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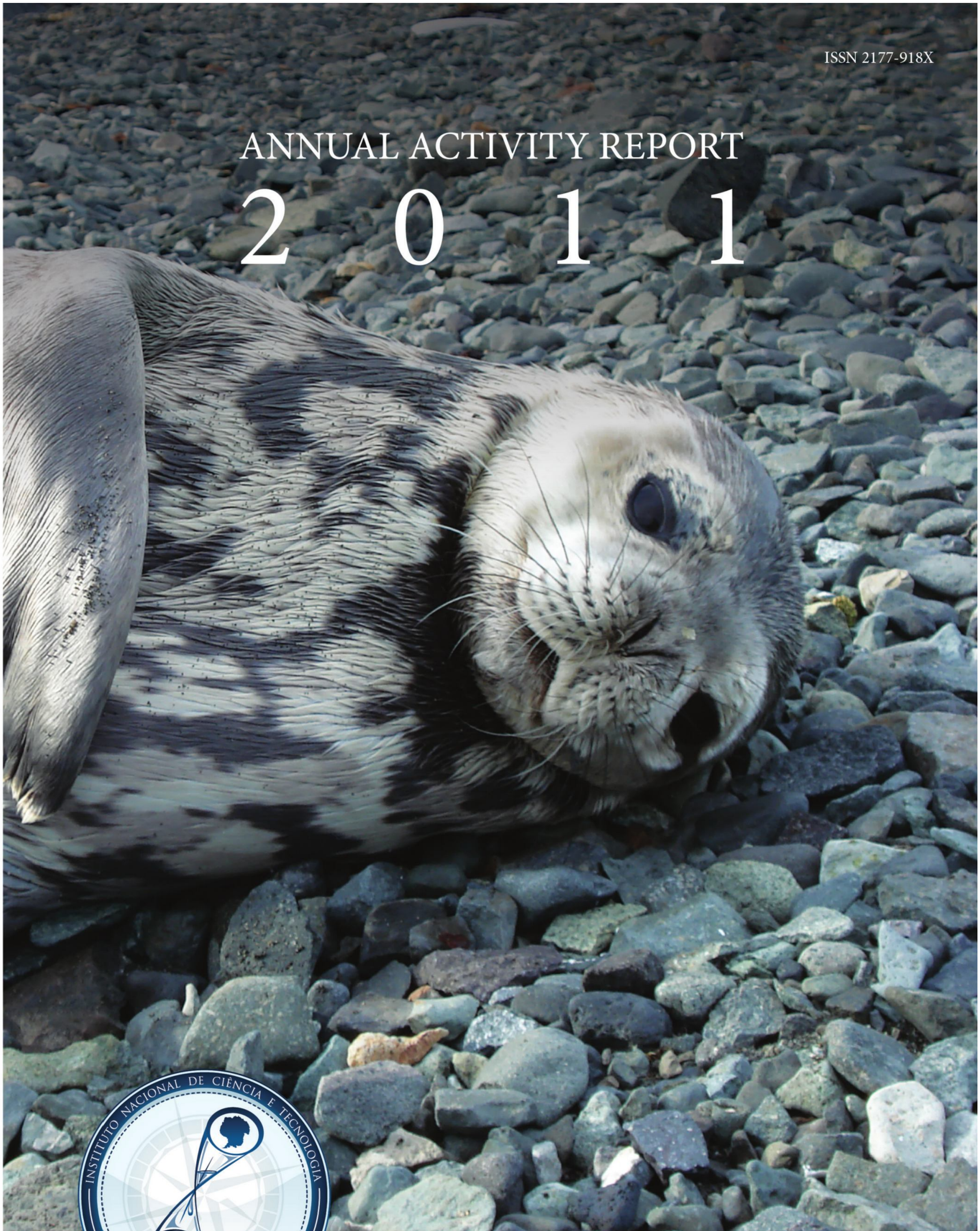

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SYNOPTIC WEATHER SYSTEM ASSOCIATED WITH INFLUENCE OF THE ANTARCTIC OZONE HOLE OVER THE SOUTH OF BRAZIL ON OCTOBER, 13TH, 2010

