



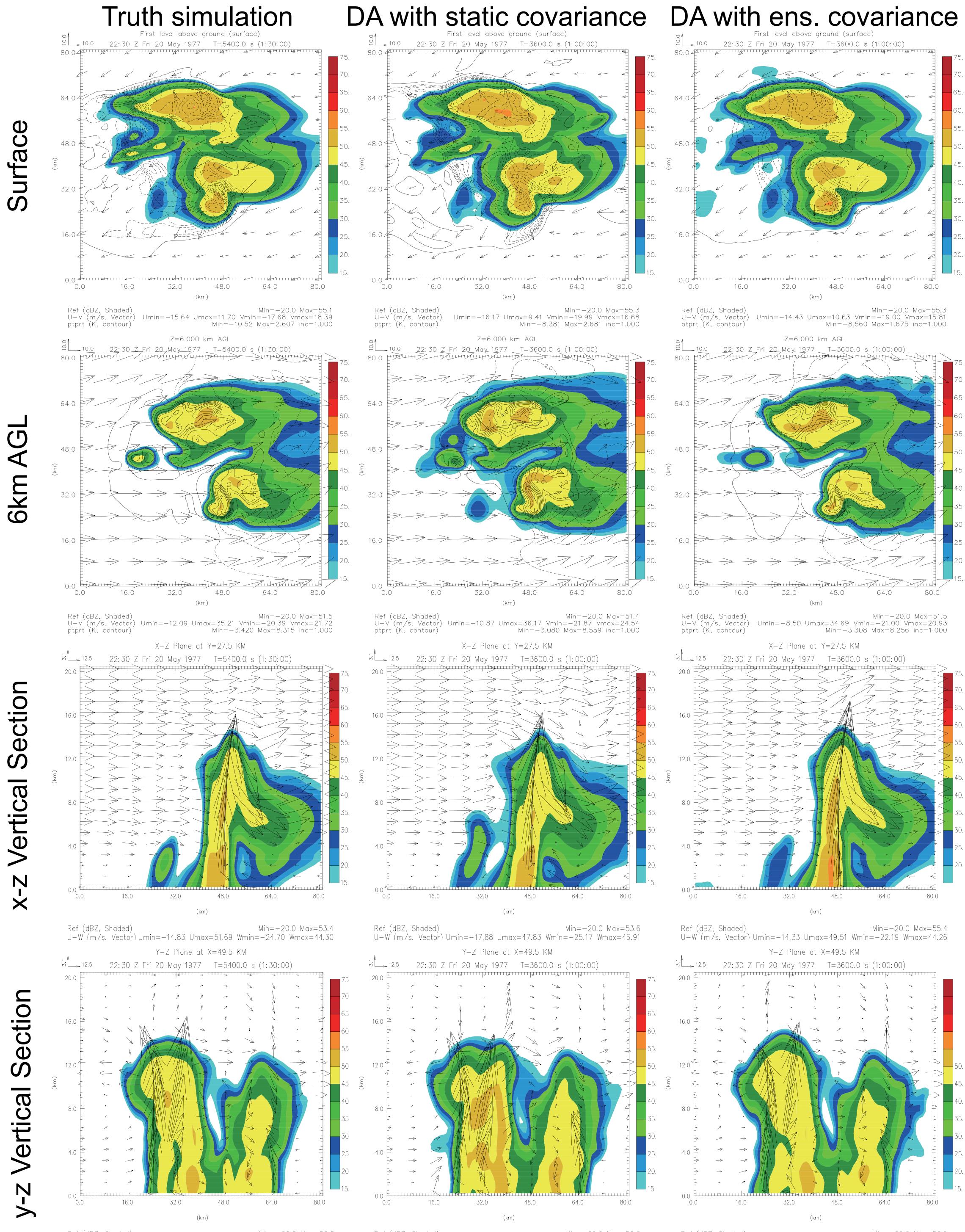
## **Research Objectives**

Develop an ensemble of 3DEnVar system which uses ensemble information in a three-dimensional variational data assimilation system which is suitable for severe convective storms.

Methodology					
Forecast 3DEr	Forecast Var	3DEnVar	Forecast	3DEnVar	Forecast
Forecast 3DEr	Forecast	3DEnVar	Forecast	3DEnVar	Forecast
Forecast	Forecast	••••	Forecast	••••	Forecast
3DEr		3DEnVar		3DEnVar	
e voico or a g		COV Repla		cov Repla	
ariance	ace mean	ace mean ariance		ace mean ariance	
Forecast 3DEr Cycles o	Forecast Var f analysis an	3DEnVar	Forecast	3DEnVar	Forecast nber
<ul> <li>Obs.: simulated radial winds and reflectivity Bkg.: background ensemble is from previous ensemble forecasts</li> <li>WRF 3D quarter-circle shear supercell si mulation with 1km horizontal resolution dx=dy=1km, and 0.5km vertical resolution dz=0.5km. 6 category water/ice microphysics of Lin et al.</li> </ul>					
<ul> <li>A nature truth simulation is started from an environmental sounding.</li> </ul>					
<ul> <li>The simulated observations are obtained periodically (every 5 min) from a 2-hour truth run.</li> </ul>					
<ul> <li>Two Types of experiments are performed, one with a static covariance and another with a ensemble covariance respectively. Each type contains 13 analysis-forecast loop.</li> </ul>					
The variations of RMS errors of wind field, potential temperature and composite reflectivity with the time are plotted here to show the quality of analysis.					

