Ozone Soundings Restarted at NOAA/SHADOZ Site in Suva, Fiji

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Patrick Cullis, Francis Mani, Matakite Maata, and Bryan Johnson launching an ozonesonde at the University of South Pacific in Suva, Fiji.

As part of NOAA's collaboration with the Southern Hemisphere Additional OZonsonde (SHADOZ) network, electrochemical cell ozonesondes are launched by balloon 2-4 times a month from sites at Suva, Fiji; Hilo, Hawaii; and American Samoa. The University of the South Pacific site in Suva, Fiji had been experiencing reception issues during balloon flights and finally stopped launches in late 2013 due to the persistent equipment failures. A site visit during February 2-5, 2015 successfully restarted the site with new receiving station equipment. In addition, a series of six ozonesondes on four balloons were launched over a three day period.

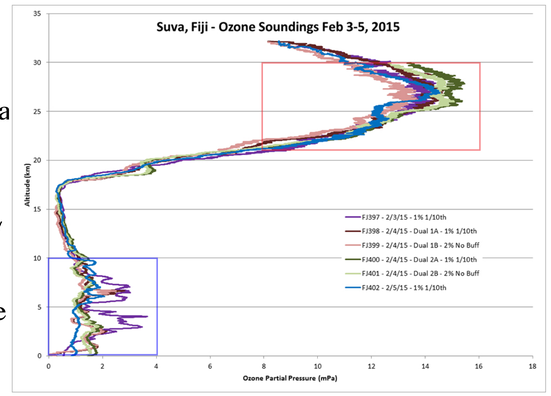


Figure 1: Ozone partial pressure of six ozonesondes launched over a 48 hour period from Suva, Fiji including two dual ozonesonde packages.

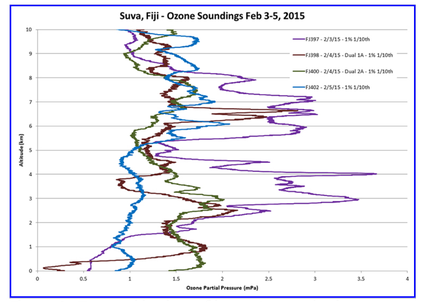


Figure 2: Zoomed in view of lower tropospheric variability from the four ozonesonde flights from Fiji using NOAA's standard recipe solution.

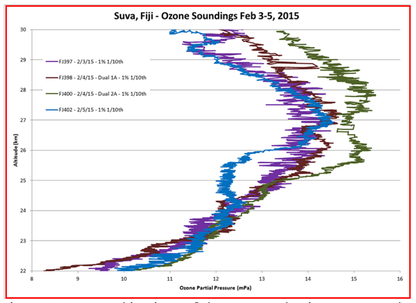
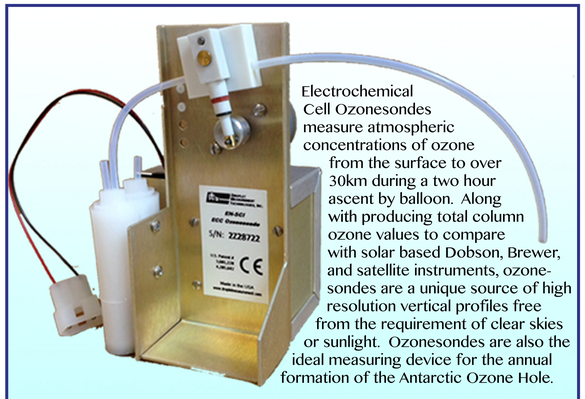


Figure 3: Zoomed in view of the stratospheric ozone peak and the variability seen over small timescales from just the four sondes using NOAA's standard recipe solution.

Ozone concentrations in the troposphere and stratospheric ozone peak varied significantly over the 48 hour period of launching.



Electrochemical Cell Ozonesondes measure atmospheric concentrations of ozone from the surface to over 30km during a two hour ascent by balloon. Along with producing total column ozone values to compare with solar based Dobson, Brewer, and satellite instruments, ozonesondes are a unique source of high resolution vertical profiles free from the requirement of clear skies or sunlight. Ozonesondes are also the ideal measuring device for the annual formation of the Antarctic Ozone Hole.

