PENNSTATE

Dynamics and predictability of secondary eyewall formation in sheared tropical cyclones

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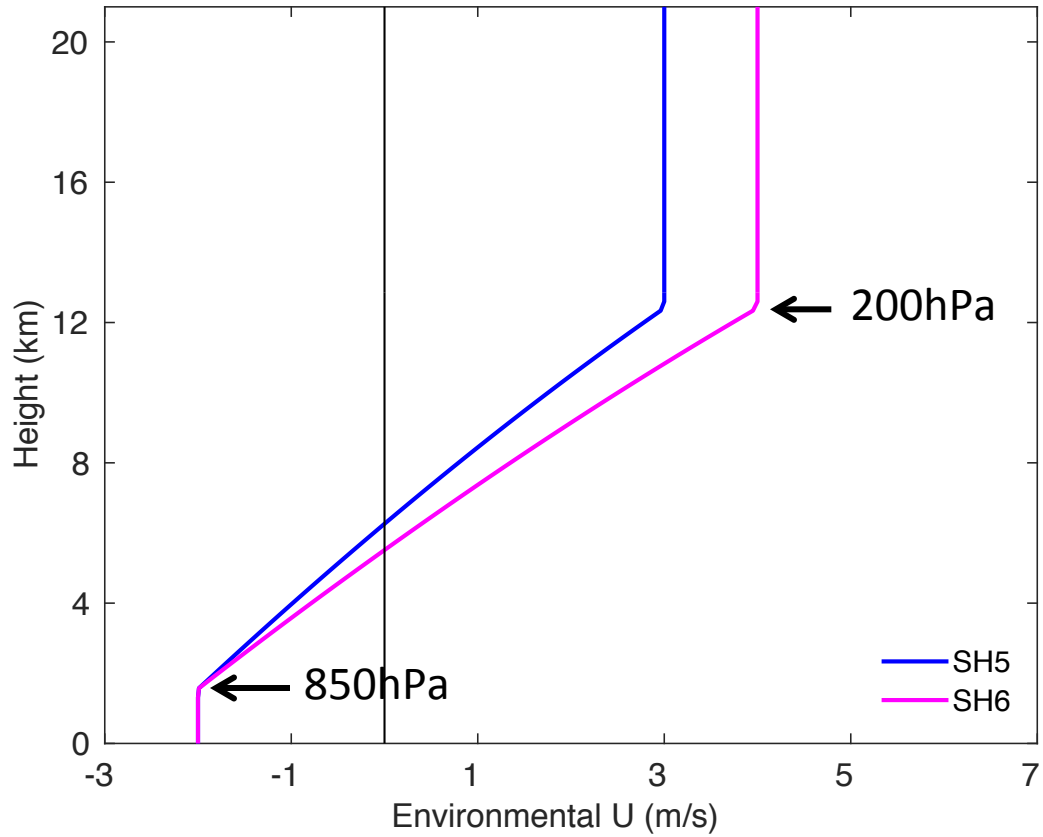
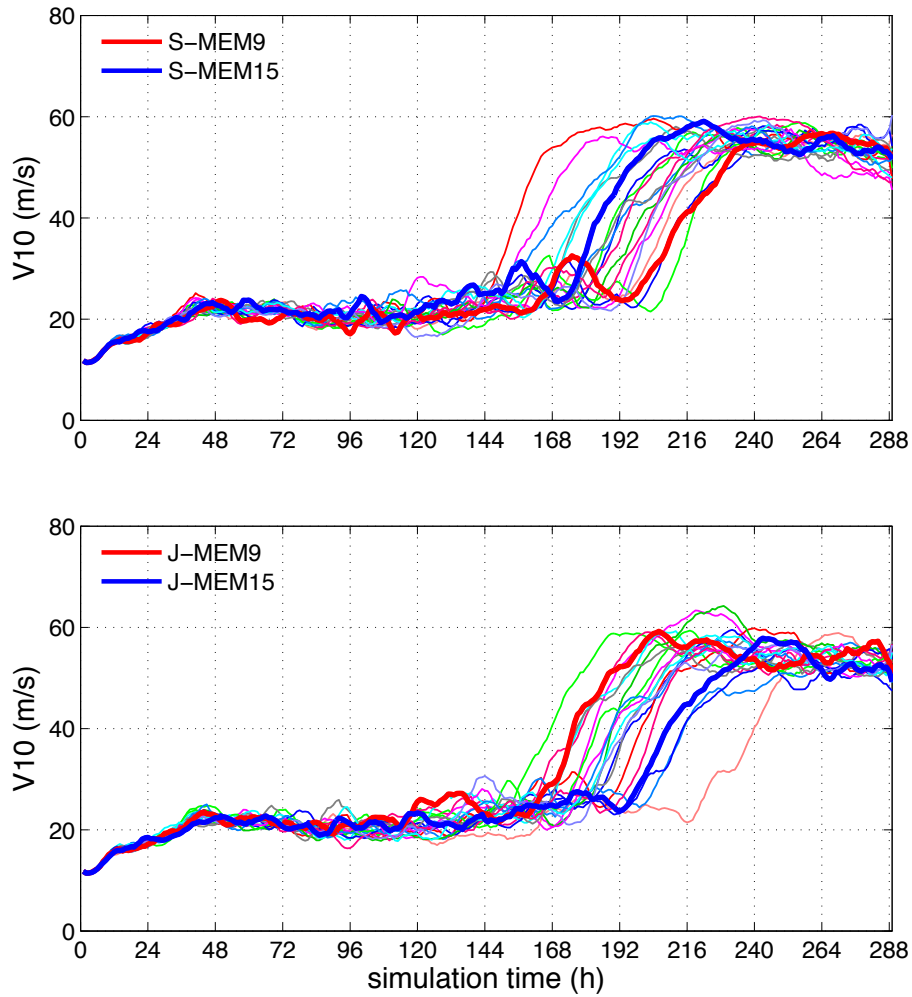
Experimental Design

- Idealized TC simulation
  - Rankine vortex Vmax=15m/s at R=135km under SST=27°C
  - Under constant deep-layer westerly shear (6m/s)
  - Using point-downscaling method (Nolan, 2011)

- Add random moisture (± 0.5 g/kg under 950hPa) perturbation to initial condition → 20 ensemble members



Max 10-m Wind of SH6-SST27 on Stampede and Jet



- The randomness of development on different computing platforms.
- The similar spread and rate of RI
- Ensemble and probability forecast

