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Trajectory Analysis of Tropical Cyclones with Shear and Dry Environment

Dandan Tao and Fuqing Zhang

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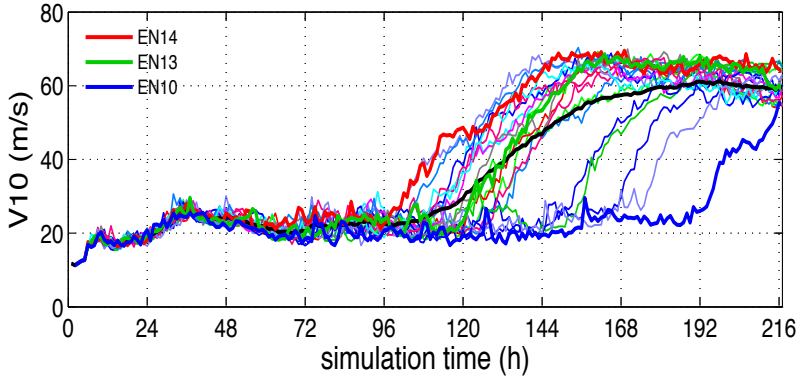
Trajectory Analysis

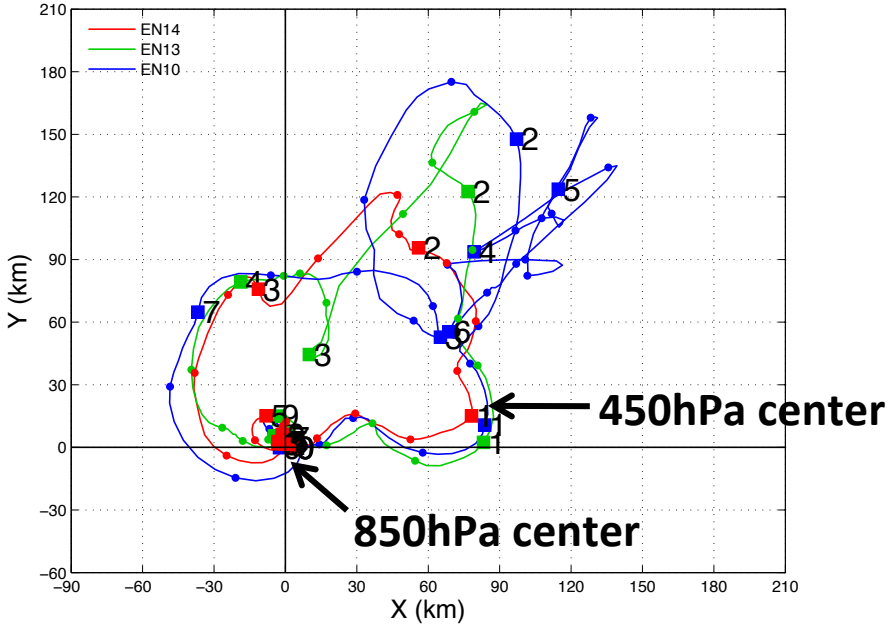
- **Purpose:** Study how the difference of the convections between members builds up.
- **Data:** Idealized simulation with 5 m/s westerly shear and dry environment (R > 300 km, 50% of the original sounding moisture) under SST = 27° (SH5_SST27_Dry50).
- d02: 6 km, 240*240 grid points (d03 is too small).
- **Method:** RIP4 parcel trajectory program
- All plots are in storm relative framework (X_{parcel}-X_{center}).

SH5_SST27_Dry50

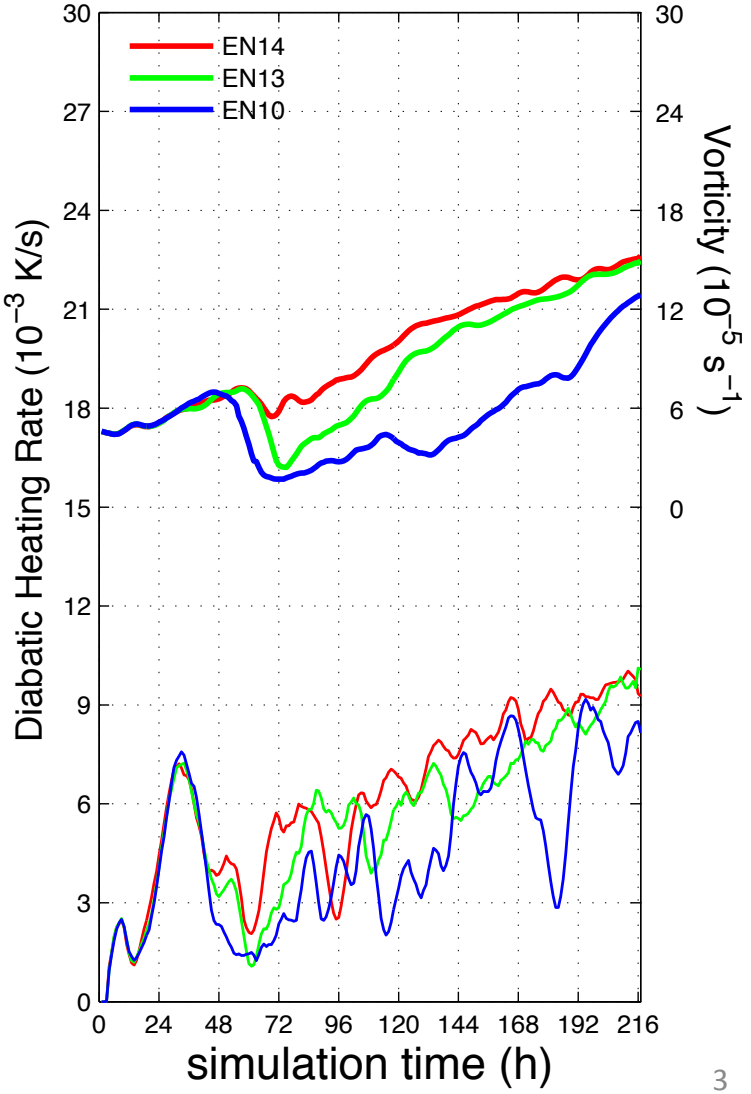
10-m Maximum Wind Speed



Tilt between 850hPa and 450hPa



450hPa Vorticity and Integrated Heating



SH5_SST27_Dry50

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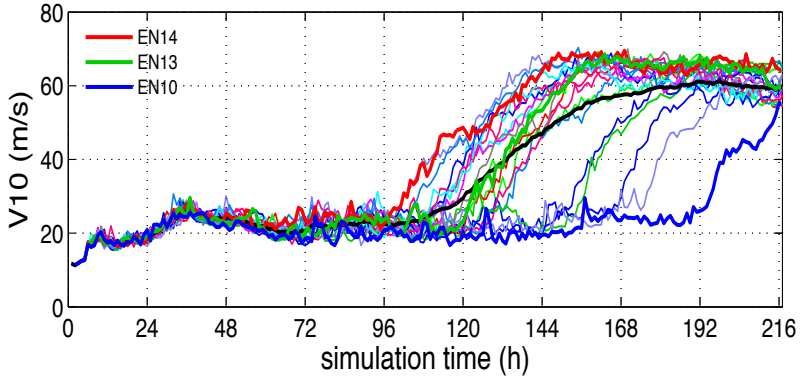

