A Comparison of NAM CONUS Nest Failures and Successes to Regional 3-km FV3 Runs With Different Microphysical Schemes

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1. Background

Goal:

- Compare simulated precipitation and reflectivity from 3-km regional FV3 runs to that from NMMB runs of cases for which the NAM CONUS nest struggled or did well.

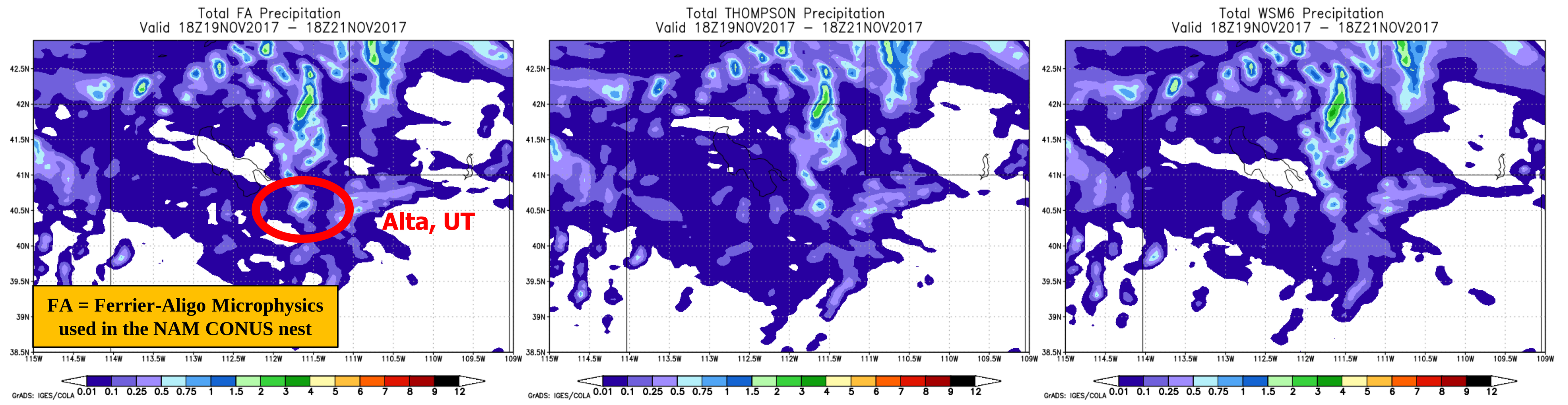
Regional domain used in all FV3 simulations is shown on the right.

FV3 is the GFDL Finite Volume Cubed-Sphere dynamical core to be the newest global prediction system.

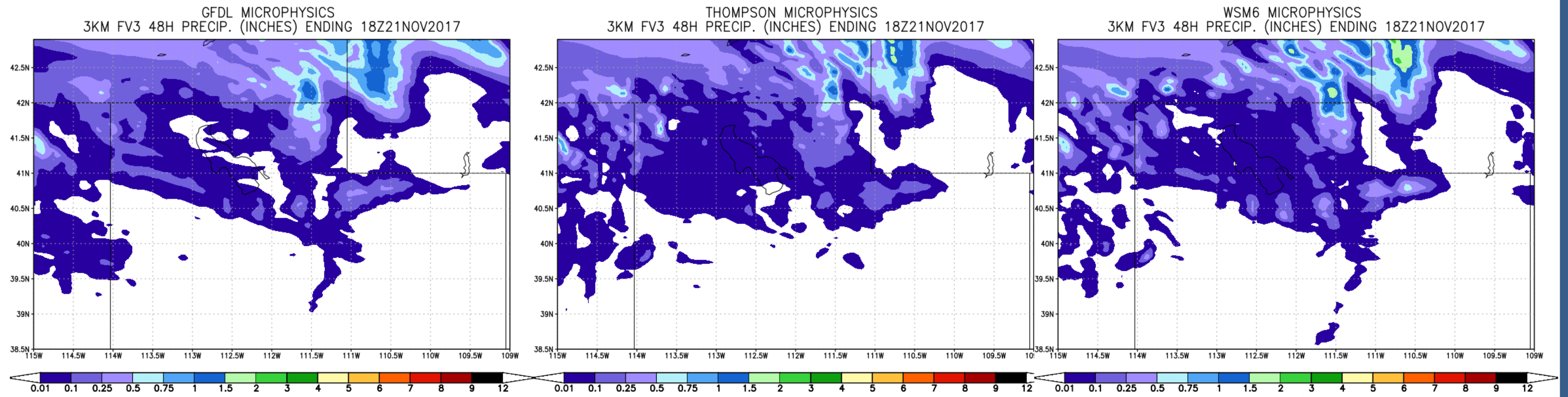
- The NAM CONUS nest is based on the Nonhydrostatic Multi-Scale Model on the B grid (NMMB) dynamic core.
- Results shown below will be based on runs with a regional 3-km NMMB and FV3.

