Demonstrating the operational value of Atmospheric Infrared Sounder (AIRS) retrieved profiles in the pre-convective environment

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The Short-term Prediction Research and Transition Center (SPoRT) is a collaborative partnership between NASA and operational forecasting partners, including a number of National Weather Service offices. SPoRT provides real-time NASA products and capabilities to its partners to address specific operational forecast challenges. One operational forecast challenge is forecasting convective weather in data-void regions such as large bodies of water (e.g. Gulf of Mexico). To address this forecast challenge, SPoRT produces a twice-daily three-dimensional analysis that blends a model first-guess from the Advanced Research Weather Research and Forecasting (WRF-ARW) model with retrieved profiles from the Atmospheric Infrared Sounder (AIRS) — a hyperspectral sounding instrument aboard NASA's Aqua satellite that provides temperature and moisture profiles of the atmosphere. AIRS profiles are unique in that they give a three dimensional view of the atmosphere that is not available through the current rawinsonde network. AIRS has two overpass swaths across North America each day, one valid in the 0700-0900 UTC timeframe and the other in the 1900-2100 UTC timeframe. This is helpful because the rawinsonde network only has data from 0000 UTC and 1200 UTC at specific land-based locations. Comparing the AIRS analysis product with control analyses that include no AIRS data demonstrates the value of the retrieved profiles to situational awareness for the pre-convective (and convective) environment. In an attempt to verify that the AIRS analysis was a good representation of the vertical structure of the atmosphere, both the AIRS and control analyses are compared to a Rapid Update Cycle (RUC) analysis used by operational forecasters. Using guidance from operational forecasters, convective available potential energy (CAPE) was determined to be a vital variable in making convective forecasts and is used herein to demonstrate the utility of the AIRS profiles in changing the vertical thermodynamic structure of the atmosphere in the pre-convective and convective environment. CAPE is an important metric because of it is a quantitative measure of atmospheric stability, which is necessary information when forecasting for convective weather. Case studies from the summer of 2010 were examined, and most impact from the AIRS retrieved profiles occurred over the data-void Gulf of Mexico with fields of convective potential closer to the RUC than the CNTL. Mixed results were found when AIRS retrieved profiles were used over land, so more cases need to be examined to determine whether AIRS would be an effective tool over land. Additional analyses of problematic convective forecasts over the Gulf Coast will be needed to determine the operational impact of AIRS. SPoRT eventually plans to transition the AIRS product to select Weather Forecast Office (WFO) partners, pending the outcome of these additional analyses.

Submitted to 24th Conference on Weather and Forecasting/20th Conference on Numerical Weather Prediction at the 91st Annual American Meteorological Society Meeting