

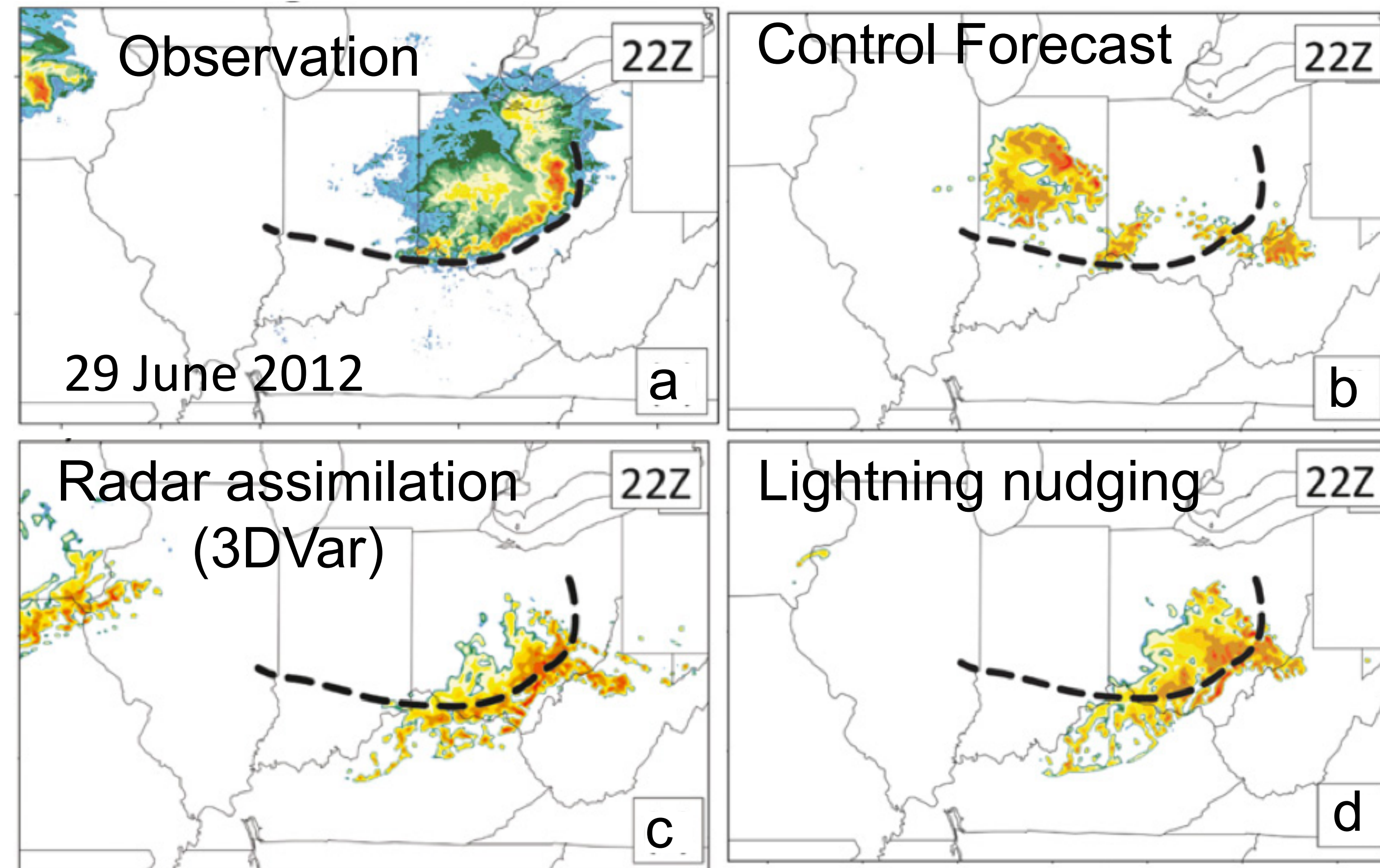
Storm-scale lightning data assimilation at NSSL

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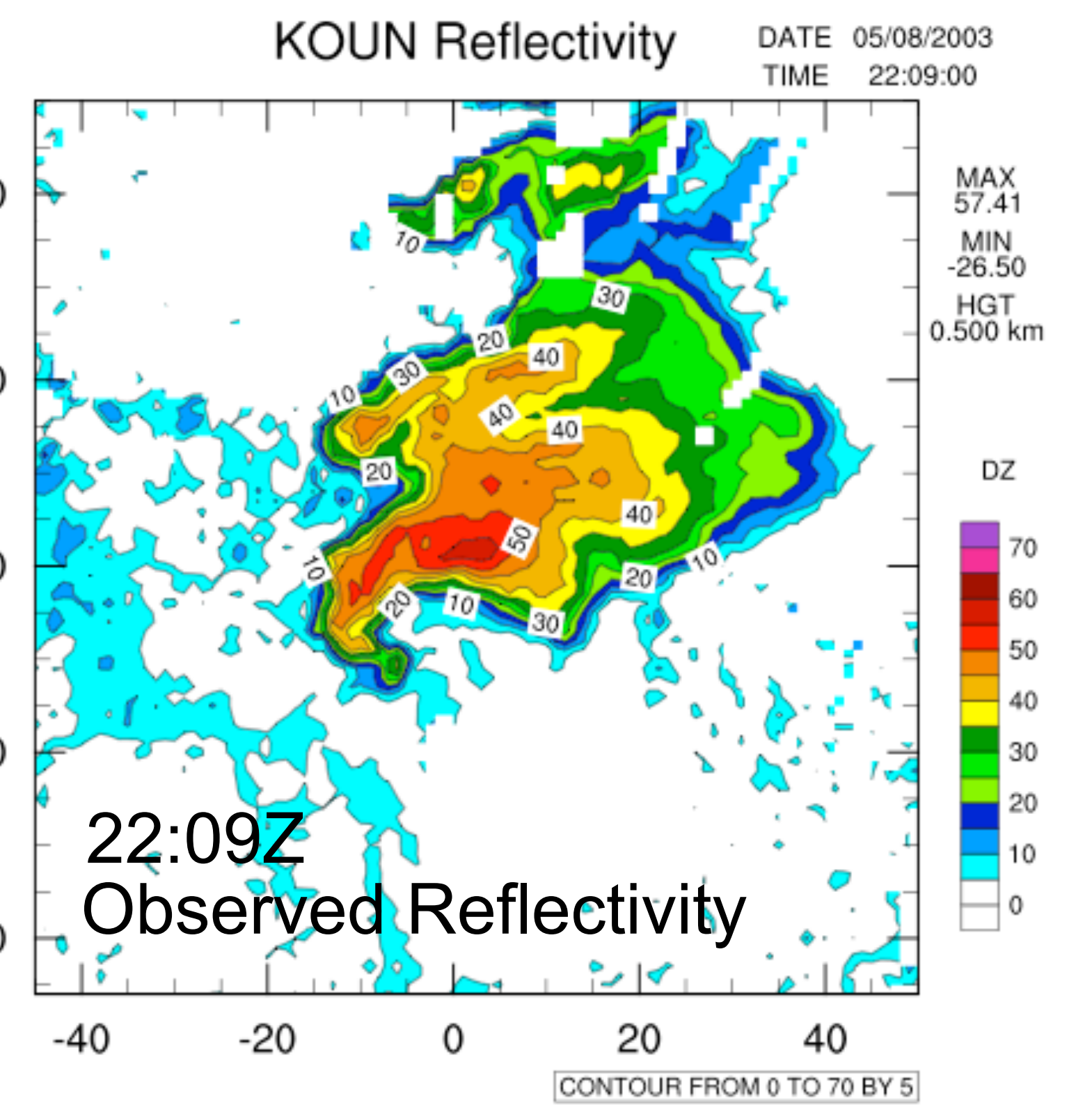
