



# Interaction between surface cold pool and mesoscale convection systems: Numerical simulations with MC3E cases

**Zhaoxia Pu and Chao Lin**

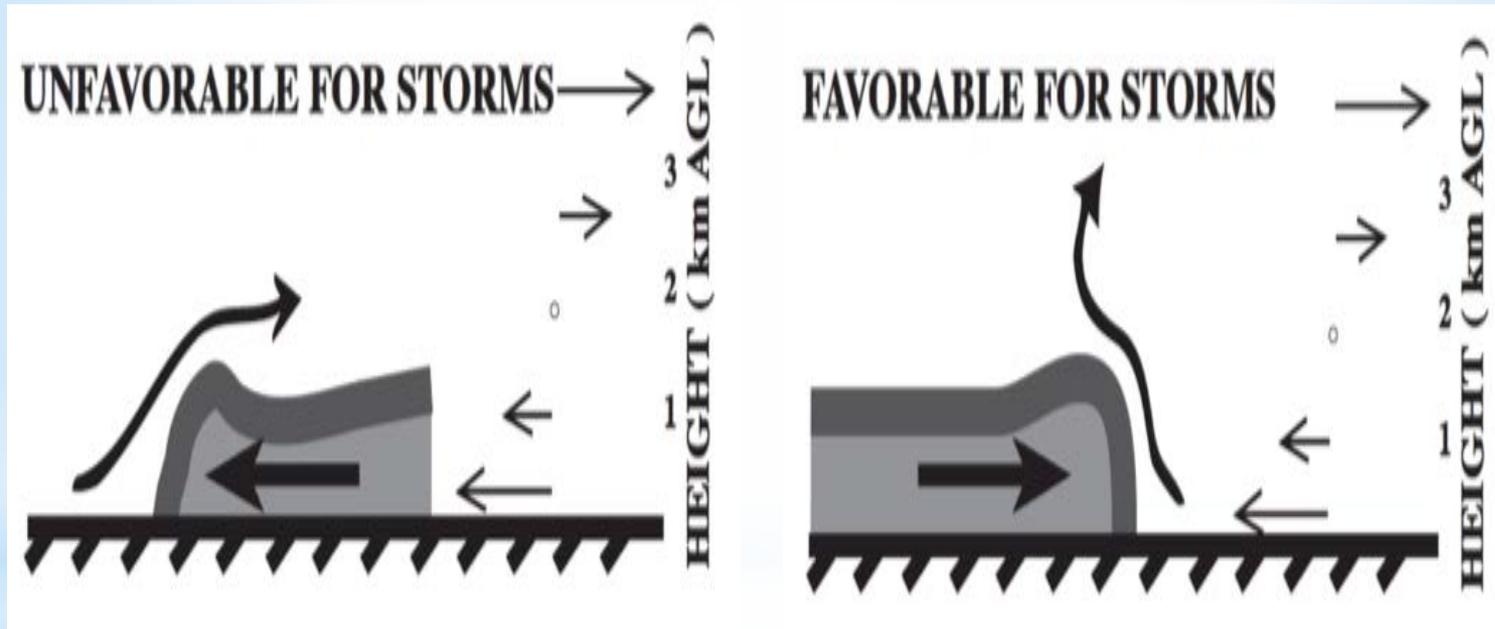
*Department of Atmospheric Sciences  
University of Utah*

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ASR Fall Working Groups  
Rockville, Maryland**

## Science Question

What is the interaction between surface cold pool and mesoscale convective systems (MCSs)? Specifically, which cold pool property influences the evolution and sustenance of MCSs?

# Interaction between convection and cold pool



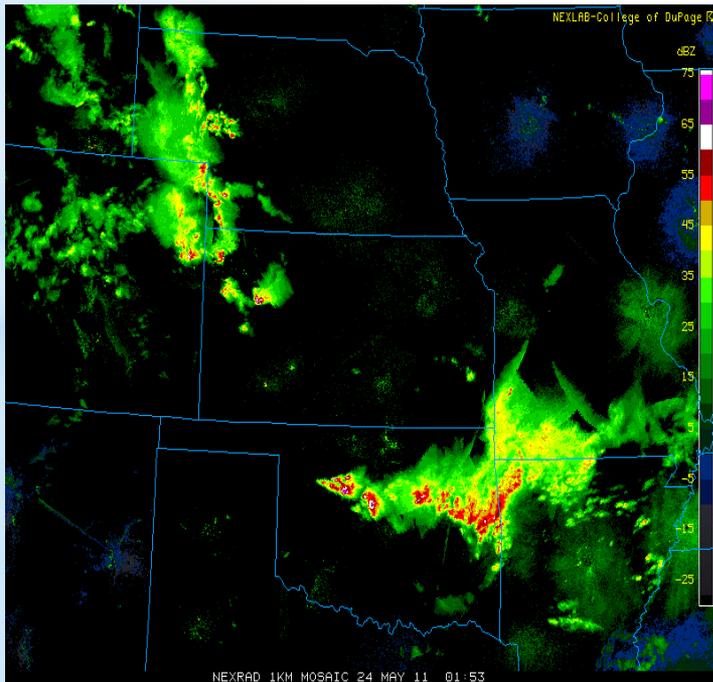
Wilson et al. 1998

Which cold pool property influences the evolution and sustenance of MCSs?

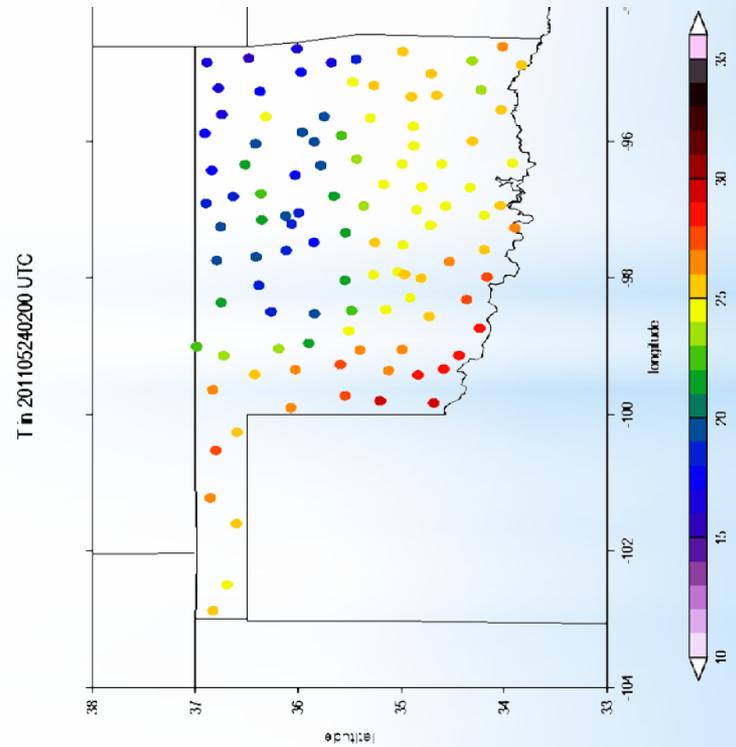
# An example of observed cold pool associated with a MCS during MC3E

