PennState

Influence of EnKF of a Severe Storm Event in an OSSE Scenario

Yunji Zhang

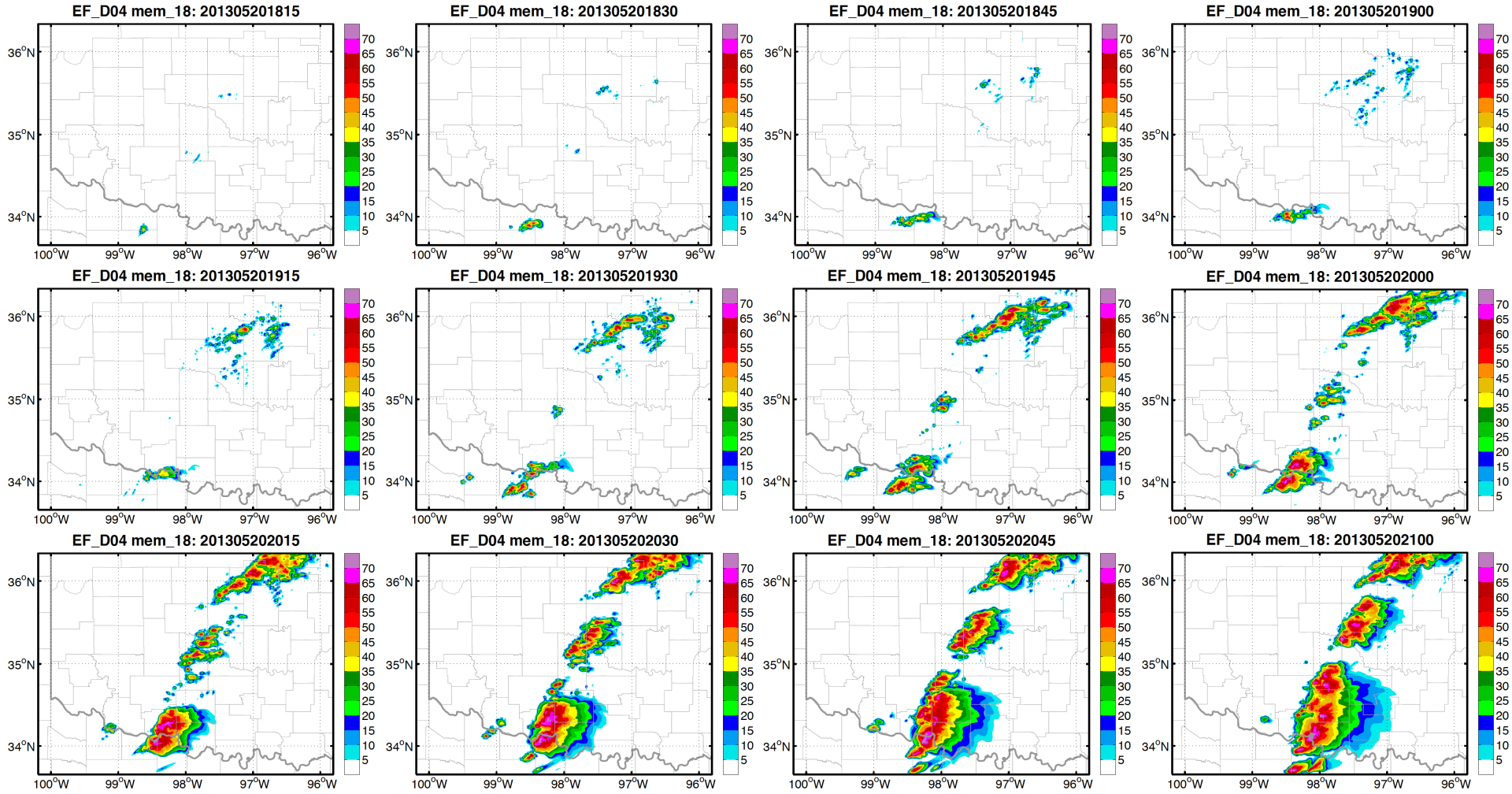
Group Meeting Dec 12, 2016

Background

- The May 20, 2013 tornadic thunderstorm event in OK
  - Performed real-data EnKF
  - Explored practical and intrinsic predictability of this event in an ensemble-forecasting scenario

- How does data assimilation influence NWP?
  - Data assimilation increments w.r.t.:
    - Observational platforms
    - Horizontal scales
    - Altitude
    - …

Truth Simulation



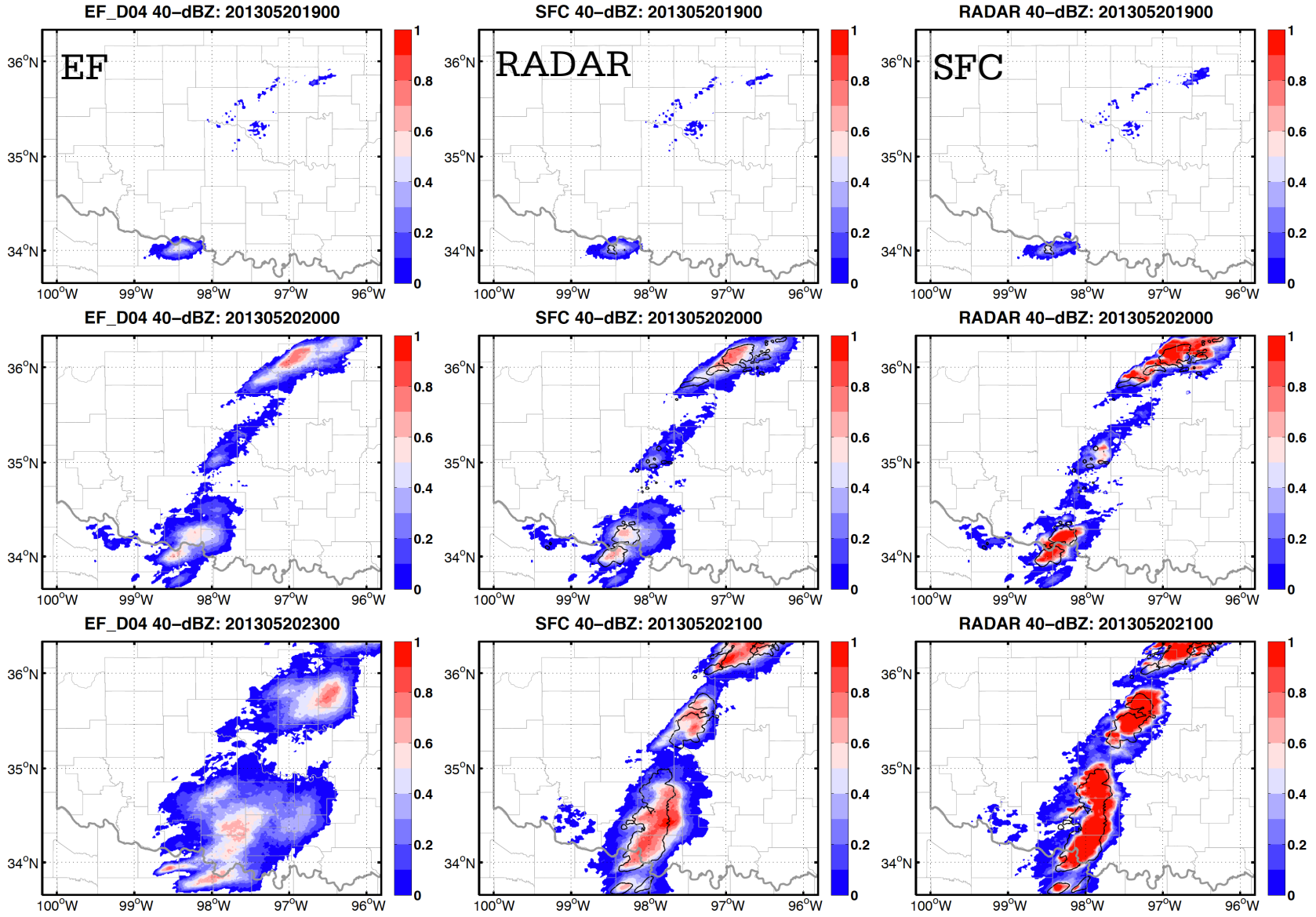
Selected from a 60-member 1-km ensemble with smallest RMDTE to mean