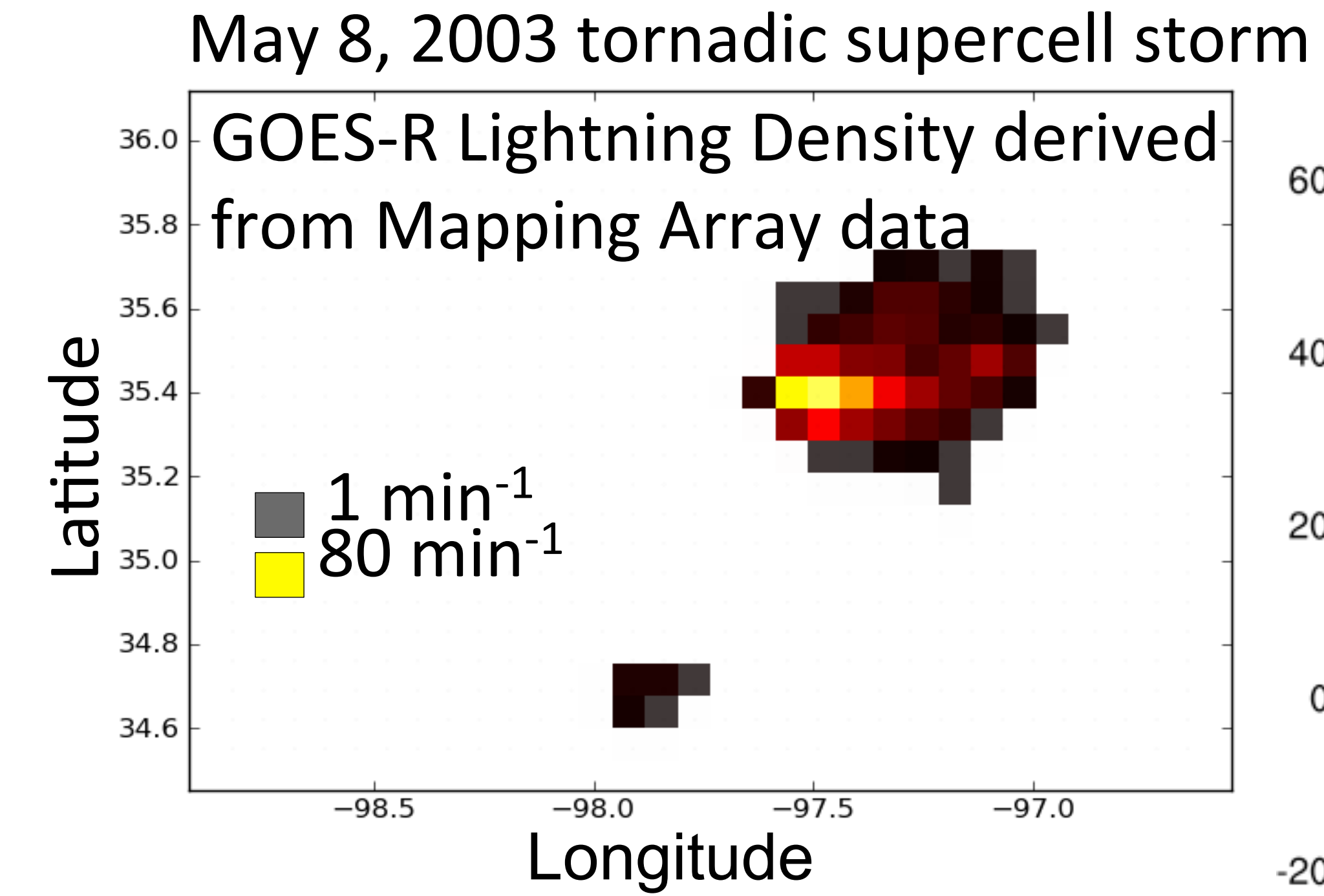
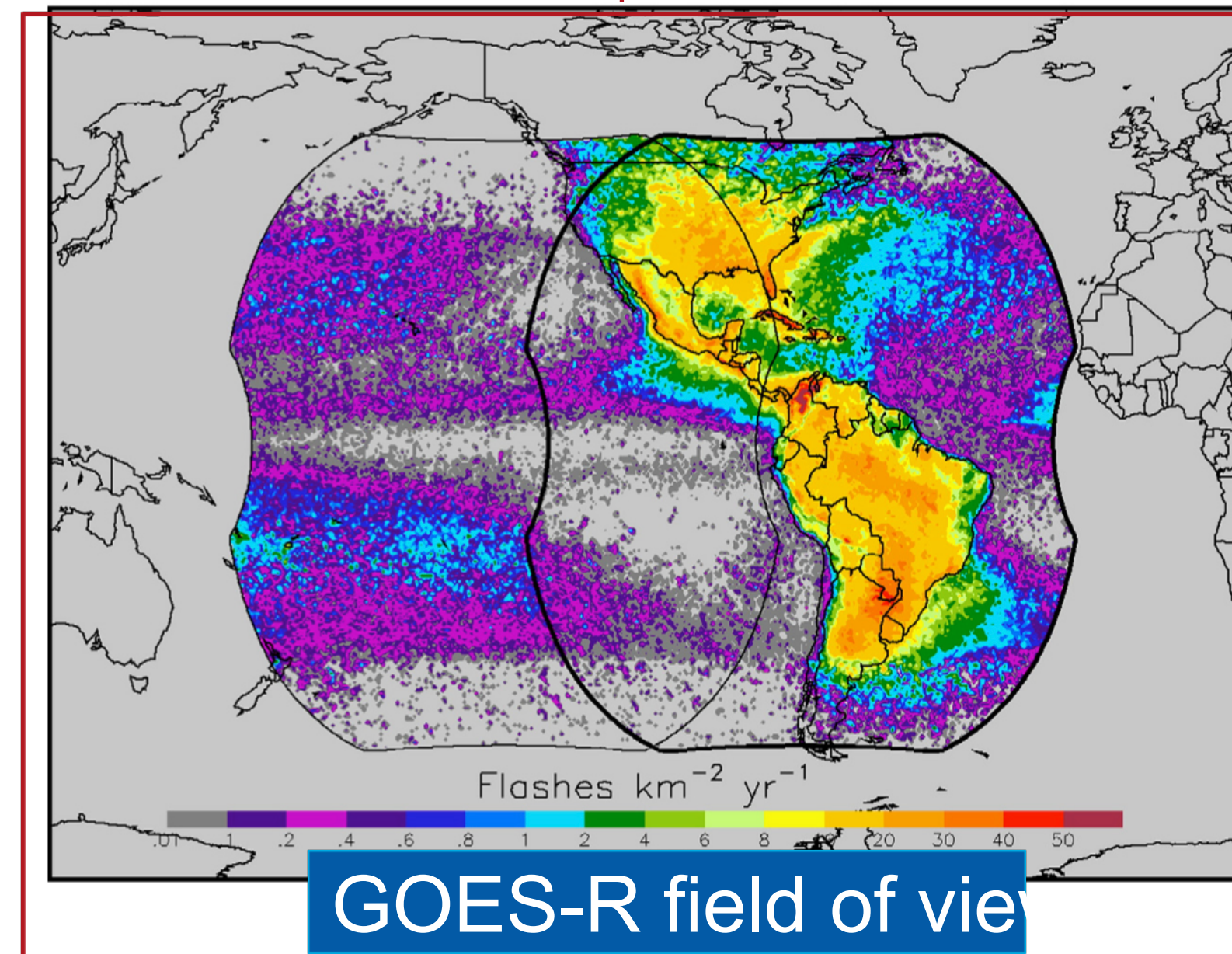
What can total lightning data provide for forecasts and analyses, in