14D.6 LOW-LEVEL KINEMATIC, THERMODYNAMIC, AND REFLECTIVITY FIELDS OF HURRICANE BONNIE (1998) NEAR LANDFALL

Rebecca Schneider[1], Gary Barnes[1], and Peter Dodge[2]

[1] Department of Meteorology, University of Hawaii at Manoa, Honolulu, Hawaii
[2] NOAA/AOML/Hurricane Research Division, Miami, Florida

1. INTRODUCTION

Eighty-five dropwindsondes were deployed from two NOAA WP-3d aircraft from 1220 to 2300 UTC on August 26, 1998, prior to and during Hurricane Bonnie's (964 hPa) landfall. Hurricane Bonnie's northern eyewall began to encroach upon land at approximately 1400 UTC. The storm was making landfall in a region of weak synoptic influence with only a 1018 hPa high centered over Chicago and a weak cold front on the far side of the Appalachian mountain chain.

The dropwindsondes extend out to a radius of 300 km from the storm center and provide measurements every 7 m in the vertical. Aircraft radar as well as the WSR-88Ds at Morehead City and Wilmington, North Carolina provide reflectivity fields. Figure 1 displays the distribution of the dropwindsondes and the locations of the WSR-88Ds.

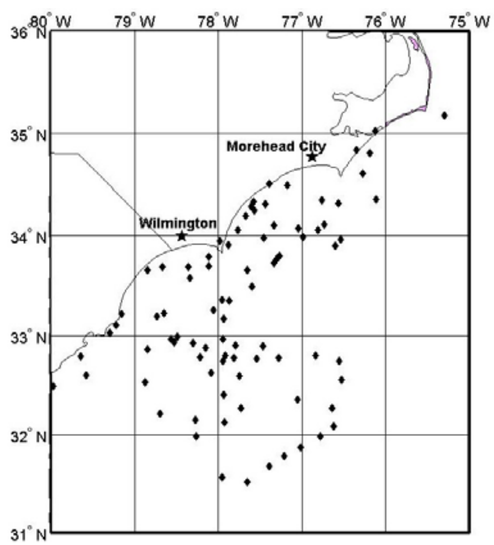

Figure 1. Location of 85 dropwindsondes deployed in Hurricane Bonnie.

Corresponding author address:
Rebecca Schneider, Department of Meteorology, University of Hawaii at Manoa, Honolulu, HI 96822.
e-mail: rsschnei@hawaii.edu

The dropwindsondes are used to establish storm-relative composites of temperature, specific humidity, equivalent potential temperature and tangential and radial winds at various horizontal levels from 10 m to 2 km altitude. We believe that this is the first time that such fields have been produced without reducing the aircraft data from higher altitudes. We are also able to compare the reflectivity fields from the WSR-88Ds with the fields derived from the dropwindsondes. The goal of this study is to examine the low-level thermodynamic, kinematic, and reflectivity fields on a meso-β scale to determine if the hurricane structure is affected by the proximity of land.

2. METHODOLOGY

Storm-relative composites are created from nearly 11 hours of data collected by the dropwindsondes. To create such composites one must assume the storm is steady-state. During this study Bonnie's MSLP did not vary by more than 3 hPa and the reflectivity features evolved slowly. Bonnie's direction and speed, established by high resolution aircraft fixes, remained roughly constant throughout the entire study.

3. PRELIMINARY RESULTS

Bonnie's low-level inflow temperature is not isothermal. At 10 m altitude (Figure 2a) cooler air (< 25ºC) is evident to the right rear of the storm, above Bonnie's SST wake. Bonnie also features a cool region that is collocated with the eyewall and rainbands, as identified by the aircraft radar and the WSR-88Ds. The storm's offshore flow is 1ºC warmer than the onshore flow at a radius of 1.5º latitude from storm center. This difference is maintained from the surface up to 500 m.

Hurricane Bonnie's radial winds at 10 m (Figure 2b) show strong inflow to the south and southwest of the circulation center, in the offshore flow. The strong inflow coincides with the location of the eyewall as identified by reflectivity features and rotates anticyclonically up to 500 m. At 10 m outflow exists to the northeast of the storm center. This region persists throughout all the levels examined. By 2 km outflow dominates most of the storm.