Thompson MP, MYNN 2.5 PBL, MM5 SFC, RUC LS, RRTM LW, Goddard SW

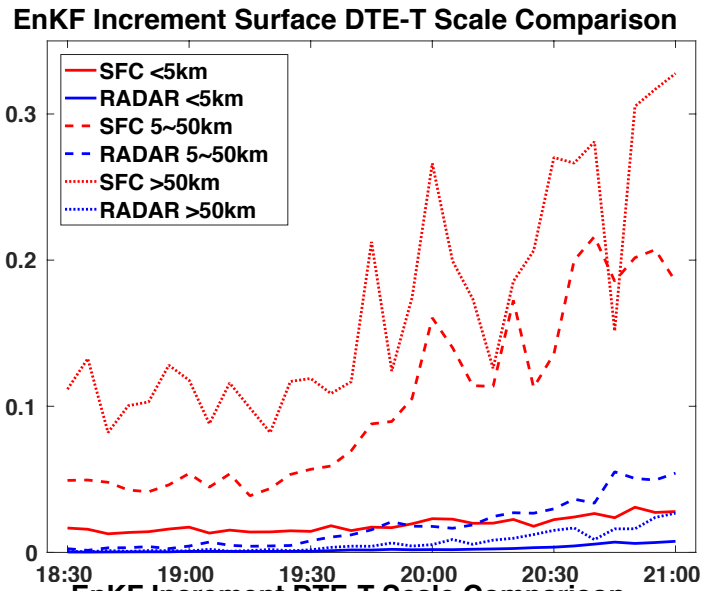
EnKF Experiment Design

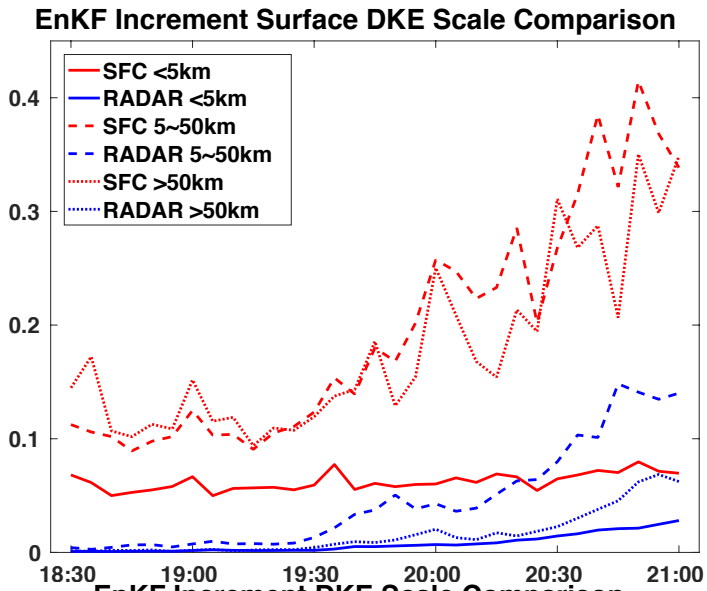
- Generate synthetic observations from truth
  - Oklahoma Mesonetθ, Td, U, V, Ps
  - WSR-88D KTLX and KFDR 2-km Vr
  - Random error from WRFDA obsproc
- EnKF from 1830 to 2100 every 5 min
  - ROI: 100 km for surface, 10 km for Vr
- Surface and radar radial velocity observations were assimilated separately (**SFC** and **RADAR**)
  - Compare with no-data-assimilation ensemble forecast (**EF**)