## The Development of an Ensemble of 3DEnVar System for Severe **Convective Weather with WRF Model Interface**

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 Ref (dBZ, Shaded)
 Min=-20.0 Max=52.5
 Ref (dBZ, Shaded)
 Min=-20.0 Max=52.6
 Ref (dBZ, Shaded)
 Min=-20.0 Max=52.9

 V-W (m/s. Vector)
 Vmin=-36.64 Vmax=25.77 Wmin=-9.18 Wmax=44.30
 Ref (dBZ, Shaded)
 V-W (m/s. Vector)
 Vmin=-10.43 Wmax=46.91
 V-W (m/s. Vector)
 Vmin=-35.14 Vmax=20.28 Wmin=-12.68 Wmax=41.77

 Min=-20.0 Max=52.9 This work was supported by NSF grants AGS-1341878 and NOAA Warn-on-Forecast project. The experiments were done on OU Supercomputing Center for Education & Research (OSCER)

16.0

# min=—14.43 Umax=10.63 Vmin=—19.00 Vmax=15.8 22:30 Z Fri <u>20 May</u> 1977 $\rightarrow \rightarrow \rightarrow \rightarrow \rightarrow \rightarrow$ Min=-20.0 Max=55.4 J-W (m/s. Vector) Umin=-14.33 Umax=49.51 Wmin=-22.19 Wmax=44.26 Y-Z Plane at X=49.5 KM 22:30 Z Fri 20 May 1977 T=3600.0 s (1:00:00)

In this study, an ensemble of 3DEnVar system for WRF model has been developed.

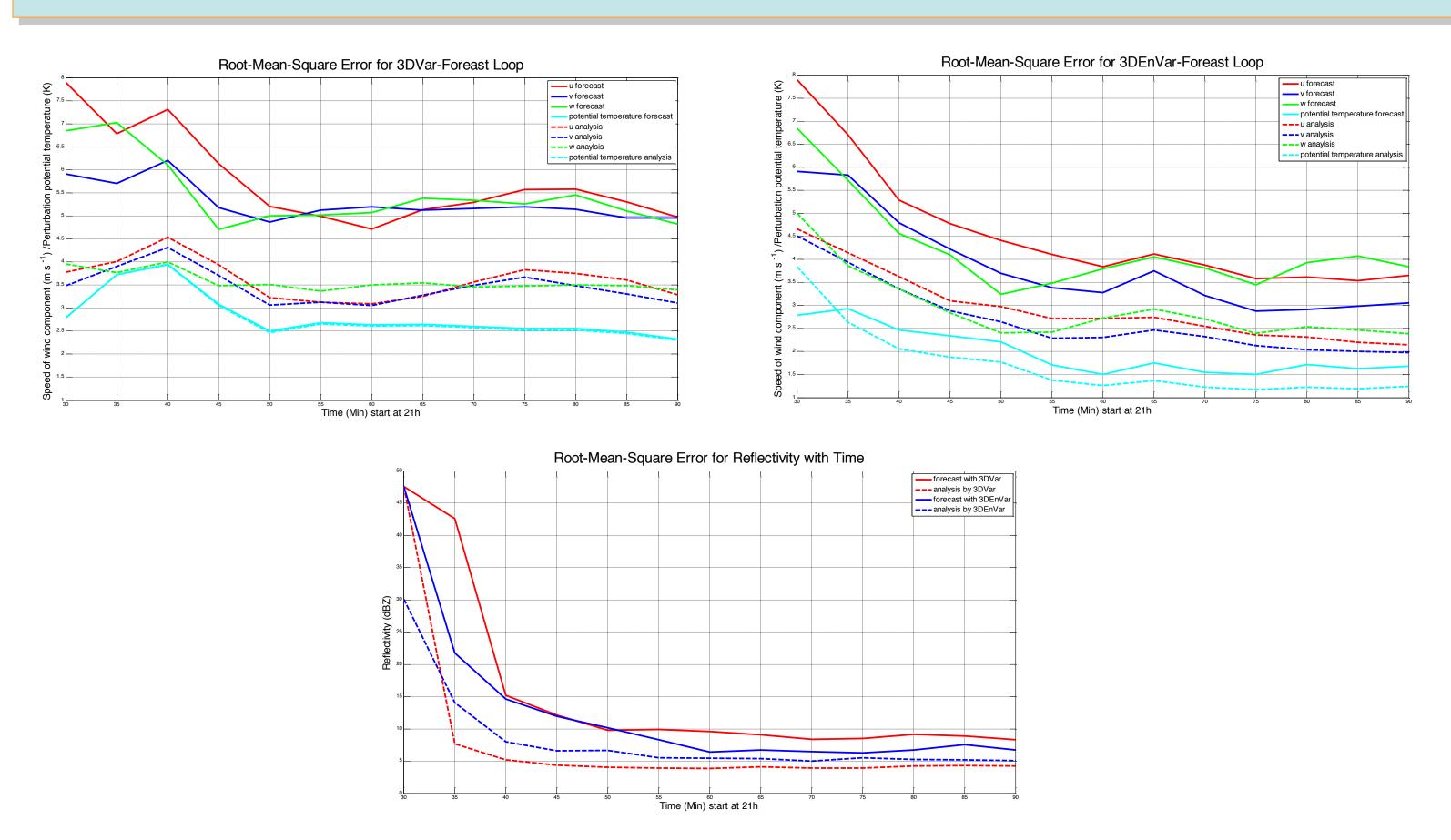
The flow-dependent covariances derived from ensemble of model forecasts are used in the ensemble of 3DEnVAR analyses.

It is shown that the flow-dependent ensemble covariances derived from this ensemble 3dvar system is effective in producing quality analysis for the WRF model.

Most important features of the simulated storm including low-level cold pool and convergence, middlelevel mesocyclone are well analyzed.

(GOES).

Apply this method to real data cases.





### Summary

## **Future work**

Add the assimilation of cloud water path derived from satellite