lieu of or in addition to radar?

1. Nudging (water vapor and/or temperature) where lightning is observed but convection is absent in the model. (Fierro et al. 2012,2014)

2. Ensemble Kalman Filter: Ensemble relationships provide adjustments to all state variables. (Mansell 2014, Allen 2014)

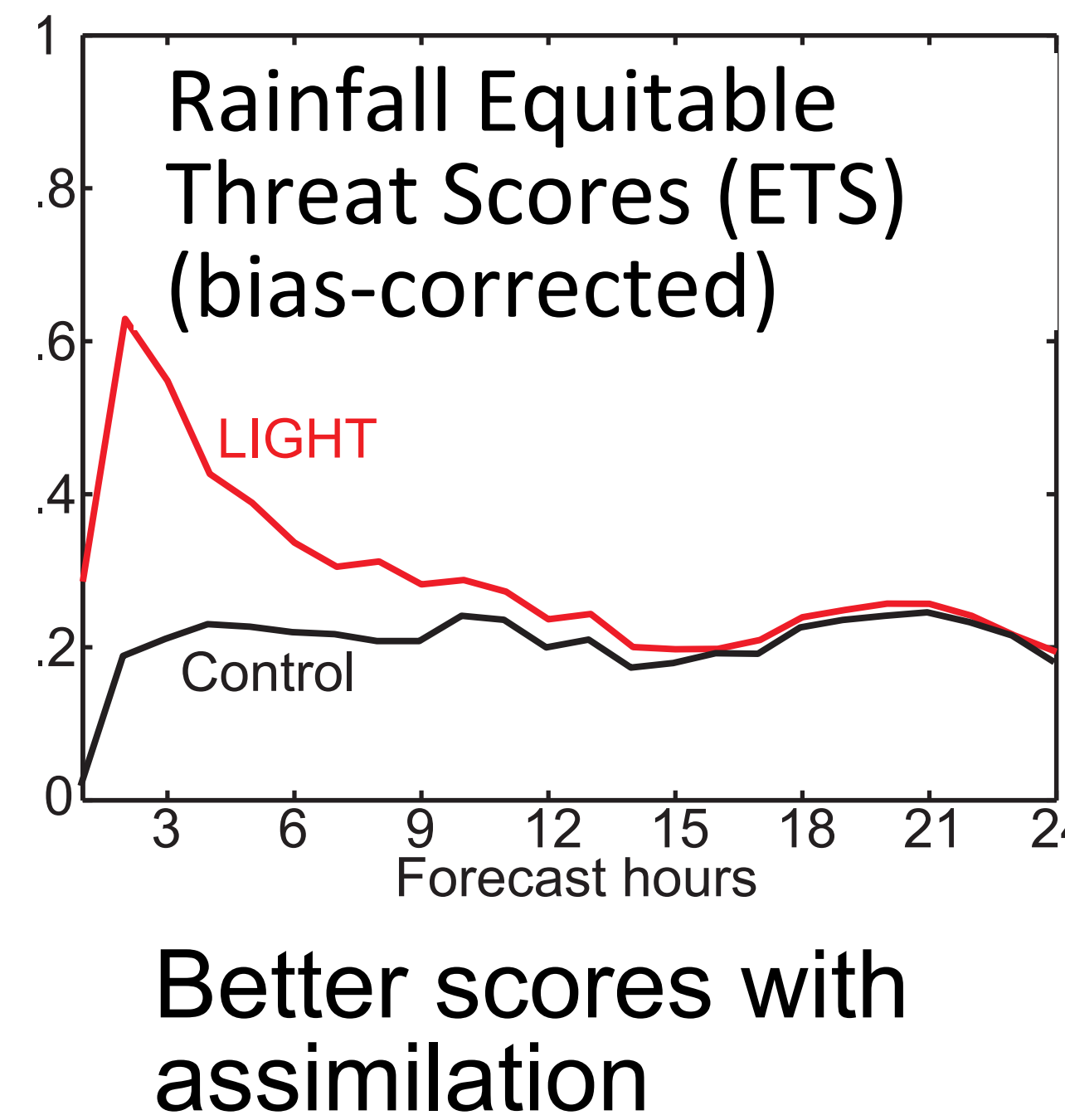
