Synoptical Analysis of the Day September 4th, 2004 with High Aerosols Optical Depth over Southern Space Observatory, Brazil.

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ABSTRACT: This paper makes an analysis of the synoptic weather patterns and atmospheric dynamics on a day, September 4th, 2004, with typical high Aerosol Optical Depth (AOD) measured over the Southern Space Observatory - OES/CRS/CCR/INPE - MCT (29.42 S, 53.87 W), in São Martinho da Serra, Rio Grande do Sul, Brazil. AOD data used in this analysis were obtained by Brewer MKIII Spectrophotometer #167, installed at Southern Space Observatory, in a partnership between the Space Science Laboratory of Santa Maria - LACESM/CT/UFSM, the Southern Regional Space Research Center - CRS/INPE-MCT and the INPE's Ozone Laboratory – LO/DGE/INPE-MCT. The day of September 4th, 2004 was chosen because its AOD values are almost two times the climatological average for the month of September. For this day and the two previous days, geopotential height and vorticity maps were generated using GRADS for the levels of 500mb and 250mb. It was analyzed humidity and wind at 850mb and pressure at sea level beside the AOD. Satellite images of GOES 12 for the visible, infrared and water vapor were used to analyze the weather systems which influenced over the weather patterns. Analysis of the NOAA satellite images from NASA showed several events of biomass burning in mid-western Brazil, Bolivia, Paraguay and northern Argentina, on September 2th and 3th, 2004, which could increased AOD over the Southern Space Observatory, according to air mass backward trajectory at 700 hPa level by the NOAA HYSPLIT model. Analysis of the weather data show that the AOD peak for 09/04/2004 occurred after the passage of a low pressure system (extra tropical) over Rio Grande do Sul state. There was the entry of a center of high pressure area, which was pushed toward the Atlantic Ocean by a low pressure area moved from mid-western Brazil, Paraguay and northern Argentina over Rio Grande do Sul state, where there was a decrease of pressure along the edge of the center of the high pressure that was already installed in the region, forming a pressure gradient that converged the airflow from the central of South America to Southern of Brazil, increasing the Aerosol Optical Depth.

INTRODUCTION: The atmospheric aerosol has a important role in the atmosphere, since they are responsible for decrease in the visibility and attenuation of the ultraviolet radiation. Recent papers (Carbone et al. 2006; Cheymol e De Backer, 2003; Kirchhoff et al., 2002) has been developed a new application for Brewer Spectrophotometer, measuring aerosol optical depth (AOD) beside ozone and ultraviolet radiation.

METHODOLOGY: To obtain atmospheric optical depth it was used Langley Method, as described by Silva, 2001. The AOD data used in this work were obtain using Brewer Spectrophotometer MKIII 167, installed at Southern Space Observatory – OES/CRS/INPE – MCT, in São Martinho da Serra, Brazil. For this analysis it was chosen the day of September 04th, 2004, which had a high value of AOD. It was generated in GRADS maps of geopotential height and vorticity at 500mb, wind at 200mb, humidity and wind at 850mb and pressure at sea level. It was also used GOESS 12 data for visible, infrared and water vapor for the day with the aim to analyzed the meteorological systems which affected climate patterns. Another data used were NOAA 16 data for biomass burning sites in South of America for September 02th and 03th, 2004 and, finally, air mass backward trajectories for September 04th, 2004 at 700 hPa using HYSPLIT model from NOAA.

