

Ensemble-Based All-Sky Infrared and Microwave Radiance Assimilation for the Analysis and Prediction of Tropical Cyclones and Severe Thunderstorms

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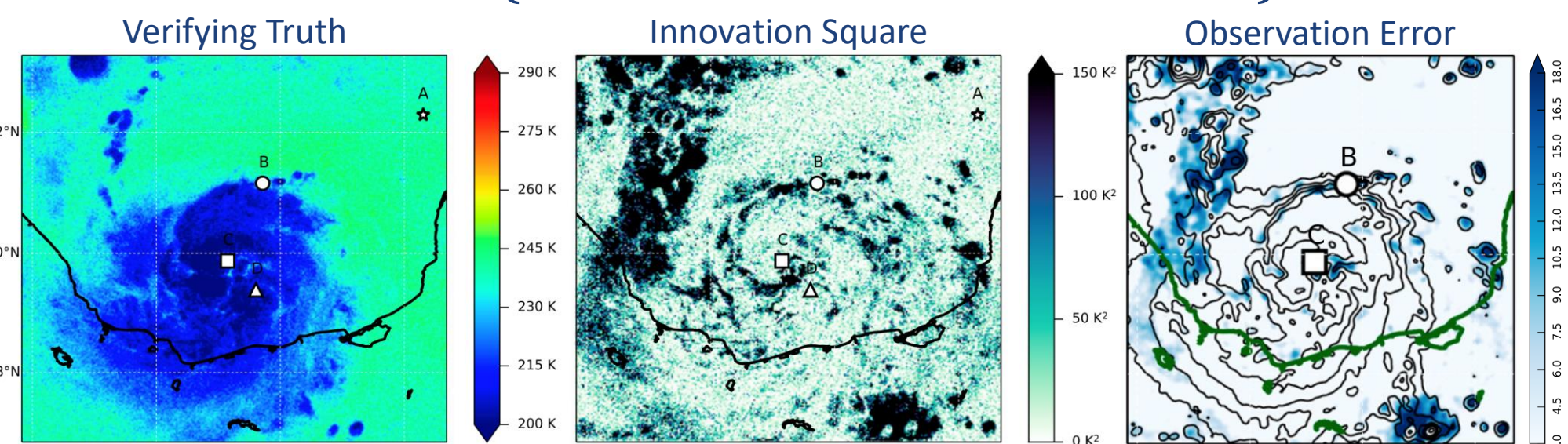


Techniques: IR Imagers and Sounders

Adaptive Observation Error Inflation (AOEI)

- Inflate observation error for large innovations:

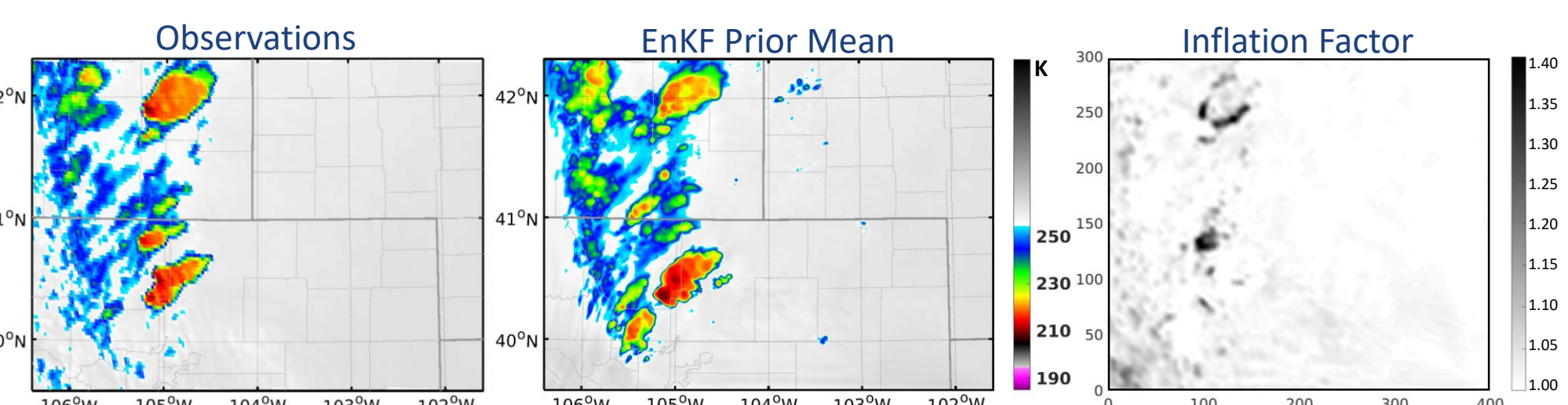
$$\sigma_o^2 = \max \left\{ \sigma_{set}^2, [y_o - H(\bar{x}_b)]^2 - \sigma_H^2(x_b) \right\}$$