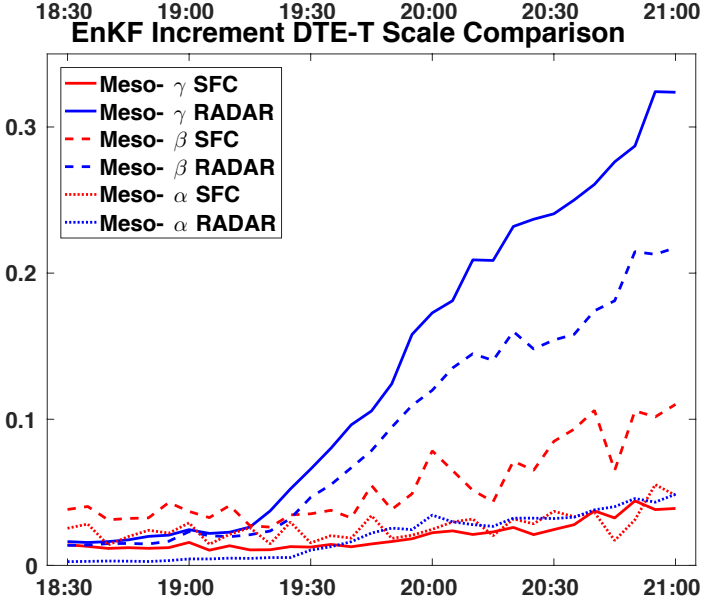
Reflectivity Probabilistic Forecast

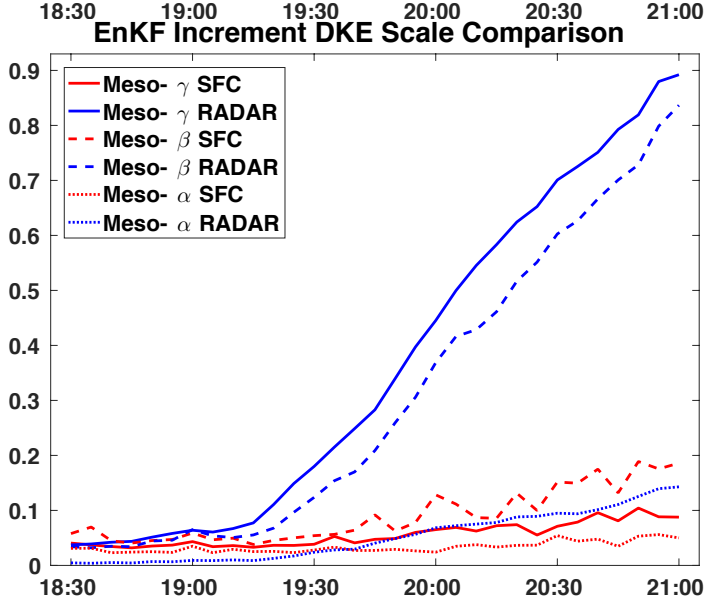


Evolution of Increments RMDTE

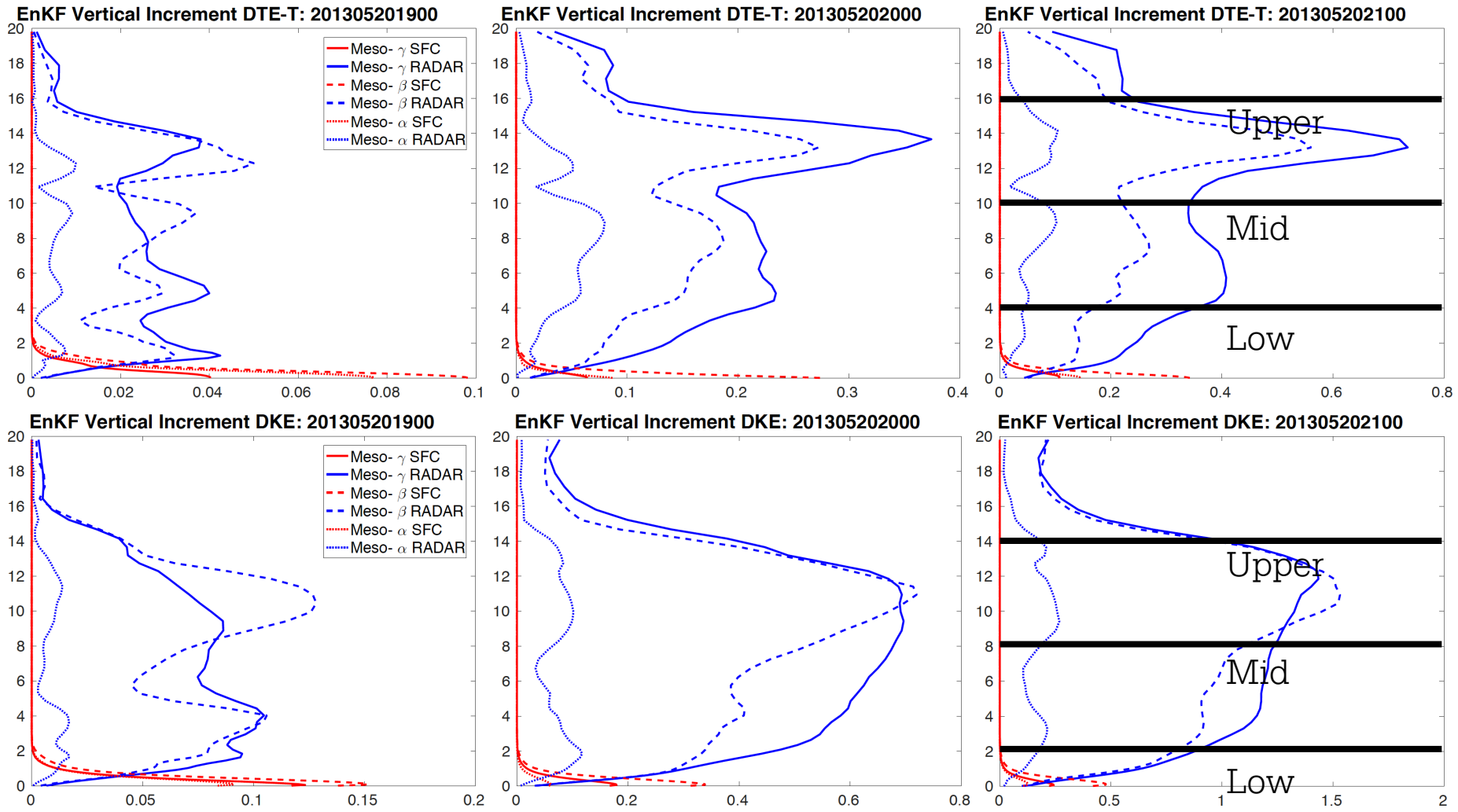