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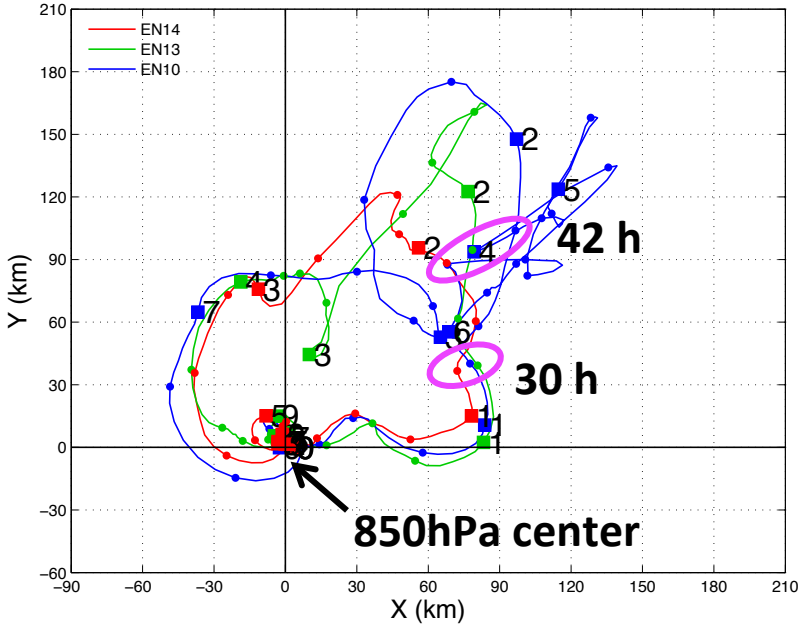

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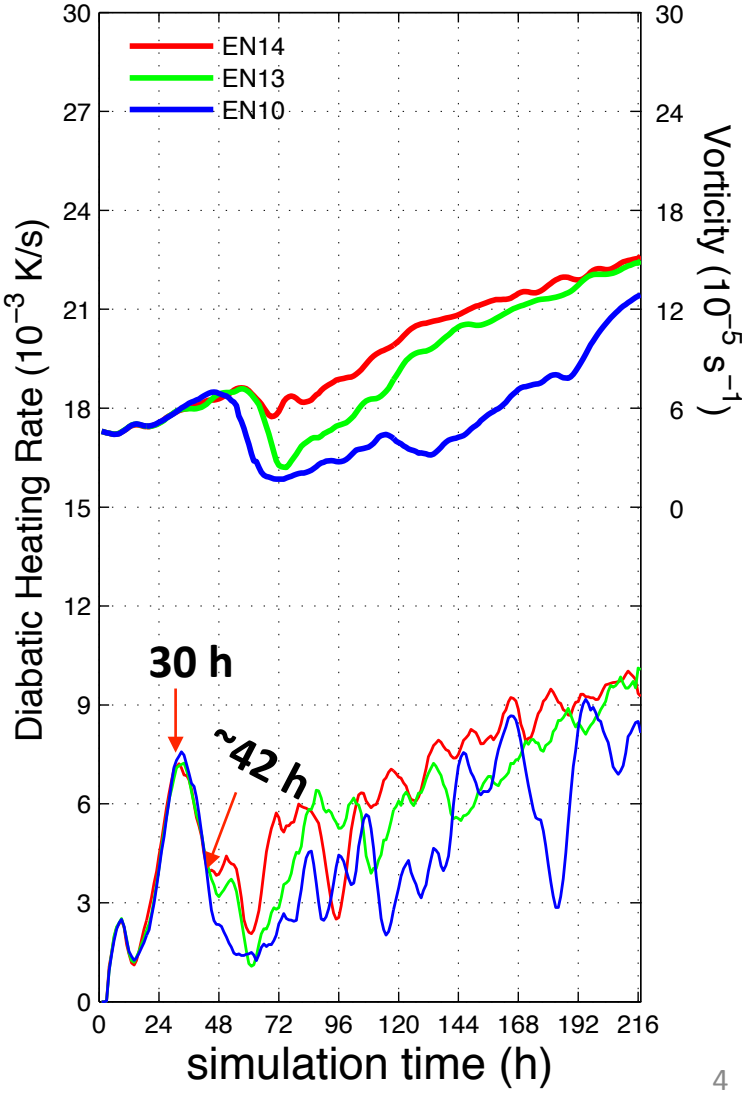
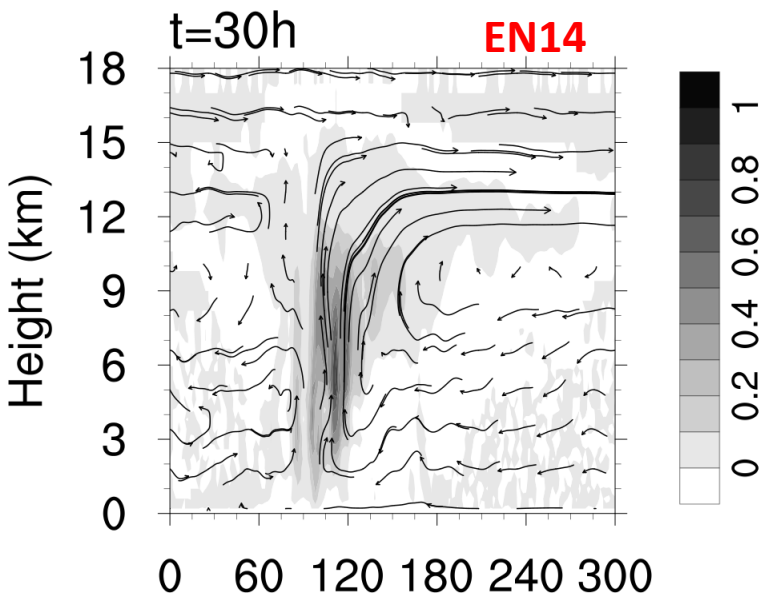
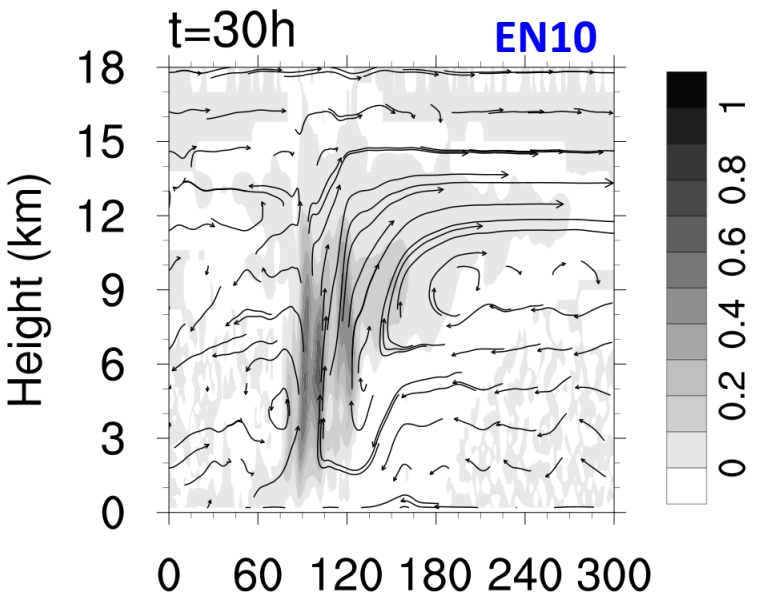
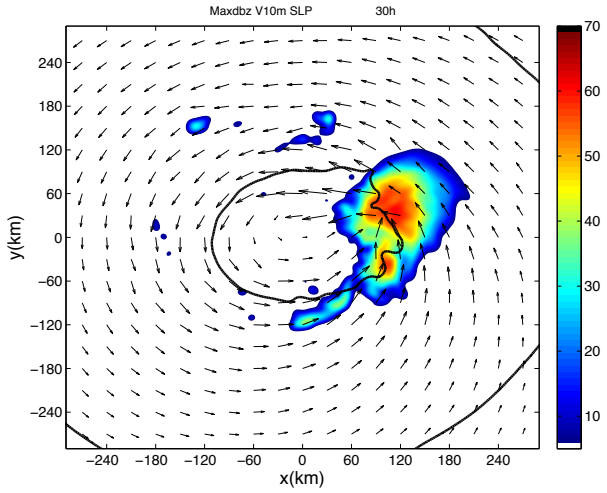
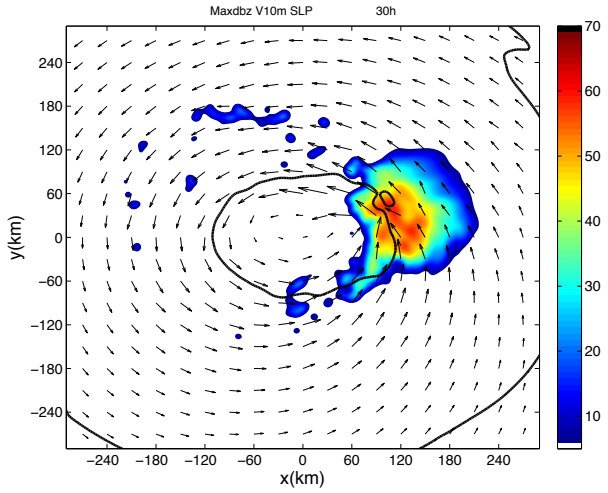


