TC TORNADOES and SPC FORECASTS in TC SITUATIONS

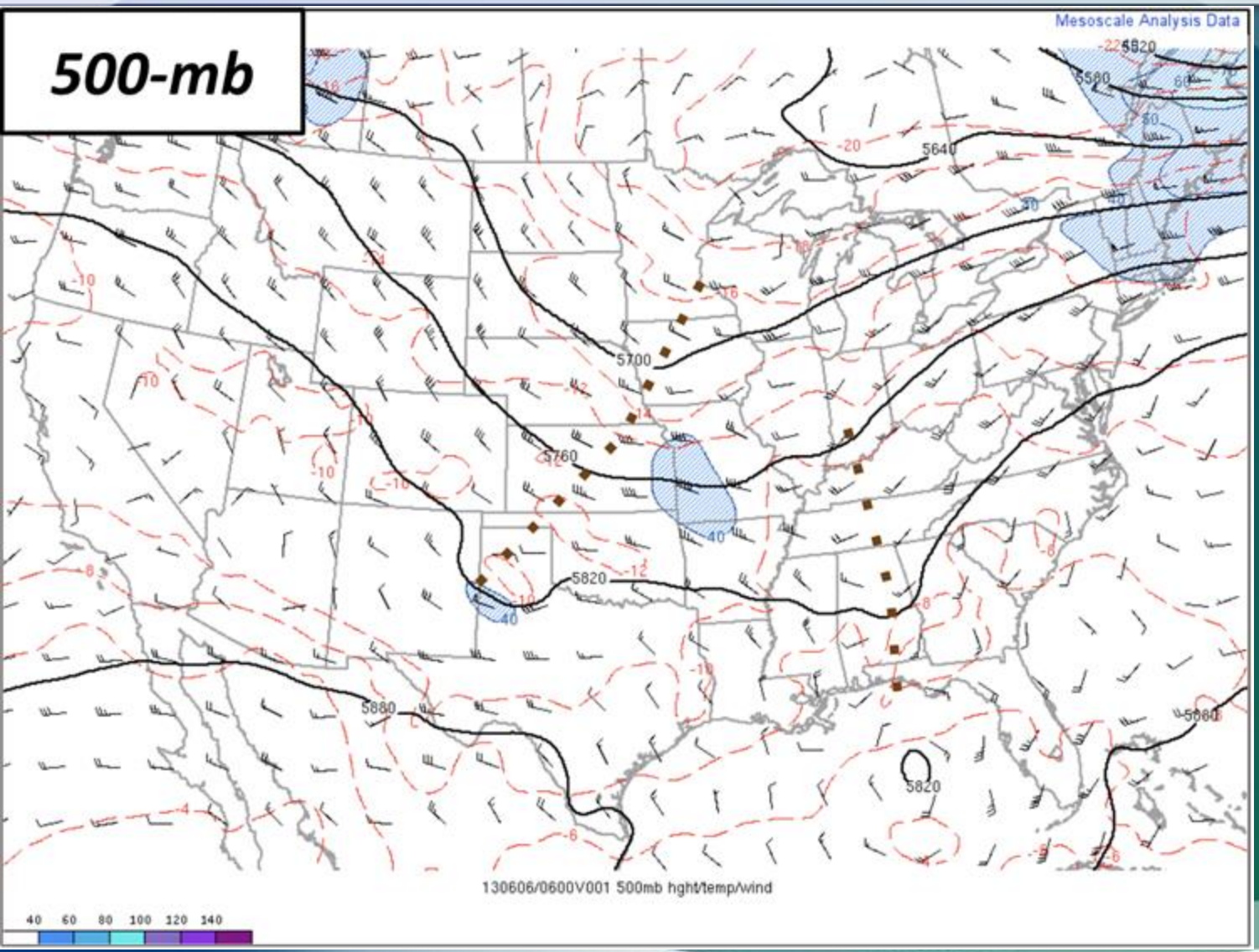
Part TWO: Case Investigations

Harry Weinman & Roger Edwards

Storm Prediction Center
Norman, Oklahoma

METR 4403/5403: Applications of Meteorological Theory to Severe-Thunderstorm Forecasting

