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Poster
Comparing RO with other types of atmospheric observations, such as radiosondes, is crucial in understanding the properties and quality of both the RO and the other observations. However, RO and other observations are rarely taken at the exact same time or location, introducing sampling errors resulting from atmospheric variability that can overshadow fundamental differences in the RO and the observations under comparison. Previous studies have compared radiosonde observations with RO observations from a certain time window within circles of a given radius (ranging between 100-300km) centered at the location of the radiosonde (Kuo et al., 2005; Xu et al., 2009; He et al., 2009; Sun et al., 2010; and Wang et al., 2013). This study investigates whether comparisons between RO and radiosondes or models within ellipses with semi-major axis along the direction of wind flow, rather than circles, will reduce sampling errors. It is hypothesized that the refractivity gradient tends to be perpendicular to the local wind direction, resulting in less variation of refractivity along the direction of flow and more variation perpendicular to the flow.
The hypothesis was first tested using the European Centre for Medium-Range Weather Forecasts Interim Reanalysis (ERA Interim) data over the Tropical West Pacific. The ERA Interim refractivity field showed a strong correlation between refractivity and the direction of wind flow, especially in regions of high wind speeds, suggesting that comparisons along the wind flow would be an optimal method to minimize sampling errors. ERA Interim model refractivites within an ellipse parallel to wind flow, perpendicular to wind flow, and two circles were compared with a reference ERA Interim point at the center (simulating a radiosonde location). The semi-major axis of the ellipse and radius of the larger circle was 6° in latitude (666km), and the radius of the smaller circle was 2.6° in latitude (~300km). Comparisons within each ellipse and circle were done twice a day (00:00UTC and 12:00UTC) at six different pressure levels and two different locations for January-February 2007.
Statistical analysis over the two-month period showed lower root mean square (RMS) differences in refractivity for the parallel ellipse by a factor of two to three compared to the perpendicular ellipse and larger circle at all six pressure levels and at both locations. The smaller circle, which contained roughly the same number of ERA Interim data points as the ellipses, had RMS differences in refractivity similar to the parallel ellipse and at certain pressure levels slightly lower RMS values than for the parallel ellipse.
We compared ERA Interim refractivities with RO observations in ellipses parallel and perpendicular to the flow, as well as the two circles, over the same two-month time period. RMS differences between ERA Interim and RO refractivities were significantly less within the parallel ellipse compared to perpendicular to the flow or within the larger circle.
Finally, RO and radiosonde comparisons were conducted at three different locations (Guam, DeBilt, Netherlands, and Upton, New York) for the full year of 2007. Results from this comparison showed smaller RMS differences in refractivity within the parallel ellipses than both the larger circle and perpendicular ellipses at all three locations and six pressure levels (with an exception at Upton at 850hPa where wind speeds were low). The lower RMS differences in the refractivity within the parallel ellipses at all three locations further suggests that comparisons along the direction of wind flow is an effective method to reduce sampling errors.
OSTS session
Regional and Global CAL/VAL for Assembling a Climate Data Record