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Abstract: *During spring, poor ozone air masses can come out of the Antarctic Ozone Hole and reach mid and low latitude areas like the South of Brazil forming a known phenomenon called "Secondary Effects of the Antarctic Ozone Hole". One of these phenomena was observed on October, 13th, 2010, by OMI Spectrometer over Southern Space Observatory (29.42° S and 53.87° W), in São Martinho da Serra, Brazil. Stratospheric potential vorticity maps on isentropic surfaces and air mass backward trajectory using HYSPLIT model by NOAA confirmed the polar origin of the poor ozone air mass. A description of the synoptic weather system during the event was made by wind field daily average at 250 hPa level and Omega at 500 hPa, thickness between 1000 and 500 hPa levels and GOES 10 enhance satellite image. It was observed that the event of low ozone occurred at the same time as a high pressure pos frontal system was passing over the south of Brazil and the subtropical jet stream left the weather stable and without clouds. These actions favored the intrusion of the stratospheric air in the troposphere and helped the stratospheric air mass transport from the polar region to the South of Brazil.*

Keywords: ozone, Antarctic ozone hole, potential vorticity, synoptic analysis

Introduction

The Antarctic continent shows a very low content of ozone layer during the spring of every year, the Antarctic Ozone Hole (Farman *et al.*, 1985; Solomon, 1999). However, its effects were not limited to the Polar Region, since poor ozone air mass could come out of the polar vortex and reach mid and low latitude (Prather & Jaffe, 1990), temporarily reducing the ozone layer. This phenomenon was first observed over South of Brazil by Kirchhoff *et al.* (1996). The relationship between ozone concentration and the passage of a synoptic weather system is not well known and it is being considered a new line of research for ozone (Ohring *et al.*, 2010), which motivated this work.

Methodology

Events of influence of the Antarctic ozone hole over the south of Brazil were detected by analysis of ozone total column, obtained by an OMI Spectrometer installed in a satellite, over the Southern Space Observatory – OES/CRS/CCR/INPE-MCTI (29.42° S and 53.87° W), in São Martinho da Serra, Brazil. Days with ozone total column daily average inferior to the monthly climatological mean less 1.5 its standard deviation ($\mu - 1{,}5\sigma$) were analyzed. For these days, the variation of the absolute potential vorticity on isentropic surfaces maps at 620 K level of potential temperature were calculated with daily parameters from NCEP/NCARreanalysis using GRADS. Air mass backward trajectory was obtained using HYSPLIT model by NOAA for confirmation of the polar origin of the stratospheric air. The synoptic weather system associate with wind occurrence was verified by analysis of the wind field daily average at 250 hPa level and Omega at 500 hPa, sea level pressure and thickness between 1000 and 500 hPa levels also using NCEP/NCAR reanalysis data with GRADS, besides GOES 10 enhanced satellite images.

Results

In this work, the example of the event that occurred on October, 13th, 2010 was used, when the ozone total column was 276.1 DU, a reduction of 5.6% over the October climatological mean which was 292,7 ± 10.2 DU. The air mass with poor ozone reached the South of Brazil on October, 12th, as can be observed at Figure 1, when there occurred an increase at the Absolute Potential Vorticity at 620 K level of potential temperature from 11th (a) to 12th (b) and higher on the 13th (c), this last day registering the lowest ozone total column in the period, confirming the polar air mass origin by backward trajectory (d) and ozone image from OMI satellite (e), showing the influence of the Antarctic ozone hole over the South of Brazil.

Because of the poor ozone air mass arrival over the South of Brazil on October, 12th, 2010, the synoptic weather system was analyzed for this day, when action of the subtropical jet

