The rain-induced boundary layer transition in QLCSs

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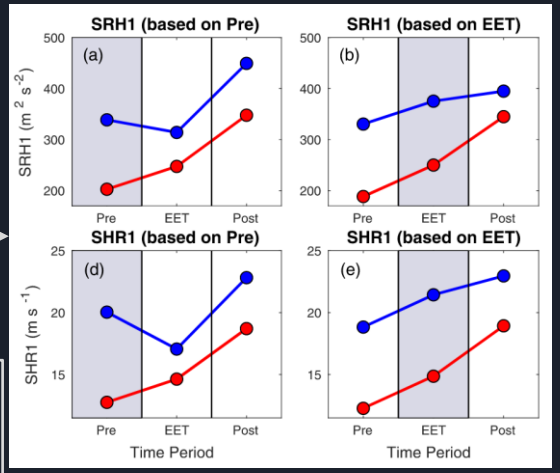
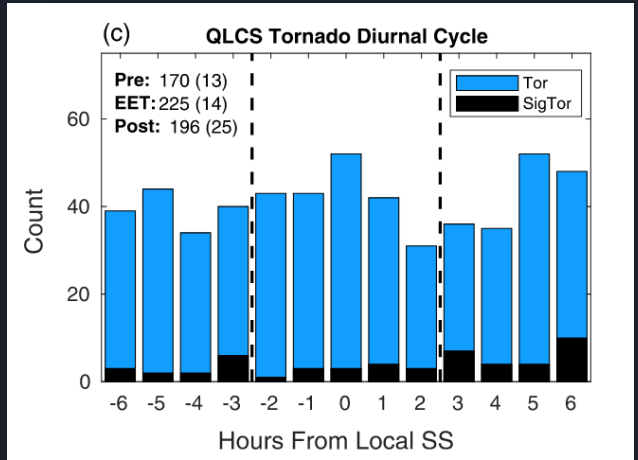
Background

The AET, a phenomenon related to the RIT, can cause rapid increase in SRH ahead of a QLCS (Brown et al, 2021).

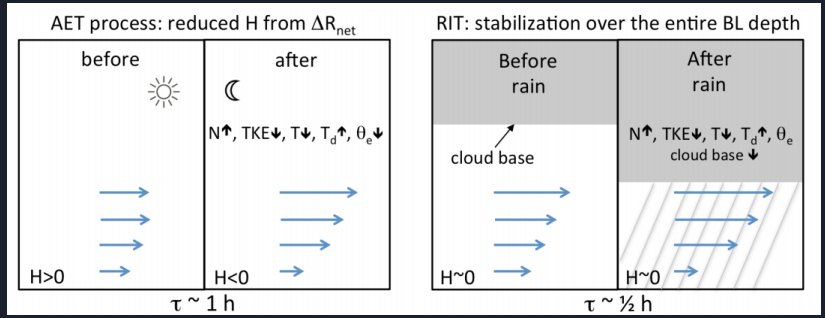
Tornadogenesis is statistically more likely around sunset due to the AET.

The AET is gradual *in comparison to* the RIT - it is likely that the RIT can have a similar but more rapid effect.



