Shock-Like Structures in the Hurricane Boundary Layer

Thursday, February 21, 2013

ATS room 101; Discussion will begin at 3:30pm
Refreshments will be served at 3:00pm in the weather lab

This talk will present high horizontal resolution solutions of an axisymmetric, constant depth, slab boundary layer model designed to simulate the radial inflow and boundary layer pumping of a hurricane. For intense vortices the \( u(\partial u/\partial r) \) term in the radial equation of motion produces a shock-like structure in the radial wind, i.e., near the radius of maximum tangential wind the boundary layer radial inflow decreases from approximately 20 or 30 m/s to zero over a radial distance of a few kilometers. Associated with this large convergence is a spike in the radial distribution of boundary layer pumping, with updrafts larger than 25 m/s at a height of 1000 m. Based on these model results, it is argued that observed hurricane updrafts of this magnitude so close to the ocean surface are due to the dry dynamics of the frictional boundary layer rather than moist convective dynamics. The shock-like structure in the boundary layer radial wind also has important consequences for the evolution of the tangential wind and the vertical component of vorticity. On the inner side of the shock the tangential wind tendency is essentially zero, while on the outer side of the shock the tangential wind tendency is large due to the large radial inflow there. The result is the development of a U-shaped tangential wind profile and the development of a thin region of large vorticity. In many respects the model solutions resemble the remarkable structures observed in the boundary layer of Hurricane Hugo (1989).

Link to colloquium videos and announcement page: [http://www.atmos.colostate.edu/dept/colloquia.php](http://www.atmos.colostate.edu/dept/colloquia.php)