2a. Precipitation: Alta, UT Winter Case

NMMB

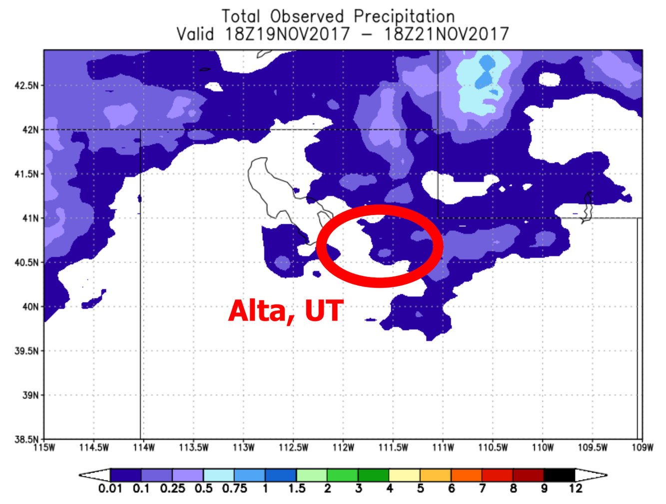


FV3

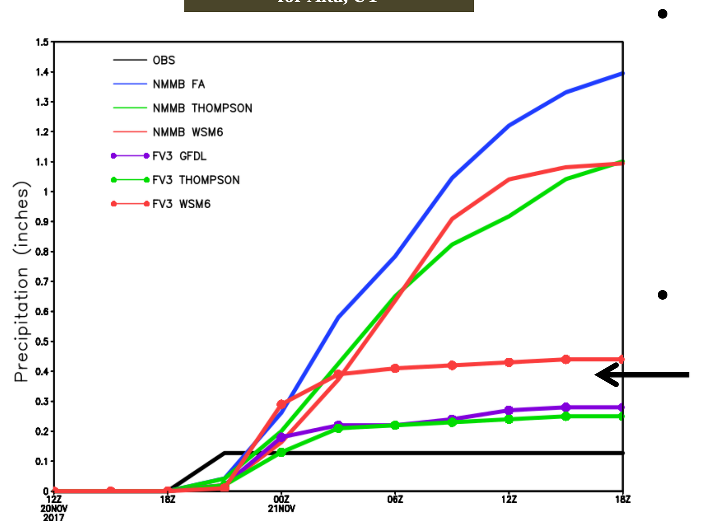


Units: Inches

OBS



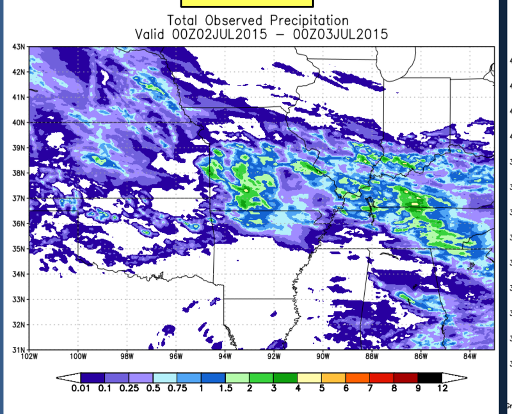
Time Series of Precipitation for Alta, UT



- All NMMB runs produced heavy precipitation over Alta, UT with FV3 runs producing much lower precip. closer to what was observed.
- Time series shows the FA microphysics produced nearly 1.5" of precipitation over Alta, UT with < 0.2" observed.