RESULTS

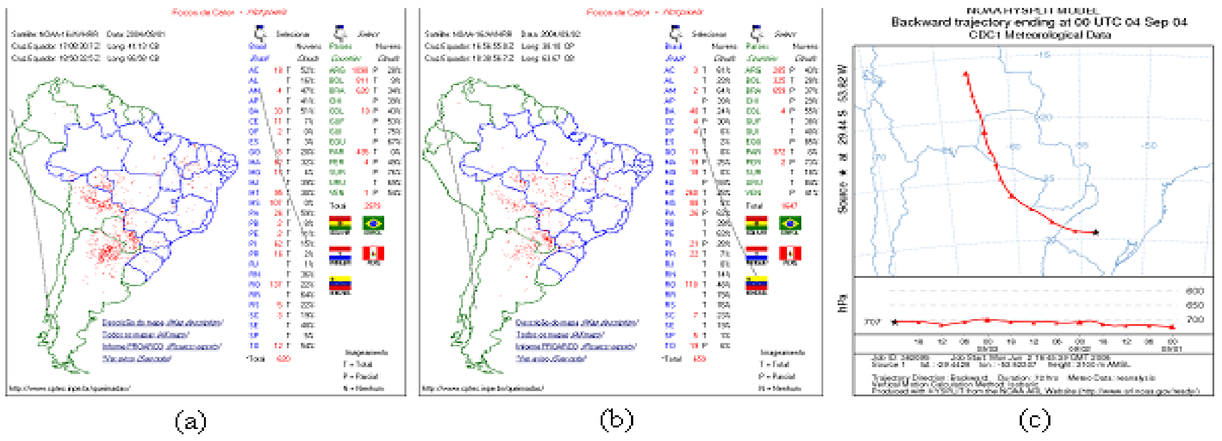

Fig.1- Images of NOAA 16 from NASA showing burning sites in South of America for (a) 09/01/2004 and (b) 09/02/2004 and (c) air mass backward trajectory over Southern Space Observatory for three days before 09/04/2004 at 700 hPa using NOAA/HYSPLIT model .

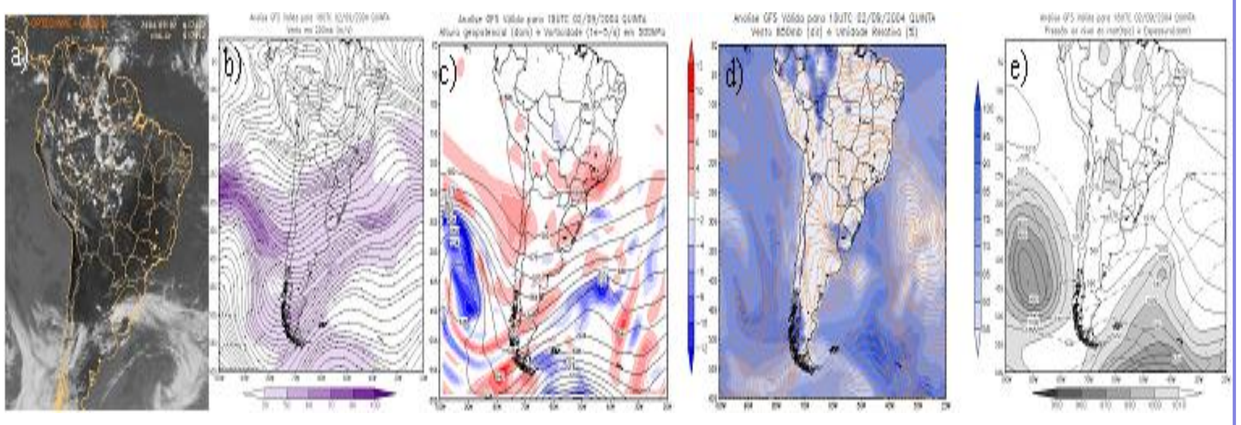

Fig. 2- Infrared image of GOES12 (a), wind at 200mb (b), geopotential height and vorticity at 500mb (c), wind and humidity at 850mb (d) and pressure at sea level (e) for 18:00 UTC 09/02/2004.