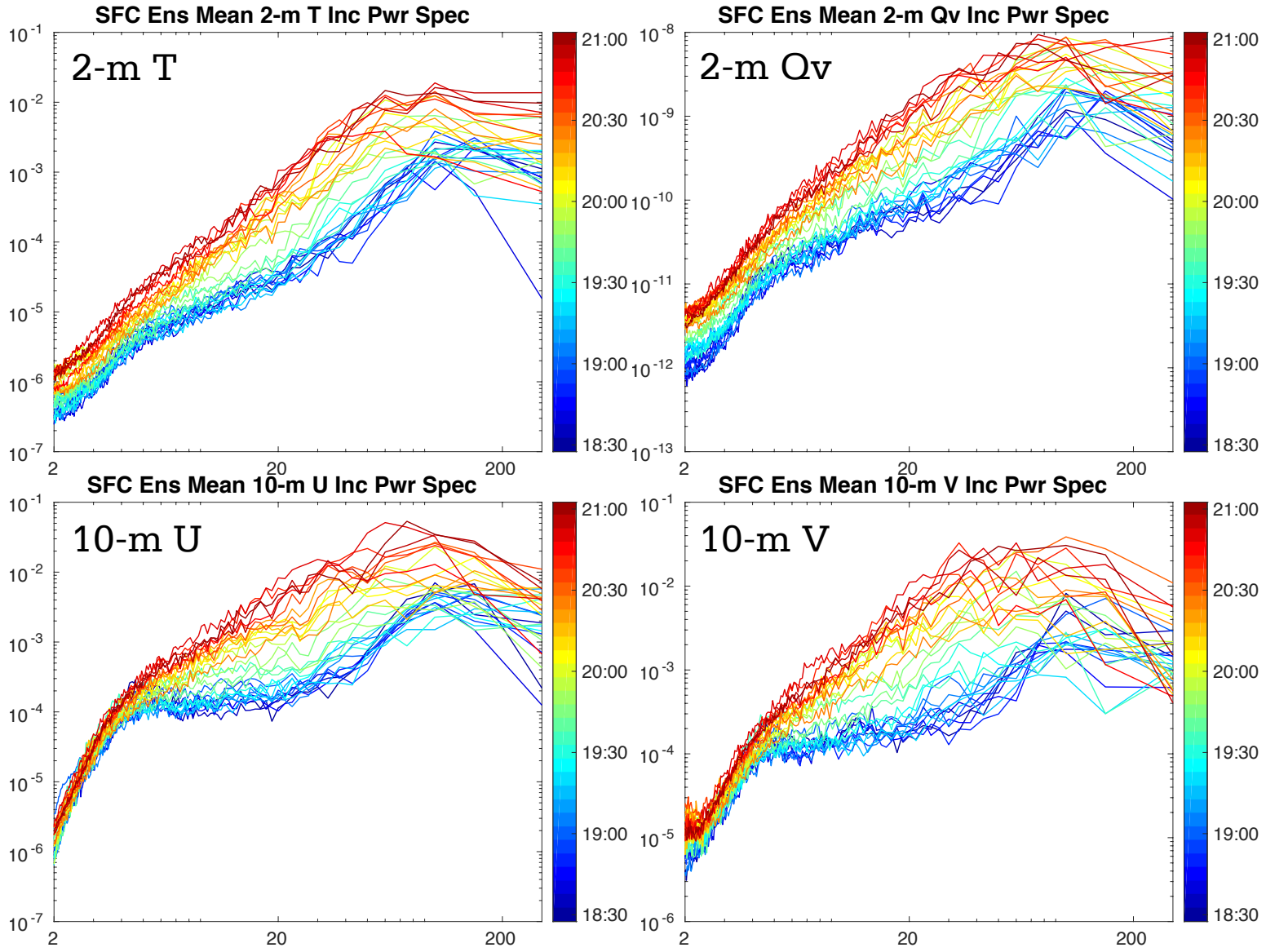


Evolution of Vertical Increments

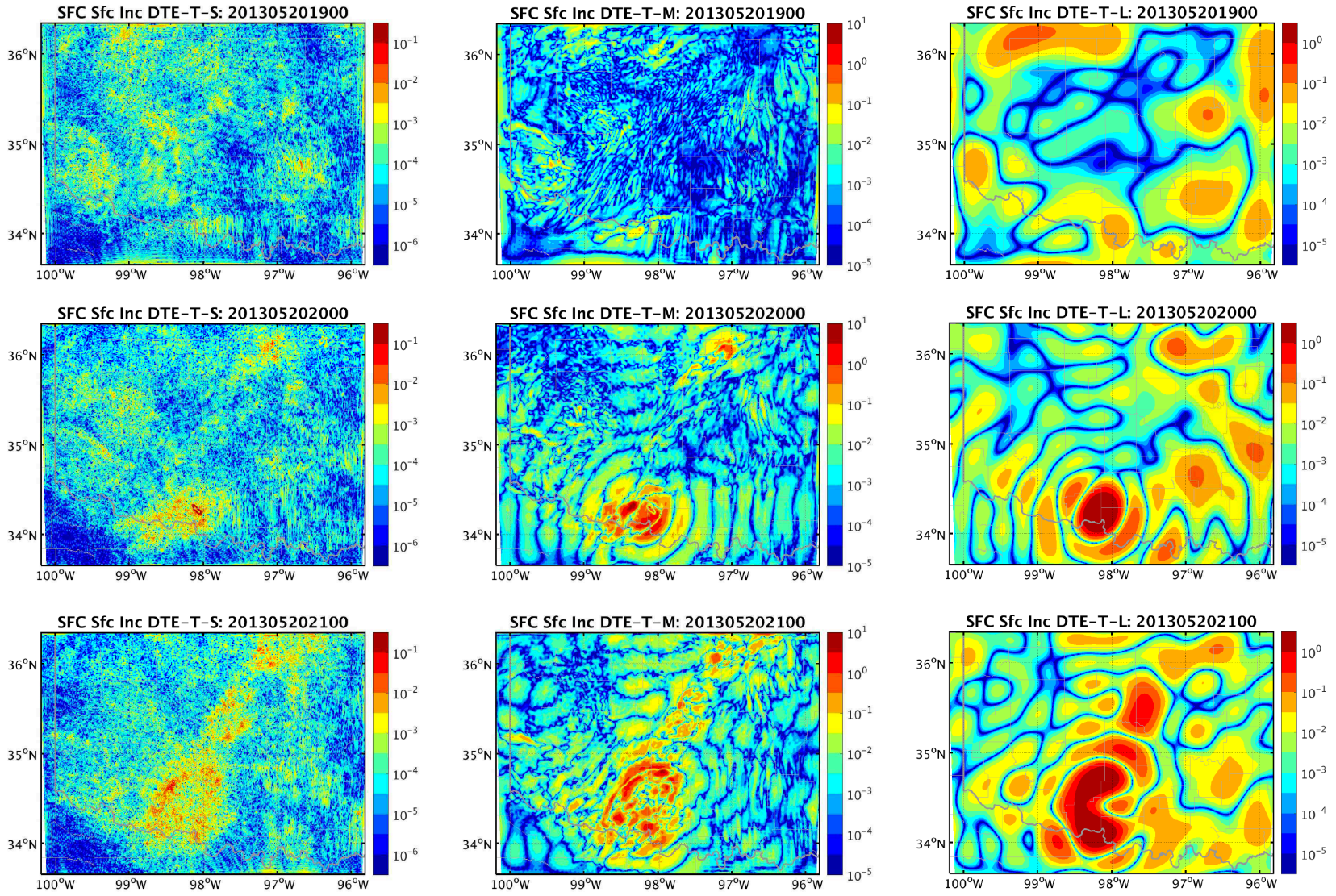


Decomposed into meso-α, meso-ß and meso-γ scales (meso-α scale omitted)

