

The SONDE Project: Remote sensing of the kinematic and thermodynamic characteristics of drylines and the adjacent boundary layer

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This proposal represents an important contribution to the *Simultaneous Observation of the Near-Dryline Environment* (SONDE-08) field campaign, to be conducted in West Texas in spring 2008. The principal goals of this joint experiment (University of Wyoming, Texas Tech University, Purdue University, and NCAR), which combines unique airborne and ground-based observations with state-of-the-art modeling, are to advance our understanding of dryline formation, structure and evolution, focusing primarily on dynamical processes that promote fine-scale dryline structure associated with convective initiation. The facilities proposed for SONDE-08 – the Wyoming King Air aircraft with the W-band radar, NCAR surface flux stations, two Ka-band radars, dense meteorological observations from the west Texas mesonet, mobile mesonets, stick-nets, the UAH Mobile Integrated Profiling System (MIPS) and Mobile Alabama X-band (MAX) radar – will provide comprehensive data to advance understanding of dryline dynamics and evolution.

This proposal offers two primary objectives: (a) to examine the structure and dynamics of the dryline convergence zone (and other convergent boundaries, such as density currents), including the development of solenoidal circulations, density current characteristics, and their relation to cumulus formation and CI; and (b) to investigate the role of vertical transport of horizontal momentum (as measured by a Doppler wind profiler and Doppler radar, and compared to in situ measurements by the ISFF and WKA, and to simulated momentum fluxes) in dryline formation and evolution. An important secondary objective will focus on comparison of vertical motion (w) and equivalent reflectivity factor from multiple-frequency radar measurements (915 MHz and 9.5 GHz (X-band) routinely from the MIPS, and 95 GHz (W-band) and 37 GHz (Ka-band) from adjacent radars), and 9.5 GHz dual polarization measurements. This goal will strive to improve w retrievals from vertically-pointing measurements through estimation of vertical insect motion, which generally produces a negative bias in w .

Intellectual Merit. This proposal represents an extension of the ongoing *Atmospheric Boundary Identification and Delineation Experiment* (ABIDE) whose primary goal is to advance understanding of convergent boundary zones (CBZ) and their impact on important meteorological phenomena such as convective initiation and modification of severe storms. This proposal will benefit from the PI's experience in other field campaigns, such as IHOP_2002, BAMEX, and other projects utilizing the UAH Mobile Integrated Profiling Systems (MIPS). Drylines represent a CBZ type that has been under sampled by the MIPS instruments; therefore SONDE-08 will present an opportunity to acquire additional MIPS measurements of drylines and compare their characteristics to those of other CBZs. The SONDE-08 data set will improve understanding of dryline *formation* mechanisms, which was not a goal of IHOP_2002 or other recent campaigns that have yielded detailed dryline observations. A unique feature of SONDE-08 is the emphasis on boundary layer measurements (e.g., momentum, heat, and water vapor fluxes) that will aid in interpreting dryline structure and evolution.

Broader Impacts: This research will be directly tied to improving forecasting of weather phenomena impacted by CBZs (e.g., convective initiation, severe storms). This research will help refine parameterizations of ABL processes and biological flier contamination of Doppler radar and profiler radial velocity measurements. This project will facilitate infrastructure improvements to profiling and radar instruments, which are an integral part of several graduate courses at UAH, the University of Wyoming, and Texas Tech University. Both undergraduate and graduate students from the 4 participating universities will receive valuable training via formal class-room lectures and participation in field campaign activities. Lastly, close collaboration with the University of Wyoming, Texas Tech University, NCAR, and Purdue University and will be established.