



Application of Airborne Phased Array Radar (APAR) Observing Simulation, Processing, and Research Environment (AOSPRES) In The NSF NCAR INtegrating Field Observations and Research Models (INFORM) Program

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Development of a new observing system, such as the proposed Airborne Phased Array Radar (APAR) by the US National Science Foundation (NSF) National Center for Atmospheric Research (NCAR), is critical for the advancement of scientific understanding of weather phenomena. The APAR Observing Simulation, Processing, and Research Environment (AOSPRES) was developed to simulate APAR's measurement and science capabilities before the APAR is constructed. AOSPRES uses Cloud Model 1 (CM1) and Weather Research and Forecasting (WRF) model simulated storms with a hypothetical C-130 operated within the model space. Radar moments and dual-pol variables are deduced from the model microphysical parameters using the Cloud Resolving Model Radar Simulator (CR-SIM). Three-dimensional dual-Doppler radar winds can be retrieved from the Spline Analysis at Mesoscale Utilizing Radar and Aircraft Instrumentation (SAMURAI). The output can be examined directly or passed through additional tools to analyze various aspects of the data collected during each flight.

AOSPRES is linked to a NSF NCAR-wide INtegrating Field Observations and Research Models (INFORM) to (1) establish and support best practices and methods for comparisons between models and observations, (2) exploit, assess and quantify the impacts of integrating observations and models to improve understanding of the prediction and predictability of the Earth system, and (3) improve the design, planning, deployment strategy of field programs and instrument development. The AOSPRES will be expanded into a field program planning tools as wells as a post campaign re-analysis tool with DA capability.

AOSPRES is developed as an open-source software. The first version of AOSPRES software has been released to the research and operational community in the last quarter of 2024. Even though the APAR construction program was suspended by NSF in April 2025, AOSPRES capability has been expanded to be a general purposed radar simulating environment for the community that can be applied to other airborne and ground-based radars. This paper will provide recent

development/accomplishment of AOSPRE and the applications of AOSPRE in the INFORM project to validate and improve model microphysics using radar observations.