Adaptive Background Error Inflation (ABEI)

- Inflate where asymmetric cloud effect parameter $C_A > 0$:

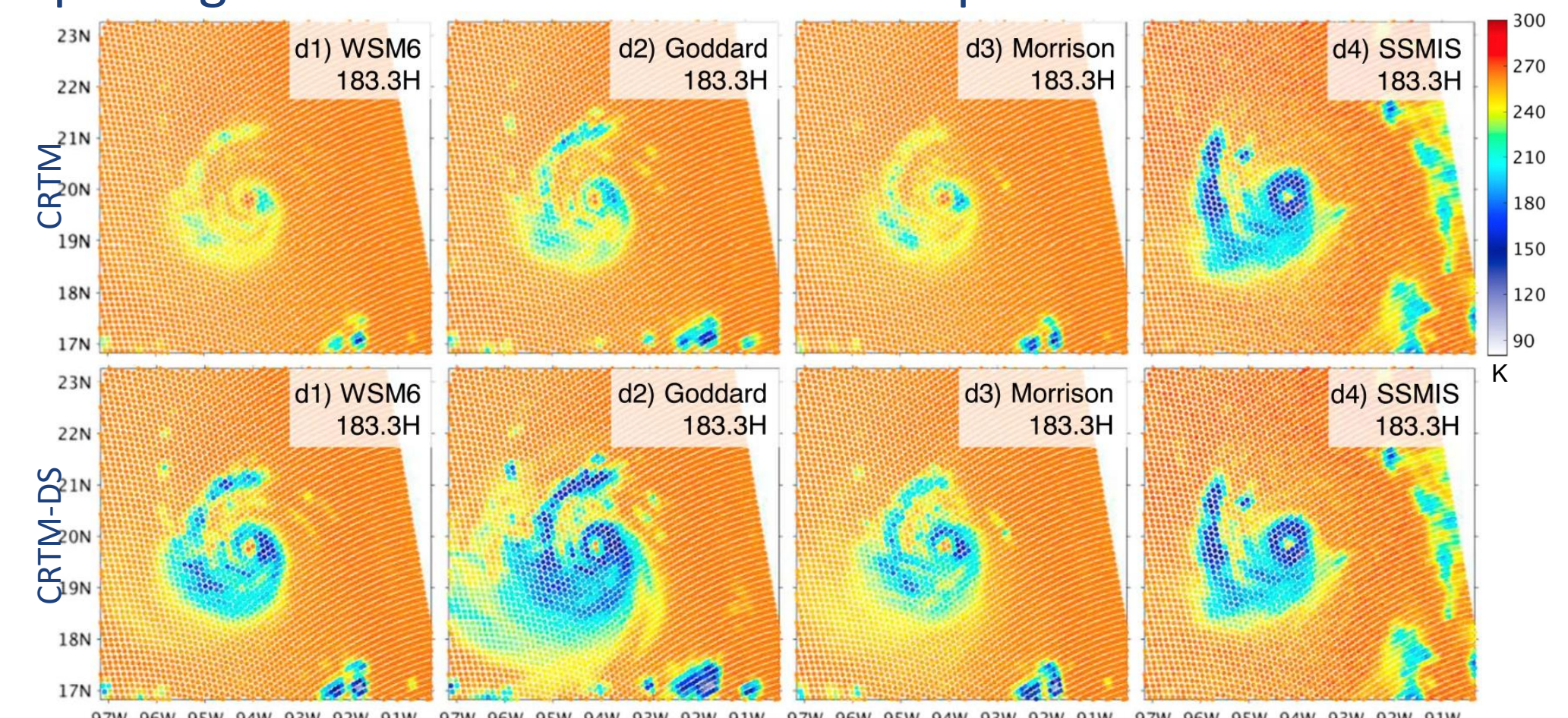
$$C_A = C_O - C_M = |y_o - H_{clear}(\bar{x}_b)| - |H(\bar{x}_b) - H_{clear}(\bar{x}_b)|$$