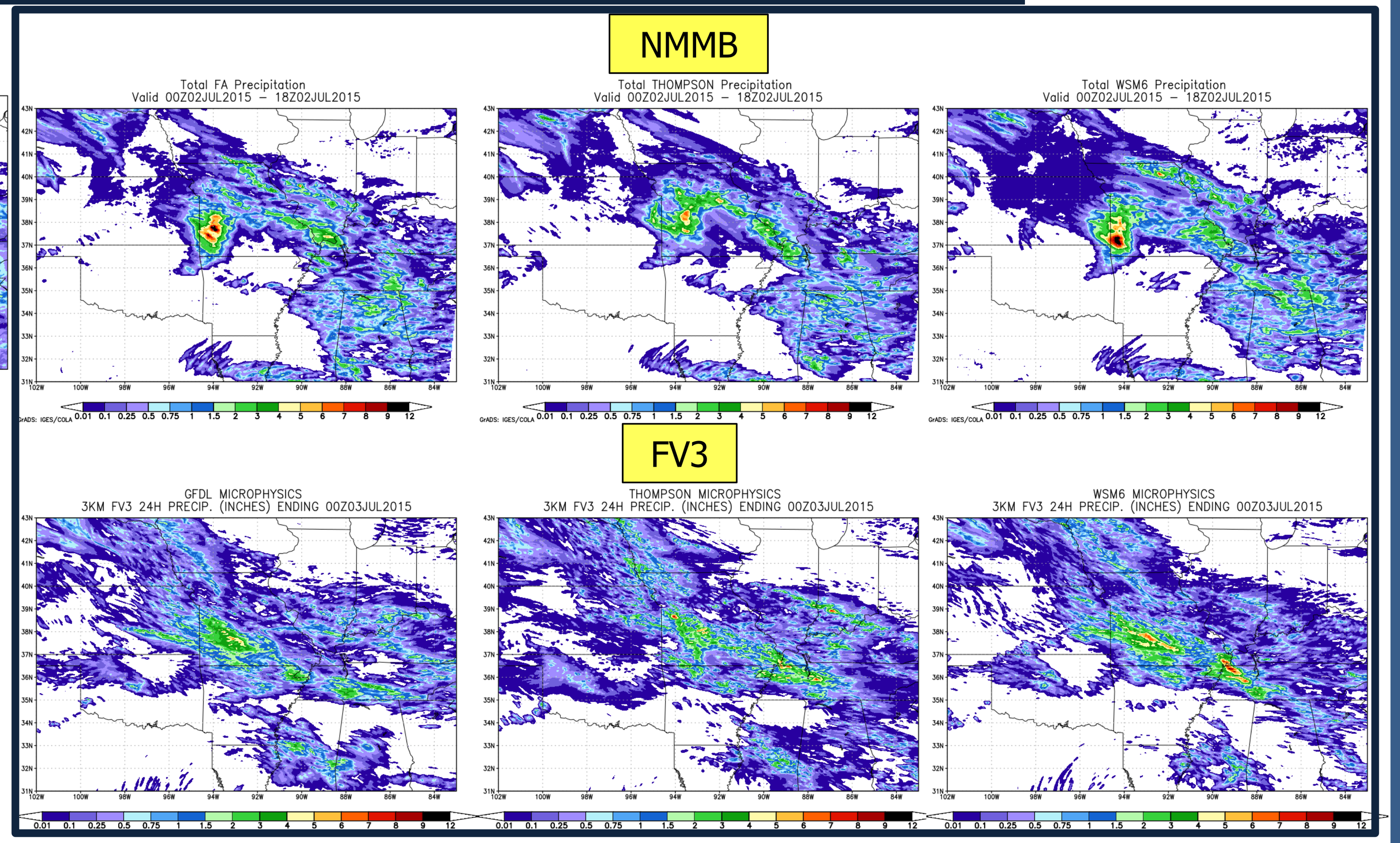
2b. Precipitation- July 1, 2015

OBS



NMMB

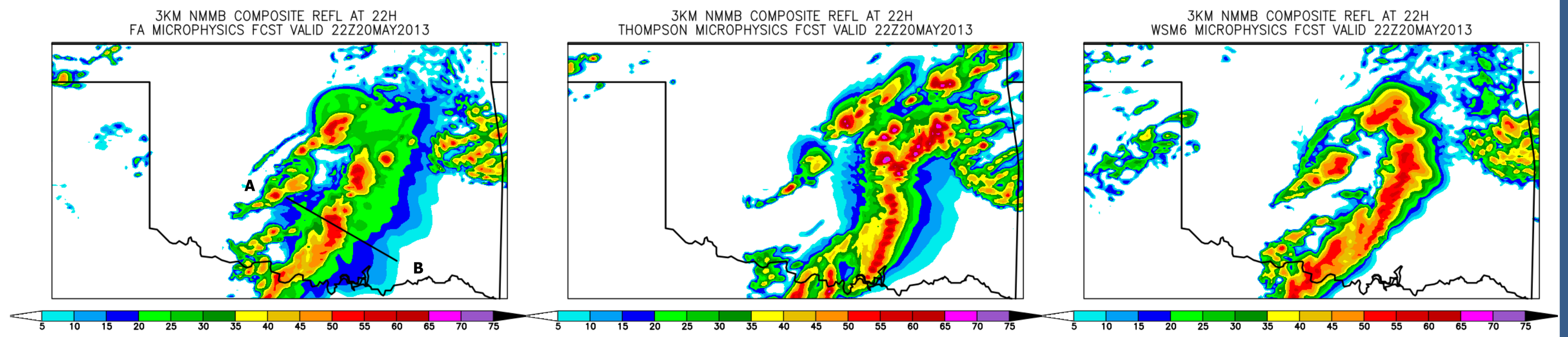
FV3



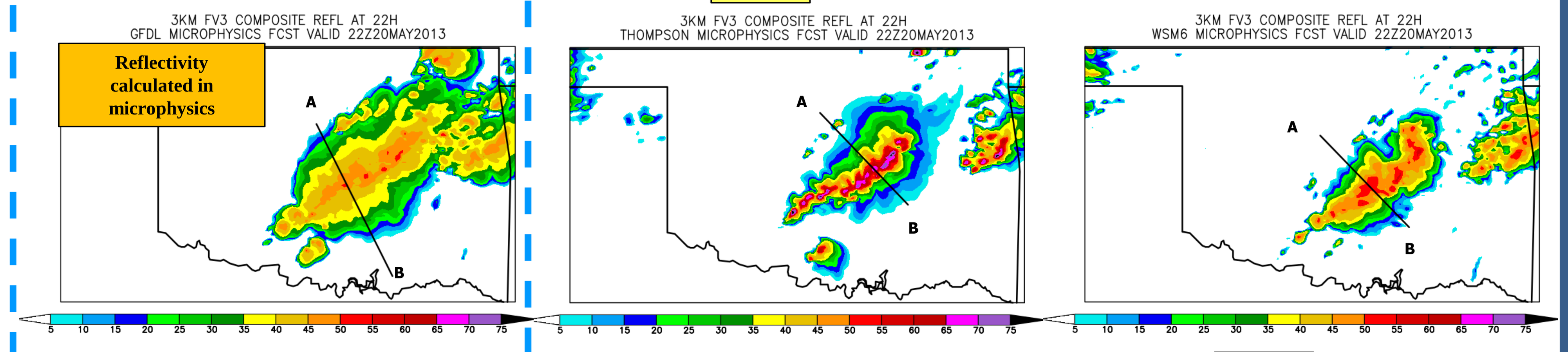
- NMMB runs produced large areas > 4" in MO.