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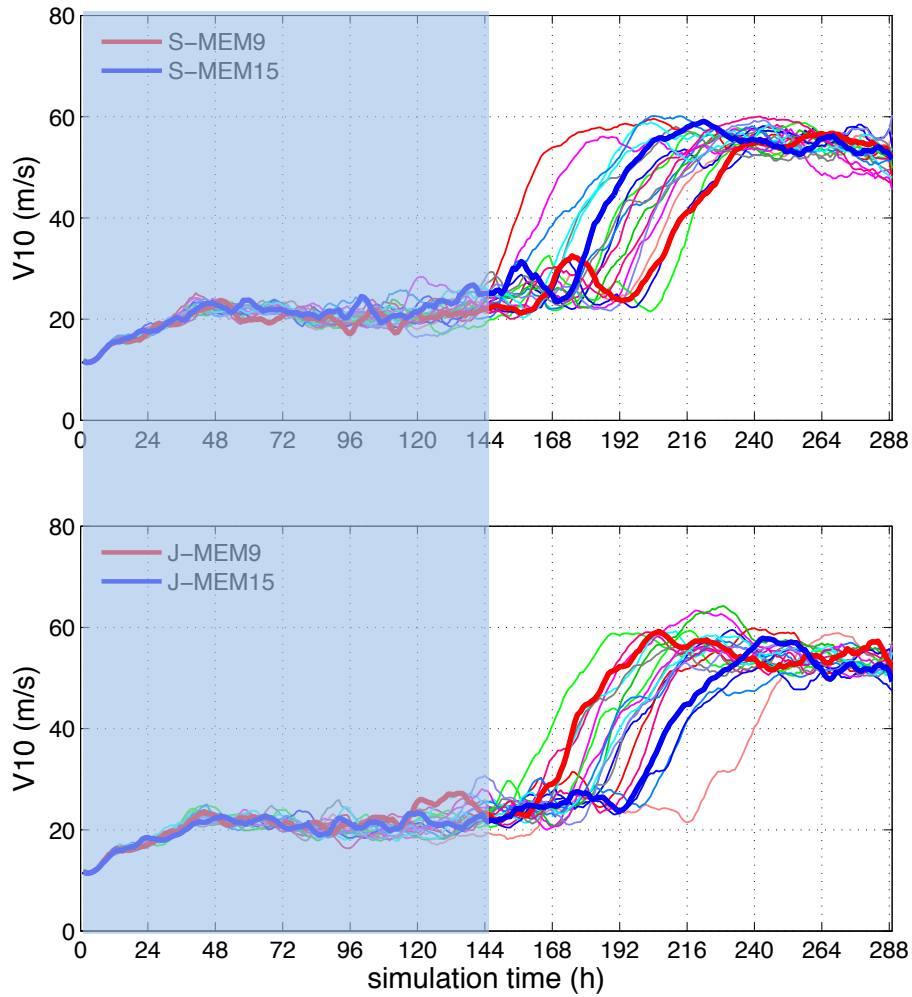