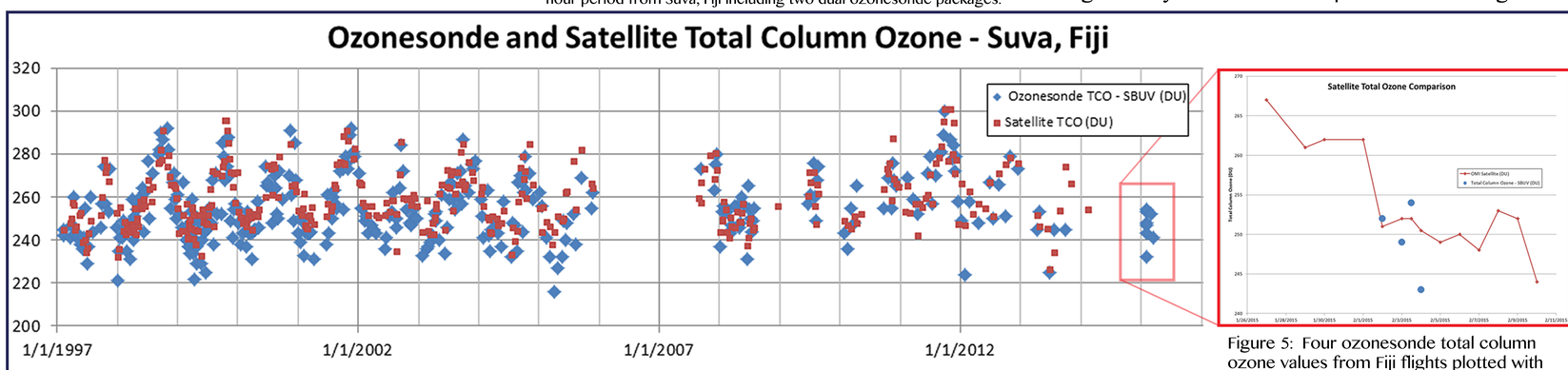
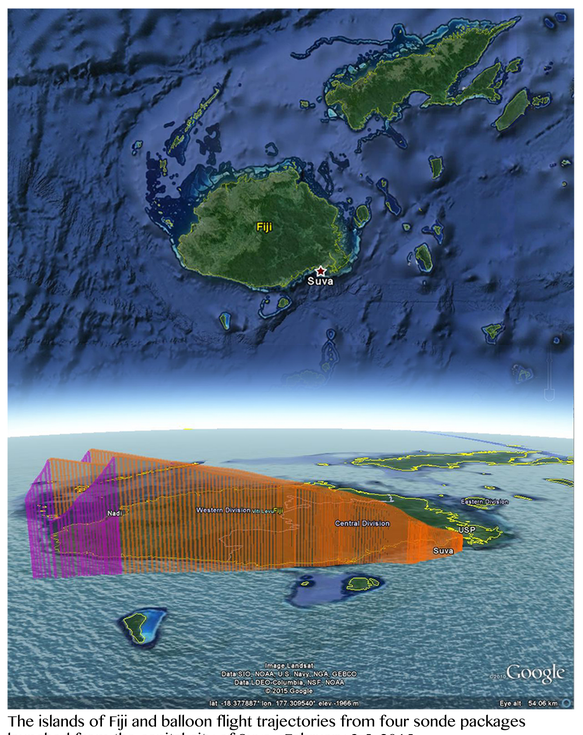


Figure 4: Total column ozone values from every Fiji ozonesonde balloon plotted with corresponding satellite values.

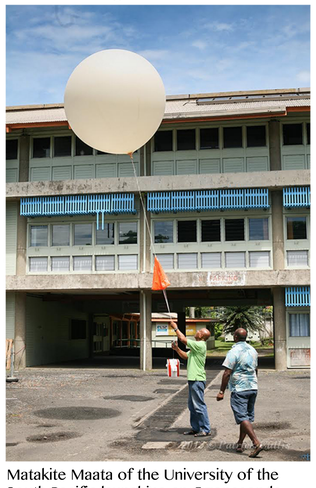
Figure 5: Four ozonesonde total column ozone values from Fiji flights plotted with daily satellite ozone values.

The Fiji ozonesonde record began in 1997 and currently spans over 18 years. Funding, staffing levels, equipment, and logistical issues have left several gaps in the data record. With new receiving equipment and the logistics of helium gas suppliers worked out, the record should continue with regular launches for the foreseeable future.

