## Low-level thermodynamic structure of Hurricanes as seen with the GPS sonde

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Global Positioning System(GPS) sondes provide unprecedented, detailed views of the hurricane boundary layer with vertical resolution as fine as 6 to 7 m. They also exhibit more reliable performance in saturated environments than their predecessors, the Omega dropwindsondes. Of particular interest are the sondes jettisoned by the NOAA WP-3d's in the inner few hundred km of Hurricanes Guillermo (1997) and Bonnie (1998).

The GPS sondes reveal several intriguing structures. These include moist absolutely unstable layers (MAULs), a nearly saturated surface layer, shallow mixed layers that do not fit the typical tropical paradigm, and an increase of equivalent potential temperature with height that occurs well below the midtropospheric minimum. Some of these structures are likely due to sensor failures, primarily due to wetting of the hygristor, while others appear to be real.

We will contrast the classic boundary layer found in the tropics with that found in the inner core of Hurricanes Guillermo (1997) and Bonnie (1998). Early results show that the mixed layer cools and moistens resulting in a lowering of the lifted condensation level (LCL). The typical tropical boundary layer, usually dominated by an unsaturated mixed layer of 500 m thickness, evolves toward a saturated layer akin to the cloud layer one often observes just below a trade wind inversion. Weak vertical gradients of equivalent potential temperature are characteristic of this layer. Beneath this layer is a shallow (100-200 m) dry adiabatic layer.

These structures serve as strong clues to what processes dominate the inner core of the hurricane. The presence of a MAUL is evidence that mesoscale forcing becomes increasingly important relative to convective forcing (buoyancy) as one approaches the radius of maximum winds. The deepening layer of high equivalent potential temperature limits the effects any downdrafts may have on hurricane intensity. Low-level cooling, the reduction of instability, the shrinking of the unsaturated mixed layer, and the lowering of the LCL favor small diameter clouds that are easily defeated by entrainment; these clouds are unable to yield heavy rain or downdrafts. A dry adiabatic surface layer in the presence of high winds, and therefore spray, is evidence that the spray droplets surrender their sensible heat much more readily than they evaporate. Several of these changes in the boundary layer favor the maintenance of the eye wall by hindering the development of nearby, potentially competing, convection.