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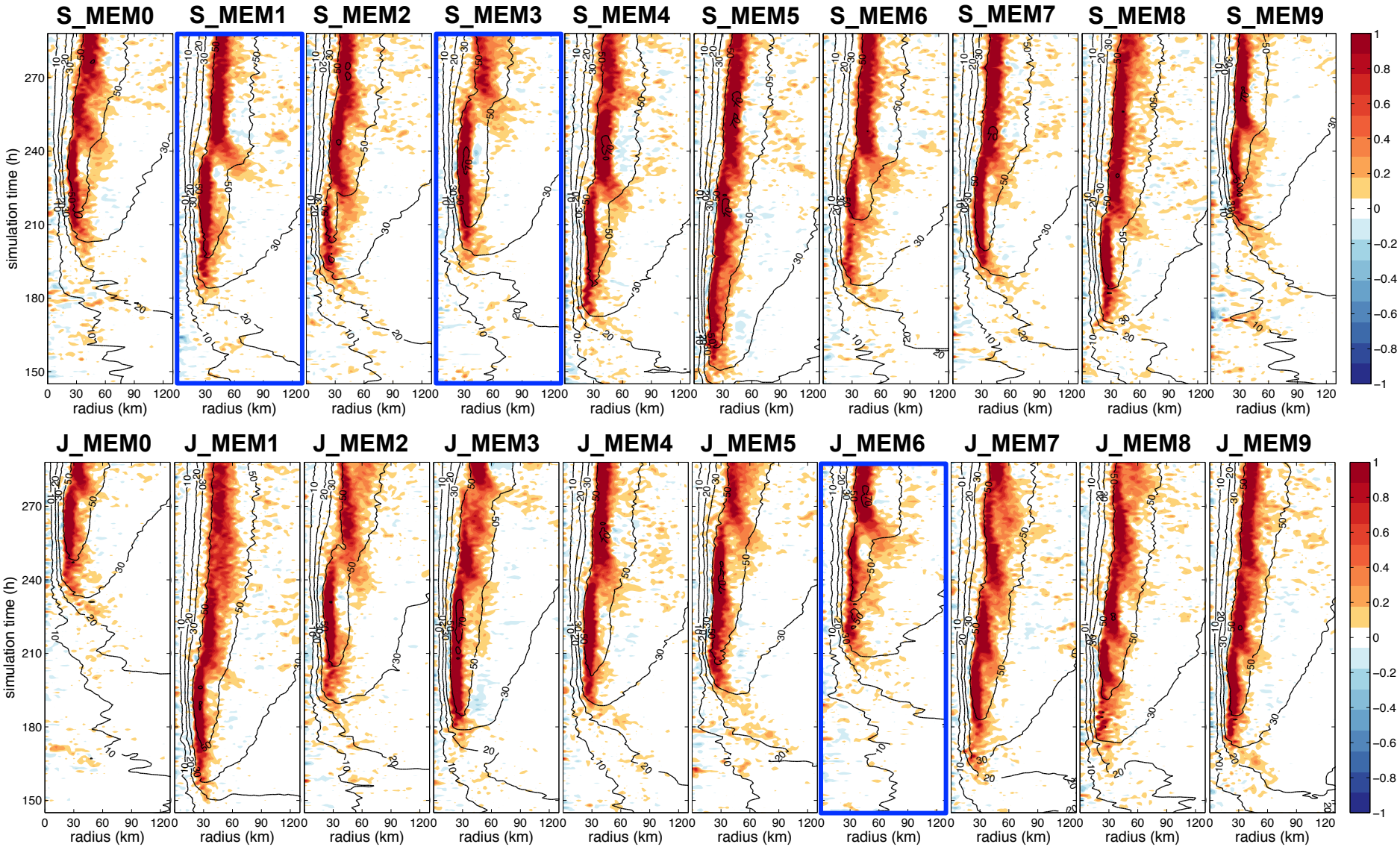
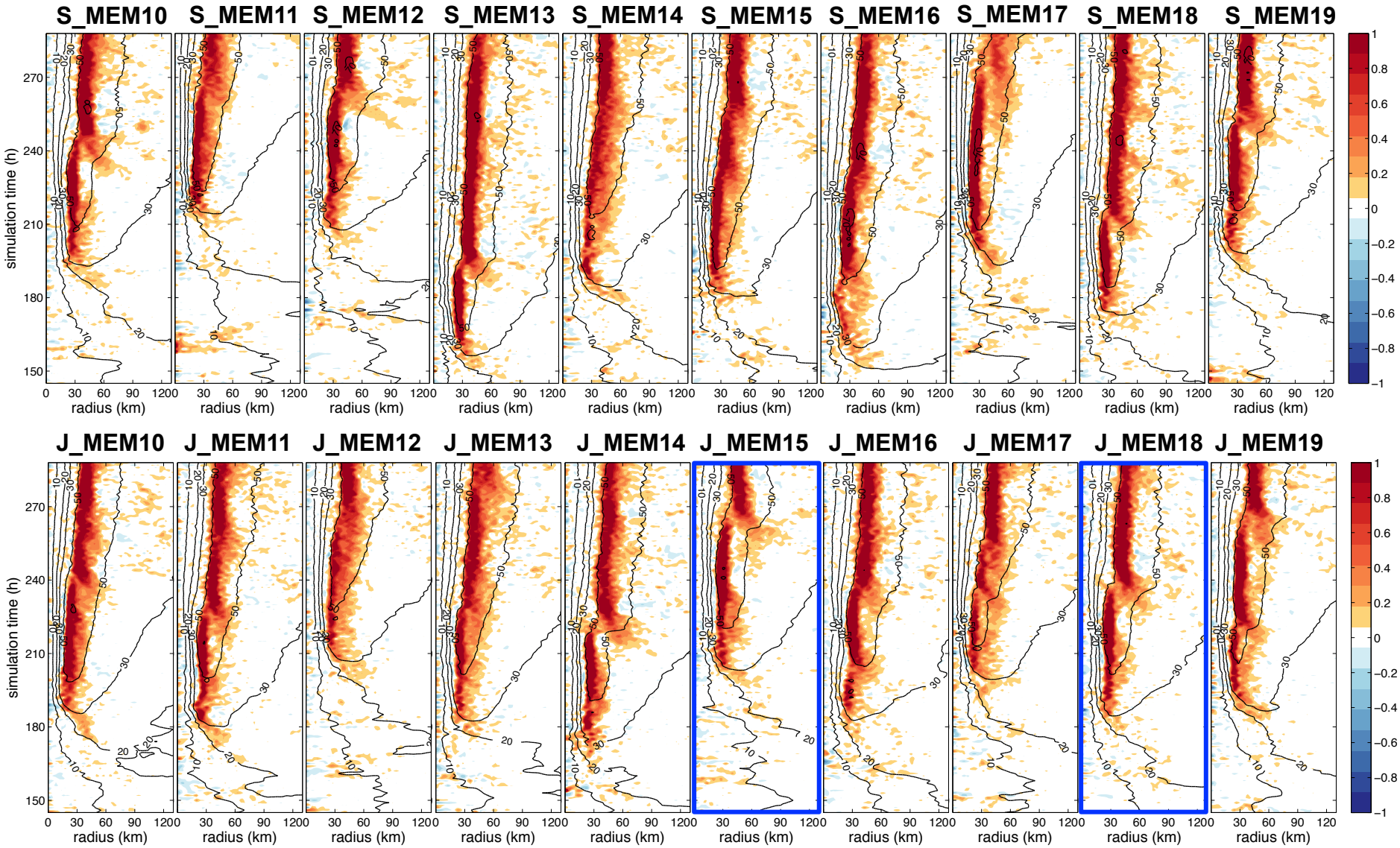
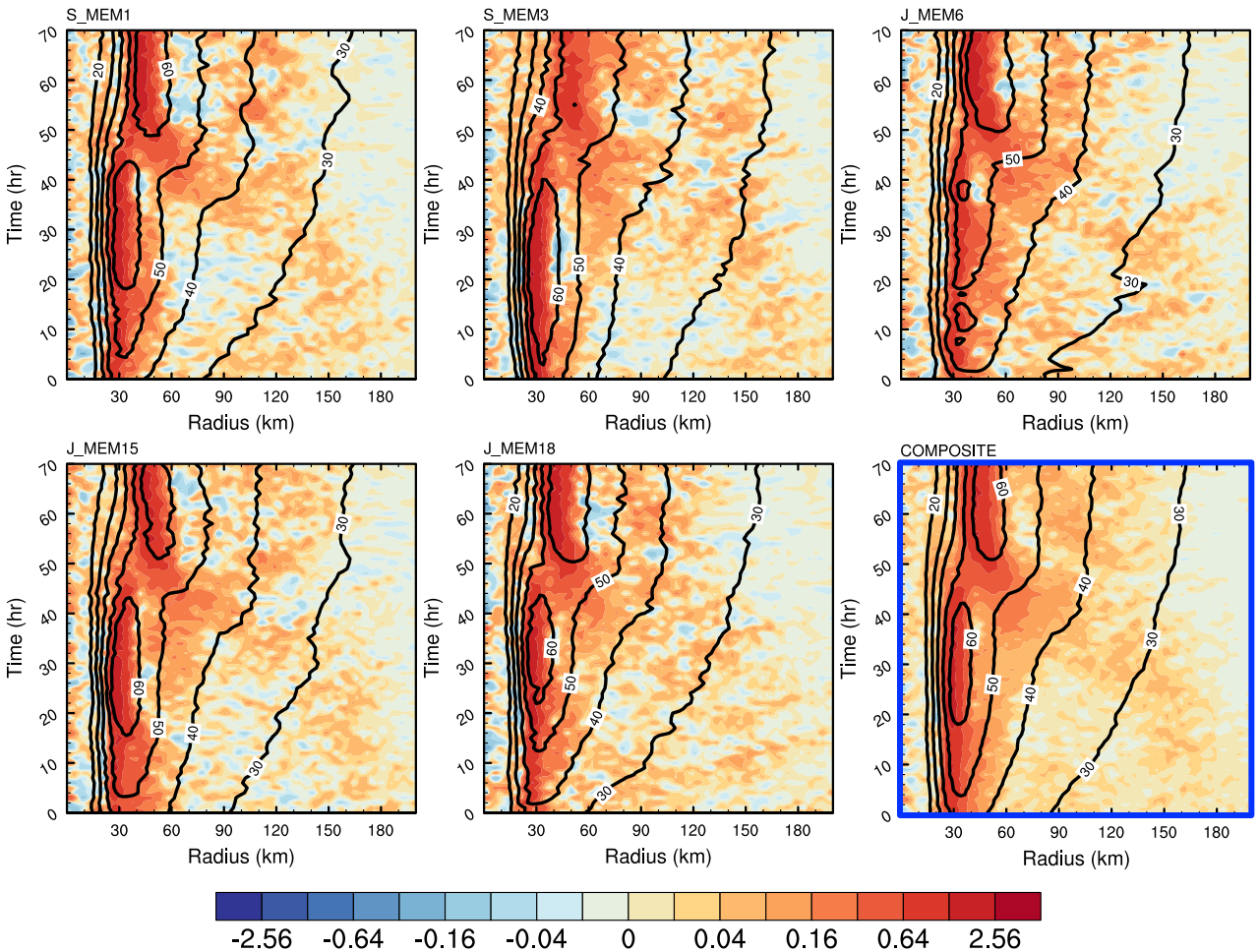
Comparison of first 10 members:
Azimuthally averaged w and tangential wind at 1km height



