Overview of the Organization

The vision of CAPS is to establish world prominence in regional environmental modeling and prediction and enhance its world leadership position in storm-scale data assimilation and numerical weather prediction, providing a venue for faculty, staff scientists and students to collaboratively explore bold new ideas, attracting the best scientists and students, and facilitating the transfer of knowledge and technology to government and industry.

In 2014 CAPS celebrates its 25th Anniversary; it was established in 1989 as one of the first National Science Foundation (NSF) Science and Technology Centers. Its primary mission is to develop techniques for automated analysis and prediction of high-impact local weather and environmental conditions. Its research also includes mesoscale and convective-scale dynamics and predictability, and interdisciplinary research on radar meteorology and information technology. It developed and supports advanced end-to-end numerical weather prediction (NWP) systems, including the Advanced Regional Prediction System (ARPS), and receives research funding from many funding agencies in the US and abroad, including the NSF, NOAA, DoD, NASA, and FAA.

Recent Highlights

- Obtained nearly $3.0 million in external funding in CY2013 from NSF, NOAA, DoD, the private sector and foreign governments for projects led by CAPS and in collaboration with other USOs.
- Continued world-leading continent-scale real-time deterministic and ensemble forecast experiments assimilating data from the entire US operational Doppler weather radar network, at resolutions sufficient to explicitly predict convective storms.
- Continued to lead the Analysis and Prediction research of the NSF Engineering Research Center (ERC) for Collaborative Adaptive Sensing of the Atmosphere (CASA).
- Developed advanced data assimilation capabilities within operational modeling frameworks that can potentially be implemented operationally.
- Demonstrated value of real-time Terminal-area Doppler Weather Radar data to real-time analysis and very-short-range prediction as part of new Network of Networks research and the Dallas – Fort Worth Urban Testbed.
- Continued major research efforts on hurricane data assimilation and prediction, and produced real-time, high-resolution (4 km) tropical cyclone forecasts.
- Extended research into new areas including coupled hydrology modeling, urban and air quality modeling, forecasting renewable energy production, forecasting of severe hail, and regional climate prediction.
- Published 73 refereed papers in CY2013.

Activities Planned for 2014

- Lead Network of Network activities and NWP research utilizing the new DFW Testbed. Deploy two new X-band radars for DFW Testbed.
- Develop new, advanced data assimilation (DA) algorithms and capabilities suitable for large-scale operational
implementations. Enhance storm-scale ensemble prediction research.
- Expand and carry out real-time storm-scale data assimilation and forecasting projects in the U.S. and abroad.
- Sustain and expend regional climate modeling efforts.
- Expand basic and applied research on tornado dynamics, hail prediction, hurricane prediction, renewable energy applications, decision science, hazard mitigation, and urban meteorology.

**Linkages and Partnerships**
- Continue and enhance collaboration with the NOAA National Severe Storms Lab and the Storm Prediction Center, working towards the Warn-on-Forecast vision.
- Continue research in several collaborative projects with ARRC faculty, and develop new projects with ARRC and other USOs, departments and research organizations.
- Strengthen ties to the South Central Climate Science Center and Geophysical Fluid Dynamics Laboratory on regional climate modeling.
- Continue collaborative research with NOAA Earth System Research Lab, National Center for Atmospheric Research, NOAA National Centers for Environmental Research, and the National Developmental Testbed Center and contribute the development and improvement of national operational weather prediction systems, including data assimilation and ensemble forecasting capabilities.
- Expand research collaboration with US Department of Defense agencies, including the Naval Research Lab, the Air Force Technical Applications Center, and Defense Threat Reduction Agency.
- Continue work with NSF ERC CASA partners on the DFW Urban testbed.
- Work with national academic partners on EarthCube activities.
- Partnership and collaborations with overseas universities and regional weather services, especially in East Asia.
- Continue hosting and supporting national and international visiting students and scientists.

**Recent Publications and Presentations**
During CY 2013, CAPS published 73 refereed papers in over a dozen journals, with a number of them based on data sets produced by the CAPS Spring Storm-scale Ensemble Forecasts for the NOAA Hazardous Weather Testbed. Highlights include papers by Alex Schenkman on tornadogenesis dynamics, by Dan Dawson on the impact of multi-moment microphysics on storm-scale data assimilation and NWP; Shizhang Wang on four-dimensional and iterative EnKF algorithms; Xiaoming Hu on the relationship between large-scale parameters, air pollutants, and the urban environment; and Jerry Brotzge publishing a review article in BAMS on the tornado warning process.

**Impacts and Outcomes of CAPS**
CAPS continues to make national contributions in the areas of advanced data assimilation techniques, numerical weather prediction, and the basic understanding of mesoscale processes and applications.

The national operational Doppler weather radar network is being upgraded to have dual-polarization capabilities so as to provide additional observed parameters that contain information on in-cloud precipitation processes, and such information is important to initializing numerical weather prediction models and for improving quantitative precipitation estimation and forecasting. A number of our studies are focusing on extracting microphysical information from such new data and improving the treatment of microphysical processes in numerical models.

The collaborative real-time forecast research with the National Weather Service (NWS) allows for potential future forecast products to be evaluated by NWS forecasters and researchers; all such efforts will help improve the forecasting of severe and hazardous weather and mitigate their economic impact.

The center is also playing a role in national efforts including Warn-on-Forecast, Hurricane Forecast Improvement Project, and Wind Forecasting Improvement Project, and is a major national participant in Network of Networks research supported by NOAA.

Finally, CAPS is now making significant contributions to improvements in hurricane/typhoon analysis and prediction, and has 5 funded projects developing and supporting real-time severe weather forecast systems for regional weather services in the East Asia region.