Techniques: MW Imagers

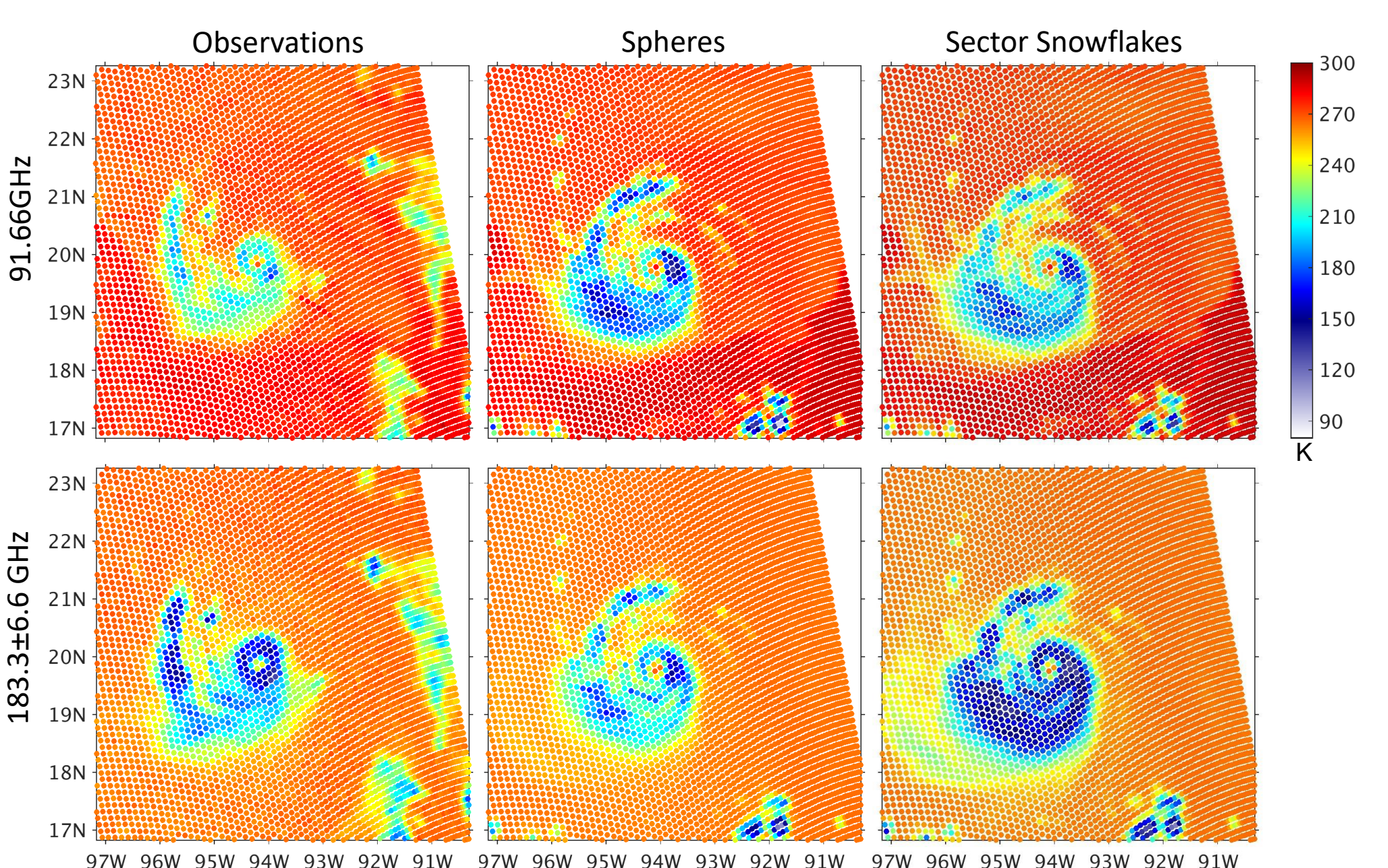
Distribution-Specific (DS) Scattering Properties