Vertical Heating and Secondary Circulation Horizontal Max dbz and Sea Level Pressure









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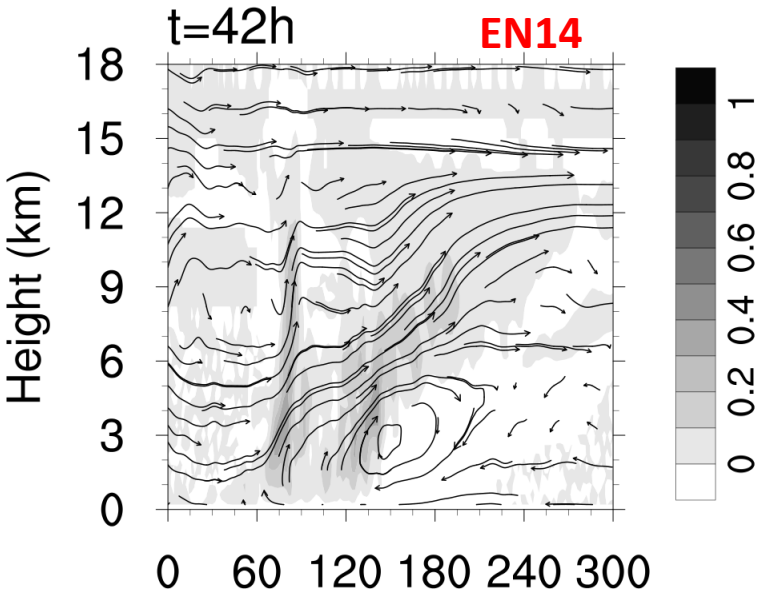