- FV3 runs generally had lower amounts.
- FV3 runs better handled lighter precip. in the NW part of domain.

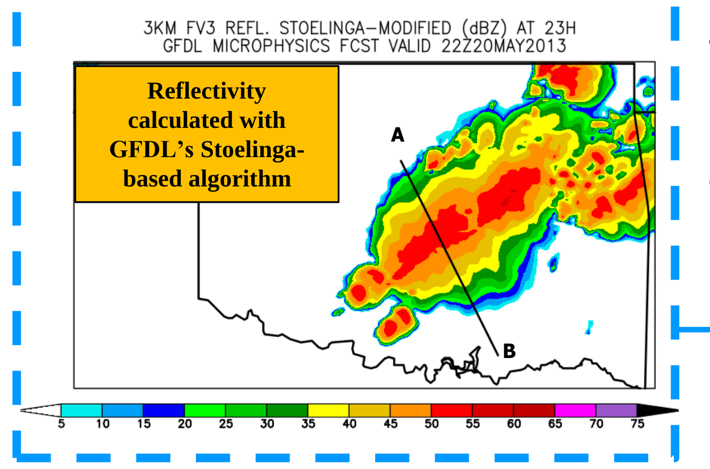
3. Convective Mode: Moore, OK Tornado Outbreak