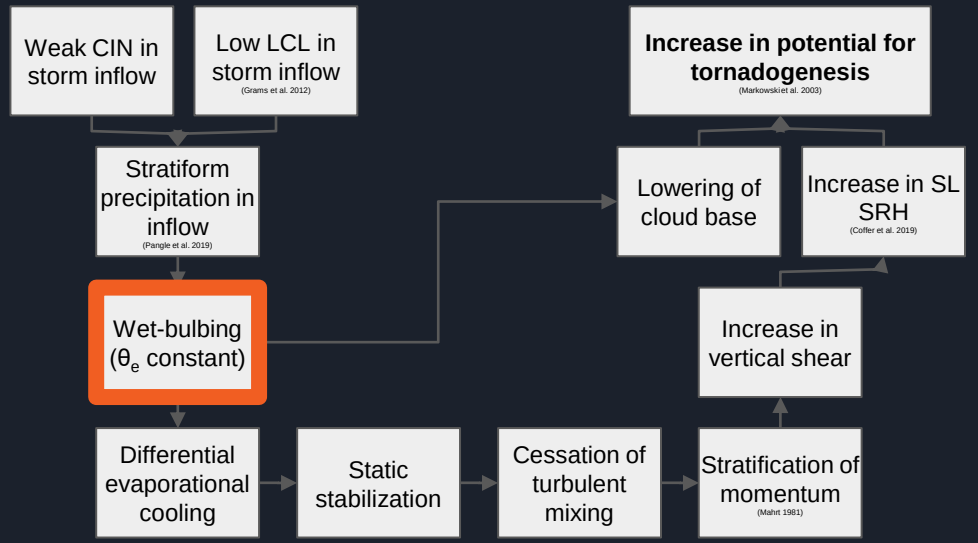


Processes

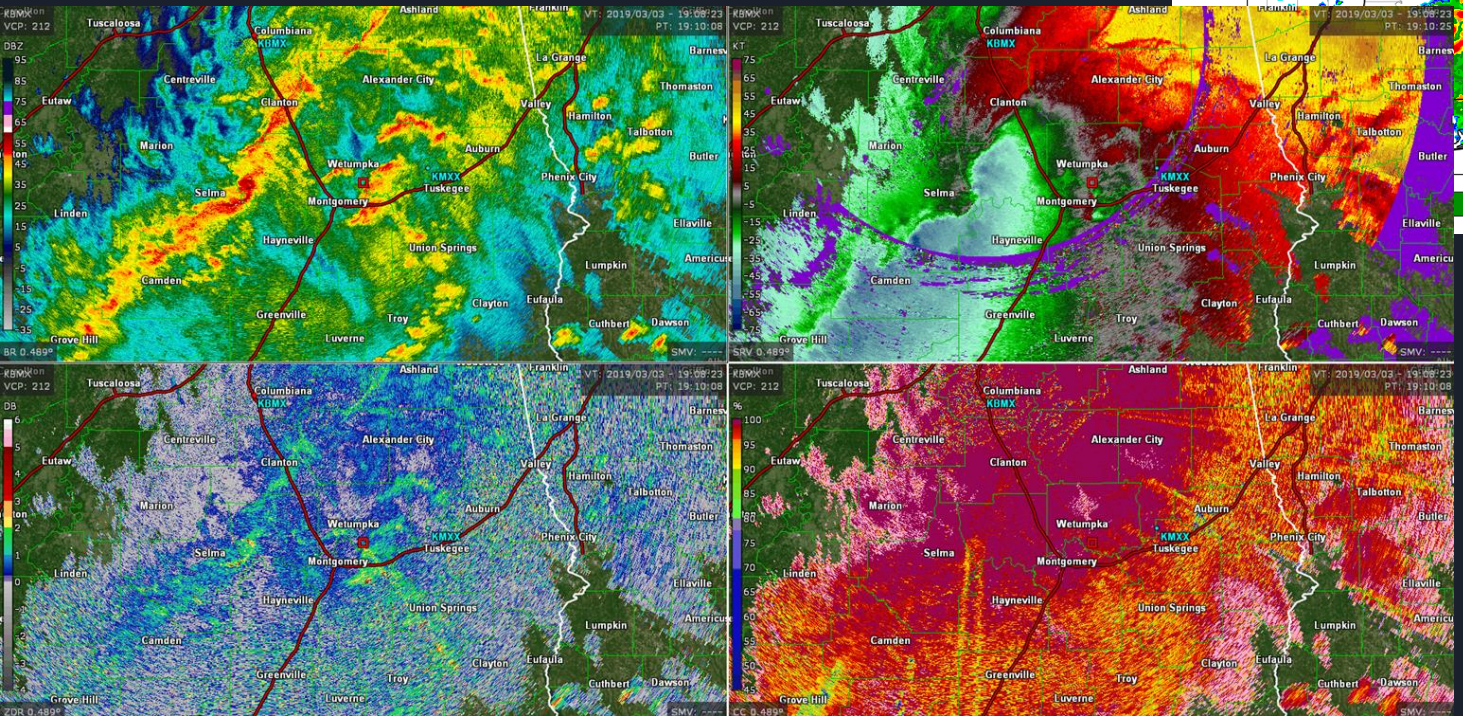


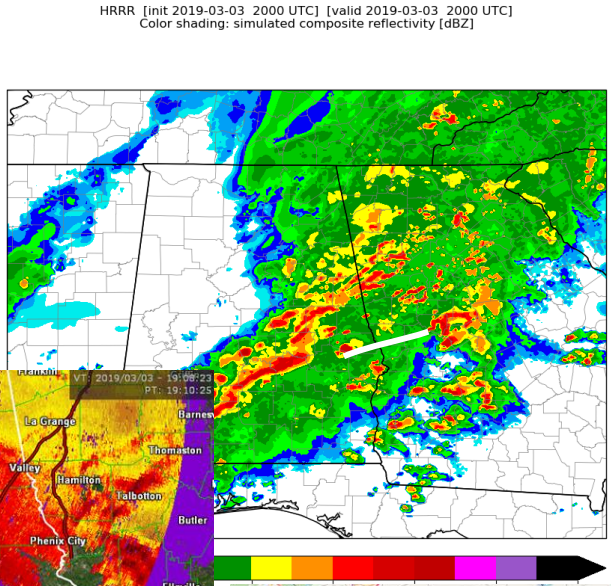
Primary research questions:

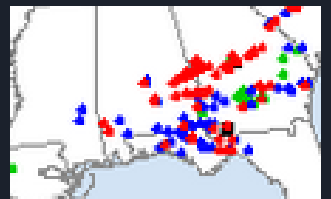
- Under what conditions does pre-QLCS rain result in convective stabilization great enough to preclude tornadogenesis?
- Under what conditions does pre-QLCS rain result in an increase in PBL shear great enough to be the cause of tornadogenesis?