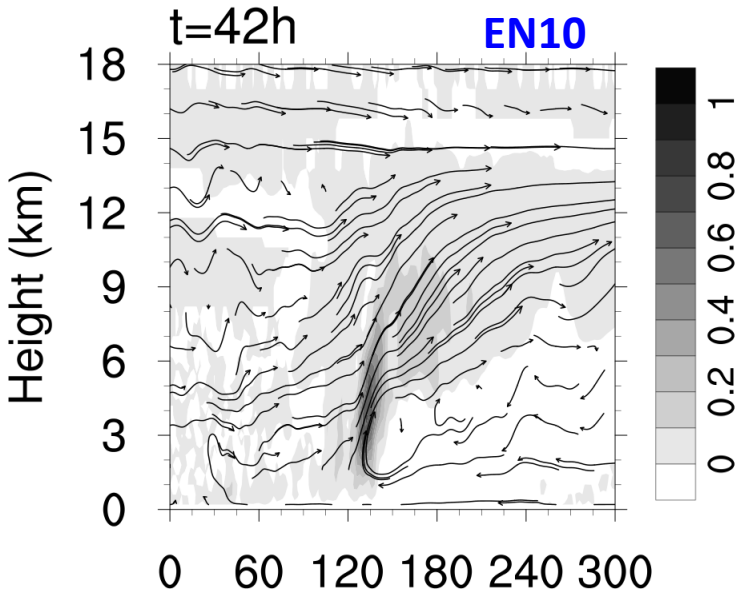

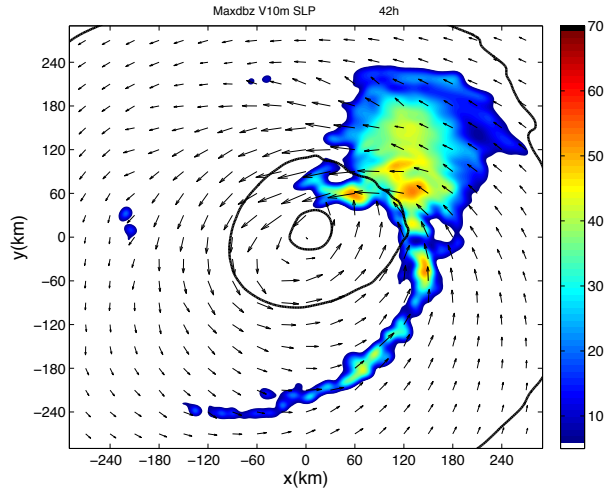

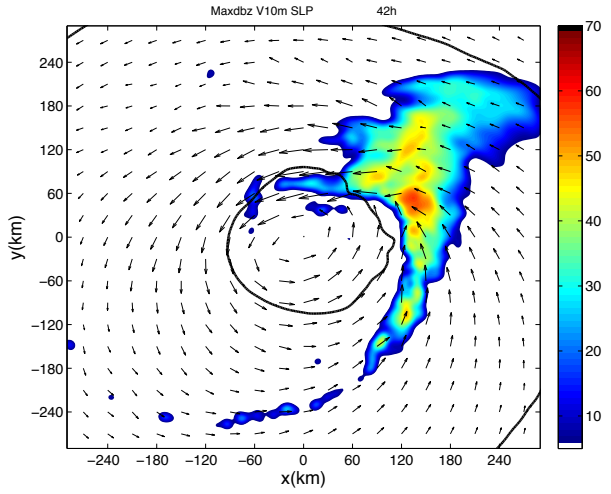

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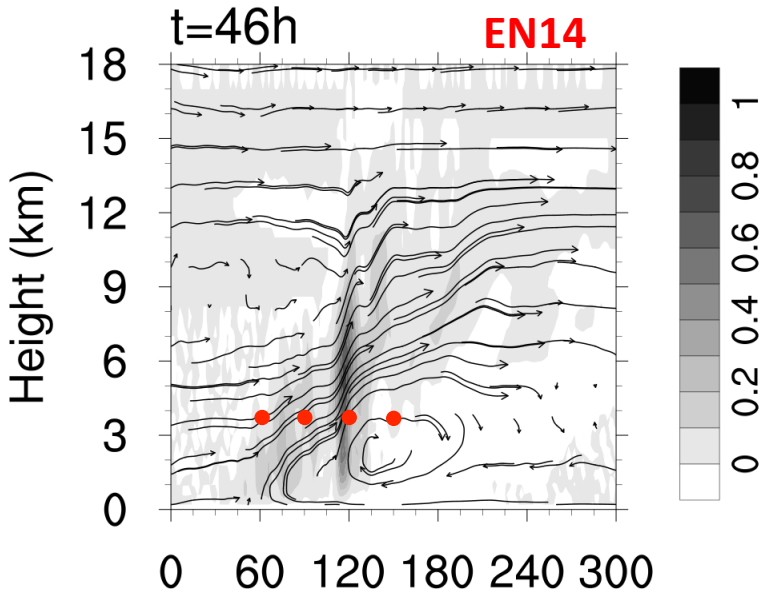

