A Long-Term, High-quality, High Vertical Resolution GPS Dropsonde Dataset for Hurricane Research: Overview and Scientific Applications [1]

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Abstract:
Since 1996 the GPS dropsonde has served well for both the operational and research communities by making high quality, high vertical resolution atmospheric profile observations in regions that are otherwise very difficult to observe. A project was conducted in the Earth Observing Laboratory (EOL) at the National Center for Atmospheric Research (NCAR) to create a research quality dropsonde data set for long-term studies of hurricane and tropical storm environments that would enable researchers to better define characteristics unique to different regions within a storm, to document common large and small scale structures, and to improve understanding of structures that influence tropical cyclone tracks, intensity and precipitation forecasts. Thirteen years (1996-2013) of high resolution dropsonde data, from the National Oceanic and Atmospheric Associations (NOAA) National Hurricane Center and Hurricane Research Division were gathered and quality-controlled to produce the highest research quality dropsonde climatology available. In the near future there are plans to add hurricane dropsonde data sets collected from EOL, The United States Air Force and the National Aeronautics and Space Administration (NASA) to this archive, and that the NOAA dropsonde data can be brought up to date.

Dropsondes are scientific instruments deployed from aircraft, most commonly over oceans. The NCAR GPS dropsonde system is currently installed on over 20 aircraft around the world. The utilization of these instruments has allowed researchers to obtain comprehensive observations of the structure and evolution of tropical storms. As they descend, dropsondes measure pressure, temperature, and relative humidity at a half second rate and GPS winds at a quarter second rate. Between 1996 and 2012, 121 storms sampled by NOAA aircraft in the Atlantic and Eastern Pacific Oceans, ranging in size and strength from tropical depressions to hurricanes, and over 15,000 dropsondes were deployed by NOAA alone. Processing of these data included subjecting them to an established set of consistent quality control procedures, developed at NCAR/EOL, that conservatively remove erroneous data while retaining finer features of the thermodynamic and wind profiles.

These data were released to the public in 2015. They have since been used in several research projects. In one project, composite wind profiles for hurricanes of varying intensity were created to verify idealized numerical models of tropical-cyclone boundary layers. These composite wind profiles are being used together with numerical models to evaluate design criteria for offshore wind turbines, which have been proposed for the East Coast of the Unites States. Efforts are also underway to evaluate parameterizations for drag coefficient at the ocean surface at high wind speeds, which remain uncertain. The addition of more than 8,000 sondes from the Air Force in the near future should help reduce the uncertainty in these analyses.

Collaboration Area: Data Preservation [3]
Discovery [4]
Sustainable Data Management [5]
Usability [6]

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