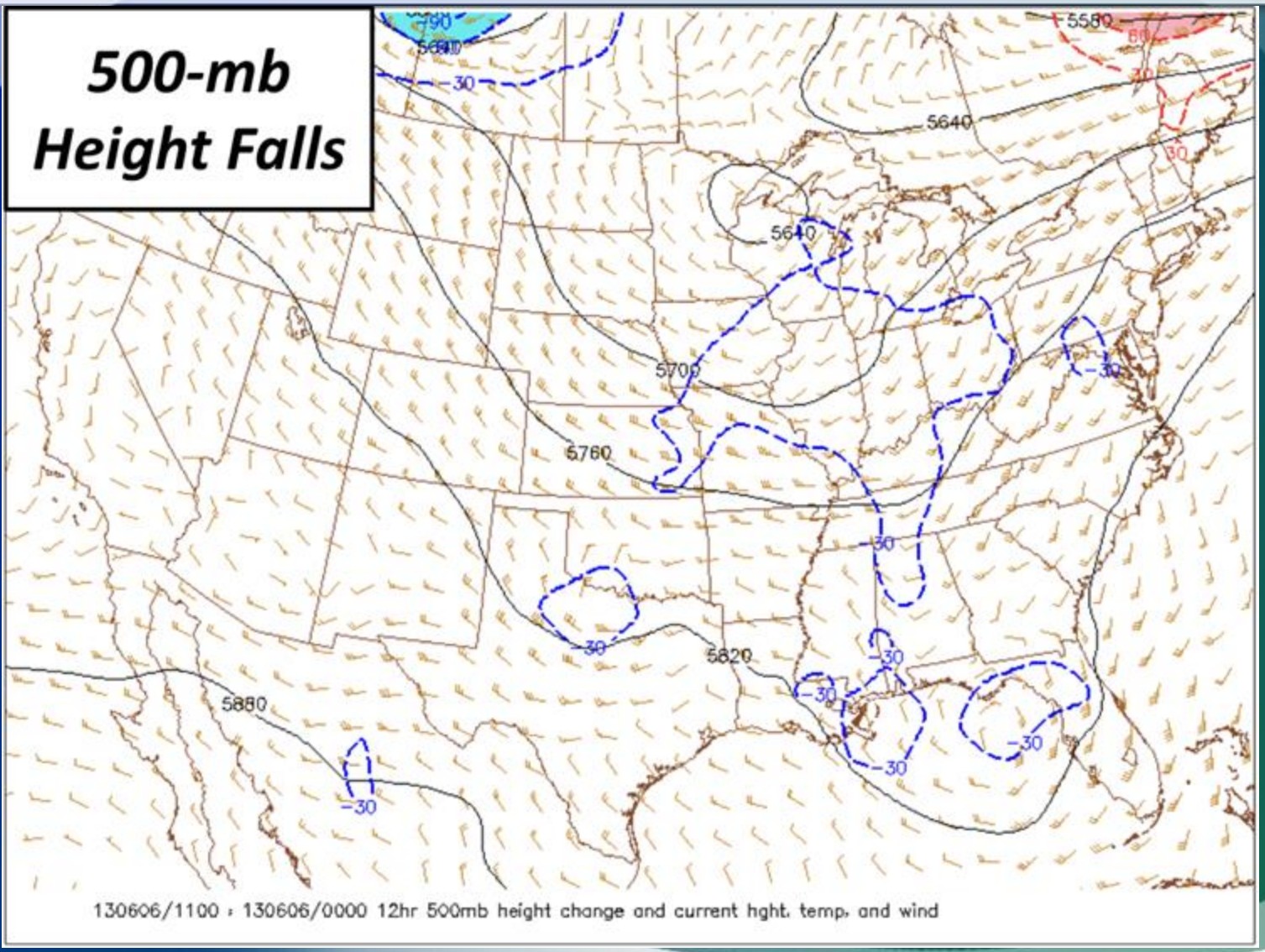
TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)



-Southern-stream shortwave trough and accompanying upstream DAVA/subsidence-induced drying tracking eastward across SE CONUS

-Introduces the potential for baroclinic-related processes to inject into the cyclonic flow envelope -- fostering opportunities for a favorable meso environment for tornadogenesis