02UTC 24 May 2011

Radar observations

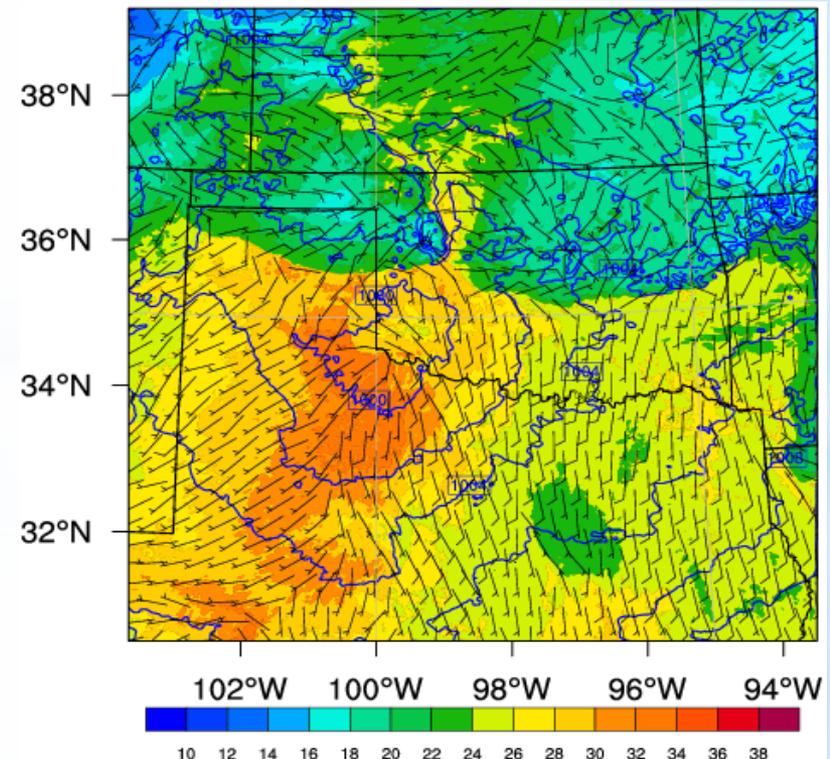
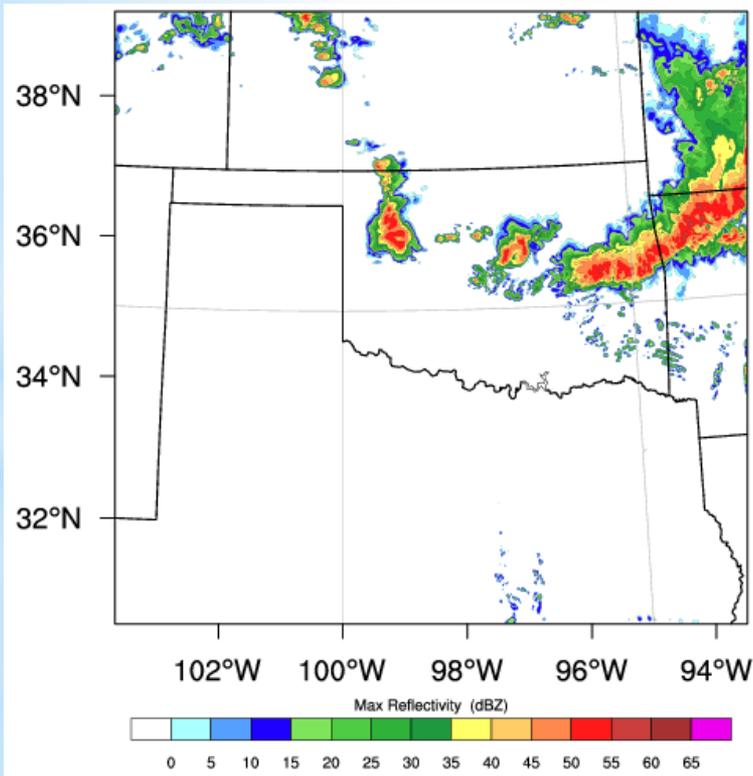


OK-Mesonet data



# WRF model simulates the MCS and associated cold pool successfully

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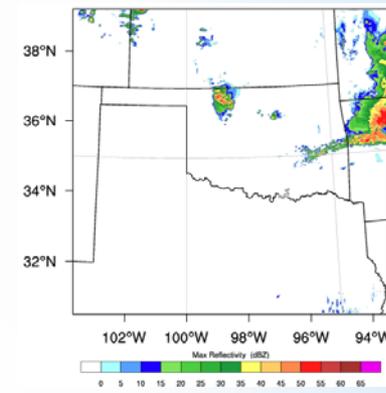
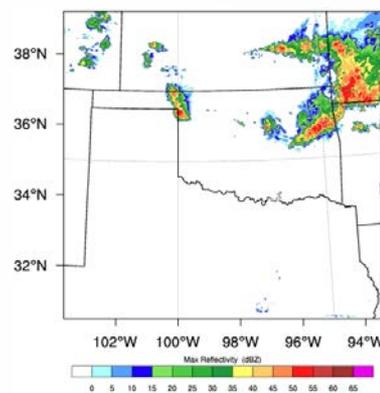
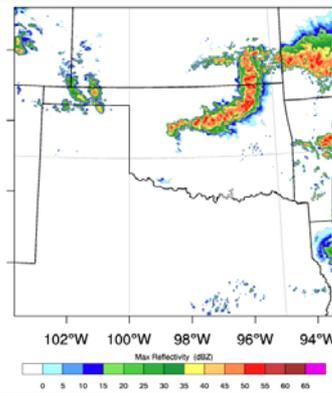
# Sensitivity of WRF simulations to Land surface processes