NMMB



FV3

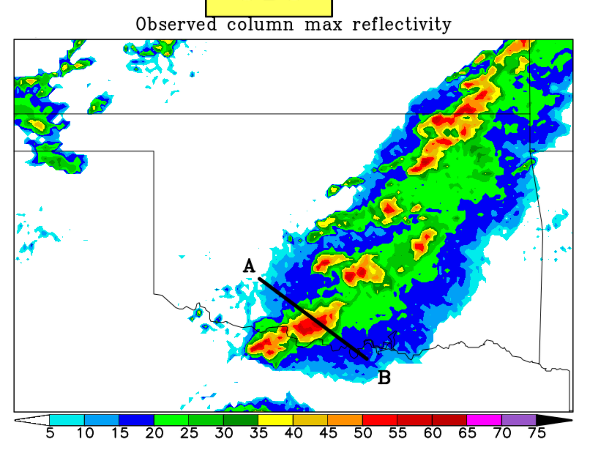




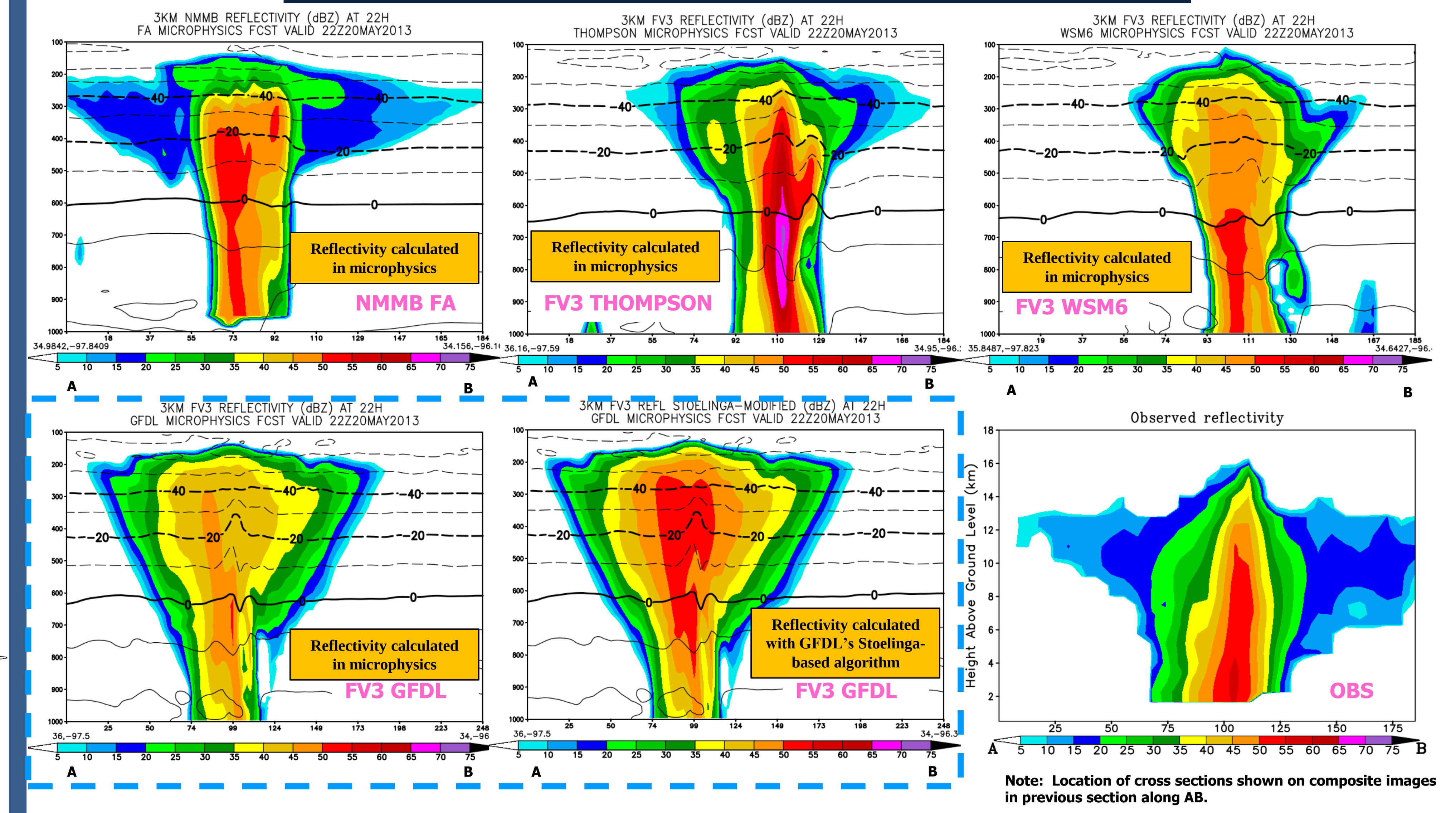
- All NMMB runs better captured the mode while FV3 runs were too linear.
- GFDL microphysics (mp) run using the Stoelinga-based algorithm for reflectivity had too broad an area of > 50 dBZ while reflectivity calculated from the mp was too weak.