Example - 2019 Mar 03







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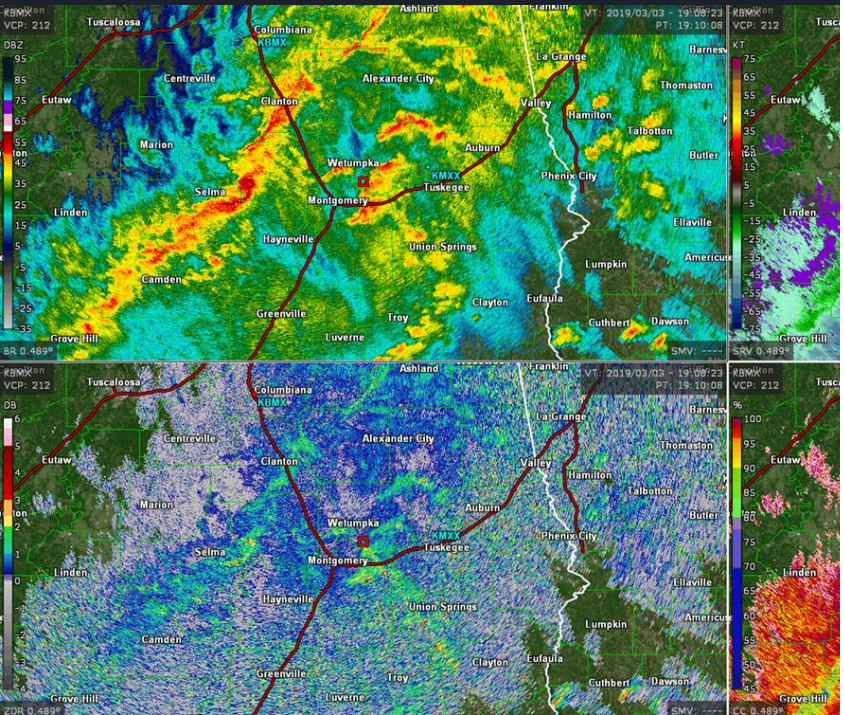