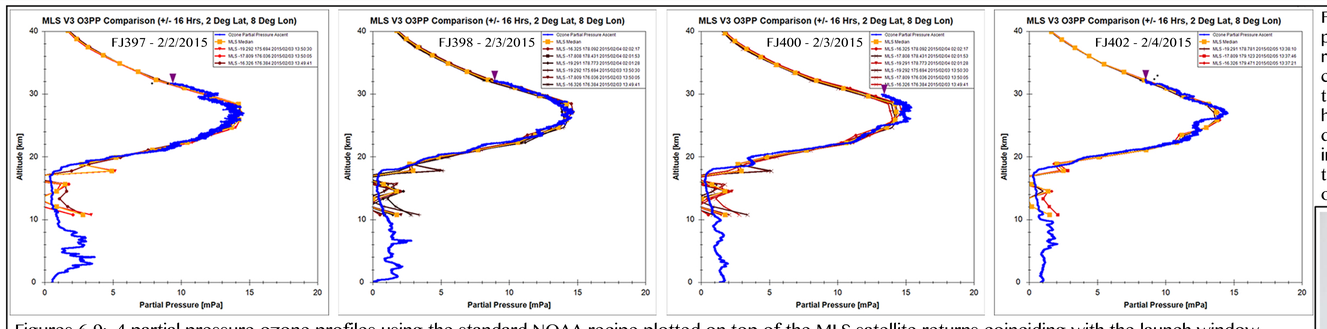


The islands of Fiji and balloon flight trajectories from four sonde packages launched from the capital city of Suva - February 3-5, 2015.

Francis Mani fills the balloon for an ozonesonde flight.

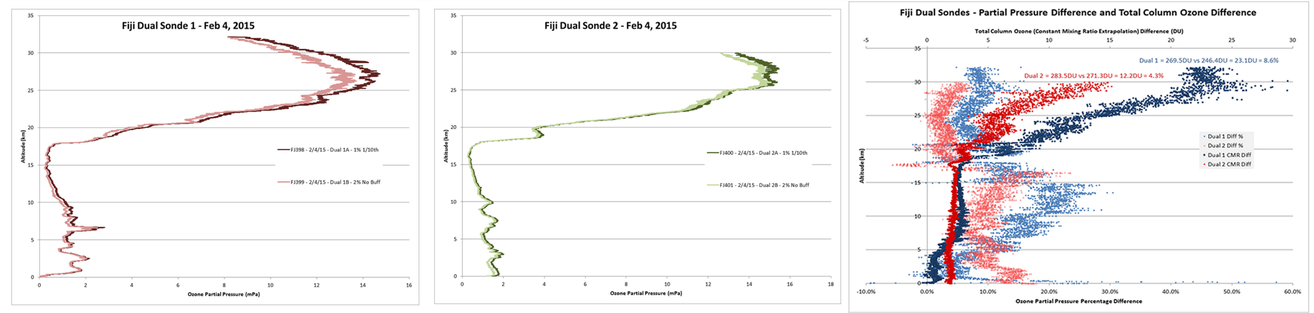


Matakite Maata of the University of the South Pacific launching an Ozonesonde.



Figures 6-9: 4 partial pressure ozone profiles using the standard NOAA recipe plotted on top of the MLS satellite returns coinciding with the launch window.

Four NOAA standard solution ozonesonde profiles plotted against MLS satellite returns provide good validation of ozone concentrations and vertical structure in the stratosphere. Satellite measurements have improved steadily, but it is still difficult for satellites to properly measure in the troposphere and they often miss the fine details of the tropopause and ozone layering in the lower stratosphere.



Figures 10-12: Two balloons carried dual-sonde packages comparing current and historical sensor solution as a critical analysis for homogenization of worldwide ozone data. Proper tropical stratospheric conditions are difficult to reproduce in environmental chambers, but flights with 2% unbuffered solution have historically read ~5% low compared to other solution recipes. The percentage difference in ozone partial pressure generally improves as the balloon rises out of the extreme variability of the troposphere, but their overall effect on total column ozone calculations dramatically increase in the high ozone concentrations of the stratosphere. The dual flights were used to help characterize this offset in order to better homogenize historical datasets.

Dual Ozonesonde Package