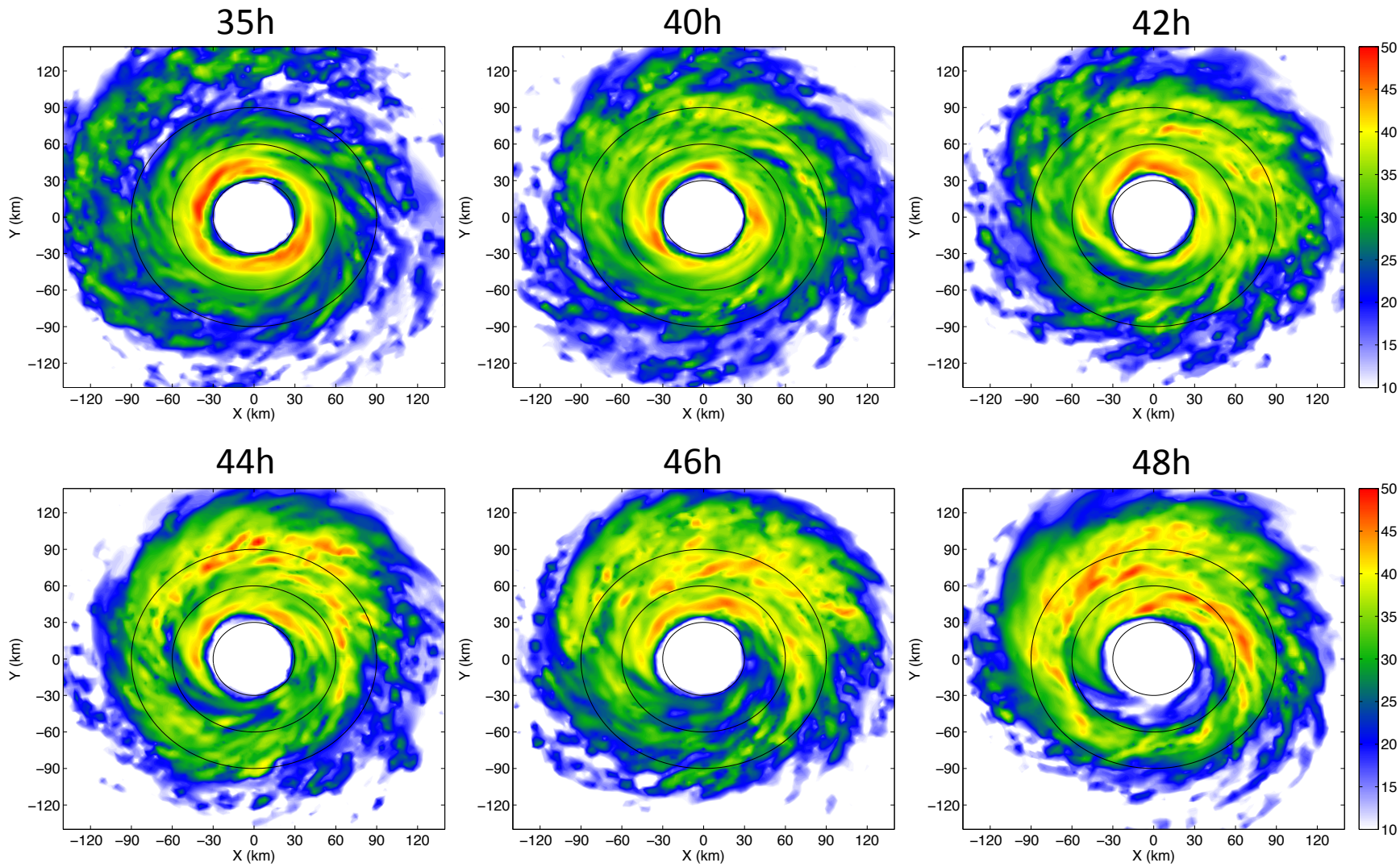
Comparison of second10 members: Azimuthally averaged w and tangential wind at 1km height



