Advances in Geosciences
An Open Access Journal for Refereed Proceedings and Special Publications

Adv. Geosci., 22, 73-78, 2009
www.adv-geosci.net/22/73/2009/

Large scale features associated with strong frontogenesis in equivalent potential temperature in the South American subtropics east of the Andes

J. M. Arraut[1] and H. M. J. Barbosa[2]
[1]Centro de Ciências do Sistema Terrestre, Instituto Nacional de Pesquisa Espaciais, Av. dos Astronautas, 1758, São José dos Campos SP 12227-010, Brazil
[2]Instituto de Física, Universidade de São Paulo, Rua do Matão, 187, São Paulo SP 05508-090, Brazil

Abstract. South American subtropics east of the Andes exhibit a region of intense climatological frontogenesis in equivalent potential temperature (EPT) in the December to March season, mostly produced by deformation of the wind field. The goal of this paper is to investigate the large scale features associated with intense and weak frontogenesis by deformation (FGD) in EPT in the region where it attains its climatological maximum. This can be approximately delimited by 32–42° S and 66–69° W, which is small enough as to contain only one synoptic perturbation at a time. The spatial average of the positive values of frontogenesis at 850 hPa over the whole region (DFG+) is used to represent the strength of the perturbation. ECMWF ERA-40 reanalysis data set is used to calculate DFG+ at six hour intervals for 21 seasons (1981–2002). Compositing analysis is carried out for strong (above the 0.75 quantile) and weak (below the 0.25 quantile) events. For strong events the geopotential field at 850 hPa exhibits the North Argentinean Low (NAL), a transient trough and the Low Pressure Tongue East of the Andes (LPT). Upon comparison with the composite field of FGD it can be observed that FGD exhibits a strong maximum over the Argentinean Col (AC) which separates the NAL and the trough. These features are absent in the weak frontogenesis composite, which exhibits a stronger South Pacific Subtropical High close to the continent. At 250 hPa the strong FGD composite exhibits a trough over the Andes with a wind speed maximum to its east. Both of these features are associated with the deepening of the NAL in the literature. These are not present in the weak FGD composites. Strong events show an intense quasi meridional corridor of water vapor transport from the Amazon to the subtropics that encounters westerly flow in the neighborhood of the AC. This is absent in weak events. A preliminary analysis of precipitation is carried out using the GPCP daily data set. An intense precipitation nucleus appears slightly northeast of the AC, with maximum intensity in the day that follows the strong events. Weak events exhibit a drying of the subtropics instead, between one and three days after the events. Higher precipitation over the oceanic South Atlantic Convergence Zone can be also observed. Analogous composites were constructed for the presence and absence of both the AC and the LPT, showing similar characteristics to the strong and weak FGD event composites respectively, but with lower intensities. This shows that by selecting strong FGD events, intense NAL and LPT events

are also singled out.

Full Article in PDF (PDF, 1251 KB)

Citation: Arraut, J. M. and Barbosa, H. M. J.: Large scale features associated with strong frontogenesis in equivalent potential temperature in the South American subtropics east of the Andes, Adv. Geosci., 22, 73-78, 2009. Bibtex EndNote Reference Manager