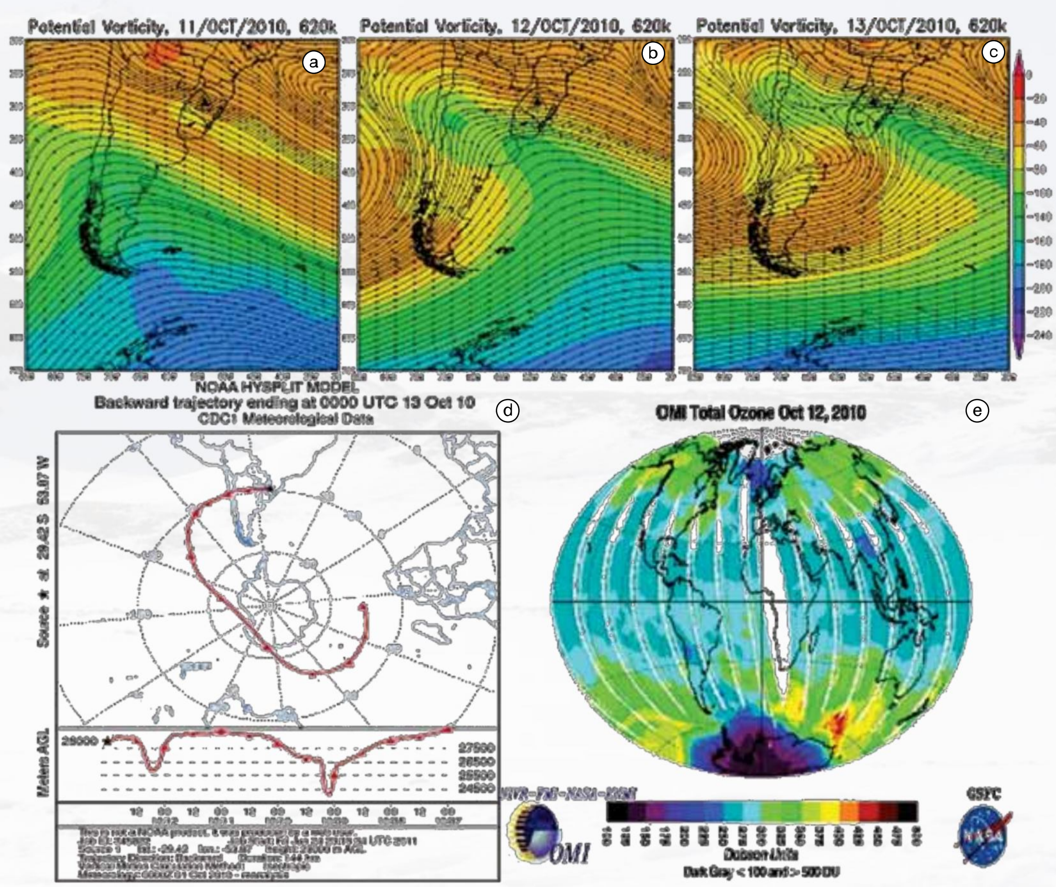

Figure 1. Potential Vorticity and Wind at 620K level for 12th (a) and 13th (b) of October, 2010. Air mass backward trajectory (c) and OMI image (d) for 13th and 12th, respectively.

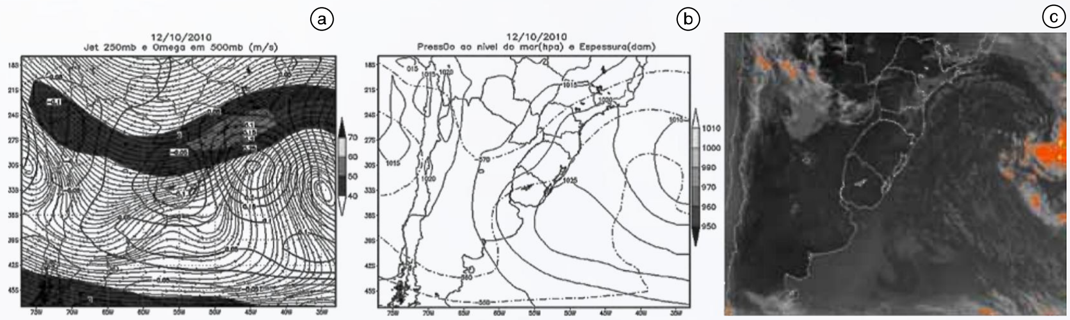

Figure 2. Wind field daily average at 250 hPa level and Omega at 500 hPa (a), pressure at sea level and thickness between 1000 and 500 hPa (b), and enhance GOES 10 image satellite at 12:00 (c) for October, 12th, 2010.

stream polar entry could be observed at 250 hPa level and positive values of the Omega vertical velocity at 500 hPa level, which was observed at Figure 2a. Furthermore, the action of an intense high pressure pos frontal system at sea level (Figure 2b) over the region was observed, getting the South of Brazil with stable weather with no cloudiness as can be observed through the satellite image (Figure 2c).

Discussion and Conclusion

The decrease in ozone total column of 5.6% less than the October climatological average which occurred on October, 13th, 2010 was due to an influence of the Antarctic ozone hole over the South of Brazil checked through the increase in Absolute Potential Vorticity indicates the polar origin of the stratospheric air mass with poor ozone (Semane *et al.*, 2006) and confirmed by air mass backward trajectory (Gupta *et al.*, 2007) and ozone image from OMI satellite in a manner analogous to events found by (Pinheiro *et al.*, 2011). The synoptic weather system acting during the event was a high pressure pos frontal system at sea level, indicated subsident movement of the air over the South of Brazil, which associated with the passage of the subtropical jet stream over the region caused intrusion of the stratospheric air into the troposphere (Stohl et *al.*, 2003). This pattern had an important role at vertical distribution and total content of ozone layer (Bukin *et al.*, 2011), enhancing the transport of air mass from polar region towards South America and the South of Brazil and probably helped poor ozone air mass transport.

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