Study of Airborne Doppler Radar Navigation Correction Using a Variational Technique

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Introduction
Airborne Doppler radar data needs to go through a careful navigation correction procedure before accurate dual-Doppler synthesis can be obtained. Over the past ten decades, separate correction techniques have been developed to correct navigational errors of ELDORA. The goal of this research is to develop a navigation correction algorithm which can be used in airborne Doppler field campaigns in realtime and in conjunction with the algorithm presented by Wolff et al. in these proceedings to quickly correct navigation errors of both the loss and aft radar. This algorithm uses three constraints (the surface height, the surface velocity, and flight level winds) to derive 12 navigation correction factors of both the fore and aft radar. The modified algorithm is able to use the new ELDORA field campaigns data recently developed by NCAR/ECOL for radar/lidar data.

The Goal of ELDORA Real-Time Dual-Doppler Project

Examples of Derived Corr. Factors (MAP)

Issues of In-Situ Cost Function

Cost Function for Navigation Correction

Cost Function for Navigation Correction (Continued)

Methodology

• Based on a thorough literature review (i.e., Testud et al., 1995, Georgia et al. 2000, and Benatt et al. 2002), a variational method originated by Georgis et al. (2000) was selected and modified to be used for the future realtime navigation correction system. This algorithm uses three constraints (the surface height, the surface velocity, and flight level winds) to derive 12 navigation correction factors of both the loss and aft radar. The modified algorithm is able to use the new ELDORA field campaigns data recently developed by NCAR/ECOL for radar/lidar data.

Cost Function for Navigation Correction

Data Quality’s Impact on In-Situ Winds

A Flow Chart for Testing the Algorithm

1. Sweep files are created to OBT(Ballistic) and OBT(Fix) files

2. Variational navigation correction code node in the flow files and produces correction factors

Algorithm Performance (Complex Terrain)

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