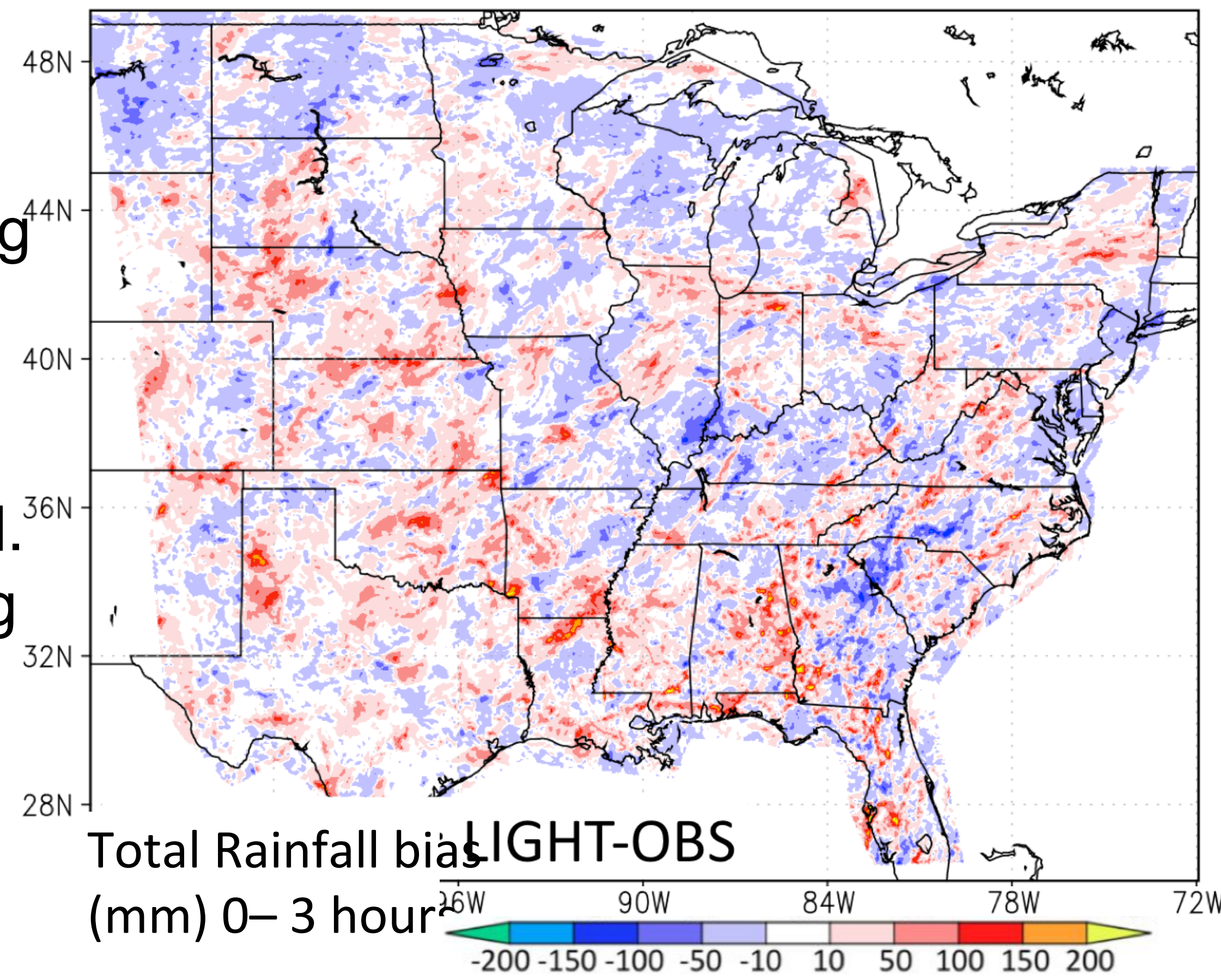


6-hr forecasts of radar reflectivity of a severe wind storm (derecho) with lightning nudging (ENTLN) or cycled radar 3DVAR methods.