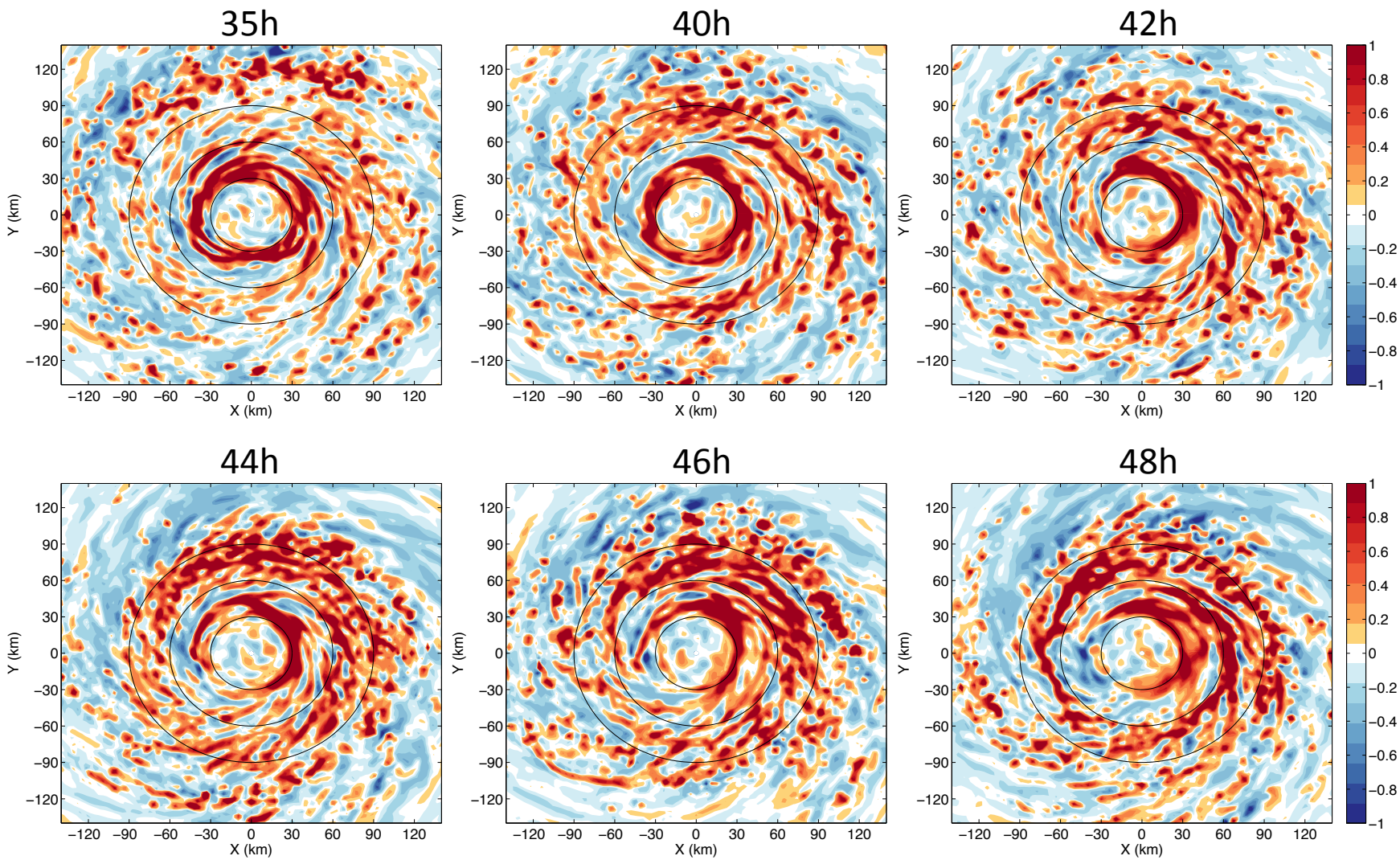
Hovmöller plot for all the 5 members and their composite: vertical wind (shading) and tangential wind (contour) at 1km



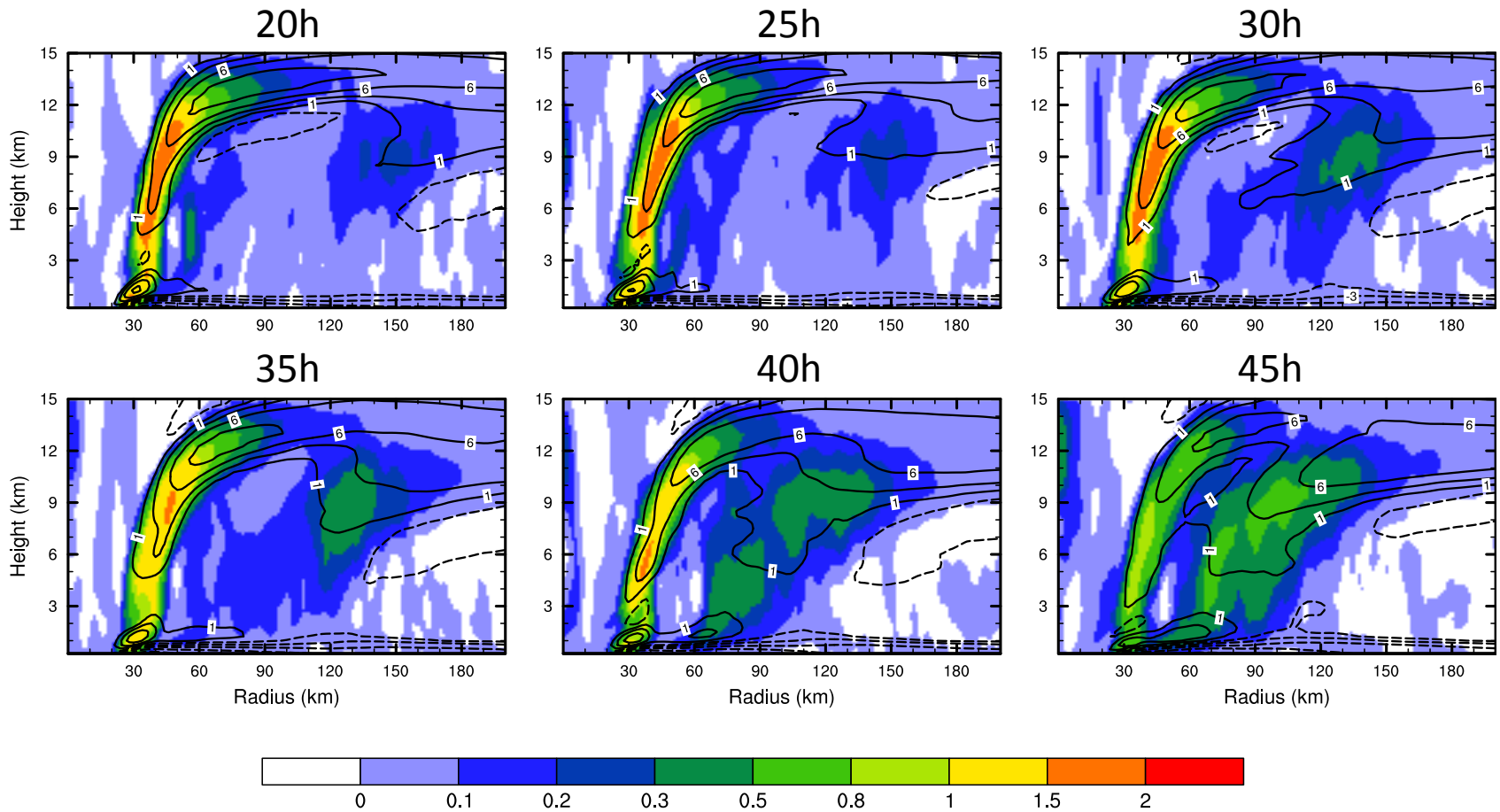
5-member composite: tangential wind at 3km