21UTC 23 May

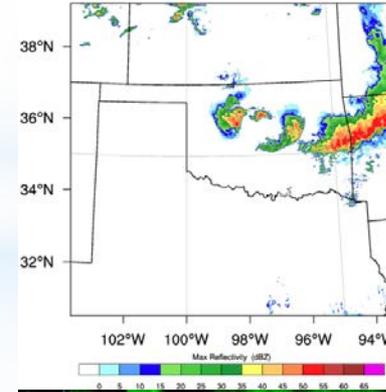
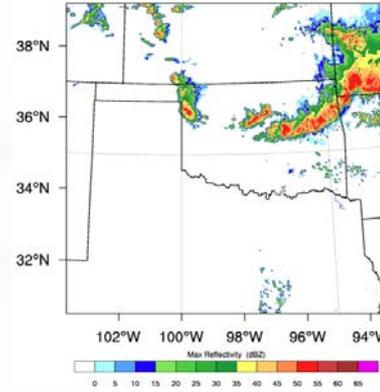
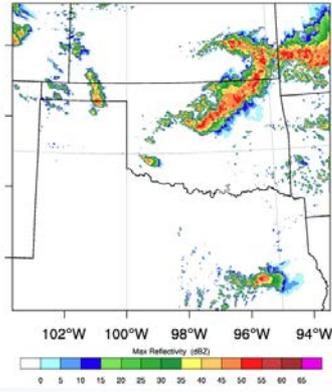
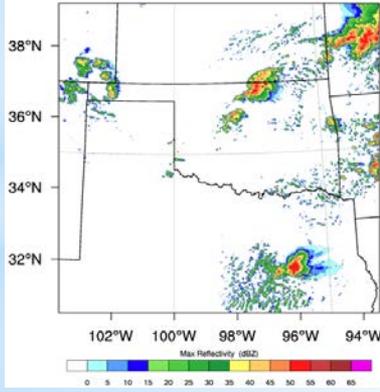
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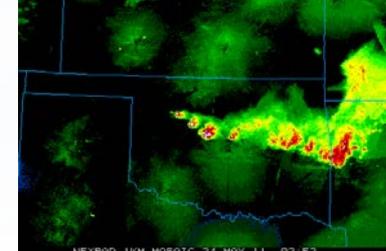
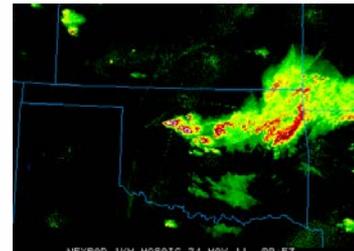
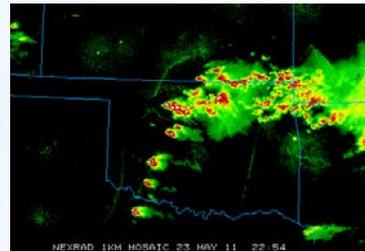
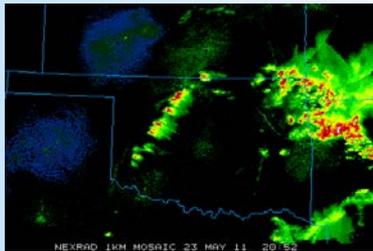
03UTC 24 May



NOAH  
LSM

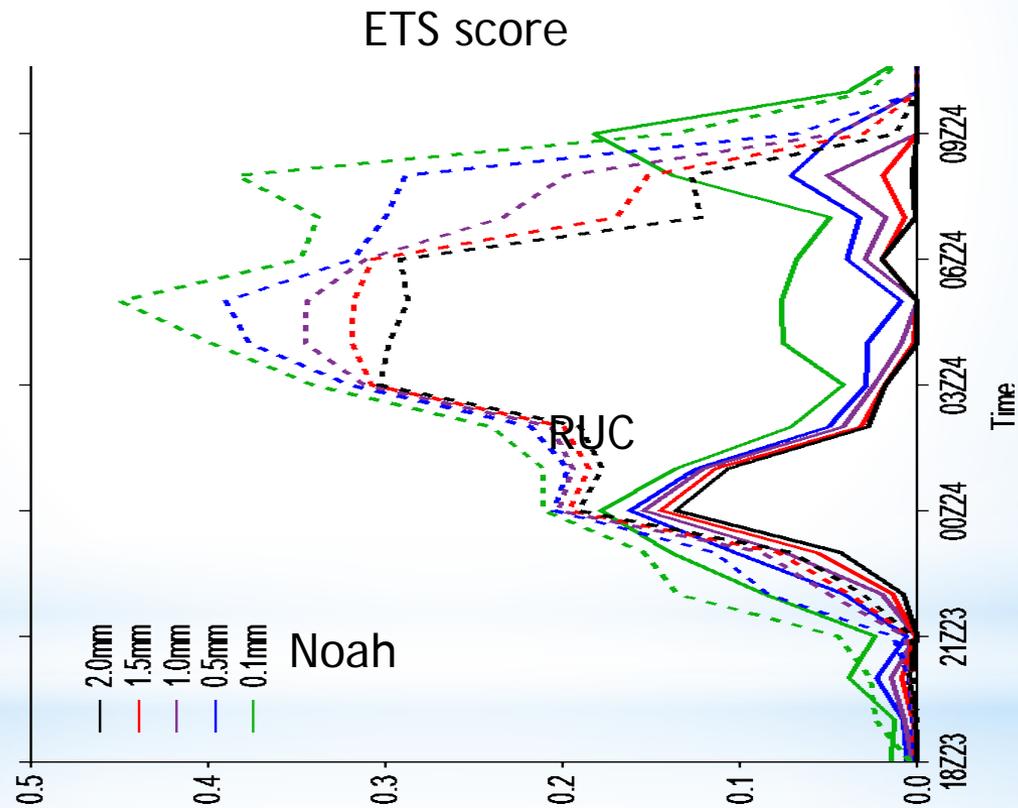


RUC  
LSM



radar

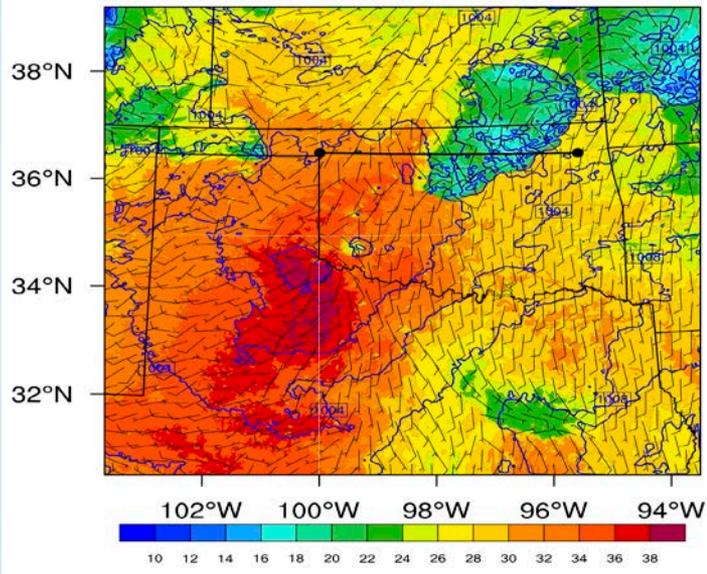
# Sensitivity of WRF simulations to Land surface processes- QPF