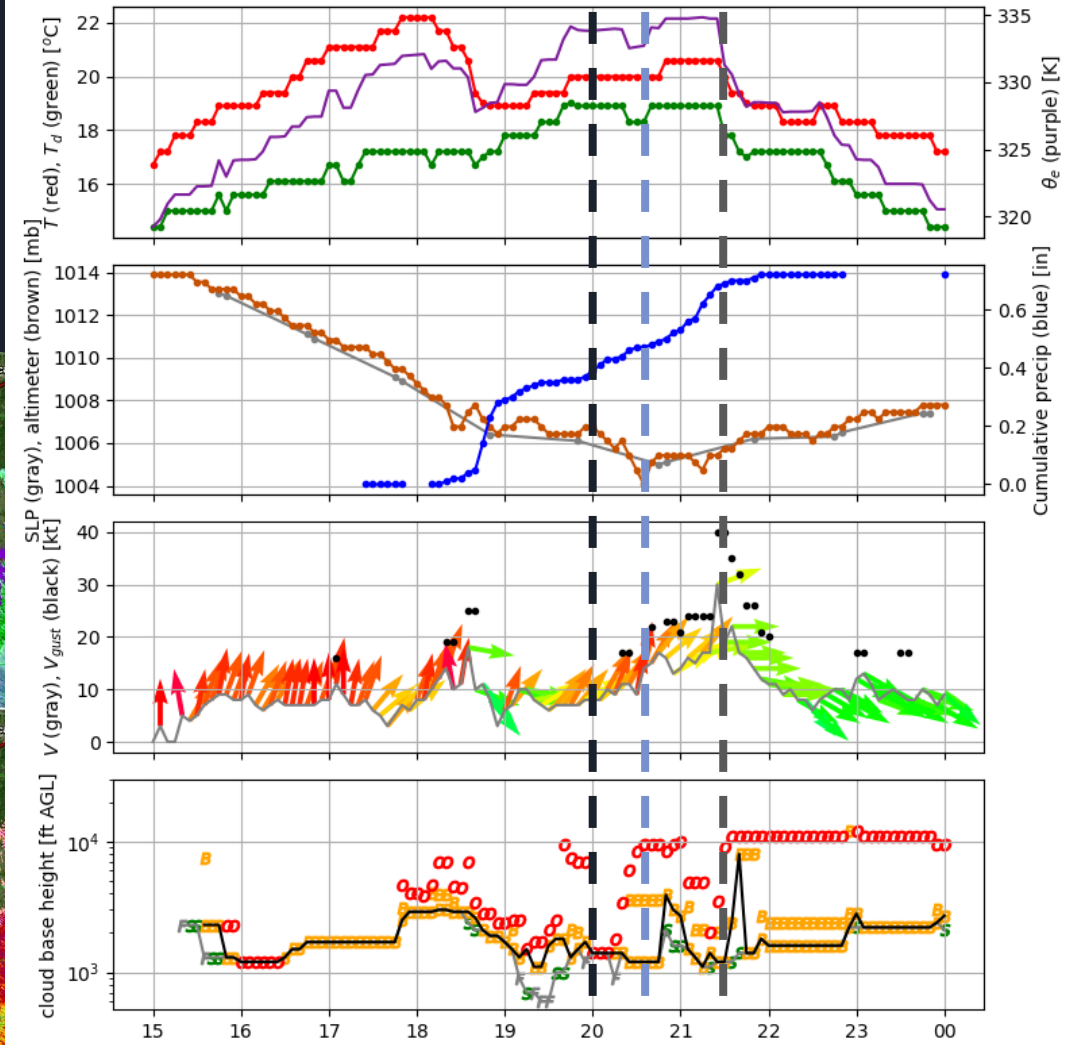
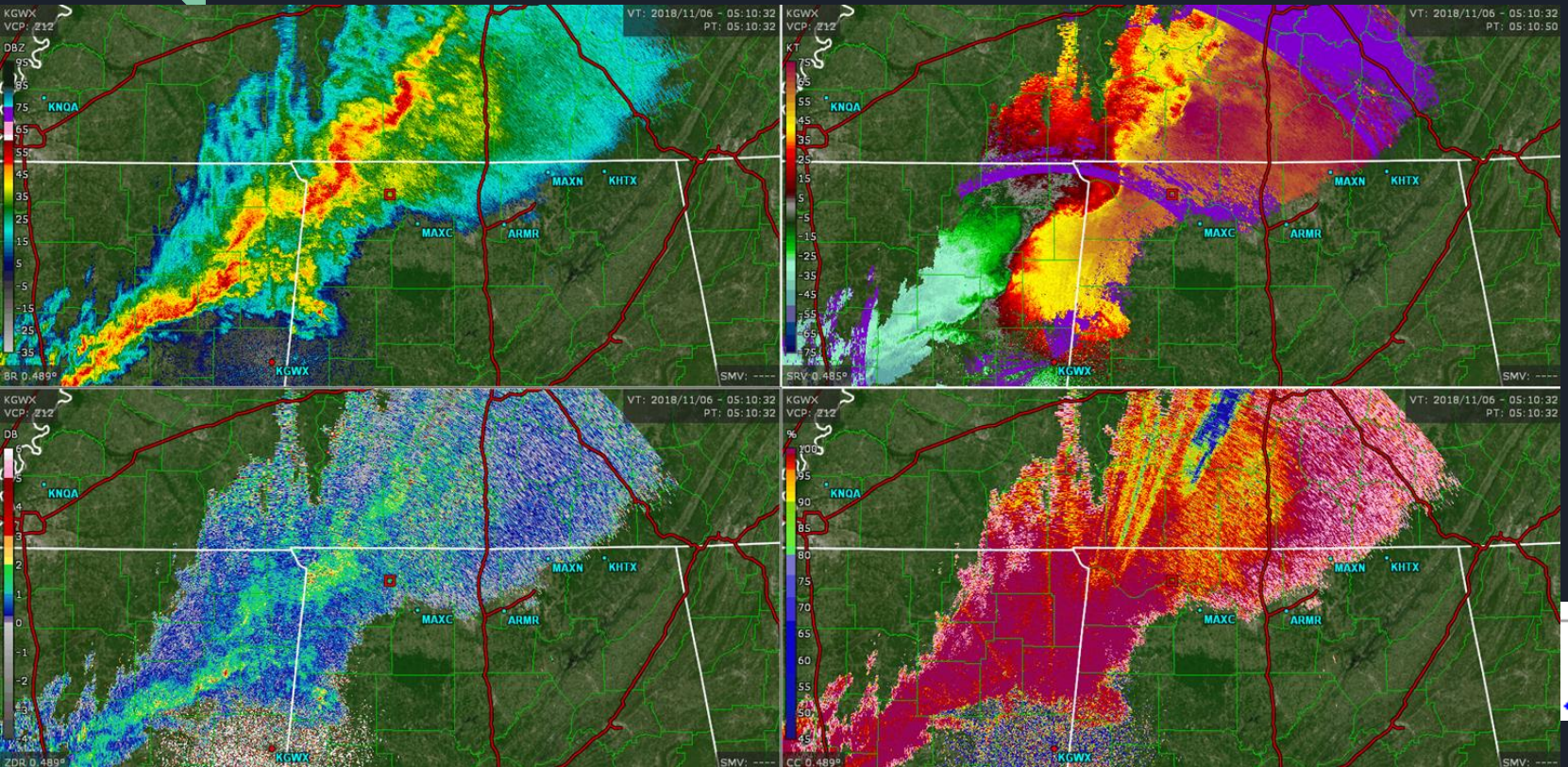