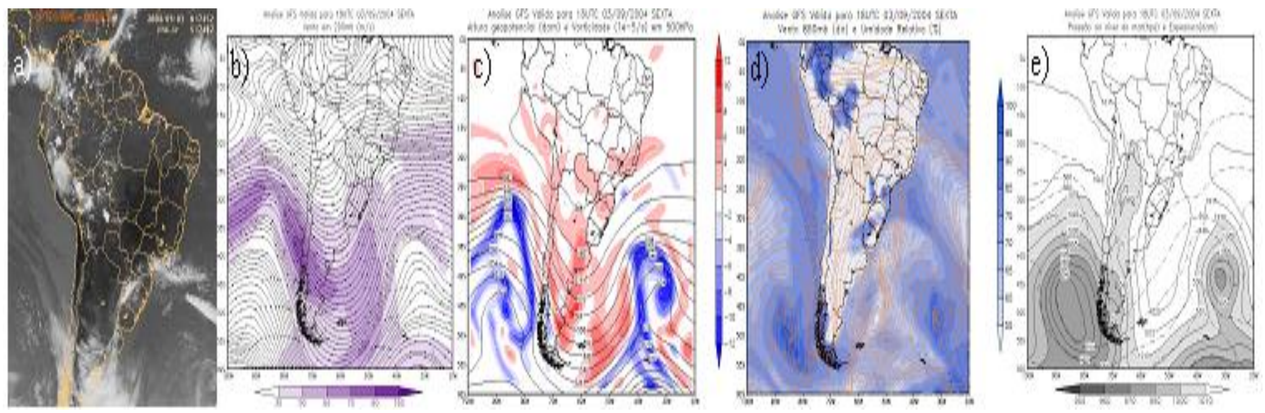

Fig. 3- Infrared image of GOES12 (a), wind at 200mb (b), geopotential height and vorticity at 500mb (c), wind and humidity at 850mb (d) and pressure at sea level (e) for 18:00 UTC 09/03/2004.

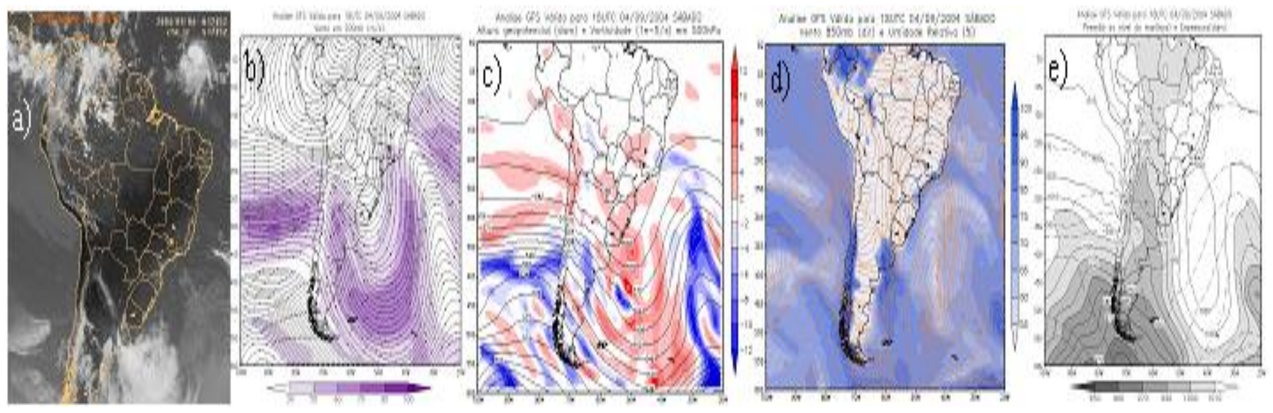

Fig. 4- Infrared image of GOES12 (a), wind at 200mb (b), geopotential height and vorticity at 500mb (c), wind and humidity at 850mb (d) and pressure at sea level (e) for 18:00 UTC 09/04/2004.

CONCLUSION

The aerosol optical depth for September 04th, 2004 occurs after a cold front pass over the South of Brazil. There was a entry of a high pressure center on surface, which moved toward Atlantic Ocean confined a lower pressure region over Midwest of Brazil, Paraguay and north of Argentina, where several biomass burning regions were detected, forming a pressure gradient that converged the airflow from the central of South America to Southern of Brazil, increasing the Aerosol Optical Depth.

ACKNOWLEDGMENTS

The authors thank PIBIC/UFSM-CNPq/MCT and PIBIC/INPE-CNPq/MCT for the fellowship and NASA/TOMS and NCEP/NCAR for the data. Acknowledgments to ATMANTAR Project for International Polar Year, process n° 52.0182/2006-5, PROANTAR/MCT/CNPq. We also thank the partner INCT-APA.

REFERENCES

- Carbone, S., Padilha, L.F., Rosa, M.B., Pinheiro, D.K., Schuch, N.J. *First estimations of the aerosol optical thickness using Langley Method at Southern Brazil (29.4 S, 53.8 W).* Advances in Space Research, 37, 2178-2182, 2006.
- Cheymol, A. e De Backer, H. *Retrieval of the aerosol optical depth in the UV-B at Uccle from Brewer ozone measurements over a long time period 1984 – 2002.* Journal of Geophysical Research, 108, D24, 2003.
- Kirchhoff, V. W. J. H.; Silva, A. A.; Pinheiro, D. K. *Wavelength dependence of aerosol optical thickness in the UV-B band*. Geophysical Research Letters, 29(12), 1620, 2002.
- Silva, A. A. *A Espessura Óptica de Aerossóis na Banda do UV-B.* Tese de Doutoramento em Geofísica Espacial, INPE, 2001.