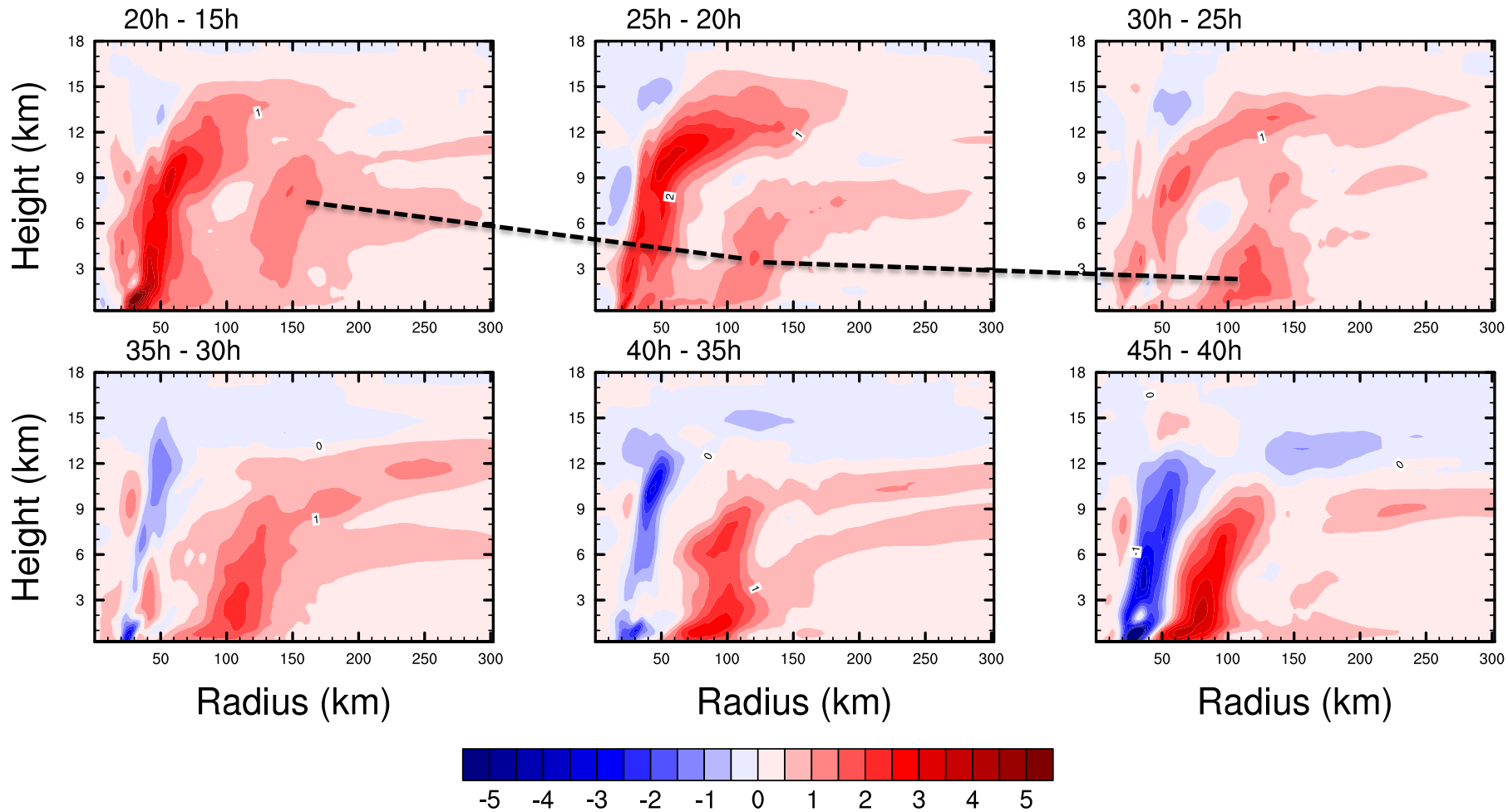
5-member composite: vertical wind at 3km



5-member composite: azimuthally averaged radial flow (contour) and vertical velocity (shading)