2018 Nov 06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PT: 05:10:32
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KNQA
MAXN
KHTX
MAXC
ARMR
KGWX
BR 0.489°
SMV: ----
KGWX
VCP: 212
VT: 2018/11/06 - 05:10:32
PT: 05:10:50
KT
KNQA
MAXN
KHTX
MAXC
ARMR
KGWX
SRV 0.485°
SMV: ----
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VCP: 212
VT: 2018/11/06 - 05:10:32
PT: 05:10:32
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MAXN
KHTX
MAXC
ARMR
KGWX
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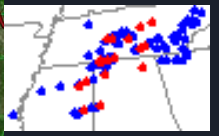

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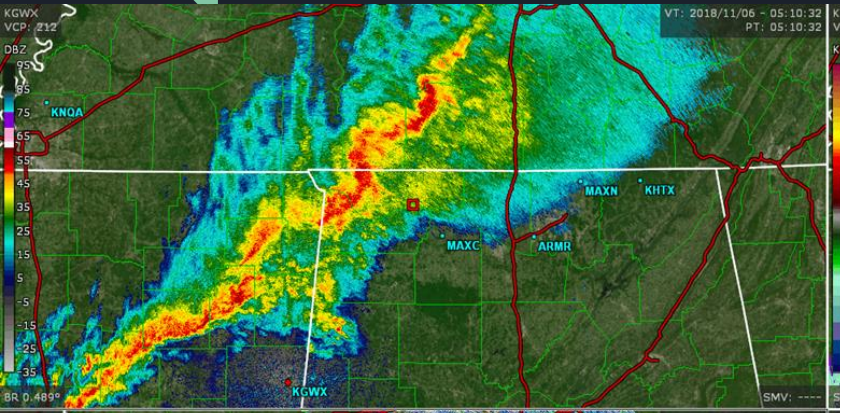
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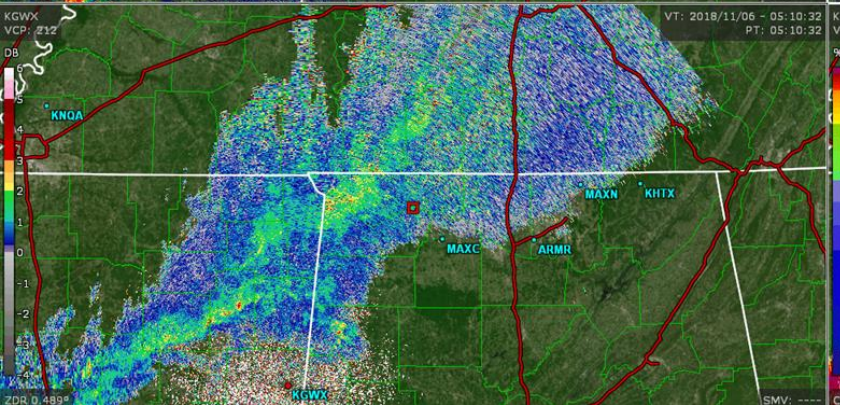
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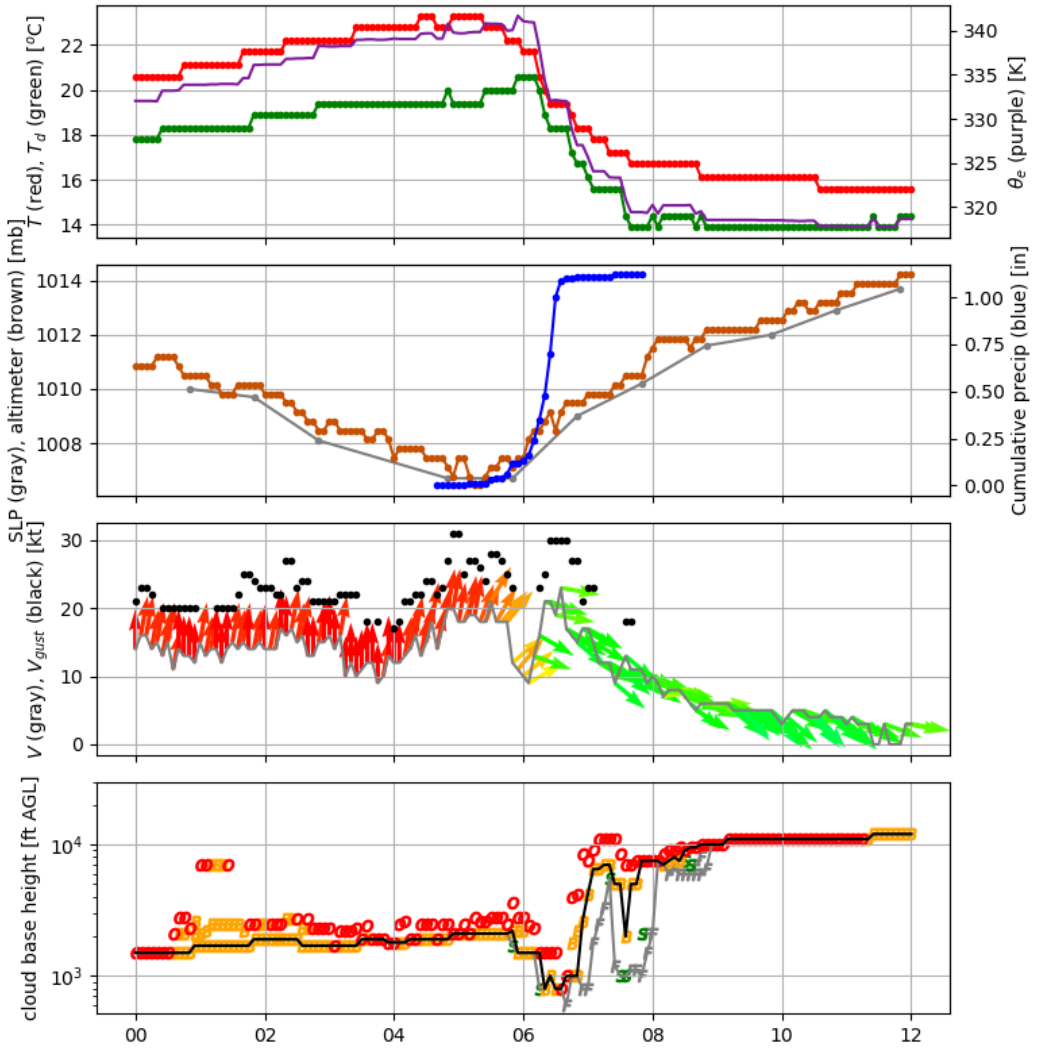
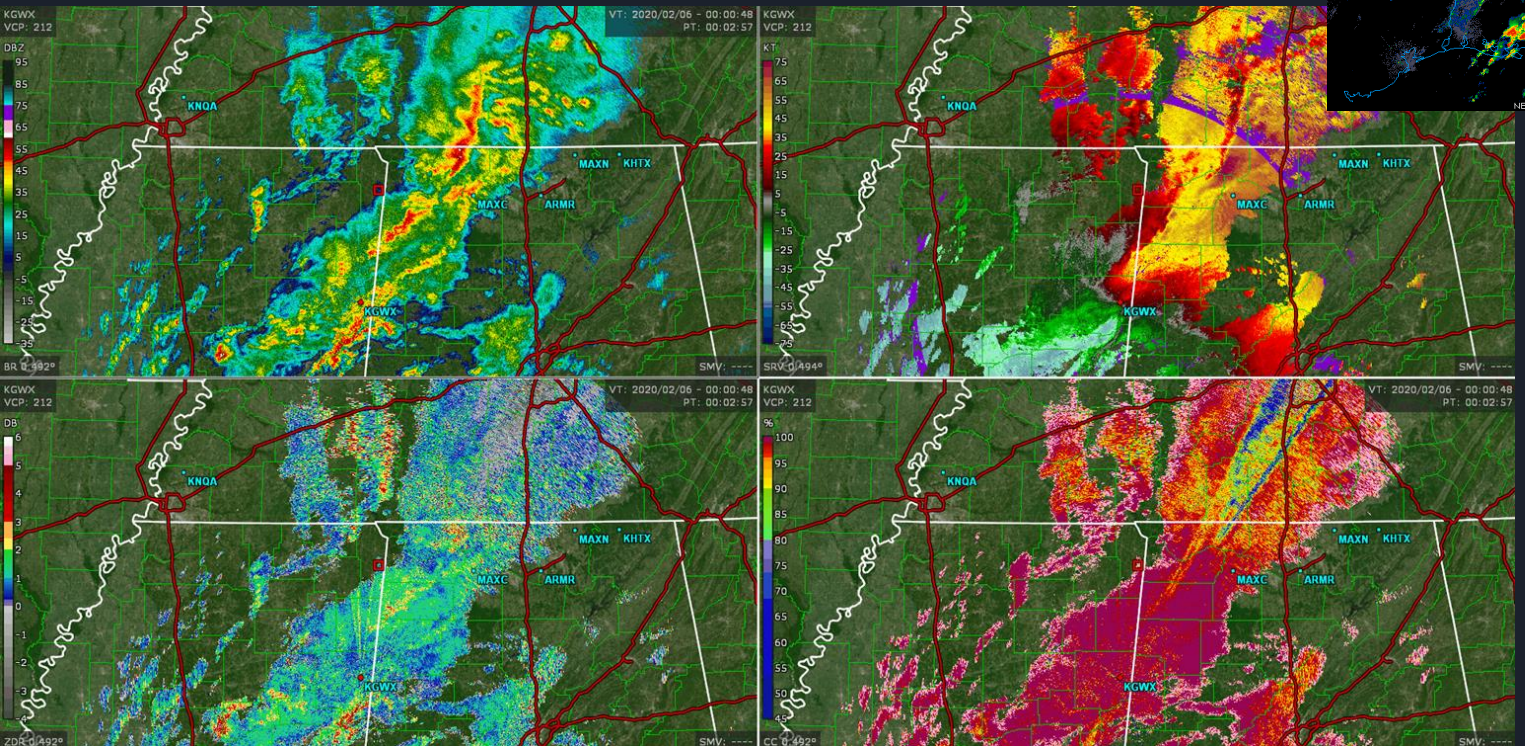
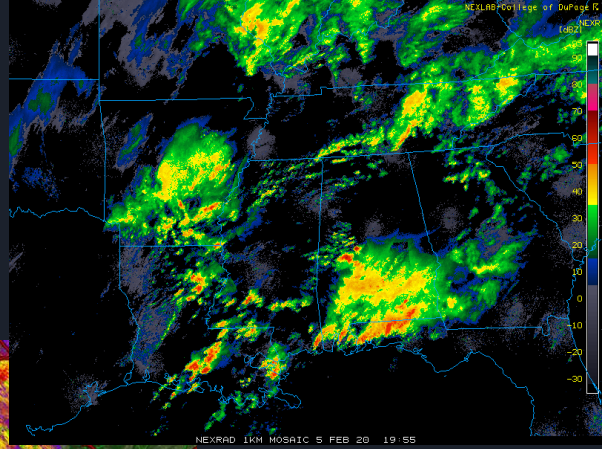
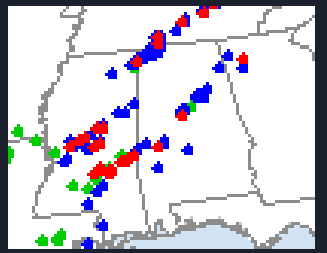