- Replacing effective-radius-based look-up tables in CRTM



Introducing Non-Spherical Particles

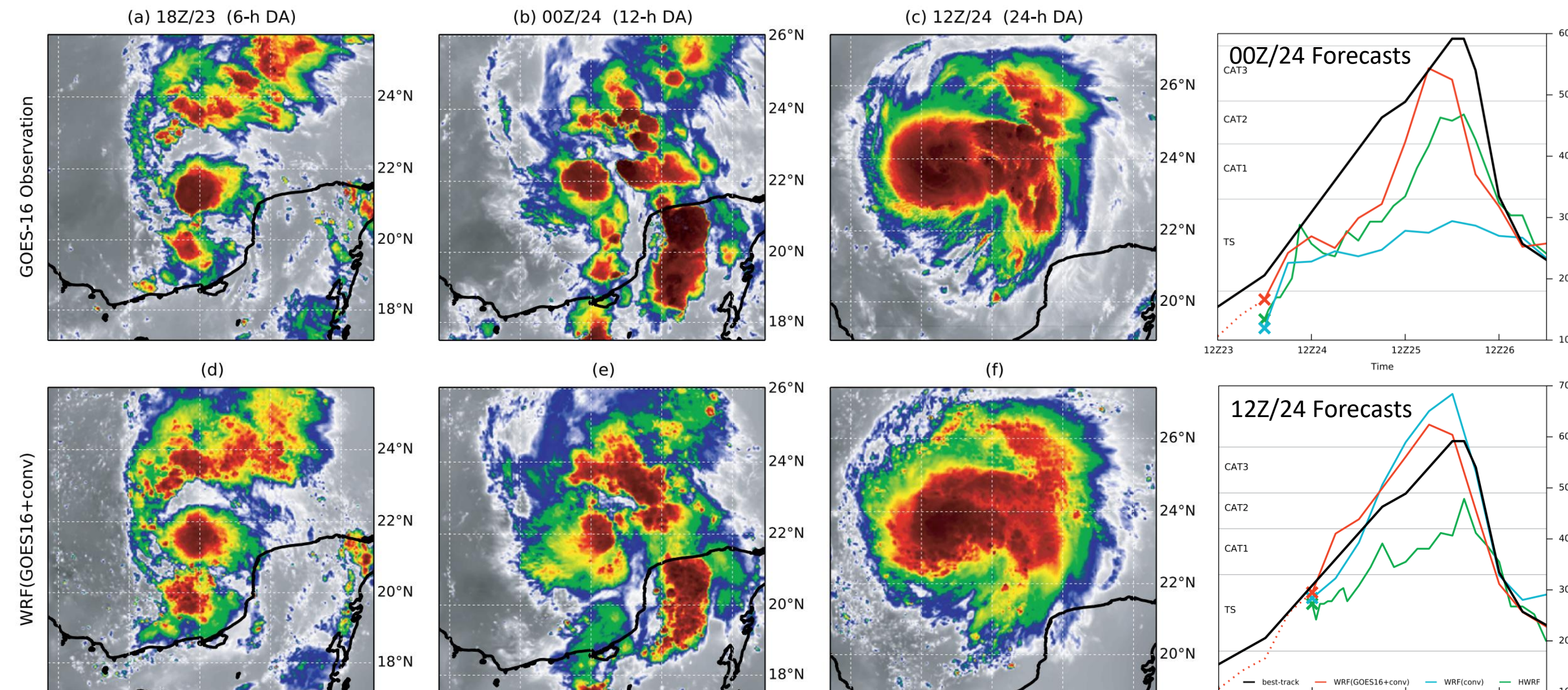
- Reduce systematic biases between 91.7 GHz and 183 GHz