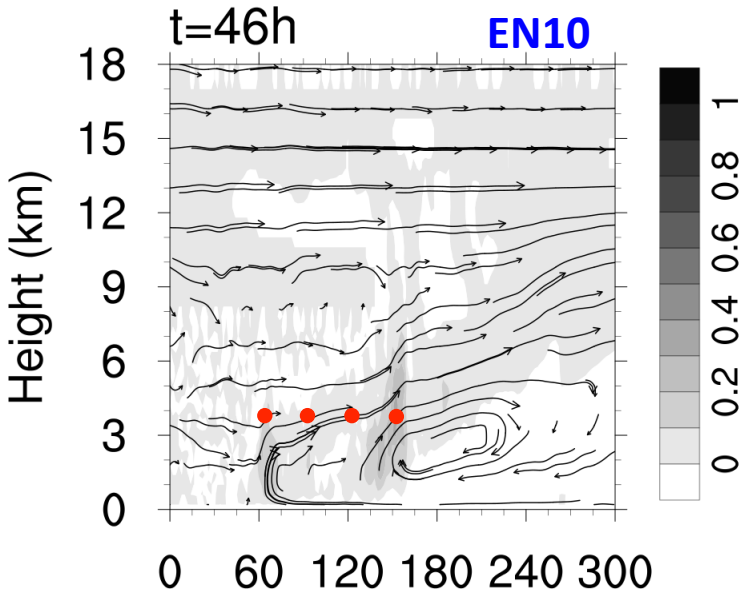

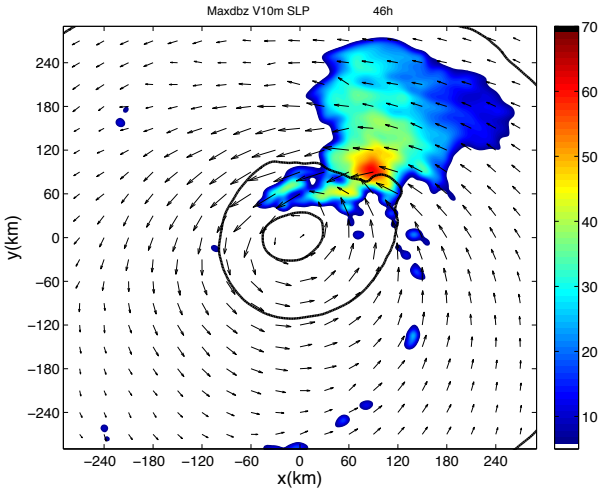

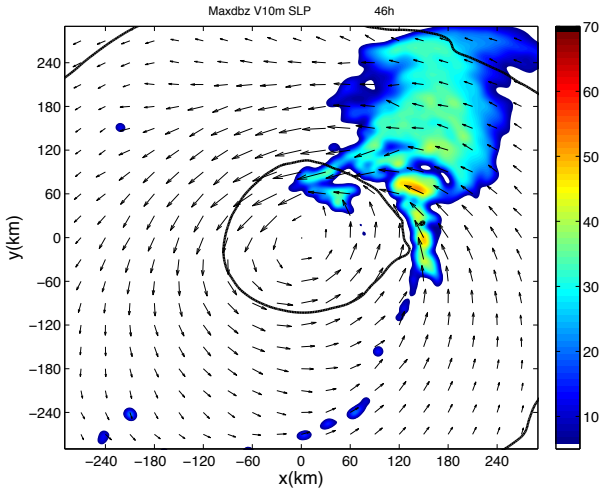

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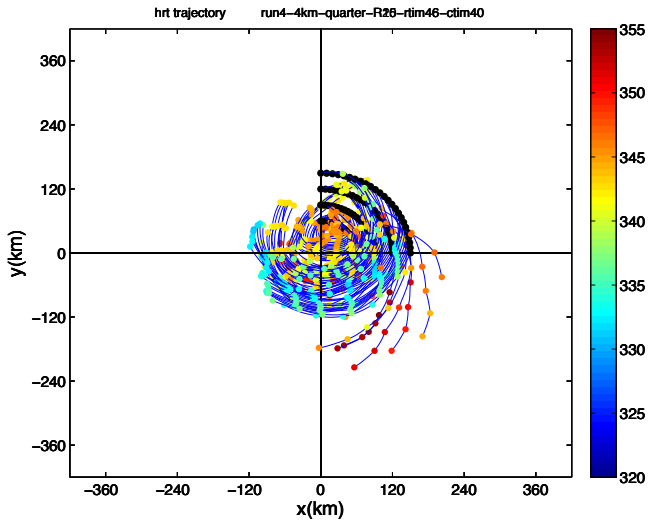
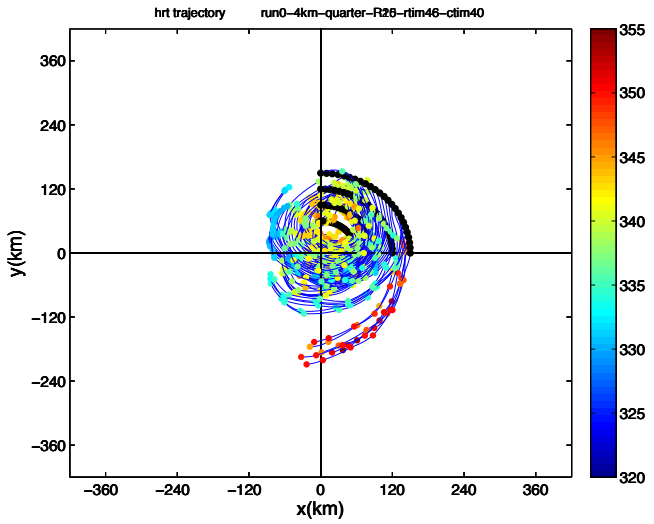
Backward Trajectory 46h -> 40h

seed at radius of 60-150km, **Z=4km**, color is θe.