T (red), T_d (green) [°C]
θ_e (purple) [K]
SLP (gray), altimeter (brown) [mb]
Cumulative precip (blue) [in]
V (gray), V_{gust} (black) [kt]
cloud base height [ft AGL]
00
02
04
06
08
10
12

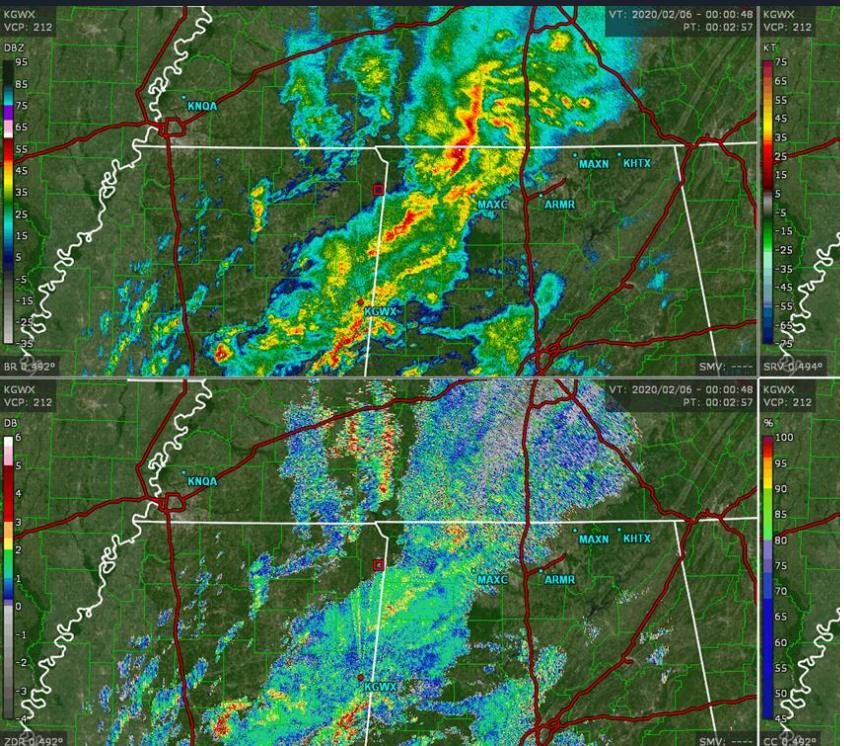
2020 Feb 05-06

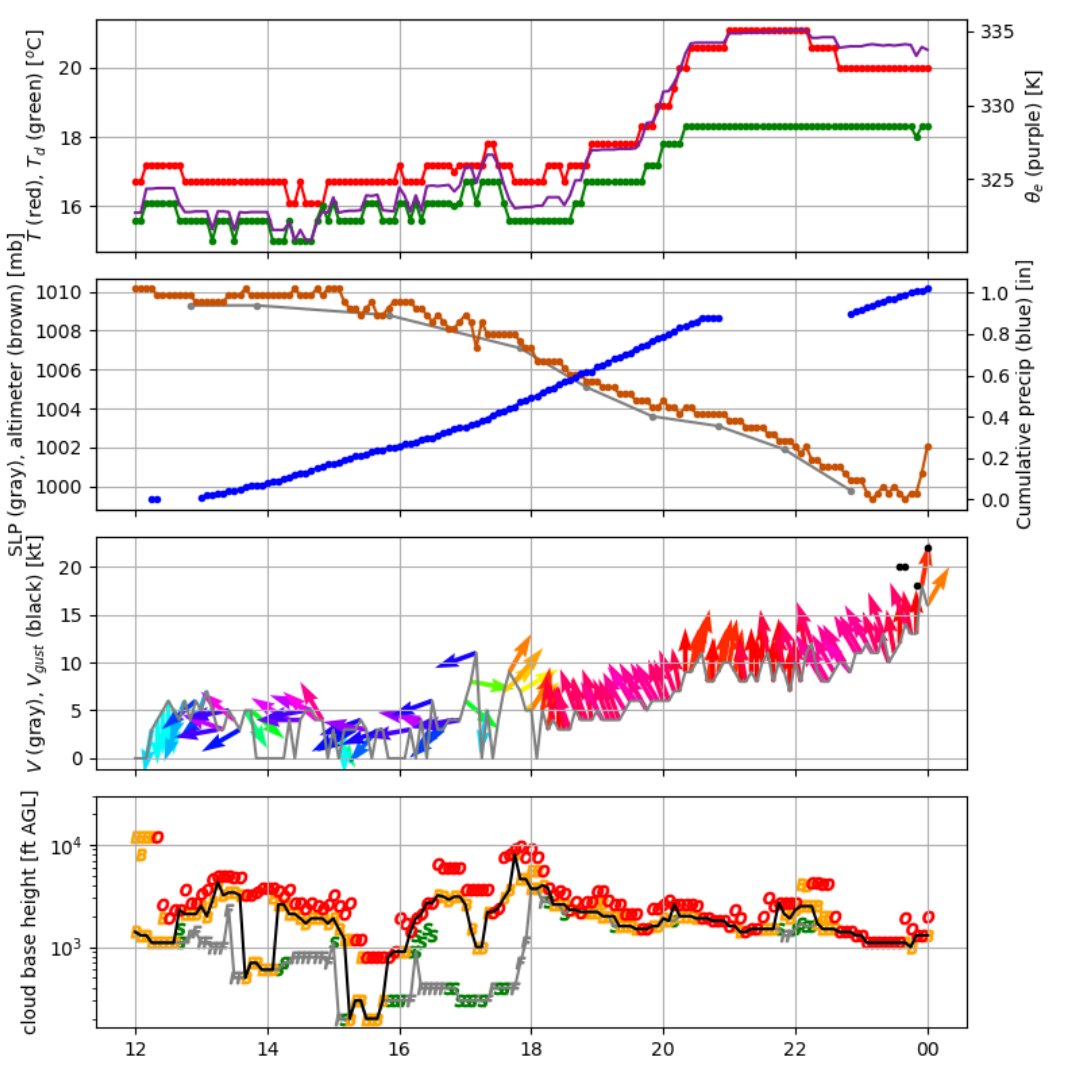






2020 Feb 05-06





Methods

The plan is to perform more detailed analyses of each of these cases and several PERiLS cases:

- 2018 Nov 6 (NW AL – mild stratiform)
- 2019 Mar 3 (Lee County – extensive stratiform, many embedded TOR SCs)
- 2020 Feb 5 (decent stratiform)
- 2022 IOP 1 (Brooksville, MS – mild stratiform)
- 2022 IOP 2 (Amory, MS – decent stratiform, some embedded cells)
- 2022 IOP 3 (Selma, AL – extensive stratiform, heavy, many embedded SVR SCs)
- 2023 IOP 1 (Brooksville, MS – extensive coastal convection)
- 2023 IOP 4 (TN Valley – mild stratiform)

The analysis will use primarily RWP and DWL data, since the focus is on changes in the wind profile.