Hurricane Passages over Florida
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Introduction

Roughness Length Parameter

- Hurricanes are one of the most destructive natural phenomena affecting the United States. Not only do hurricanes cause death and injuries, but they destroy personal property, electrical systems, and other vital infrastructure.
- Being able to diagnose the damage potential to electrical systems will allow electrical companies to provide a more efficient response to areas that are in greatest need of repairs.
- Damage surveys have shown that high resolution data are needed to capture the various types of mesoscale features (terminals, roll clouds, downdrafts, etc.) that are embedded within the hurricane’s wind field.

The primary objective of this research is to produce high resolution spatial field estimates of surface (10 m) winds and 3-gage using Level II archived Doppler radar data.

Bottom image taken from: http://incarta.nws.noaa.gov/media/4653/607/hurricane_opt1_destruction.html

Data and Methodology

Level II Doppler Radar Data

- Data contains reflectivity and radial velocities at a horizontal resolution of 1 degree radial, 0.27 n mi (0.5 km) range gates, and a temporal resolution of approximately 1 min.
- Right: Depending on the Volume Coverage Pattern (VCP) of the radar, the data can contain up to 14 elevation scans ranging from 0.5 to 19.5 deg.
- Images are right taken from: http://weather.noaa.gov/radar/radarinfo/vcp21.html

Quality Control and Velocity Alising

- To provide a ‘clean’ version of reflectivity data, quality control steps must be applied.
- Quality control and alising techniques performed by the Warning Decision Support System – Integrated Information (WDSS-II) that was developed at the National Severe Storms Laboratory and the Cooperative Institute for Mesoscale Meteorological Studies at the University of Oklahoma.
- WDSS-II quality controls reflectivity data by using a neural network that eliminates the contamination associated with anomalous propagation, ground clutter, and clear-air returns.
- There is an upper limit to the magnitude of the target velocity (the Nyquist velocity) that stationary radars can detect unambiguously.
- Velocity aliasing occurs once that limit is exceeded.
- The maximum aliasable radial velocity of 27.21 kt corresponds only to marginal tropical depression force winds, which are generally undetected for hurricanes. The de-aliased velocity field contains wind speeds exceeding 188 kt, a more realistic portrayal of the radial velocity field.

Radial Velocity Dilemma

- Doppler radars only measure the component of the wind that is directly along the radar beam.
- Any wind component that is tangential to the beam will be seen as zero, only if the wind is parallel to the beam will be fully measured.
- Presents a major problem when diagnosing the location of the maximum wind speeds at the surface, since the radial velocity problem produces gaps through the velocity field.
- To calculate the true surface winds using only Level II Doppler data, an algorithm must be created to convert the radial velocity field into a true wind field.

Radial Velocity at this point is 180 mph. Radial velocity of this point is 250 mph.