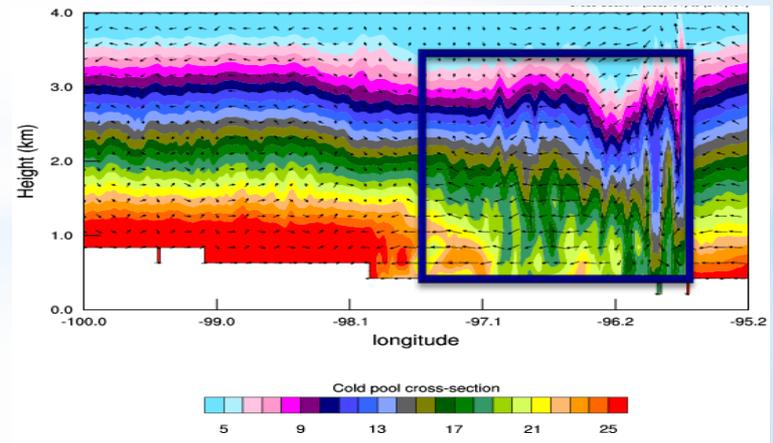
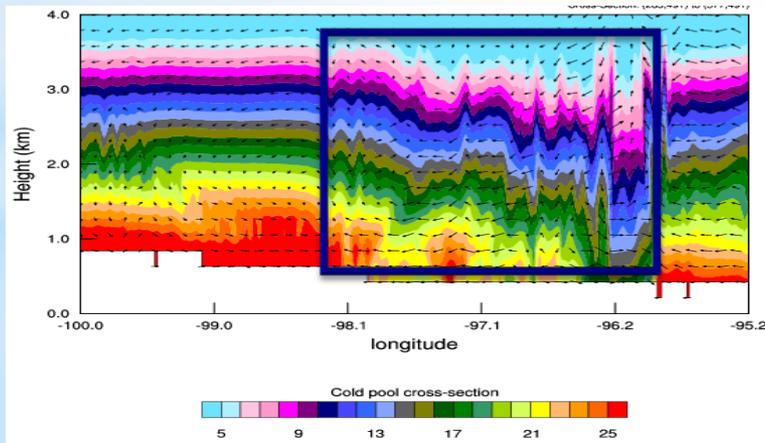
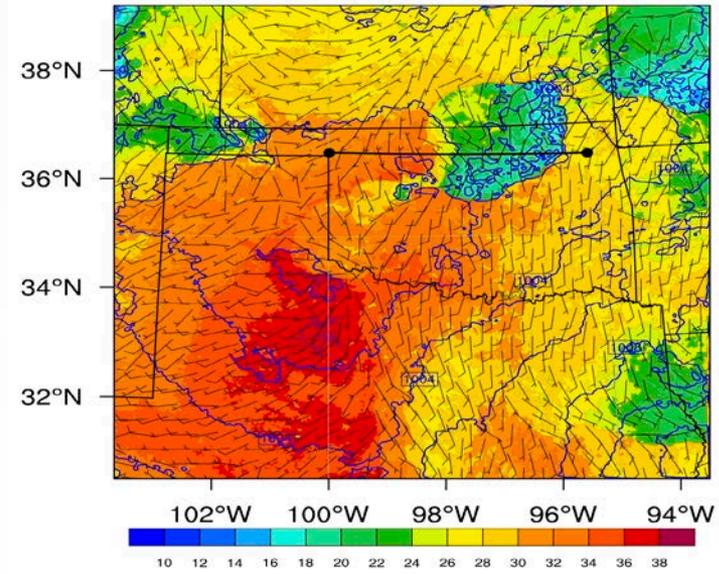
# Cold pool and outflow boundary

23UTC 23 May

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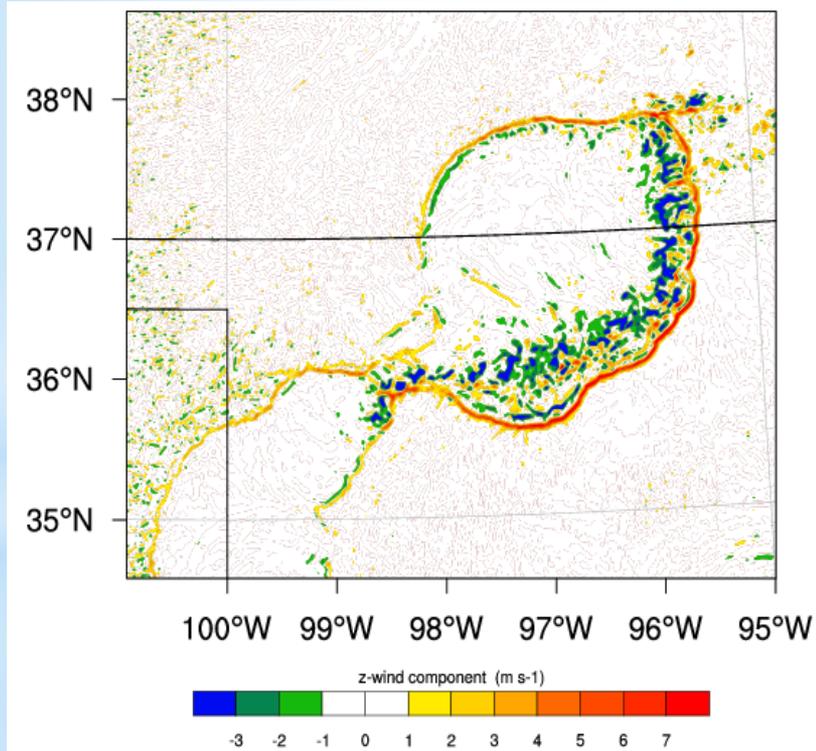