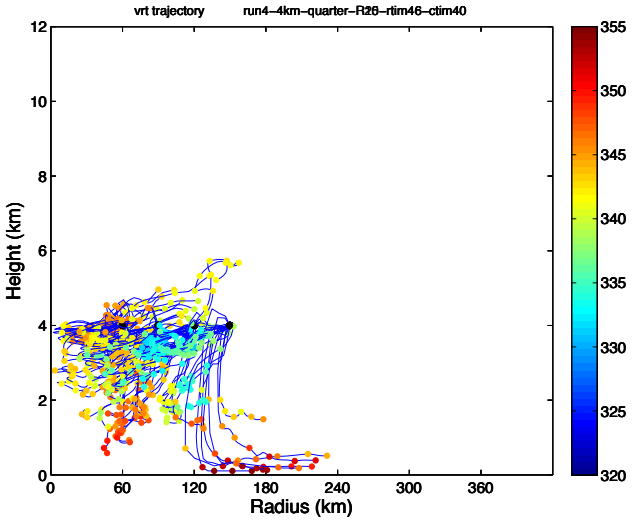
EN14 **EN10**

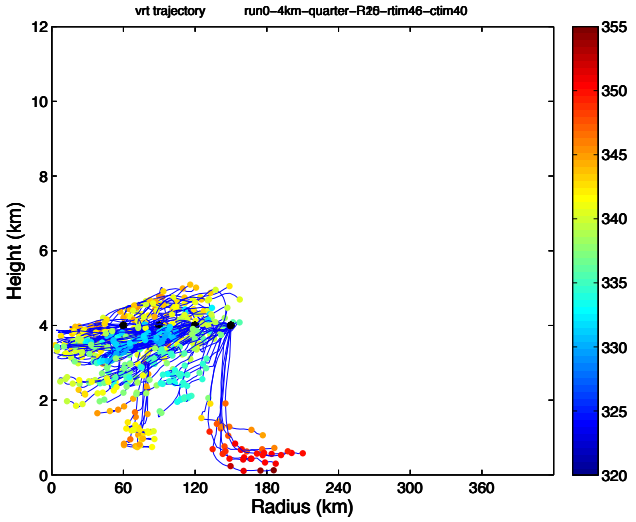
Horizontal





Vertical





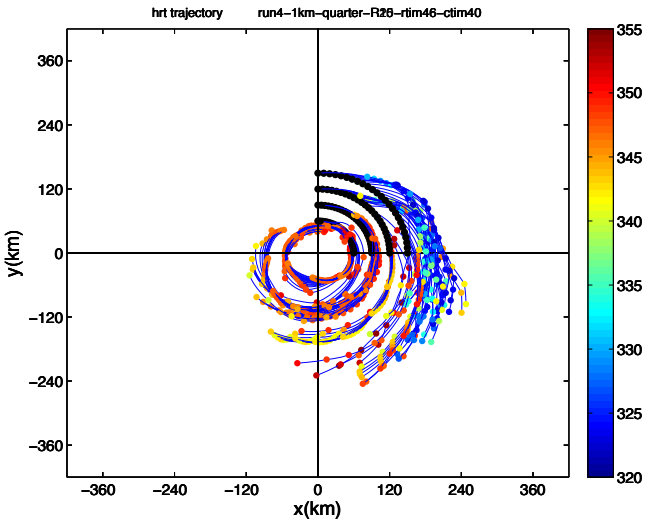
PENNSTATE

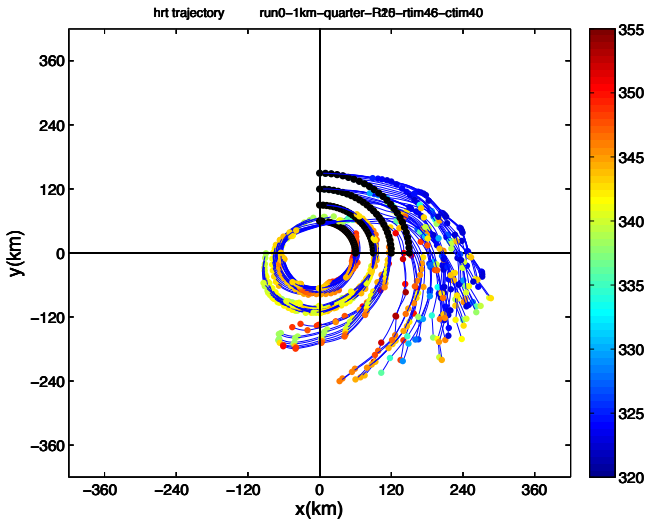
Backward Trajectory 46h -> 40h

seed at radius of 60-150km, **Z=1km**, color is θe.

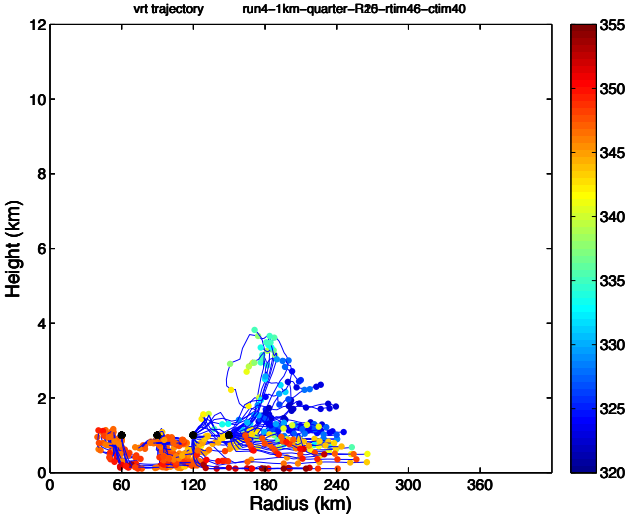
EN14 **EN10**

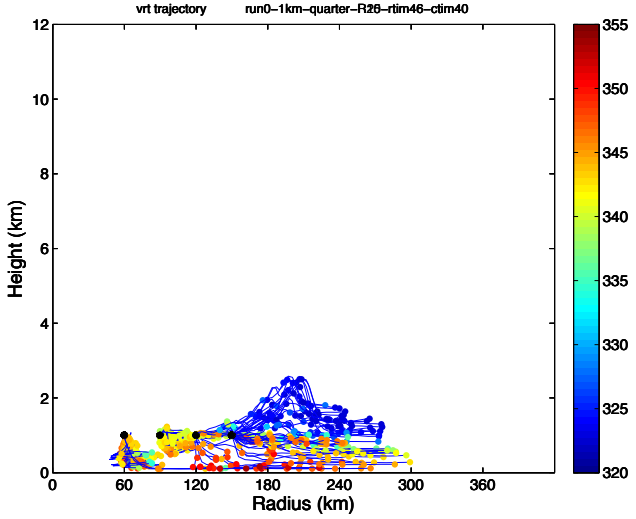
Horizontal





Vertical





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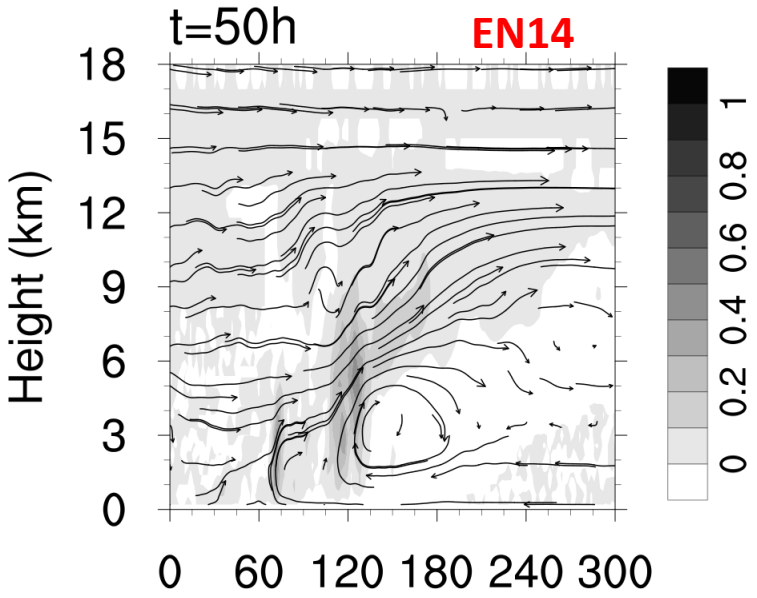