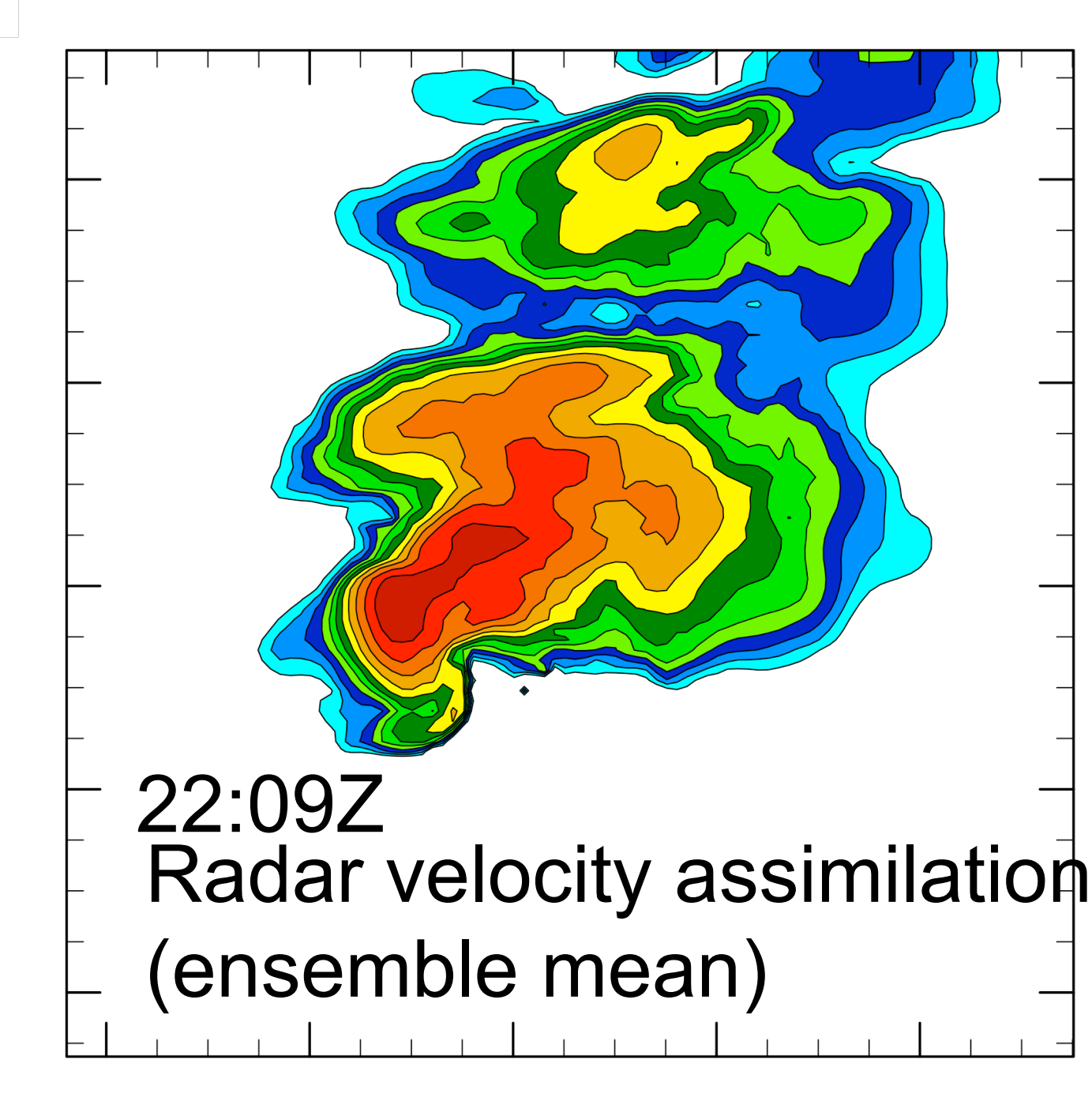
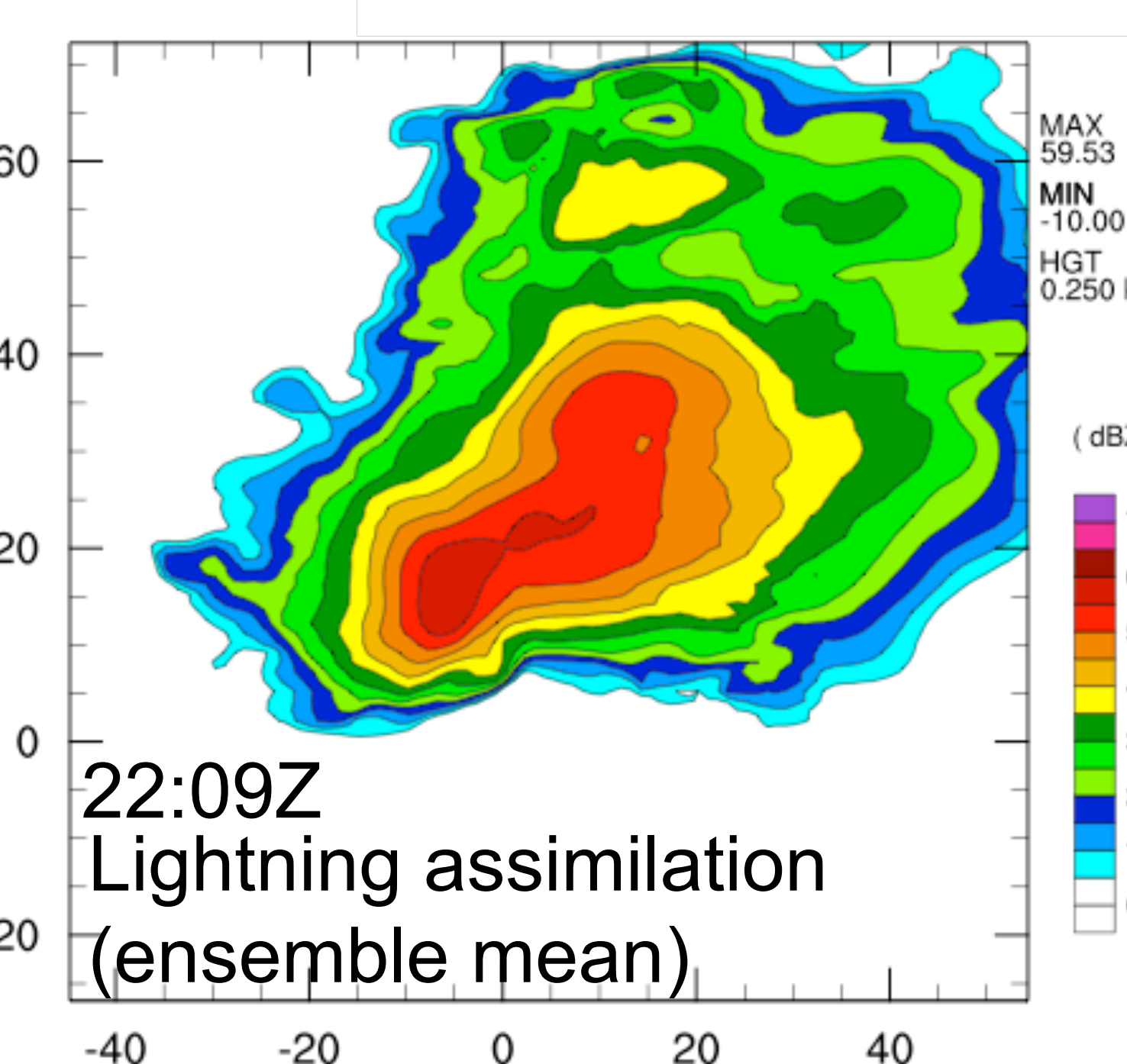
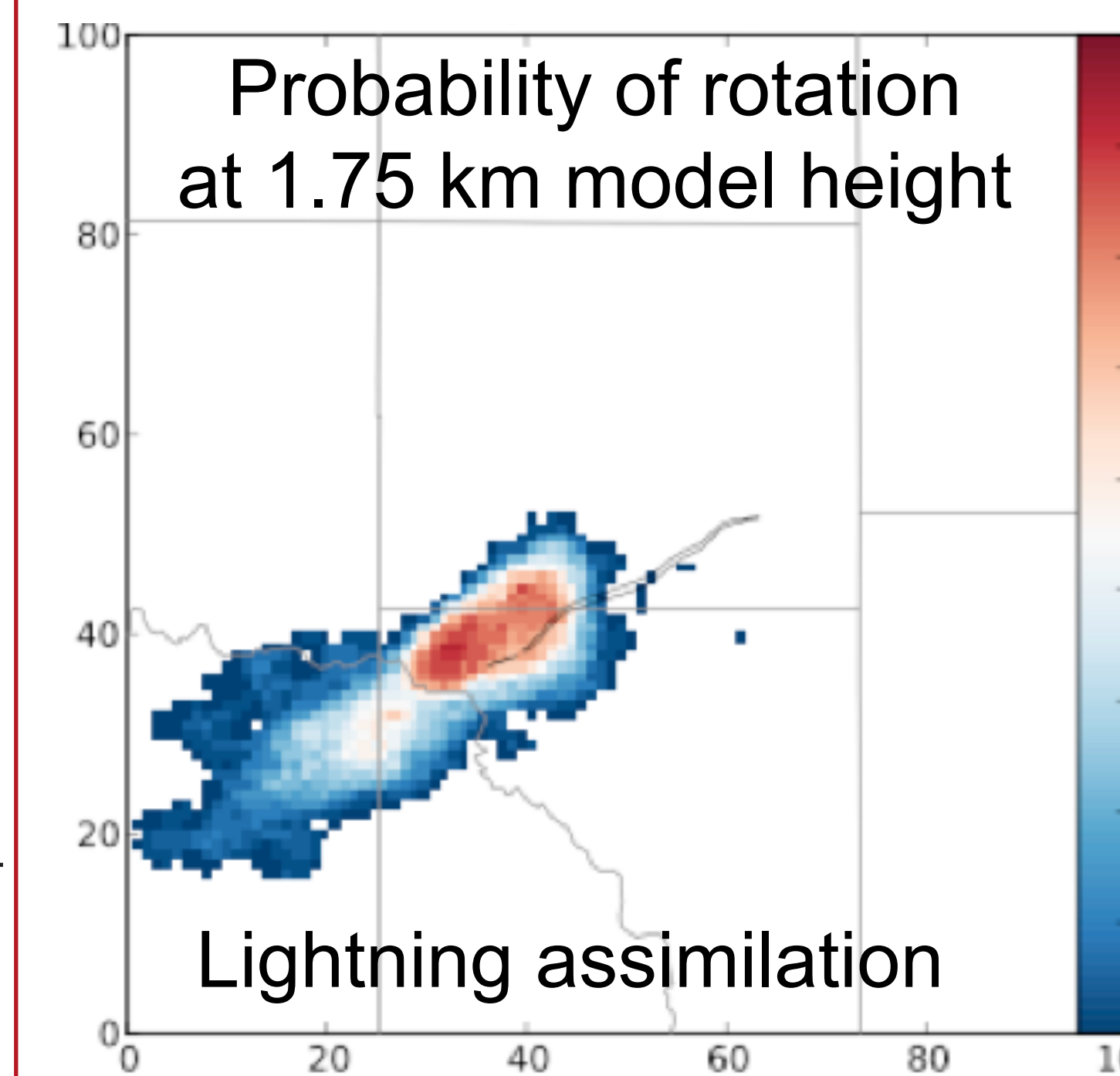


Good preliminary results were found with a simple linear flash density operator: $LD = (0.017) * (\text{graupel volume})$
[Will try to use with 3DVAR, as well.]

Nudging tested on 67 daily NSSL real-time forecasts during spring 2013. Generally improved low biases in accumulated rainfall. Needs further tuning to avoid increasing high biases. (Fierro, Clark, Mansell et al. 2015)



Better scores with assimilation



Analyses produce a supercell storm with low-level rotation. Less detailed than is possible with radar data, but shows promise in radar data-poor areas (e.g., mountains, off-shore)

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