Electromagnetic Propagation Environment in Tropical Disturbances Using Dropsonde Measurements

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Electromagnetic propagation environment has been characterized by numerical simulations and/or mostly by rawinsonde measurements based on ships, island, or land surfaces. While rawinsondes provide direct measurements of the atmospheric temperature and moisture, it is generally difficult to use the measurements for identifying surface-based ducts or evaporative ducts over the ocean due to ship or island contaminations unless an up-down sampling approach is adopted. In recent years, dropsonde measurements have been used in many field programs over some oceanic environments and thus can be used to quantifying the near-surface environment over Ocean. Although the sensor technology between dropsondes and rawinsondes are similar, the near-surface sampling of the downward going dropsonde are normally made in undisturbed environment away from potential flow distortions such as those near a ship. Hence dropsonde measurements have the potential to represent the near-surface altitudes better than the upward going rawinsonde carried by balloons.

This presentation will first examine the potential of using dropsonde measurements to quantify near-surface profiles of the modified refractive index (M). We use measurements of more than 20,000 dropsondes from over 125 tropical cyclones, tropical storm, or tropical depressions since 1996 over different parts of the global ocean and examine the near-surface temperature and moisture variability revealed from these dropsondes in storm environments. In this effort, the modified refractive index (M) profiles are generated from each dropsonde measurement. The trapping layer characteristics will then be identified and will be categorized into different type of ducting conditions. Because of the broad spread of the dropsonde measurements in the storm relative environment, we will categorize the ducting environment within and in the periphery of the sampled storm for the objective of identifying the storm relative regions critical to radar and communications performance. These characteristics should be related to the cyclone track and other storm related factors using the best track products archived by NOAA. Statistical analysis methods will be used to examine the characteristics of ducting conditions in different quadrants of a hurricane relative to its motion. While in the past it has been generally recognized that the atmospheric environment in a tropical cyclone (TC) is hostile to the development of ducts, recent studies of limited cases have found that ducts are likely to be formed on the periphery of a TC and in its eye. These findings will be verified using a much larger dataset in this research effort.