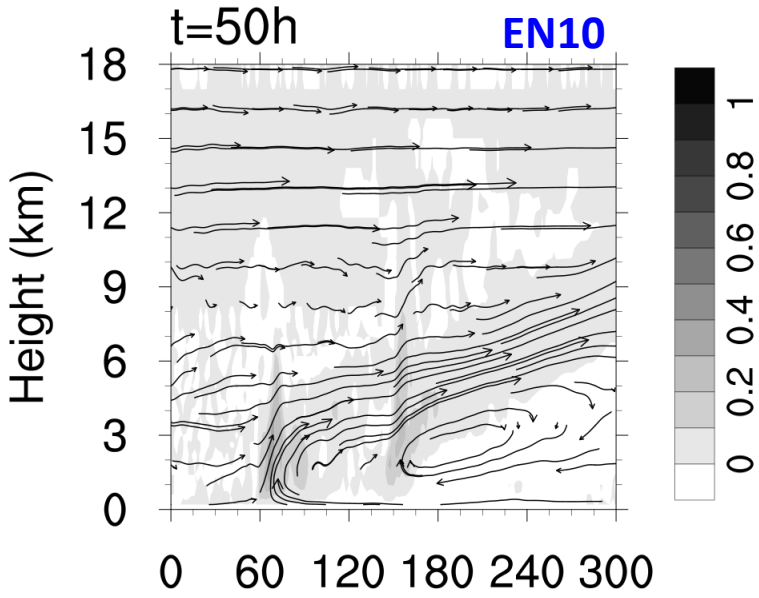

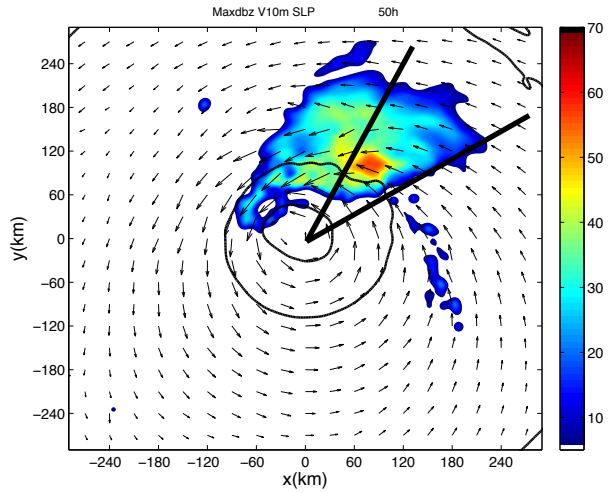

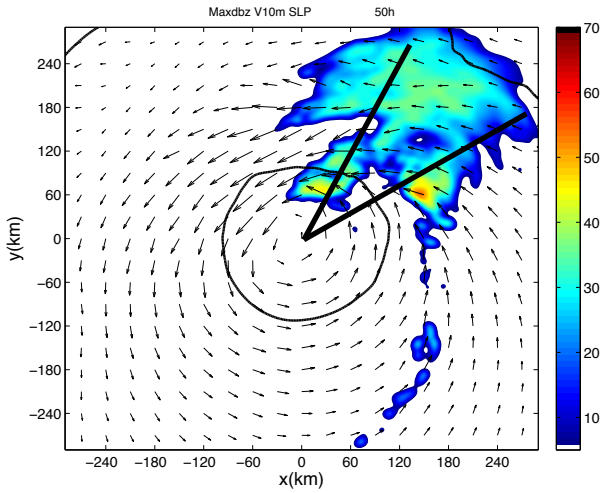

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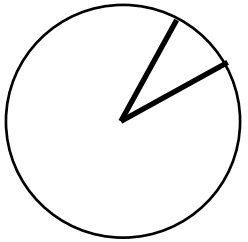
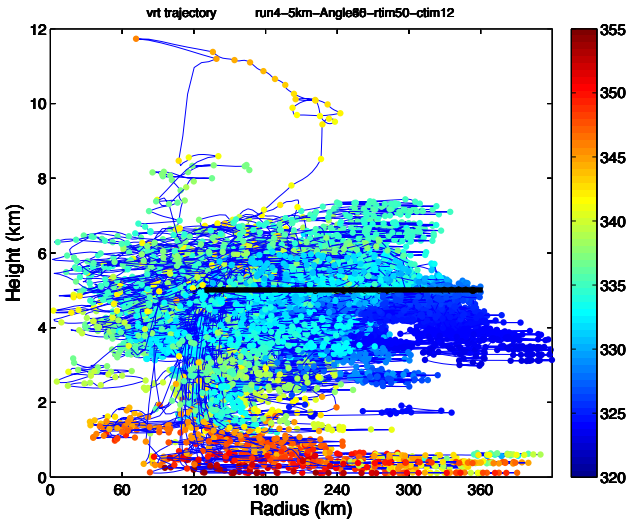
Backward Trajectory 50h -> 12h

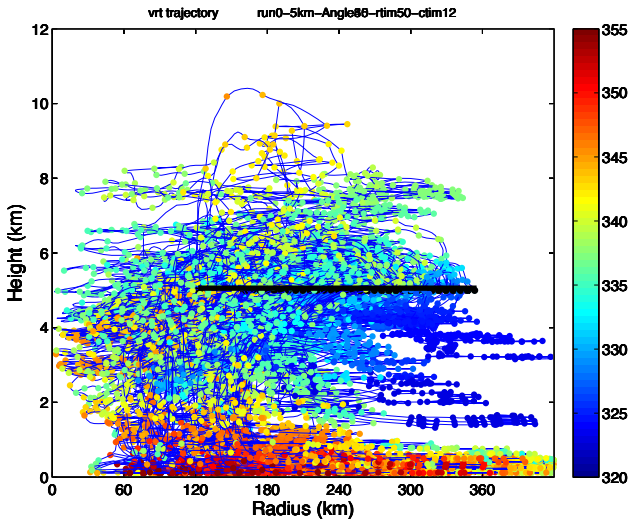
seed at angle of 30-60°, 5° interval, **Z=5km**, color is θe.



