The Modelling Team covers many different research and engineering topics. One focus is satellite data assimilation into the Warn-on-Forecast (WoF) system to improve high impact weather forecasting. High impact weather may include tornadoes, high winds, flash flooding, and landfalling tropical cyclones. Satellite observations from the recently operational GOES-16 satellite are ideal for WoF applications due to their high spatial and temporal resolution. Assimilated observations include cloud water path (CWP), which represents the total amount of liquid and ice cloud water in a cloud, clear-sky water vapor channel radiances, and atmospheric motion vectors (AMVs). CWP and water vapor radiances are currently assimilated into the WoF experimental real-time system and AMVs will be added in 2019. All data types have shown the ability to increase skill of high impact weather forecasting. Additional areas of interest include cloud microphysics development and validation against model output. The choice of cloud microphysics scheme used in numerical weather prediction (NWP) is vital to correctly analyzing and forecasting clouds and convection (Figure 1). Continued refinement of advanced microphysics schemes is currently underway with concurrent validation efforts against radar and satellite data ongoing.

In addition, members of this team are also involved in Doppler radar radial velocity data quality control and dealiasing techniques. The goal is to improve the quality of the radial velocity observations prior to their assimilation in storm-scale NWP models. Another project explores ways to best assimilate temporally-frequent (every ~1 min) phased-array radar (PAR) volumetric data onto a 1-km grid domain using an ensemble Kalman filter (EnKF). More specifically, this analyzes the impacts of frequent DA cycling intervals (< 15 min), adaptive cycling intervals, ensemble spread maintenance via adaptive covariance inflation and various stochastic perturbation methods, and 3-D and 4-D EnKF. Investigating the impact of correcting storm displacement errors on analyses and forecasts of severe convective weather by using my version of the feature-alignment technique (FAT) prior to each data assimilation cycling step is also ongoing. In addition, a WoFS configuration that implements a 1.5-km resolution two-way nest into the 3-km Real-time WoFS parent grid was developed to assess whether or not higher resolution data assimilation improves forecasts.

Dr. Reames leads the Data and Pre-Processing team for the first release (Medium Range Weather App v 1.0) of the Unified Forecasting System and developed a key software tool (grib2 capability of chgres_cube) that enabled this public release. Currently leading the same team for the Short Range Weather App UFS release. Additional modifications to the FV3 core code have been made to be able to run an idealized case initialized from a single sounding, much like ideal.exe for WRF. Many simulations of a supercell with various namelist parameters changed in order to both test the sensitivity of idealized results to these changes and to develop a baseline for comparison to other models have been completed (e.g., WRF, MPAS, etc.). Finally, the maintenance and continued improvements in high performance computing aspects of WoF represents an important part of this team’s activities.
Figure 1. Probability of forecast 2-5 km UH greater than 60 m$^2$s$^{-2}$ over a 3-hour forecast initiated at 2100 UTC on 28 May for each experiment. Severe weather reported during this period are shown (red=tornados, green=hail, and blue=wind) with severe (blue) and tornado (red) warnings valid at the end of the forecast time also shown.

For more information, please contact Dr. Thomas A. Jones (tajones@ou.edu)

Team Members:
Gerry Creager
Dr. Swapan Mallick
Dr. Larissa Reames

Dr. Thomas Jones
Kang Nai
Dr. Derek Stratman