SHADOZ (Southern Hemisphere Additional Ozonesondes): A Tropospheric and Lower Stratospheric Profile Climatology (2005-2009) and Comparisons to OMI Total Ozone

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BACKGROUND & GOALS

The SHADOZ project has operated in the tropics and subtropics since 1998 (Thompson et al., 2003; 2011a,b). During the Aura period, July 2004 - present, four stations joined SHADOZ so that 15 stations operated during 2005-2009, **Figure 1**.

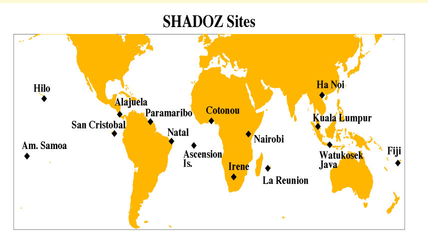

Figure 1.

In this study data from the 15 stations during 2005-2009 are used to:

1) Illustrate the annual cycle of tropospheric and lower stratospheric ozone at two diverse southern hemisphere sites, Hanoi and Cotonou, Benin.
2) Create profile climatologies at each station.
3) Compare stratospheric and column amounts among stations and with ground-based and OMI overpass total ozone measurements.

SEASONAL OZONE CYCLES

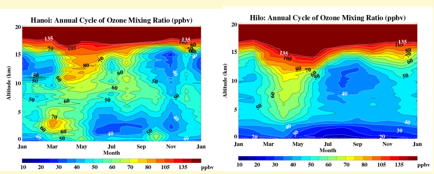

Figure 2.

In **Figure 2** two newer SHADOZ stations show a contrast in pollution; Hanoi is greater in ozone, Hilo is much lower. Low ozone features in the mid- and upper troposphere (above 5 km) indicate seasonal convective mixing. Stratospheric intrusions into the troposphere are also seasonal as illustrated in Hilo during March-May. Over Hanoi, both surface and free tropospheric pollution are evident. A combination of industrial-urban and biomass burning sources have been implicated as sources in field studies (Kondo et al., 2004).

MEAN PROFILES & CONVECTIVE INFLUENCE

Kuala Lumpur and Watukosek represent the 'cleanest' sites with respect to tropospheric ozone. They are strongly influenced by convection (**Figure 3**), with the star symbol denoting a region of dominant cloud outflow. Moving eastward, convective influences are somewhat less distinct and the altitude of cloud outflow (minimum ozone) is slightly lower. This is illustrated by two sites in the transition region between Pacific and Atlantic that is denoted as the "equatorial Americas", represented by San Cristobal and Alajuela.

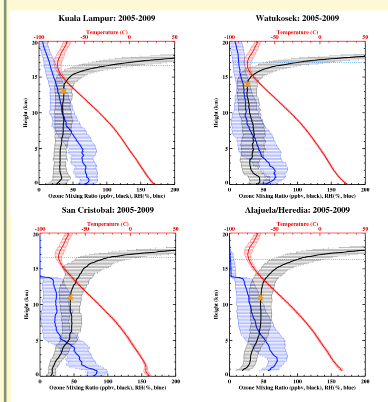

Figure 3.

Moving farther east, there are fewer signatures of convection and more influence of high ozone from descent in the Walker circulation, appearing in the upper troposphere, along with pollution in the lower and mid-troposphere. The pollution is evident at Natal, Cotonou, Ascension and Nairobi, the latter two illustrated in **Figure 4.**

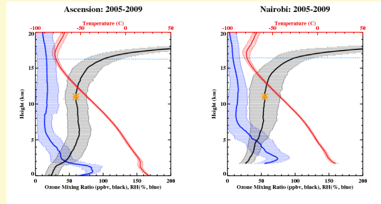

Figure 4.

TOTAL COMPARISONS: SONDES, OMI, GROUND-BASED INSTRUMENTS

Figures 5 & 6 show generally good agreement between total ozone (in DU) from the sondes and OMI overpasses, as well as surface ozone instruments where these are available. At Kuala Lumpur, the sondes are lower relative to OMI, but they are much higher than OMI at Paramaribo.

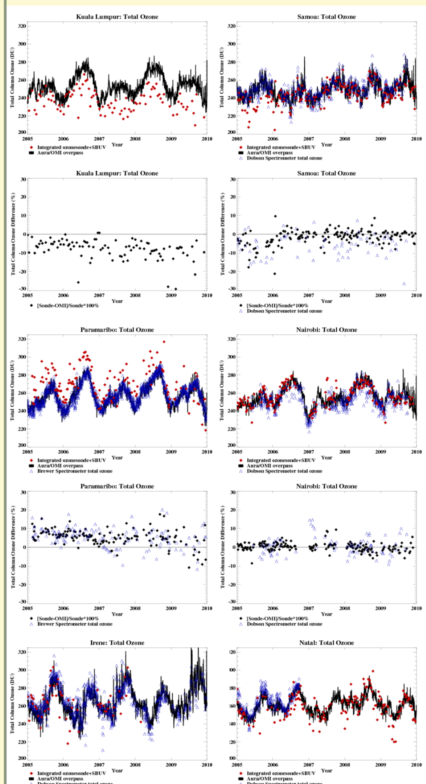

Figure 5.

The summary of OMI-sondes total ozone agreement, depicted in **Figure 6,** is generally better than during the Earth-Probe/TOMS period (Thompson et al., 2007). Some of the improvement appears to be due to a modified above-burst MLS-SAGE-based climatology developed by McPeters et al. (2007). Fiji, Samoa, and San Cristobal modified the ozone sensing solution in the sonde in 2006; this may also have brought OMI and the sonde agreement closer.

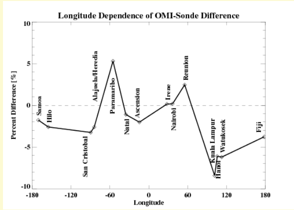

Figure 6. A summary of OMI-SHADOZ total ozone agreement for 14 stations operating during 2005-2009.

In studies with 1998-2004 SHADOZ data, we explored possible sonde biases in the stratospheric segment of the profile by referencing the mean profiles between 10 and 100 hPa to an all tropical SHADOZ profile (Thompson et al., 2007). Extending this record with the OMI-era sondes shows similar patterns. Nairobi and Paramaribo are offset on the high side; Watukosek, San Cristobal and Cotonou in the lower stratosphere are systematically low (**Figure 7**).

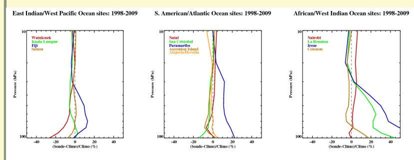

Figure 7.

ACKNOWLEDGMENTS & REFERENCES

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