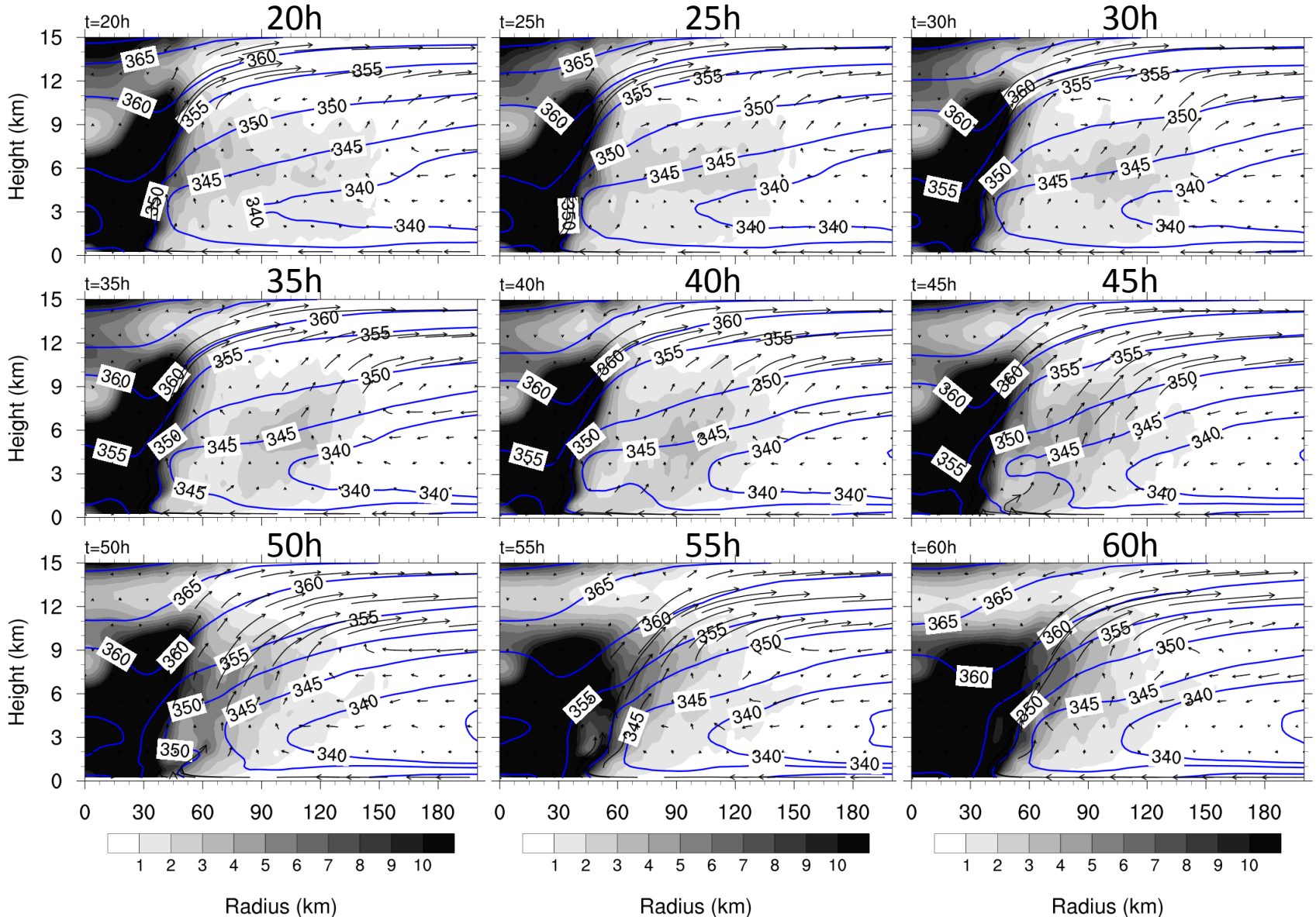


5-member composite: tangential wind tendency in 5h

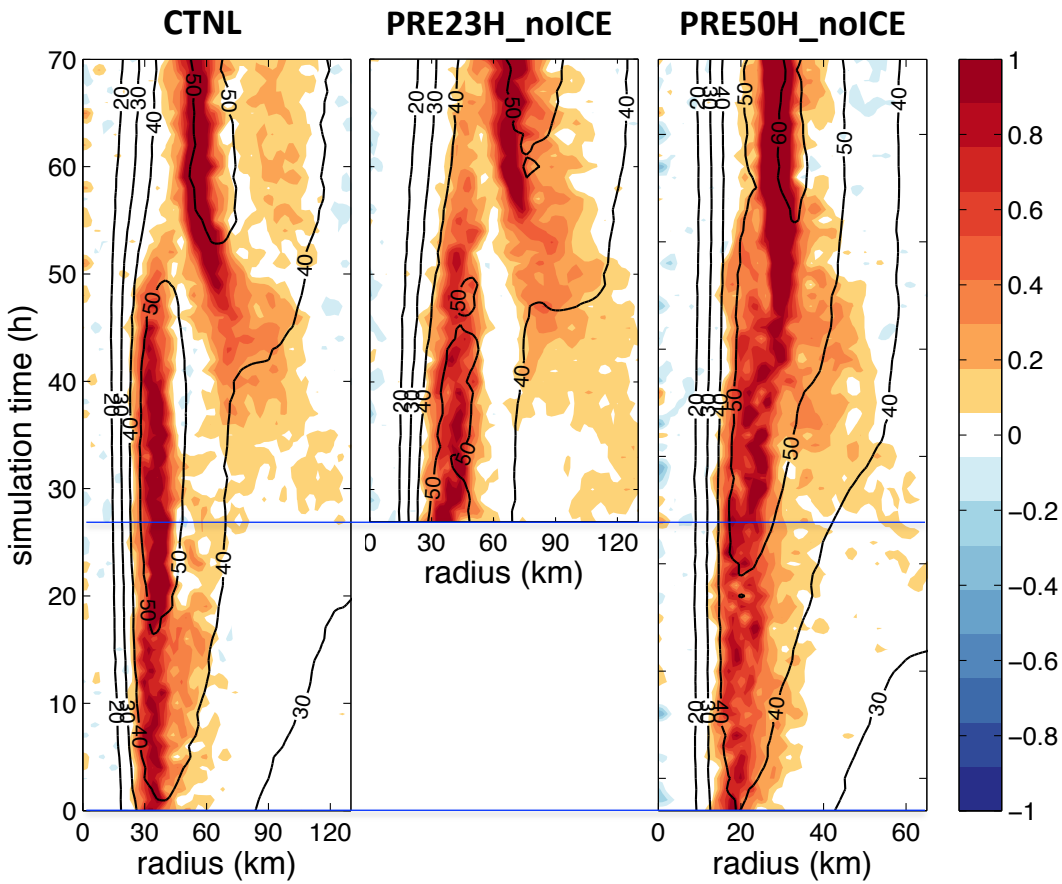


- Downward building of tangential wind tendency

5-member composite: azimuthally averaged PV (shading), secondary circulation and Θ_e