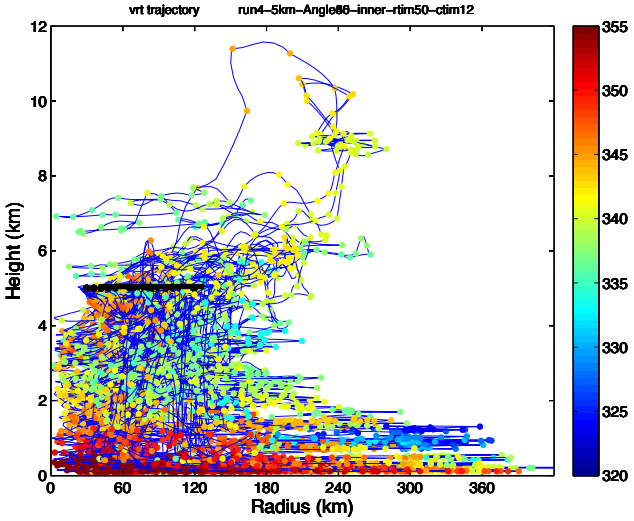
EN14 **EN10**

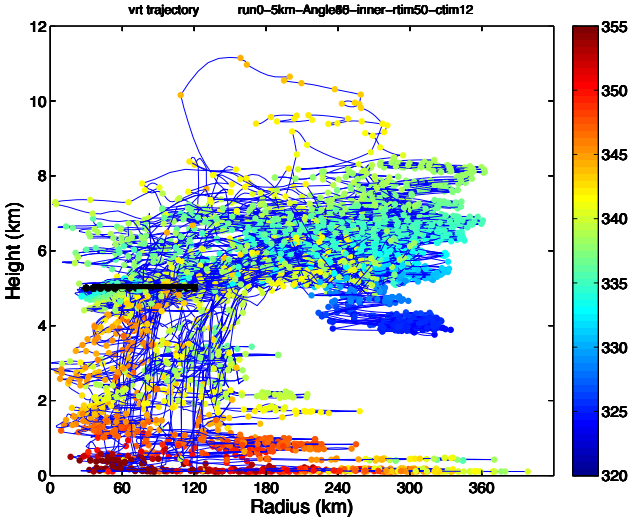
120km – 360km





30km – 120km





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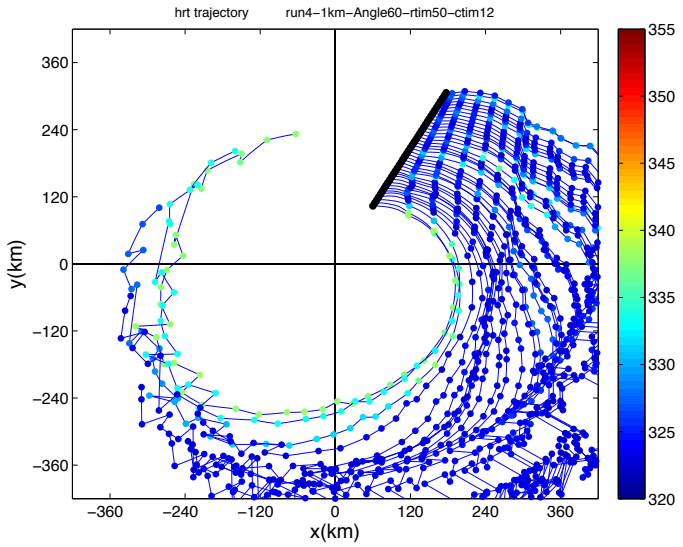
Backward Trajectory 50h -> 12h

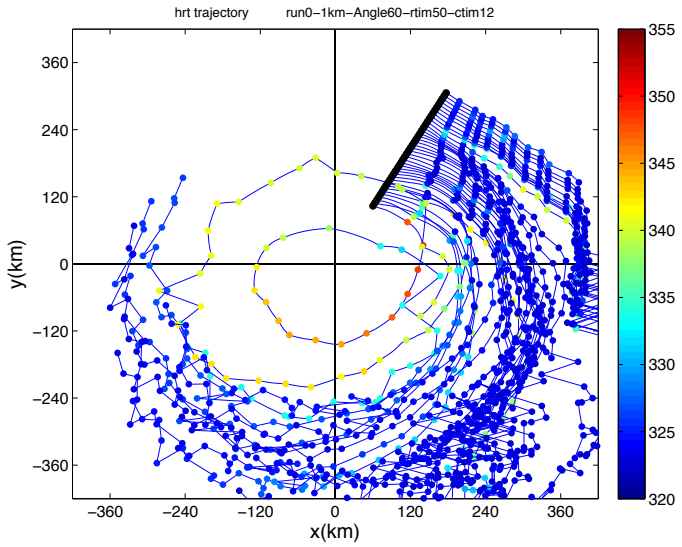
seed at angle of 60°, **Z=1km**, 120-360km, color is θe.

EN14

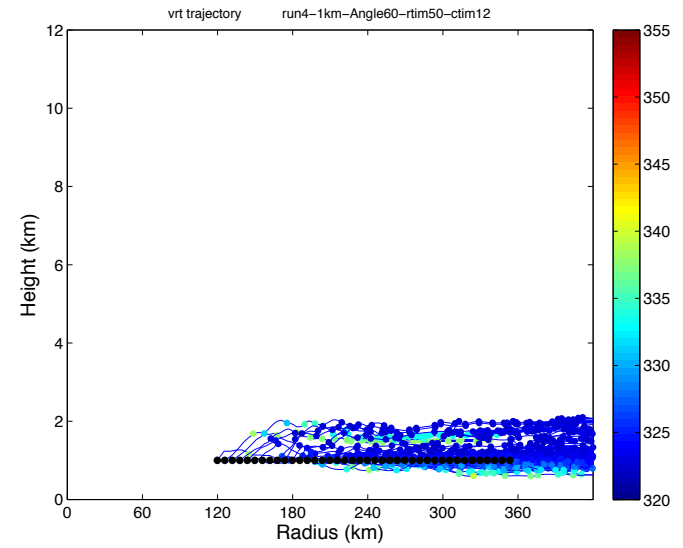
EN10

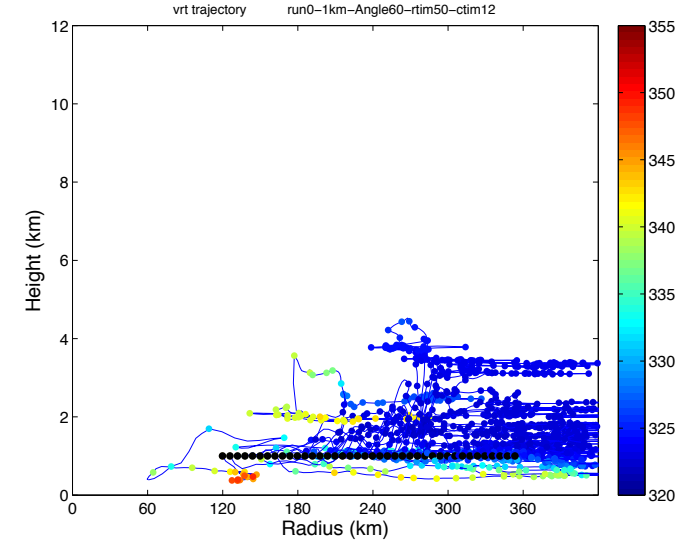
Horizontal





Vertical





Concluding Remarks

- The structure of the convection differs between members before the occurrence of integrated values like vorticity, heating, and instant values like 10-m Vmax. Tilt of the storm is more sensitive to this structure change.
- At t=46h, EN14 has higher θe air in the low level inner core, which could be the reason of the further deviation from EN10.
- At t=50h and z=4km, most inner core air in the convection of EN14 comes from low level/high θe air, while in EN10 some of the inner core air come from the midlevel/high-level low θe air and most low level/ high θe air goes to outer convection.
- More midlevel dry air is flushed down to the low levels in EN10.