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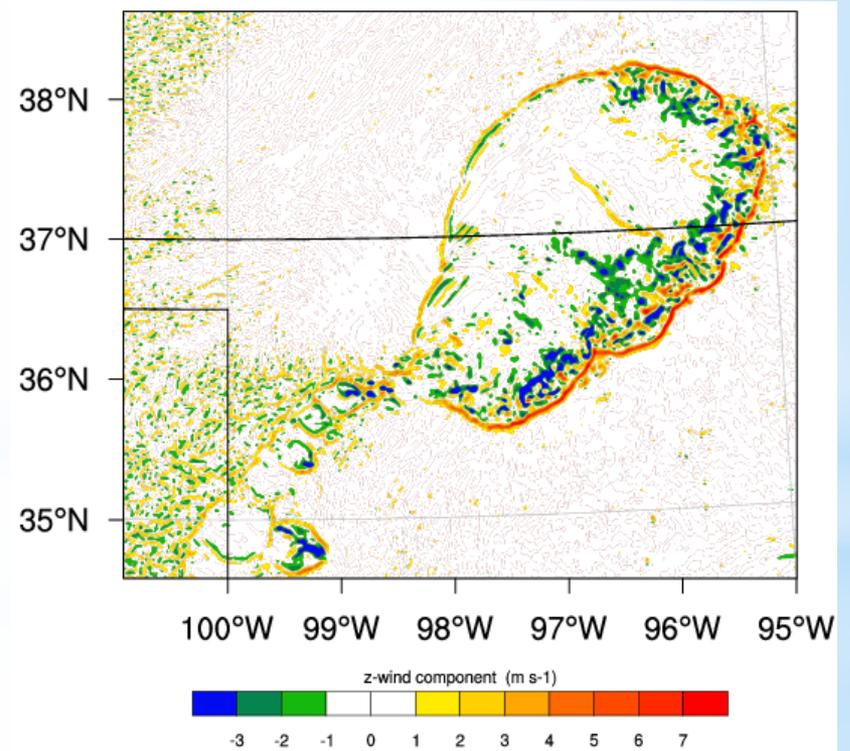


# Vertical velocity at 850 hpa( 22 UTC 23 May, 2011)

Noah



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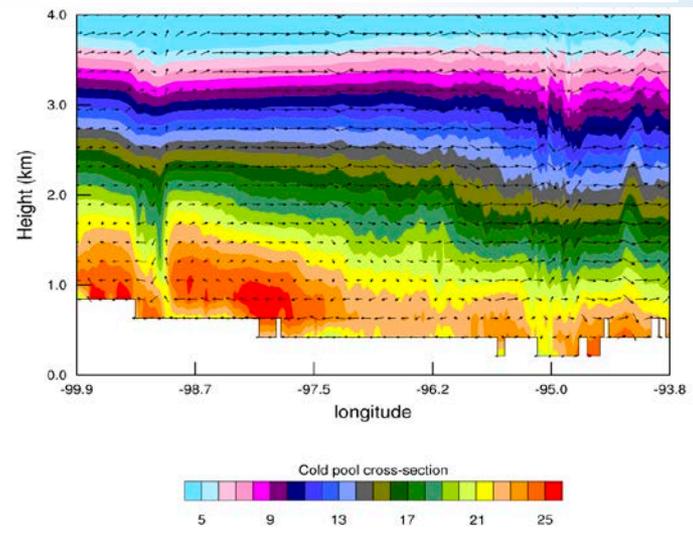
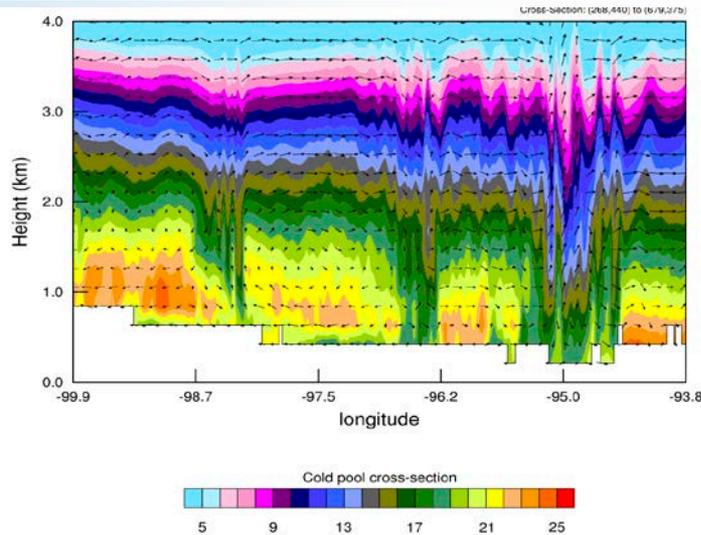
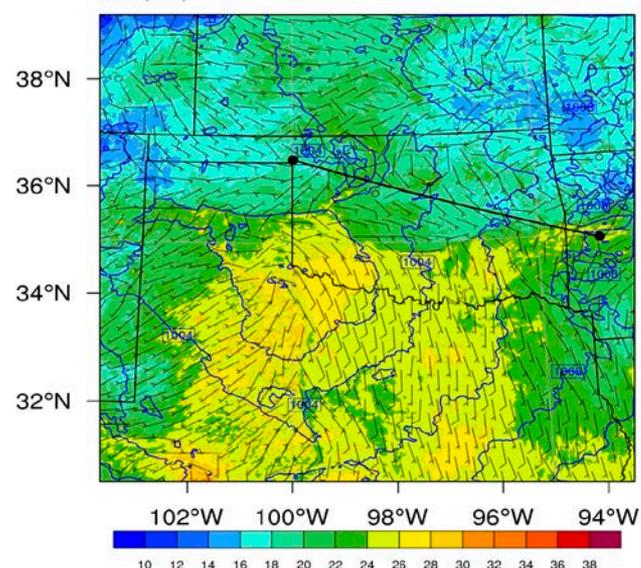
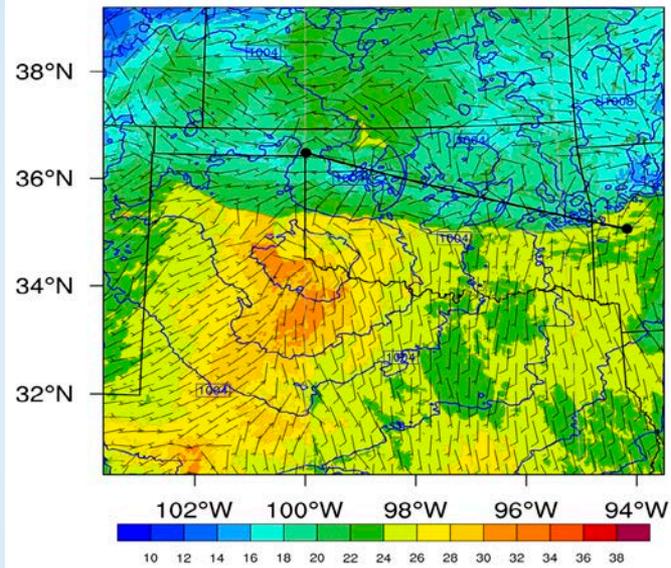