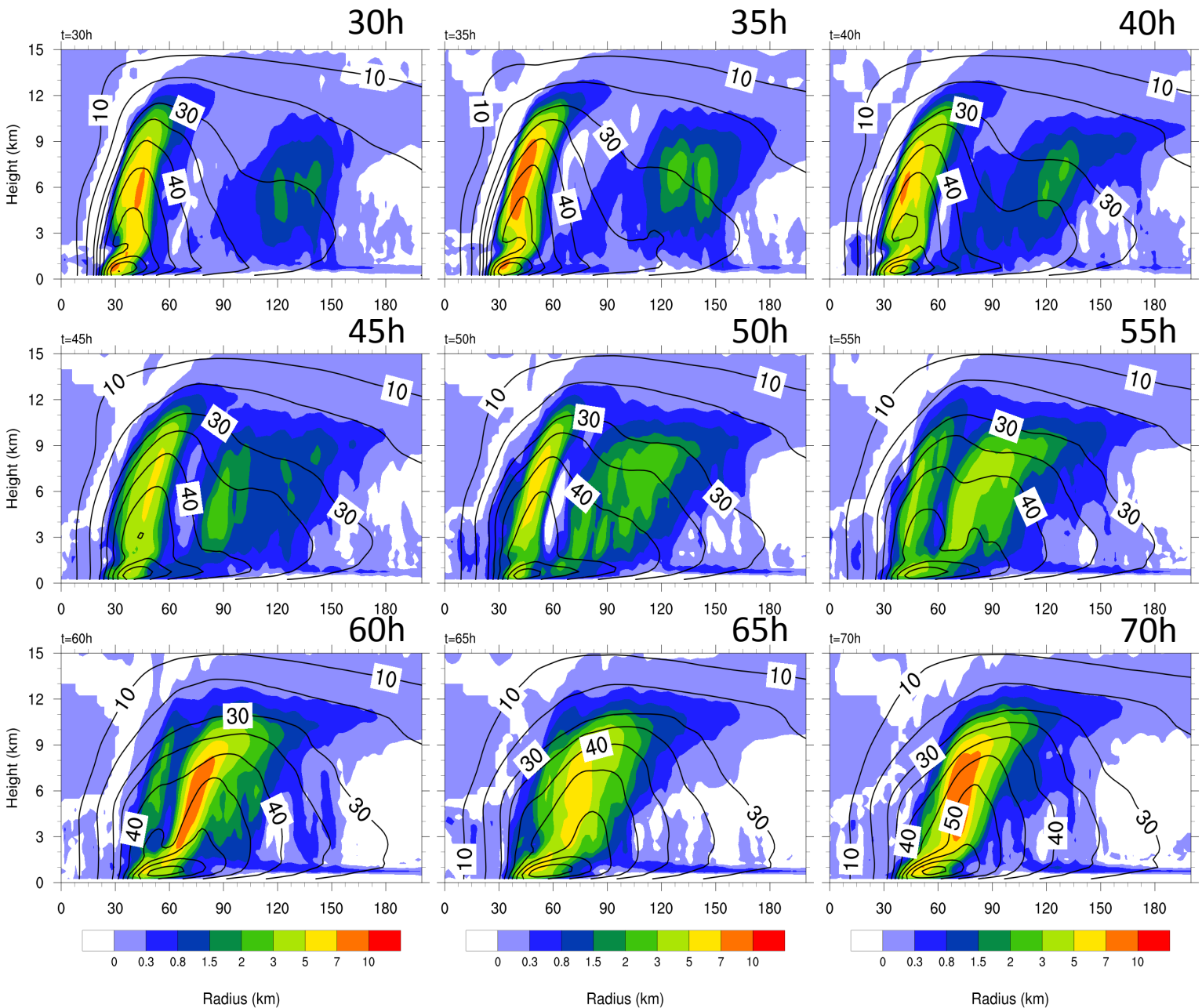


noICE sensitivity experiments: warm rain microphysics vertical velocity (shading) and tangential wind (contour) at 3km

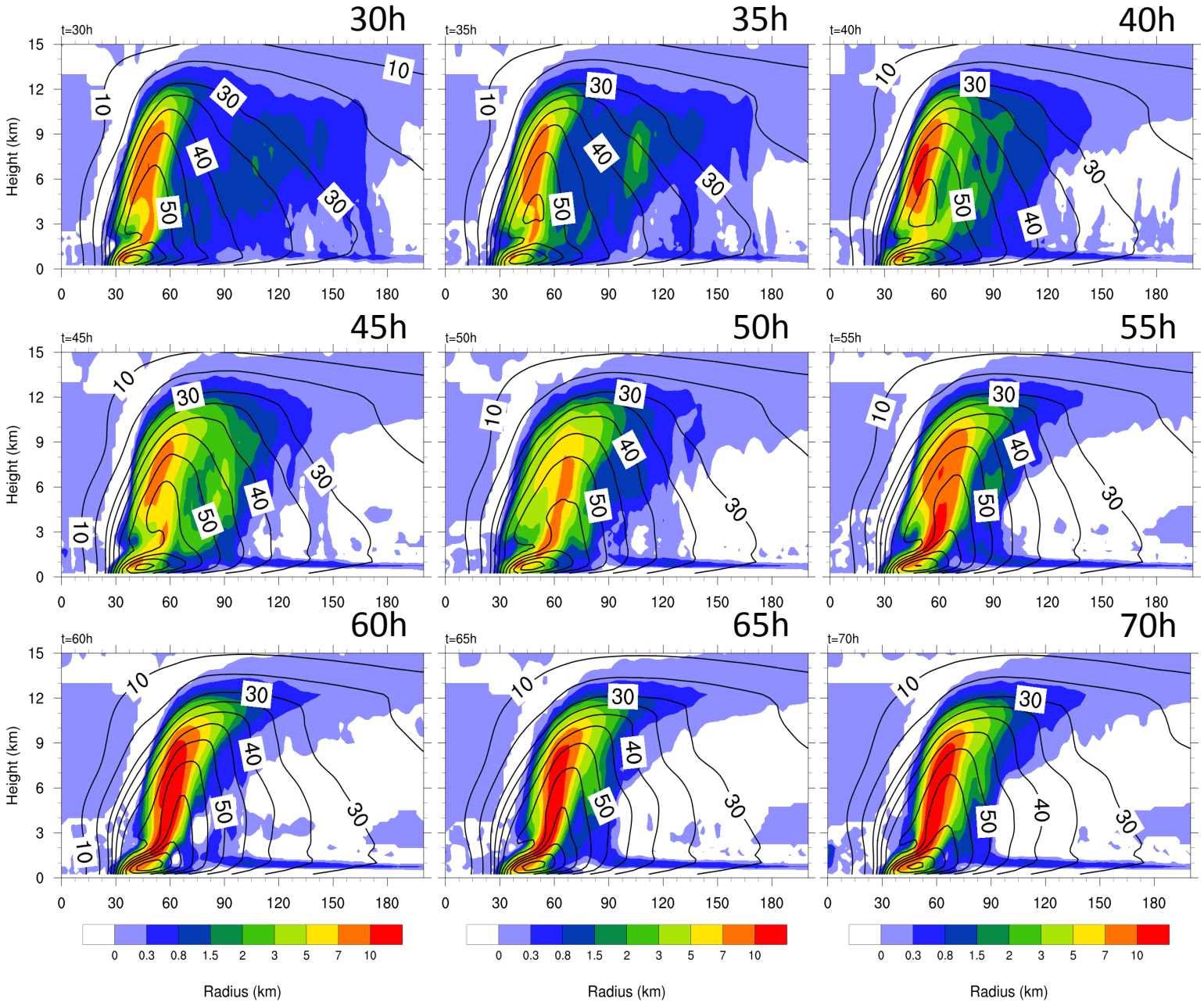


- The role of ice microphysics in moat formation.

PRE23H: Tangential wind (contour) and heating (shading)



PRE50H: Tangential wind (contour) and heating (shading)



Concluding Remarks:

- Exactly the same initial conditions under the same environmental but performed on different computer clusters can lead to dramatic difference in TC development.
- Expansion of outer wind fields is seen before SEF starts.
- Downward building of the outer rainband from stratiform clouds.
- Moat formation facilitated by the ice microphysical processes between the primary and secondary eyewalls.