

VAD and Dual-Doppler Analysis of Doppler Velocity for HIWRAP

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The Velocity Azimuth Display (VAD) and the dual-Doppler analyses techniques established for ground-based scanning radar are applied to the NASA Goddard Space Flight Center High-Altitude Imaging Wind and Rain Airborne Profiler (HIWRAP). A modified formula of VAD analysis for the HIWRAP is presented to examine the error due to aircraft motion. We found that this error is small in general. For typical values of HIWRAP's antenna's scan rate and aircraft ground speed, errors in the horizontal wind fields are less than 0.5 m s⁻¹. We assume a constant hydrometeor vertical velocity on the HIWRAP scan circle in the analysis. This assumption introduces unbiased error with the mean of ~ 0.04 - 0.16 m s⁻¹ and standard deviation of ~3.42 - 4.04 m s⁻¹ in the VAD-derived horizontal winds, respectively. We have applied the VAD analysis to the HIWRAP's first field experiment data collected during NASA's Genesis and Rapid Intensification Processes (GRIP) mission. The results show that the along track wind from VAD technique and dual-Doppler analysis agree in general. The VAD horizontal winds derived from HIWRAP capture Hurricane Karl's vortex structure, and they are in general agreement with horizontal winds from nearby dropsondes except for regions about 6 km altitude and above where the data has low signal-to-noise ratio and contaminated by velocity folding. VAD winds represent a mean over an area within the radar scan region and therefore smooth out many of the transient or small-scale features so that only the larger scale feature of the winds remain, and therefore it can provide valuable information for data assimilation studies.