# Cold pool and Outflow boundary

03 UTC 24 May

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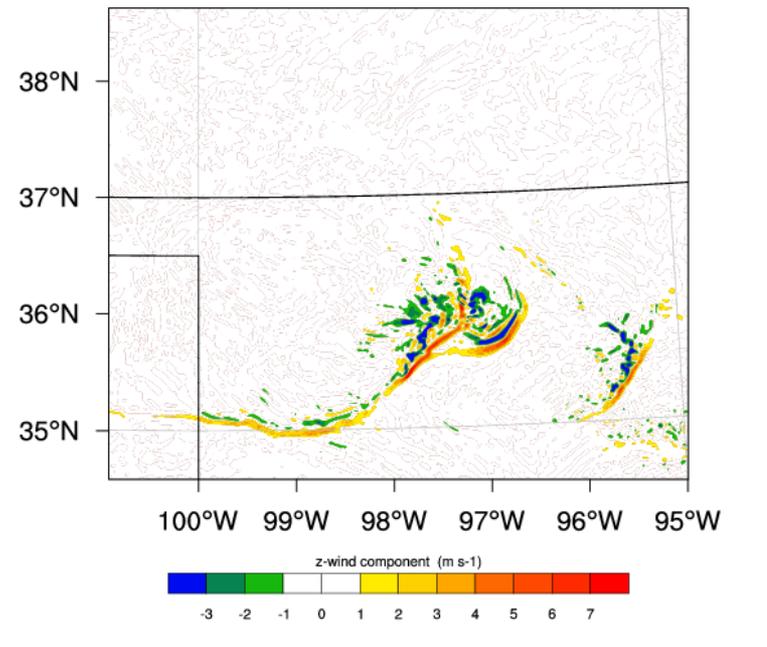
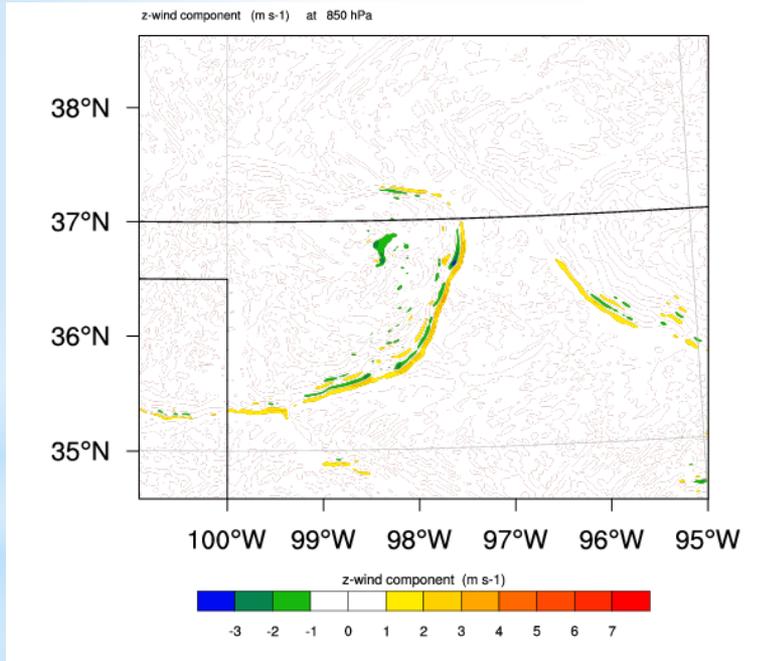
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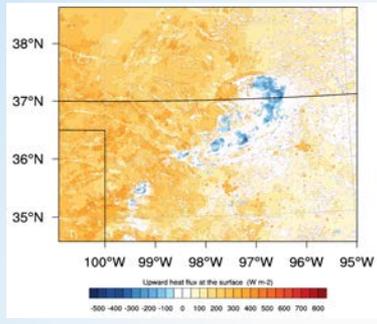
# Vertical velocity at 850 hpa( 03 UTC 24 May, 2011)

Noah

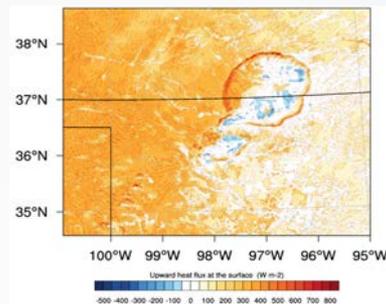
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22Z23



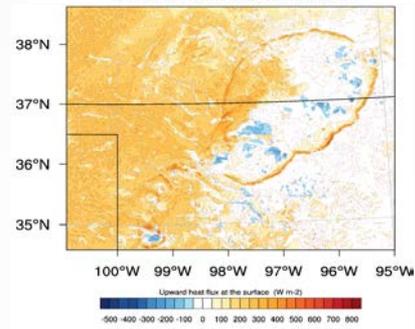
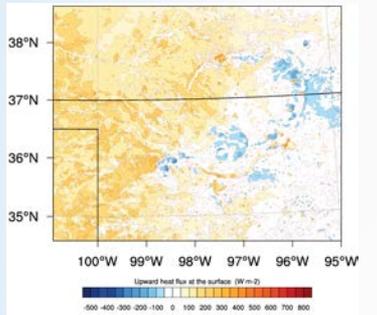
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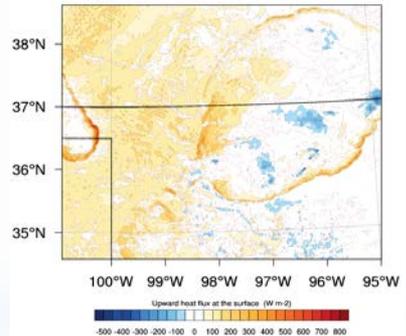
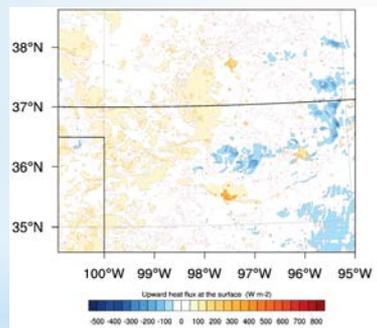
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Upward heat flux at surface

23Z23

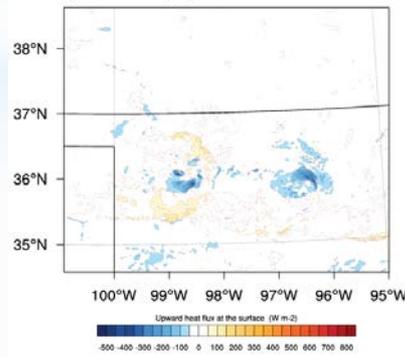
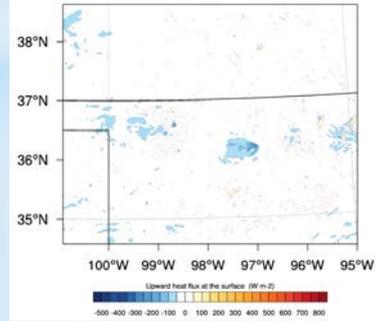


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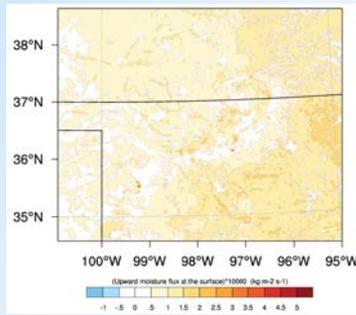


Strong upward heat flux at outflow boundary.