Increments Power Spectra: SFC

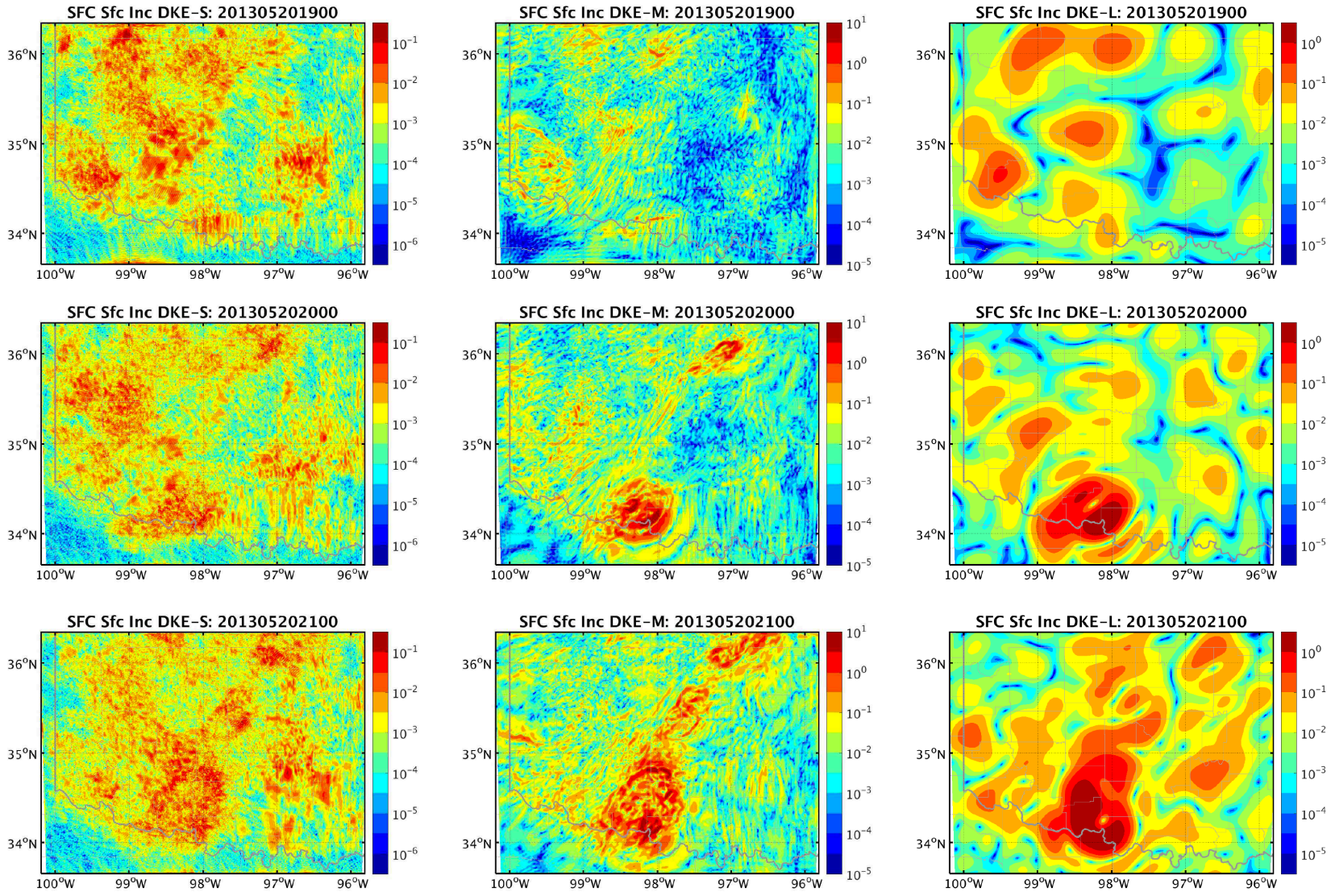


Scale Decomposition of Increments



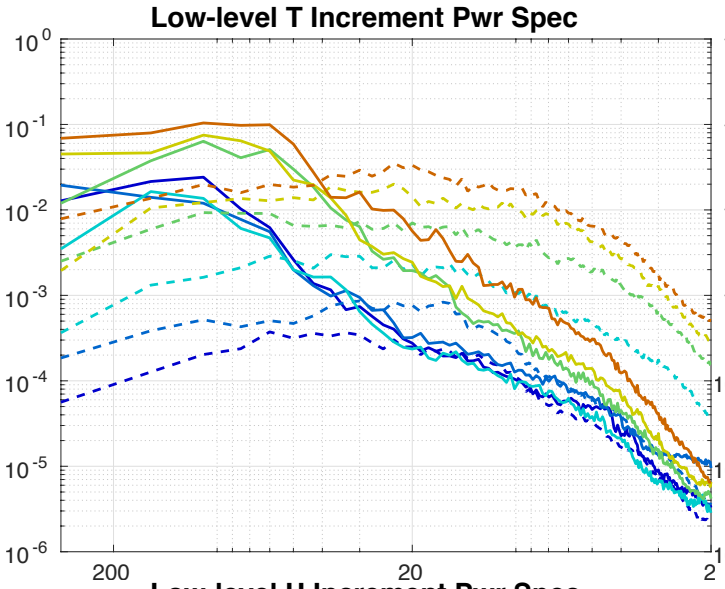
Decomposed into small (< 5 km), medium (5 – 50 km) and large (> 50 km) scales