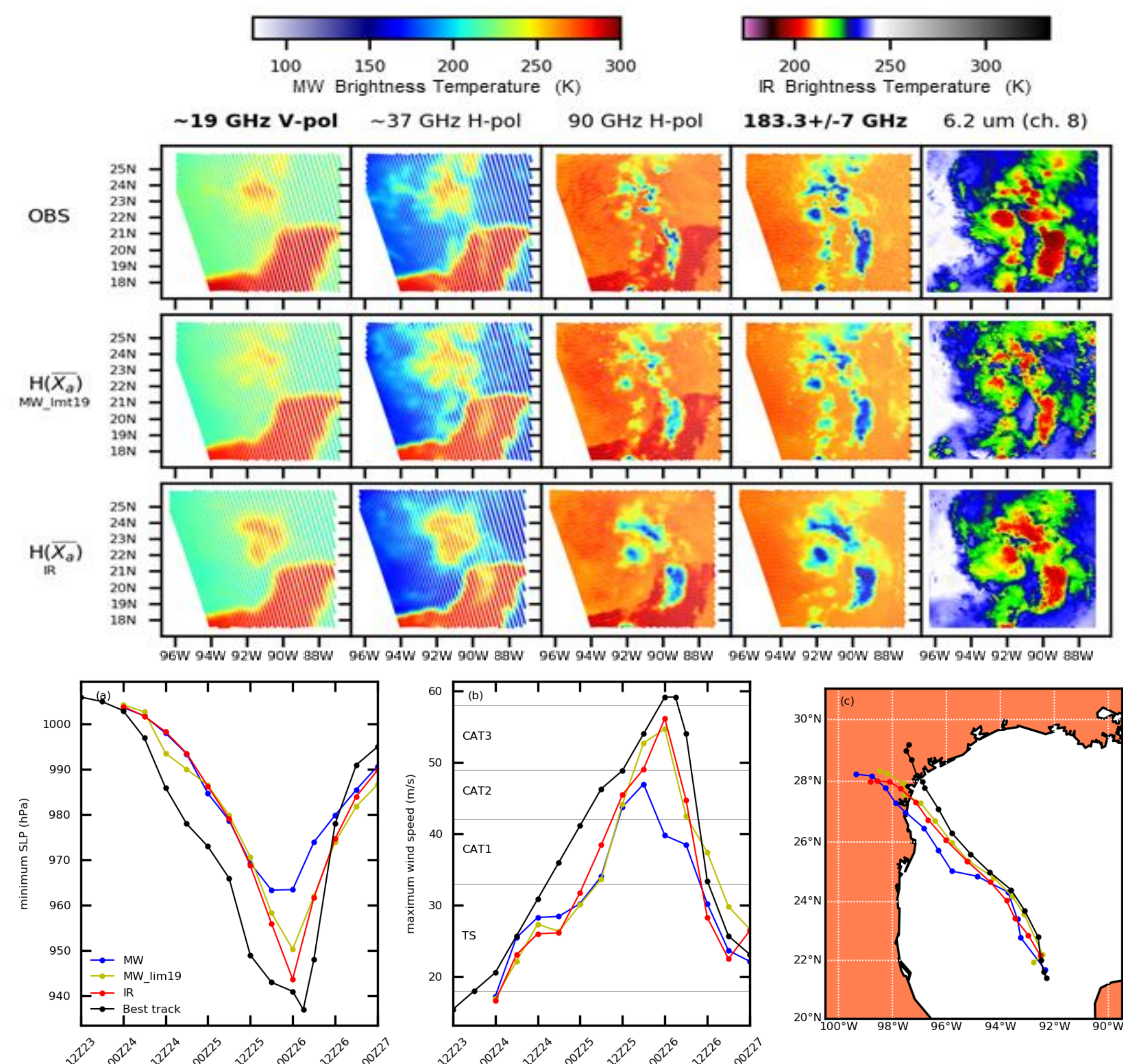
Applications: Tropical Cyclones

2017 Hurricane Harvey

- Assimilating ABI CH-8 every 1 hour from 12Z 23 Aug 2017 for 24 hours
- EnKF analyses and forecasts from different times:



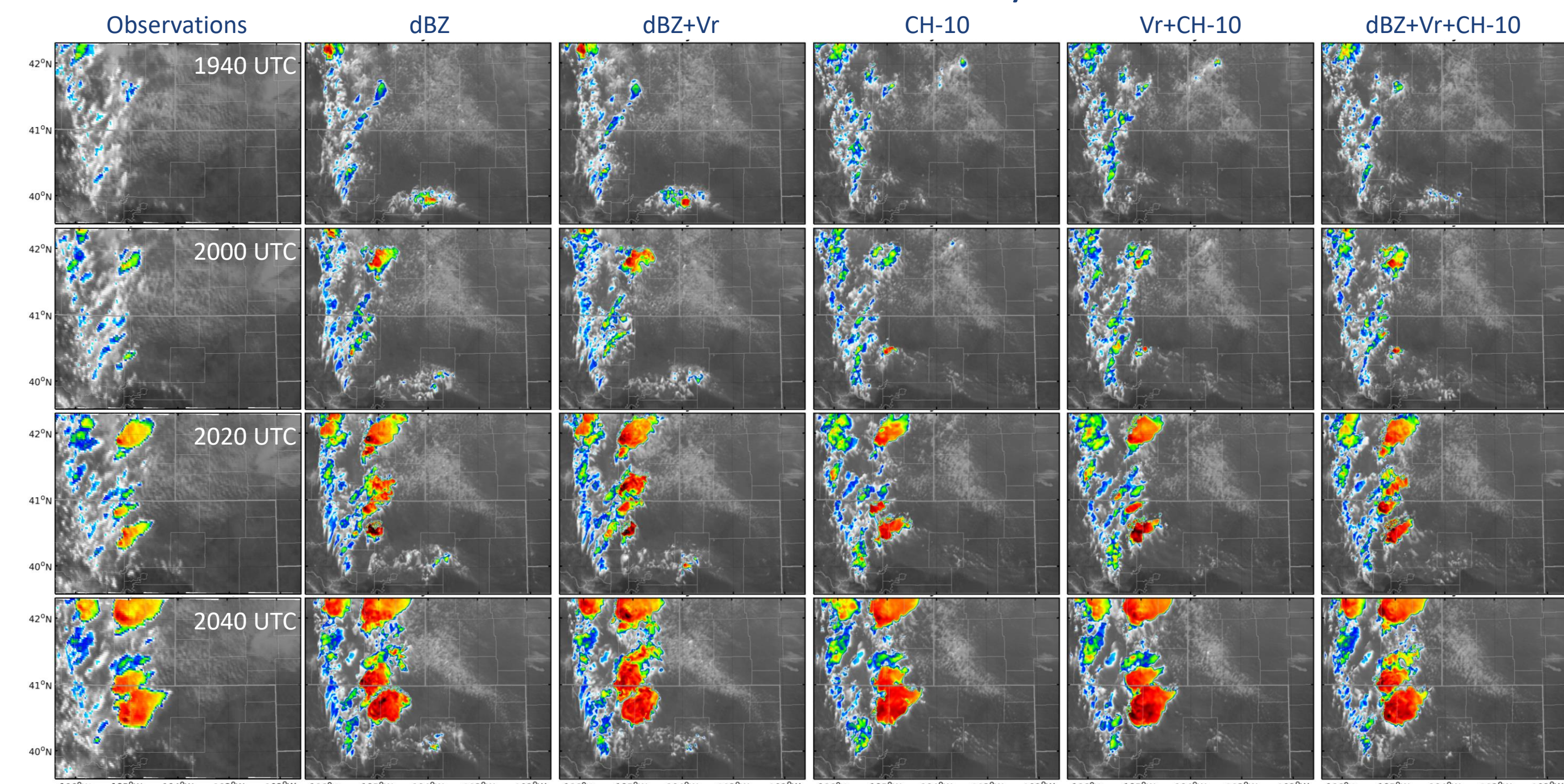
- Preliminary tests combining IR from ABI and MW from GPM for 12 hours
- EnKF last analyses and forecasts from last analyses:



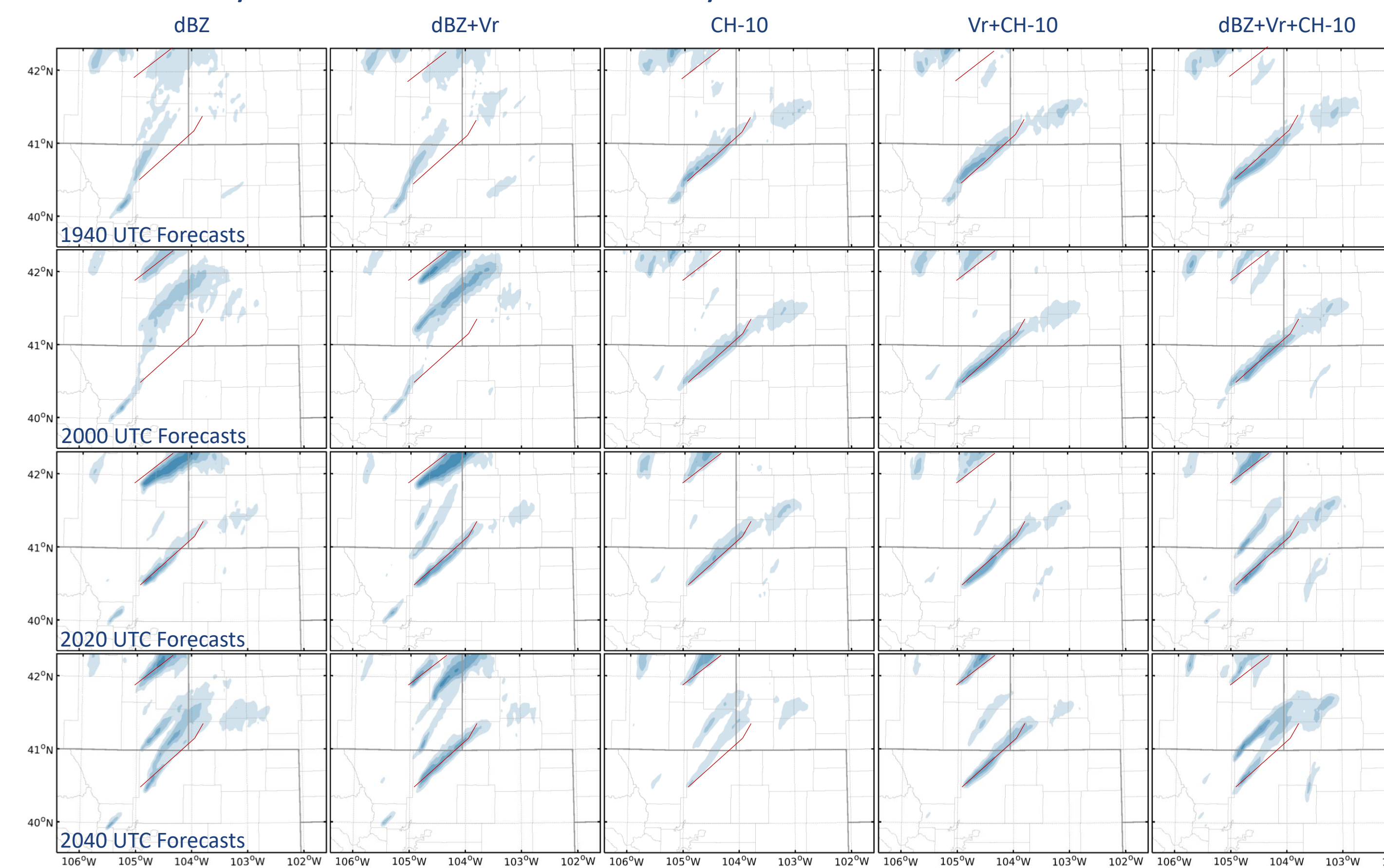
Applications: Severe Thunderstorms

12 June 2017 Nebraska Tornadoic Thunderstorm Event

- Assimilating ABI CH-10 solely and combined with WSR-88D radars
- Comparing impact of satellite IR and radar observations
- Observations and simulated ABI CH-14 of EnKF analysis mean:



- Probability of UH of forecasts from analyses at different times:



Take-Away Messages

- Assimilating all-sky IR observations from geostationary satellites significantly enhanced our ability to predict tropical cyclones and severe thunderstorms
- Difficulties exist in the assimilation of all-sky MW observations, and overcoming them may improve our prediction of precipitation