Additional fields will be presented at the conference.

4. DISCUSSION

Preliminary results prove that Bonnie's proximity to land resulted in warmer, drier and more stable air being entrained into the outer portion of the storm's circulation. Closer to the storm center the thermodynamics reveal a more symmetric storm.

Radar indicates that the warm and dry air in the offshore flow is collocated with a precipitation-free region. In the onshore flow echoes are not affected in intensity or orientation as they cross land.

Bonnie's kinematics reveal the strongest inflow in the offshore flow while outflow is present at 10 m to the northeast of storm center.

Hurricane Bonnie was influenced by the proximity to land, yet the major effects are seen at larger radii from storm center and do not affect intensity.

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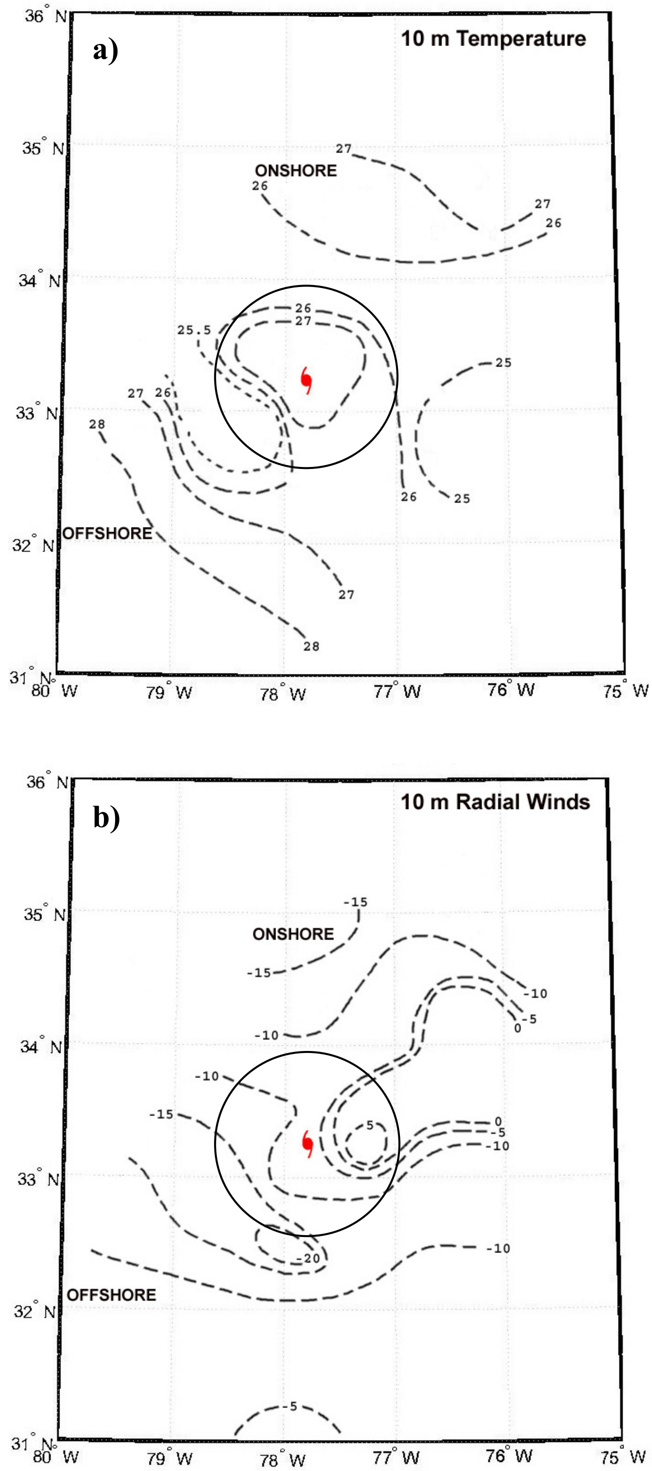

Figure 2. a) Bonnie's storm-relative temperature (ºC) and b) radial wind field (m s^{-1}) at 10 m. The circle denotes the eyewall. The coast has been omitted to avoid the impression of analyzing fields over land.