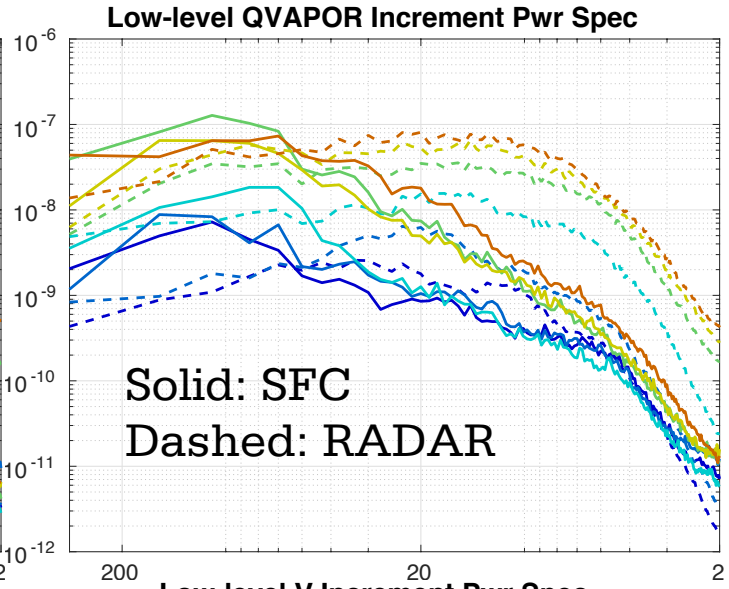
Scale Decomposition of Increments

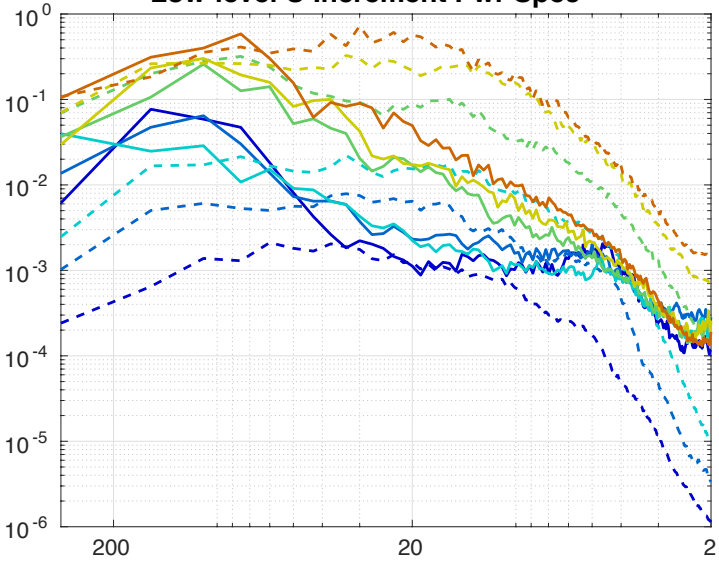


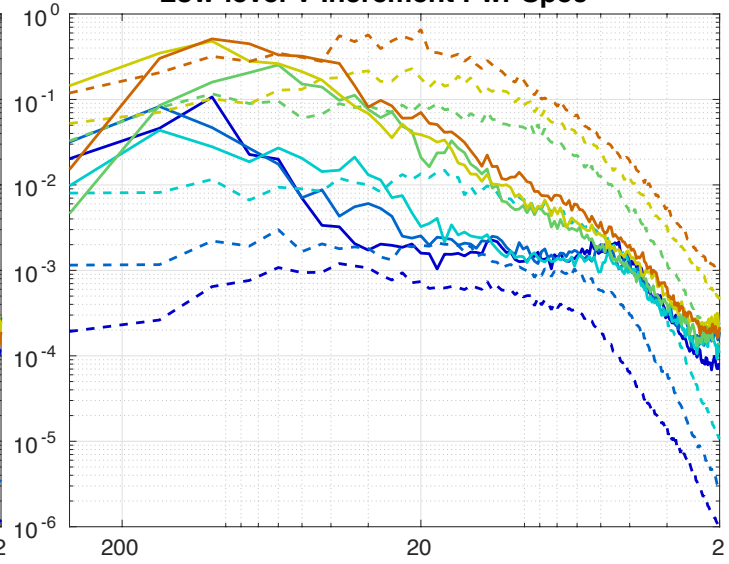
Decomposed into small (< 5 km), medium (5 – 50 km) and large (> 50 km) scales

