NOAA Ozonesonde Sites from the Tropics to Midlatitudes: Ozone Variability, Links to Meteorological Conditions, and Validation of NASA Chemical Models

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NOAA oversees the regular launching of balloon-borne ozonesondes at sites all over the globe, including the Boulder, CO, and Hilo, HI; sites, which are operationally about 40 years old. NOAA also participates in the Southern Hemisphere Additional Ozonesondes (SHADOZ) network, the gold standard for tropical ozone profile data for over 20 years. In this work, we use a statistical clustering technique (self-organizing maps; Stauffer et al., 2018, JGR), NASA MERRA-2 meteorological reanalyses, and state-of-the-art NASA chemical simulations (Stauffer et al., 2019, JGR) to compare and contrast the ozone profile data sets at NOAA sites. We examine the differences in ozone/meteorological relationships and chemical model performance at midlatitude (Boulder), subtropical (Hilo), and tropical (Fiji) sites. The clustering technique identifies major patterns in ozone profile shape and assists the linkage of meteorological and chemical conditions to the ozone profile (See Figure for ozone/convection example at Fiji). Our comparisons with ozone output from NASA models highlight the poor representation of tropical tropospheric ozone, and the need for continued monitoring, particularly at low latitudes.

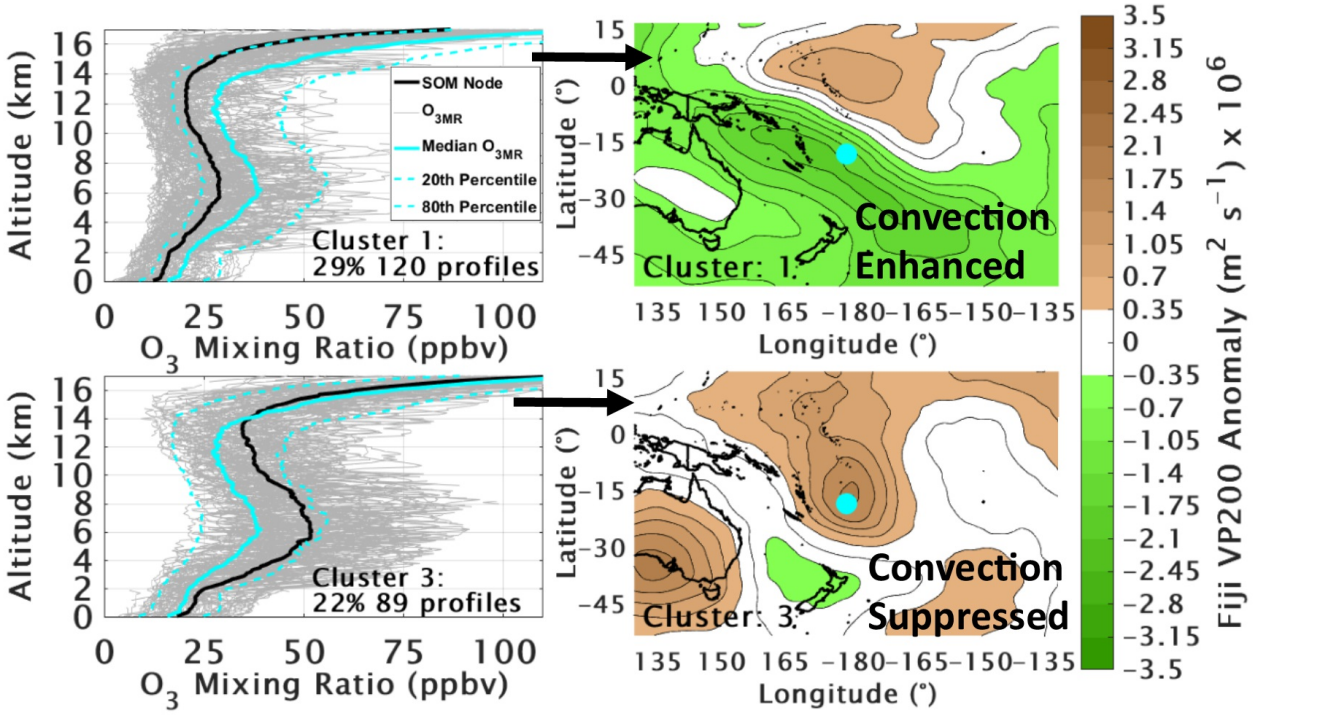

Figure 1. Figure: (L) Ozone mixing ratio profile clusters from the Fiji SHADOZ site. Individual profiles are shown in grey, with the cluster mean in black. For reference, the median and 20th and 80th percentile O_3 for the entire site data set is shown in cyan. (R) Contoured maps of average MERRA-2 calculated 200 hPa velocity potential anomalies from climatology (colors) corresponding to the ozone profile clusters shown on the left. Fiji's location is marked by the cyan dot in the center of the panels. In general, low tropospheric ozone amounts at Fiji are linked to enhanced convective activity, and high ozone amounts are linked to suppressed, or a lack of, convective activity.