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Special features of ozonesonde profiles from the SHADOZ site at Irene, South Africa

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With the discovery of the Antarctic in the 1980s and 1990s and ozone depletion on a global scale, there emerged much research on the stratospheric ozone layer where 90% of the atmospheric ozone resides. Balloon soundings were an ideal remote sensing technique to keep track of the ozone layer during the season of intense loss and throughout the year. Ozone soundings also paved the way for the focus being shifted to the lower troposphere region as we moved toward an era of many new satellites and more scientific questions, including those related to ozone pollution.

On 5 June 1990, the first official Vaisala / Omega navigation system ozonesonde ascent was made at the Irene, (South Africa) Weather Office (25.9 S, 28.2 E, 1524m). This date for this sounding was chosen amongst reasons, to make a feature of World Environment Day celebrations on that date. From this start a routine balloon ozonesonde sounding program was initiated and operated (with some data gaps) until 2007. In 1998 collaboration started with the Southern Hemisphere Additional OZonesondes (SHADOZ-http://croc.gsfc.nasa.gov/shadoz/) program from NASA, USA. The Irene data is also submitted to WOUDC and has been cited in many refereed articles. A short break in the ozone sounding programs was experienced during 2008 - 2011, due to a lack of capacity and faulty upper-air system processors.

This paper presents special features from the 100 profiles collected since resuming ozone soundings with the acquirement of a new upper-air system at Irene in September 2012. These profiles comes from a dedicated system for ozone soundings only, as normal day to day upper air soundings PTU and wind ascents at Irene are conducted with a InterMet system by the meteorological observers. Up until May 2006 the Vaisala MW15 Digicora system with Metgraph Software were used, together with the ECC cells and RS80 radiosondes. The new Vaisala system consists of a new MW31 signal processor and Metgraph software, and the RS92 are attached. Currently, soundings are conducted every second Wednesday, with the release time as close as possible to 0800UTC. This is done to ensure that the atmospheric conditions and processes are consistent to avoid potential bias from the diurnal changes in ozone in the boundary layer. The signal processing results in 2sec. intervals (10 meters) of ascending measurements: and with the GPS wind conditions also recorded add value to the meteorological interpretation of the profile.

Ozone profile features that are examined include:

- Characteristics of the ozone maximum in the stratosphere. At times, within thin layers, less ozone appears as jagged ozone gaps in the stratosphere profile. Is this real or perhaps faulty measurements? The average height of stratosphere maxima is 25.047km, with about 127 DU of column ozone stretching up to it from the surface. The ozone concentration on average at this peak level is 14mPa, but varies from 10 - 16mPa: the typical layer profile appears thinner or thicker as at times.

- Enhanced ozone or reduced ozone concentration at the level of the troposphere/stratosphere exchange region is looked into. Episodes of tropopause folding are evident during the crossing of a strong mid-latitude westerly upper-air disturbances that move in over Irene.

- Tropospheric ozone loading occurs on many occasions. On average the troposphere column displays about 38DU, but this varies from 25DU to 60DU. One sees a distinct high ozone concentration at the near surface layer, which is attributed to meteorological conditions and site location. At 3000 – 4000m above sea-level these peaks show high concentrations of up to 6mPa. Irene, over the last 25 years has been more enclosed in the industrialised Mega-City of the Soweto - Johannesburg - Pretoria region.