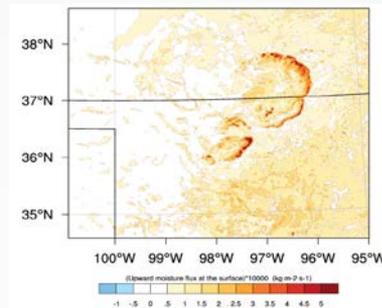
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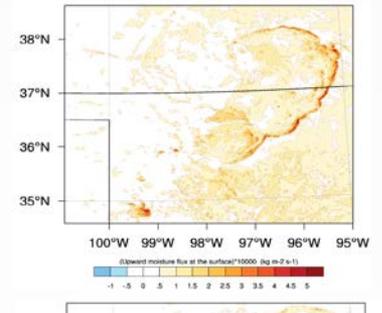
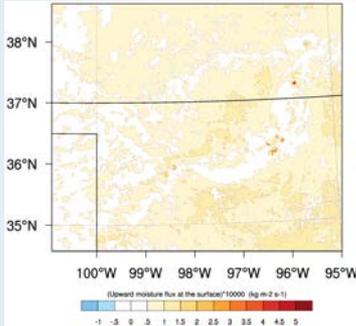


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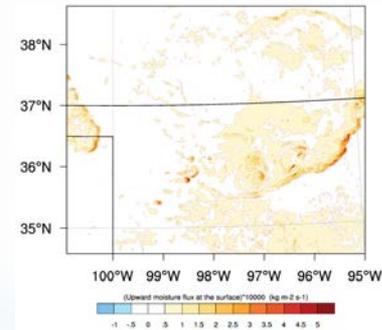
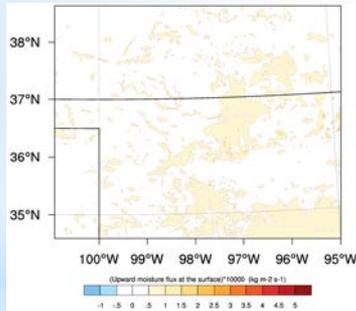


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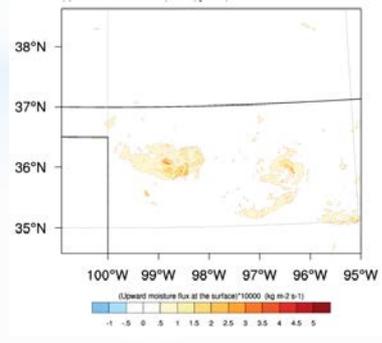
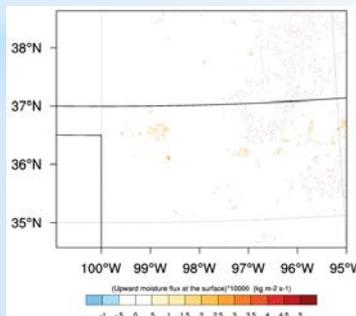
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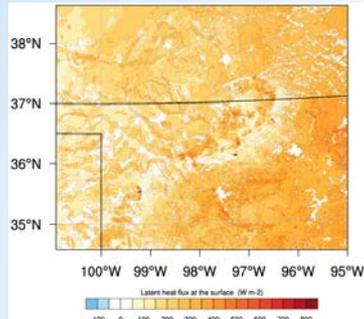
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Upward moisture flux

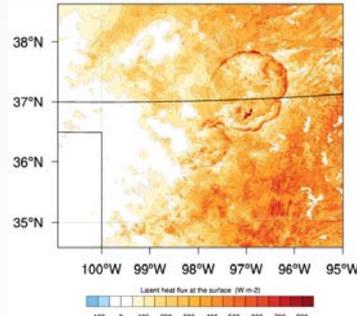
Strong upward moisture flux at outflow boundary

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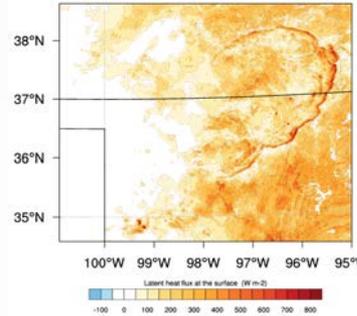
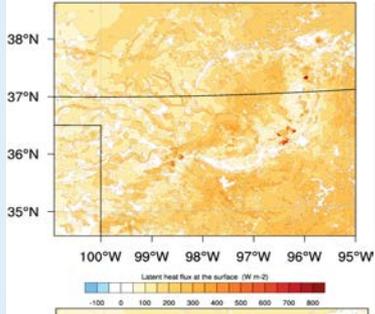