Evolution of Low-level Increments





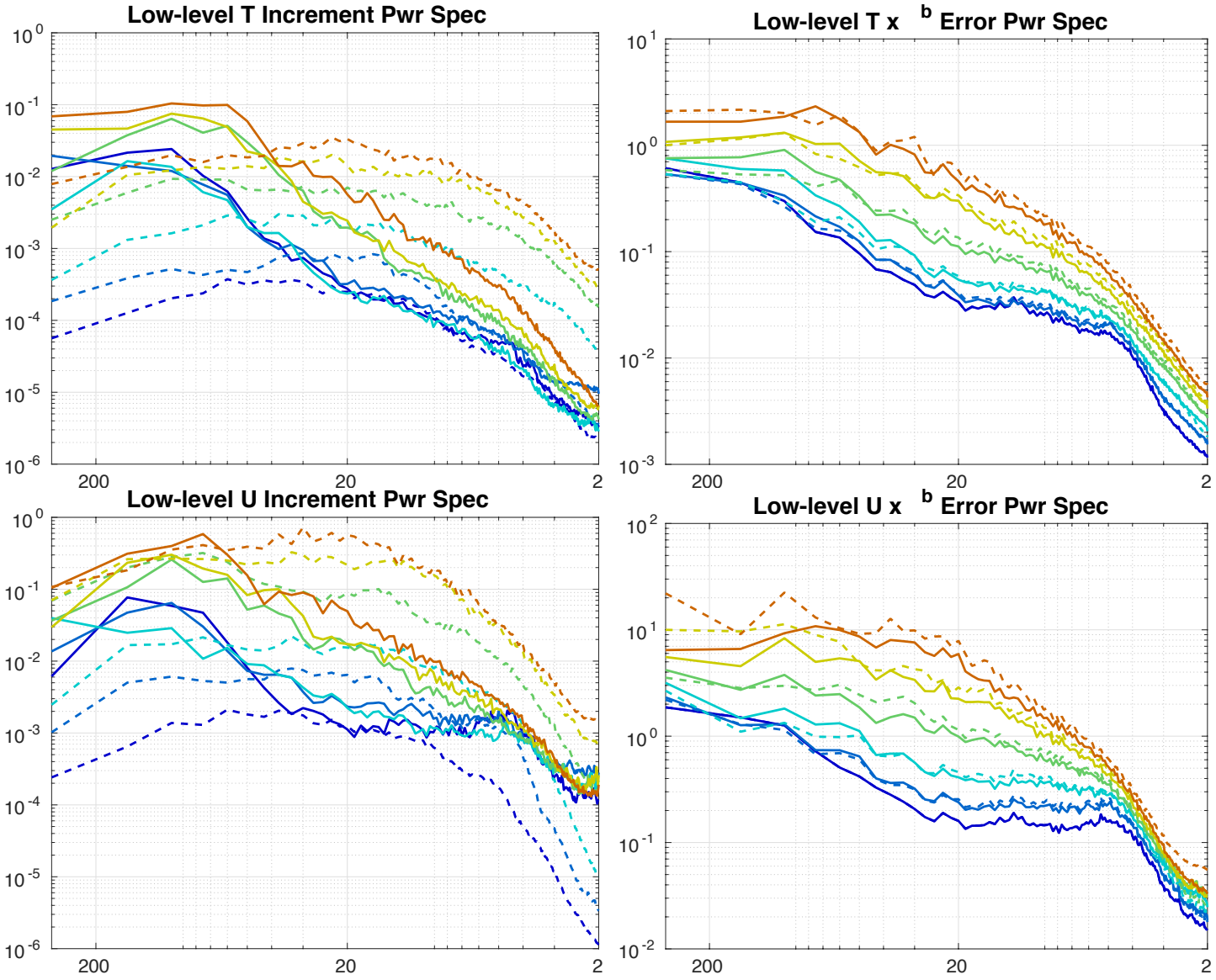




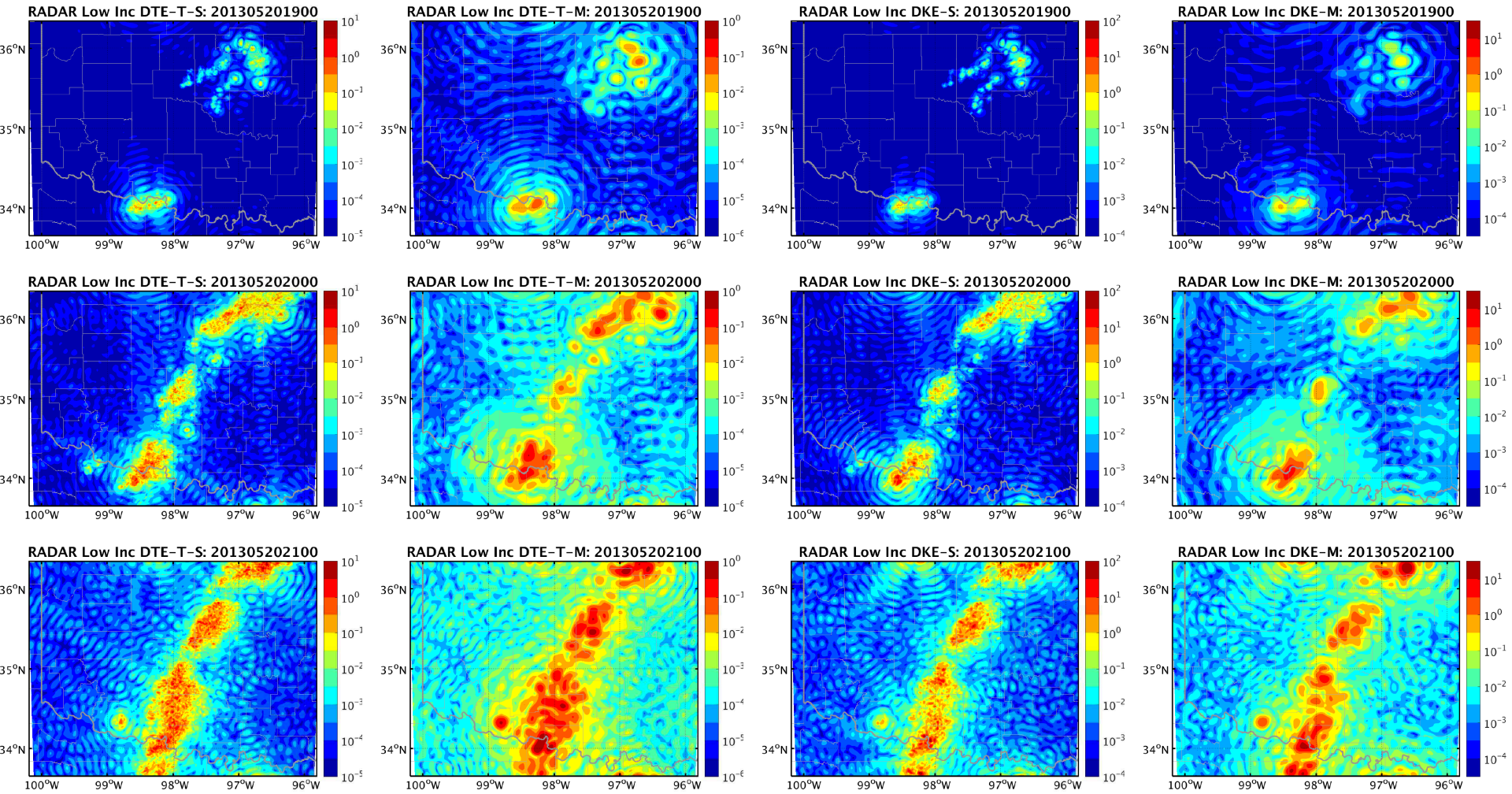
T & Qv:
Low: 0 – 4 km
Mid: 4 – 10 km
Upper: 10 – 16 km