OBS

Units: dBZ



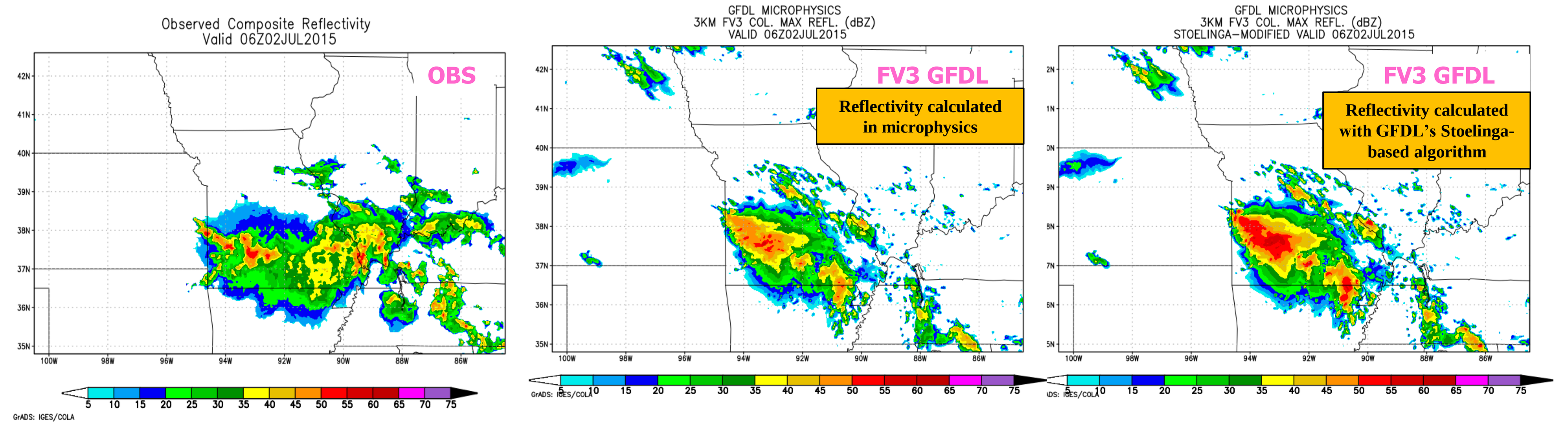
4. Reflectivity Algorithms



Note: Location of cross sections shown on composite images in previous section along AB.

- NMMB and FV3 runs that calculate reflectivity in the microphysics indicate highest reflectivity extending to the surface.
- FV3 GFDL mp run that uses the Stoelinga-based algorithm has a broad area of > 50 dBZ reflectivity mostly above the melting layer and agrees the least with observations.

July 1, 2015



- Small areas of 50 dBZ echoes observed in south-central MO.
- FV3 GFDL mp run using reflectivity calculated in the mp had too broad an area of > 35 dBZ in central MO, but similar area of > 50 dBZ.
- FV3 GFDL mp run using the Stoelinga-based algorithm had too large an area of > 50 dBZ in MO.

5. Summary

- Precipitation in the cold season event over Utah was heaviest in the NMMB and with the FA mp scheme.
- Isolated rainfall amounts of 9-12" over 48-h were found only in the NMMB runs of the July 1 2015 case with the much lower amounts in the FV3 run closer to observations.
- Convective mode was better forecast in the NMMB runs for the Moore, OK case with the FA mp most similar to observations.
- The Stoelinga-based algorithm provided by GFDL produces a much higher reflectivity than the algorithm computed directly in the microphysics scheme.
- **Future work** will evaluate the NAM CONUS nest physics in 3-km FV3 runs for various cases, and compare against the WSM6, Thompson and GFDL mp schemes.