Impact of Atmospheric Data Assimilation on the Prediction of Shallow and Deep Convective Clouds near the SGP site during HI-SCALE

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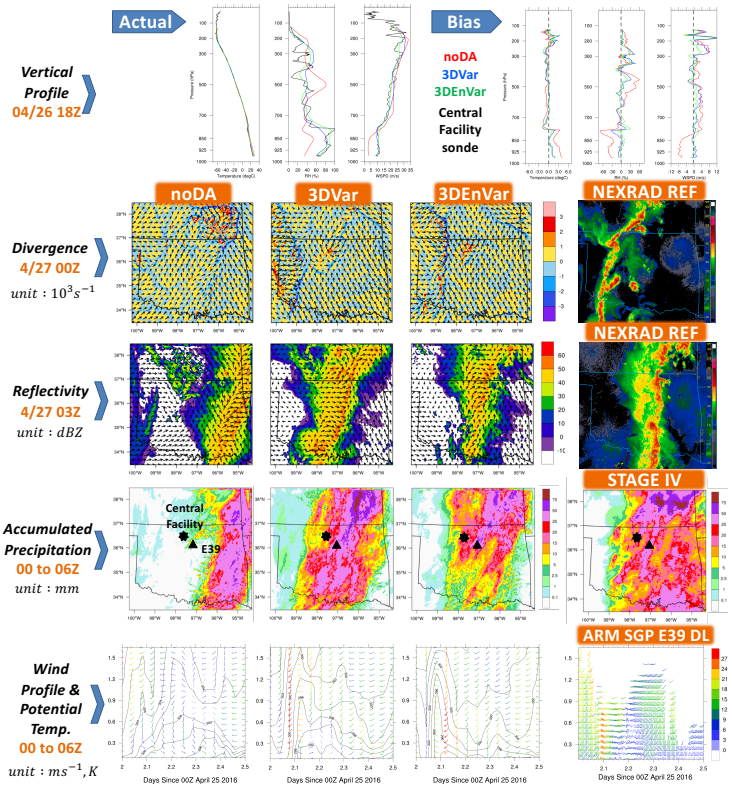
❖ Motivation

The 2016 **HI-SCALE** campaign at the **ARM SGP** site provided observations to help 1) understand the processes governing the lifecycle of shallow clouds and 2) improve models. Regional model forecast errors arise from uncertainties in initial conditions (I.C.) and parameterizations. **Data assimilation** significantly reduces I.C. uncertainty, so that we can focus on improving parameterizations (*e.g. PBL, convection, microphysics*).

❖ GSI 3DVar and 3DEnVar

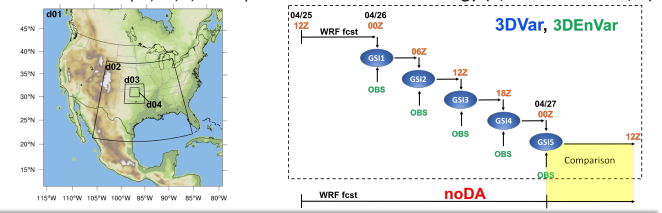
- Cost function: $J = \frac{1}{2}[x - x_b]^T B^{-1}[x - x_b] + \frac{1}{2}[H(x) - y]^T R^{-1}[H(x) - y] + J_c$
- Background error covariance: $B = \alpha_f B_f + \alpha_e B_e \quad \frac{1}{\alpha_f} + \frac{1}{\alpha_e} = 1$
- B_e estimated from ensemble forecasts initialized by NCEP GEFS 21 members

❖ Deep, convective clouds (April 27)

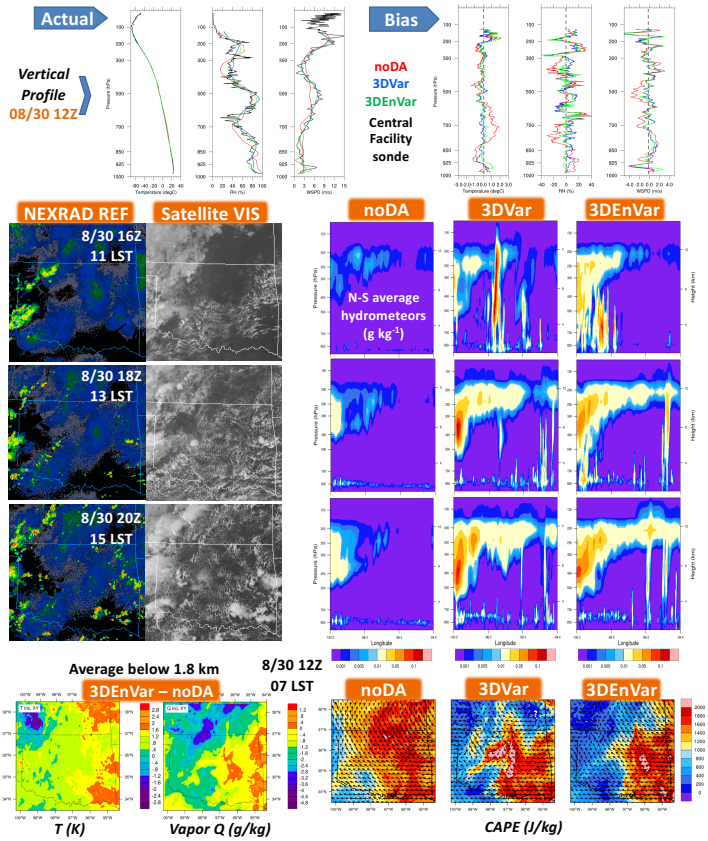


❖ Experimental design

- WRF Domain (36, 12, 4, 1.3 km) :
- Assimilation Strategy (Apr. 27 case as example):



❖ Shallow clouds (Aug. 30)



❖ Next steps

- Assimilation of ARM sites measurements
- Forecast sensitivity study with various parameterization schemes
- Provide constrained and more realistic I.C. and B.C. for LES simulation (i.e. LASSO)
- Perform mesoscale simulation for entire HI-SCALE

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