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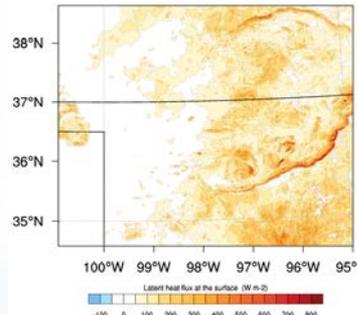
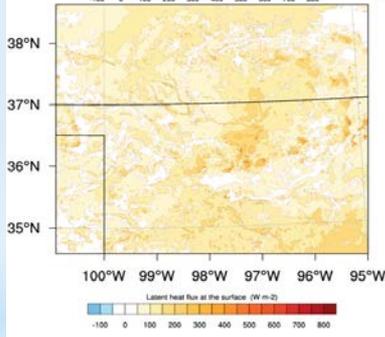
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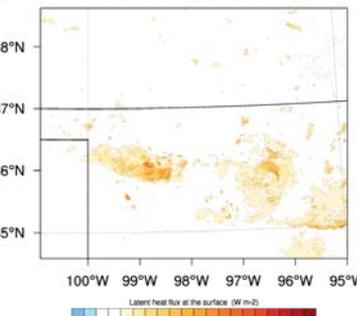
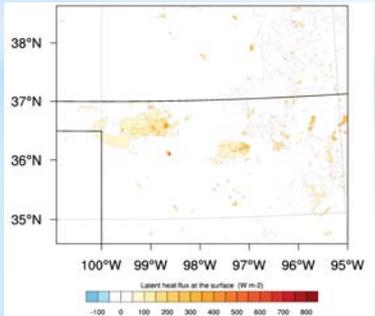
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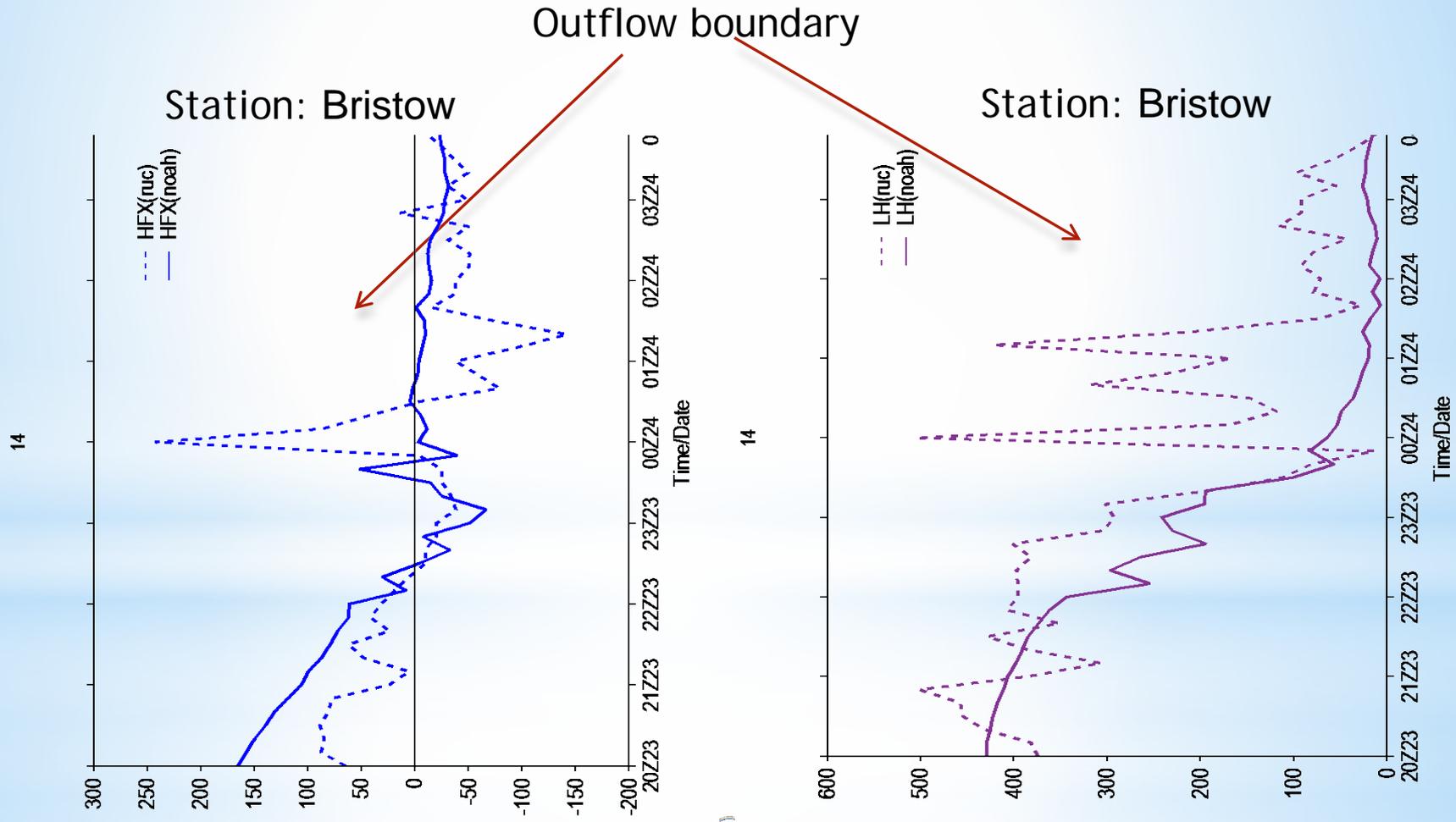


Latent heat flux

Strong upward latent flux at

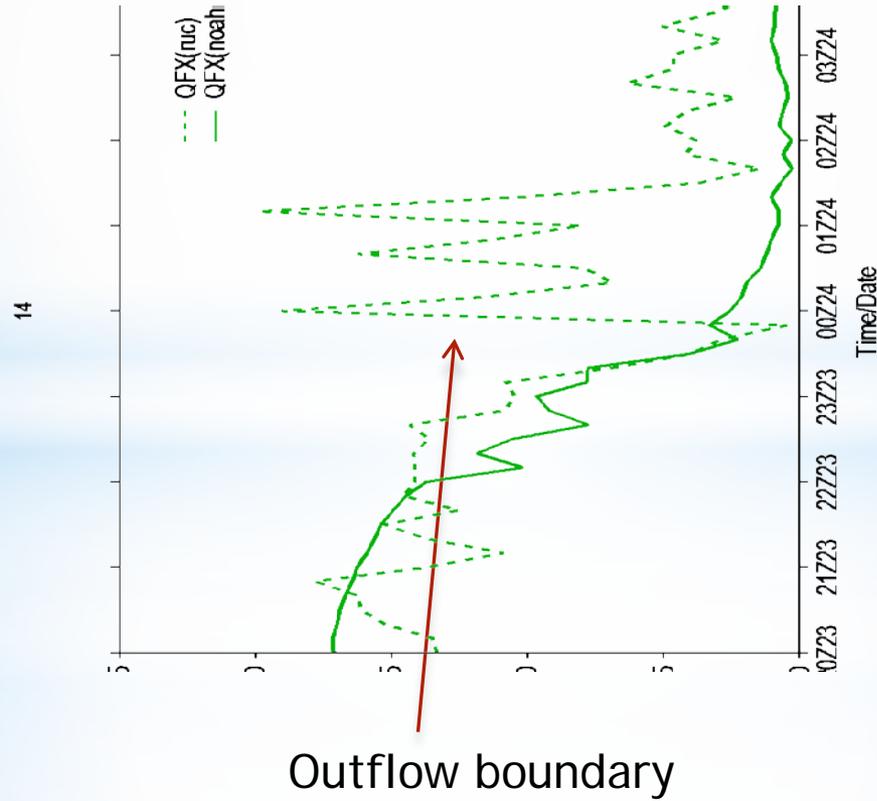
outflow boundary, Noah missed it.

# Time series of sensible and latent heating fluxes



# Time series of moisture fluxes

Station: Bristow



## Summary and concluding remarks

- The sustainability of outflow boundary is a major mechanism that determines maintaining and developing multi-cell MCSs.
- WRF simulations are sensitivity to land surface process
- Surface heat and moisture fluxes are strongly associated with the sustenance of convection and outflow boundary.
- More diagnostic work are in progress to understand the interactions among MCSs, cold pool and land surface processes.