U & V:
Low: 0 – 2 km
Mid: 2 – 8 km
Upper: 8 – 14 km

Comparison of Increment and Error

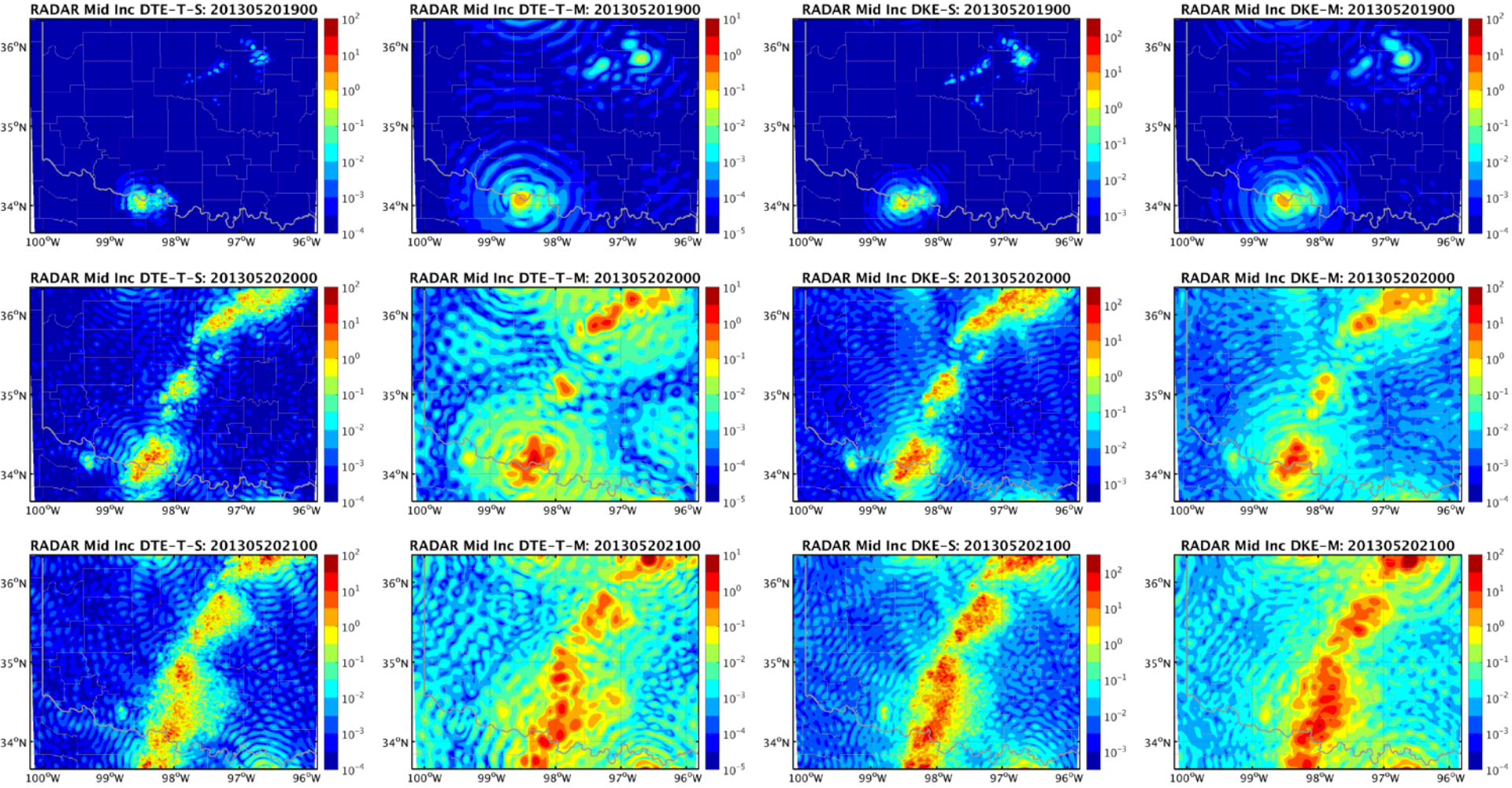


Evolution of Low-level Increments



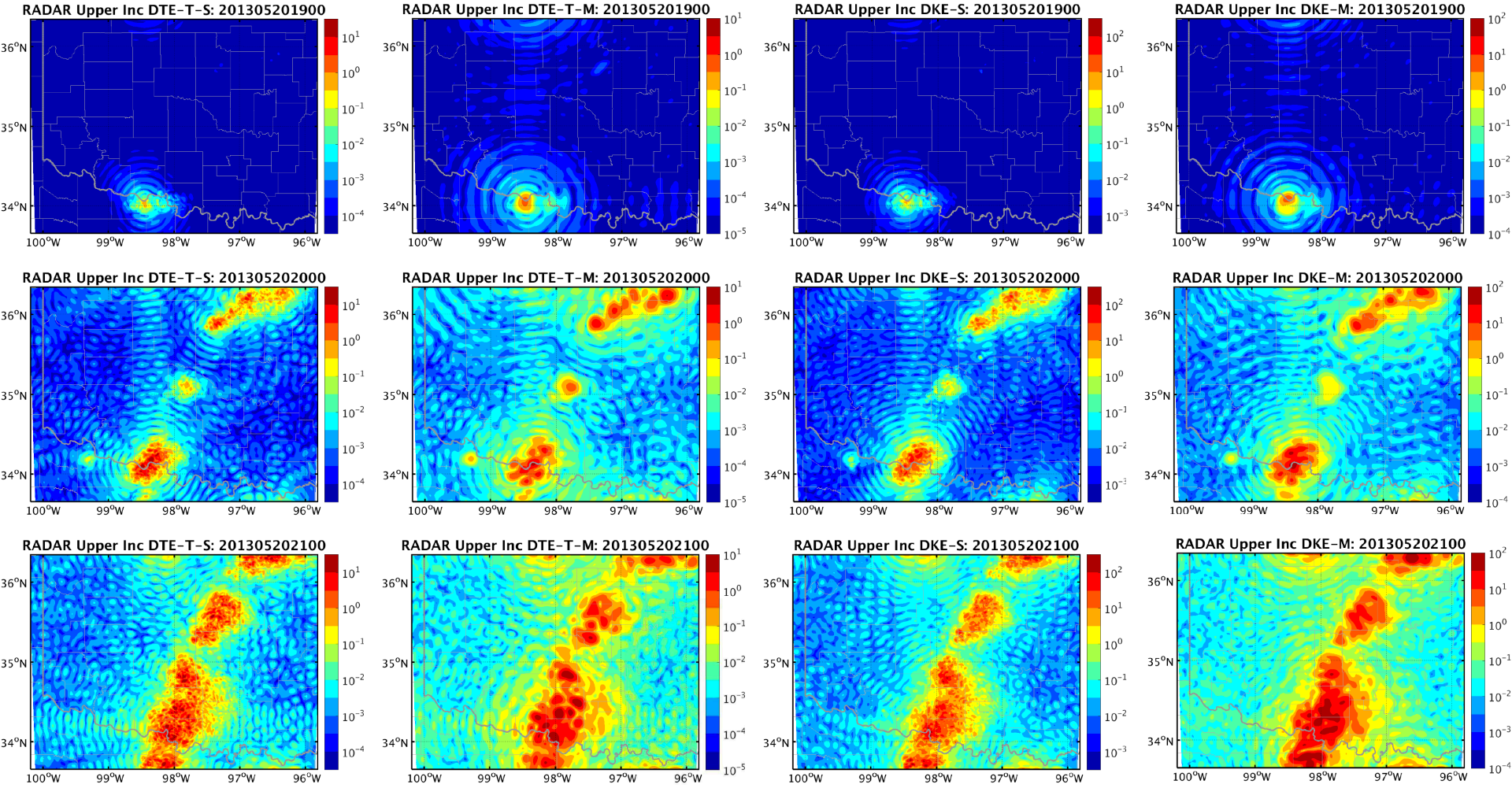
Decomposed into meso-α, meso-ß and meso-γ scales (meso-α scale omitted)

Evolution of Mid-level Increments



Decomposed into meso-α, meso-ß and meso-γ scales (meso-α scale omitted)

Evolution of Upper-level Increments



Decomposed into meso-α, meso-ß and meso-γ scales (meso-α scale omitted)

Summary

- Increments are closely influenced by…
  - Features that the platform observed
  - Resolution of the observations
  - May not follow regions of larger errors
- Comparably weak covariance between atmospheric and surface variables in smaller scales (< 50 km)
- What's the relationships between increments, base state energy and error growth?