospheric warm core and an upper level cold core. These systems ideally develop in a tropical-like environment, with weak vertical wind shears and high sea surface temperature; however, subtropical cyclogenesis is possible even when these conditions are not met. Over the subtropical South Atlantic Ocean, near the eastern coast of South America, these cyclones generally occur over relatively cool waters (around 23°C). As the local source of heat and moisture associated to surface turbulent fluxes is reduced, remote source regions may play an important role in the development of such systems. To investigate this hypothesis, a composite analysis of moisture source and sink regions was carried out for 112 cyclogenesis days, in the period of 1979-2008, using the Lagrangian FLEXPART model and data from ERA-Interim reanalysis. The cyclones were tracked over the RG1 cyclogenetic area (30.5°S-21°S, 49.5°W-35.5°W) using an algorithm based on relative vorticity of horizontal wind field at 925 hPa, and the subtropical ones were selected by applying the Cyclone Phase Space (CPS) methodology. The Lagrangian analysis shows that most of the moisture available for these subtropical cyclogenesis in summer (DJF), autumn (MAM) and spring (SON) originates in the South Atlantic around the latitude 15°S and is advected to the RG1 by the South Atlantic Subtropical High flow. During autumn, an important contribution is seen from the region to the south of RG1, due to enhanced transient anticyclones activity. The moisture transported by the South Atlantic Low Level Jet does not contribute significantly for the subtropical cyclogenesis, as the air parcels lose most of its moisture content by precipitation over the continent, before reaching RG1. As expected, the local source of moisture presents a negative anomaly in all season's composites. A case study of the Hurricane Catarina (2004), the only documented tropical transition in this basin, indicates the Atlantic Ocean region over the northern branch of the Subtropical High again as an important remote source region, but as the system transitions from extratropical to subtropical, the local contribution increases. This enhanced input energy may have helped the system to undergo tropical transition, unlike other subtropical cyclones.