

**CAPS CAM Ensemble and
Machine Learning Forecasts for the HMT Winter Weather Experiments**

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The Center for Analysis and Prediction of Storms (CAPS) at OU has been running CAM ensembles as part of the NOAA Hydrometeorology Testbed (HMT) Winter Weather Experiments (WWE). The ensemble forecasts are used to compute the standard ensemble probabilities and means as well as novel ensemble consensus products such as the Spatial Aligned Mean and Machine Learning snowfall.

For the 14th WWE (2023-24), the CAPS ensemble was comprised of 11 members of the FV3 Limited Area Model (FV3-LAM) at 3-km grid spacing over the contiguous United States (CONUS). Forecasts were produced in real-time out to 84h for all the operational days of the WWE from early December, 2023 to mid-March, 2024, for a total of 30 case days. The real-time WWE ensemble was comprised of a control member with the Thompson microphysics, MYNN PBL and Surface Layer scheme and NOAA Land Surface Model. Other members used various combinations of microphysics, PBL/Sfc and LSM physics modules, some with initial and boundary condition perturbations obtained from the operational GEFS ensemble. Statistical analysis of the results from the 14th WWE will be discussed.

A Deep Learning U-Net Machine Learning algorithm has been developed to predict snowfall using output from the operational HREF and four of the CAPS FV3-LAM ensemble members (the HREF+ ensemble). Over the past year, hyperband optimization has been performed to improve the ML results. Details and recent results of these efforts will be shown.

For the 15th WWE we are beginning a pivot toward including 3-km MPAS members in our ensembles, though we've run into some post-processing challenges with that, resulting in 5-member FV3-LAM ensemble being run for input to the ML models and for the HMT intensive evaluation weeks, while MPAS members will be evaluated statistically after the fact.