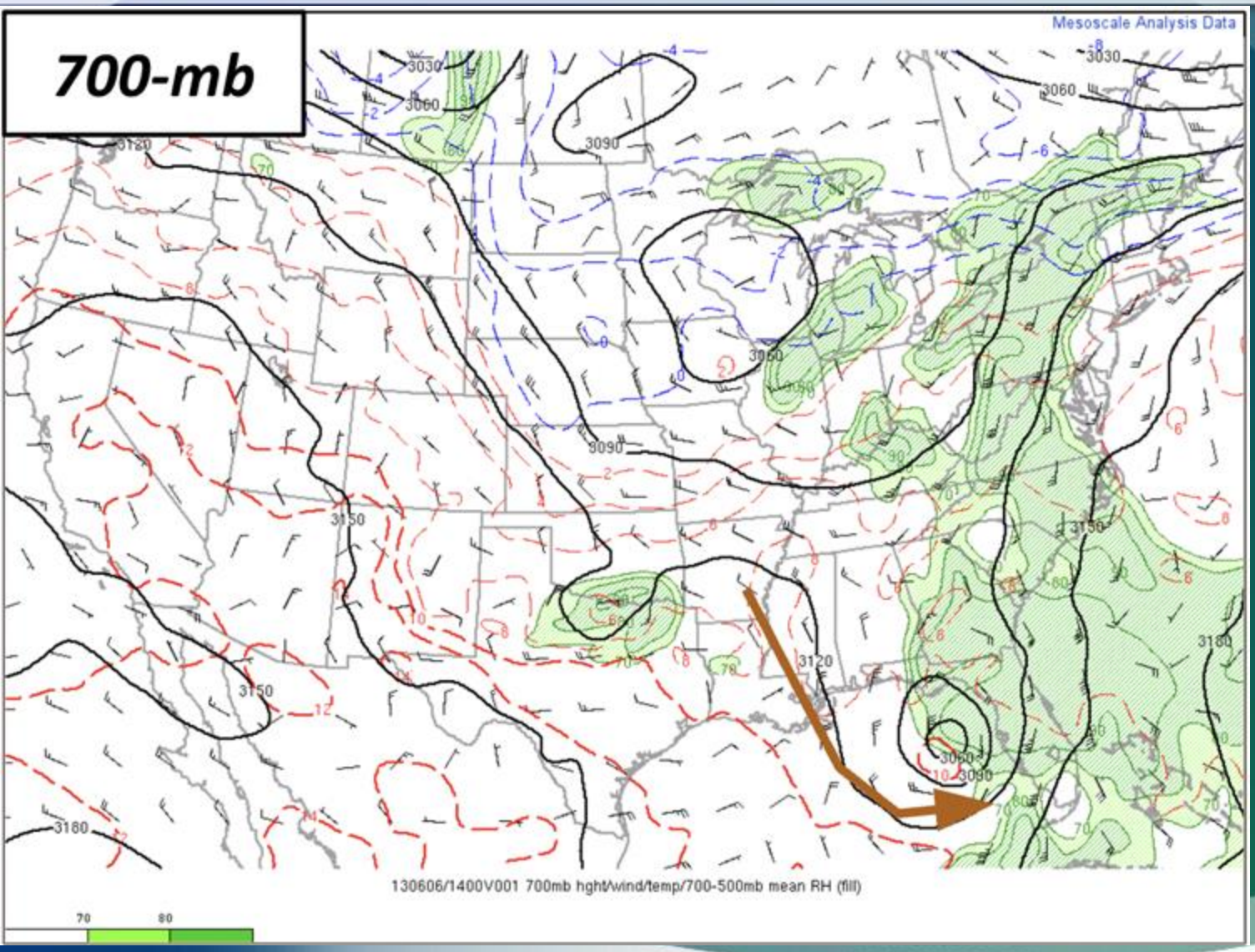
TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)



-Mid-level height-falls associated with baroclinic shortwave trough spreading eastward into the tropical environment

-Essentially injecting baroclinicity into the cyclonic flow envelope -- facilitating a conducive mesoscale environment for tornadogenesis

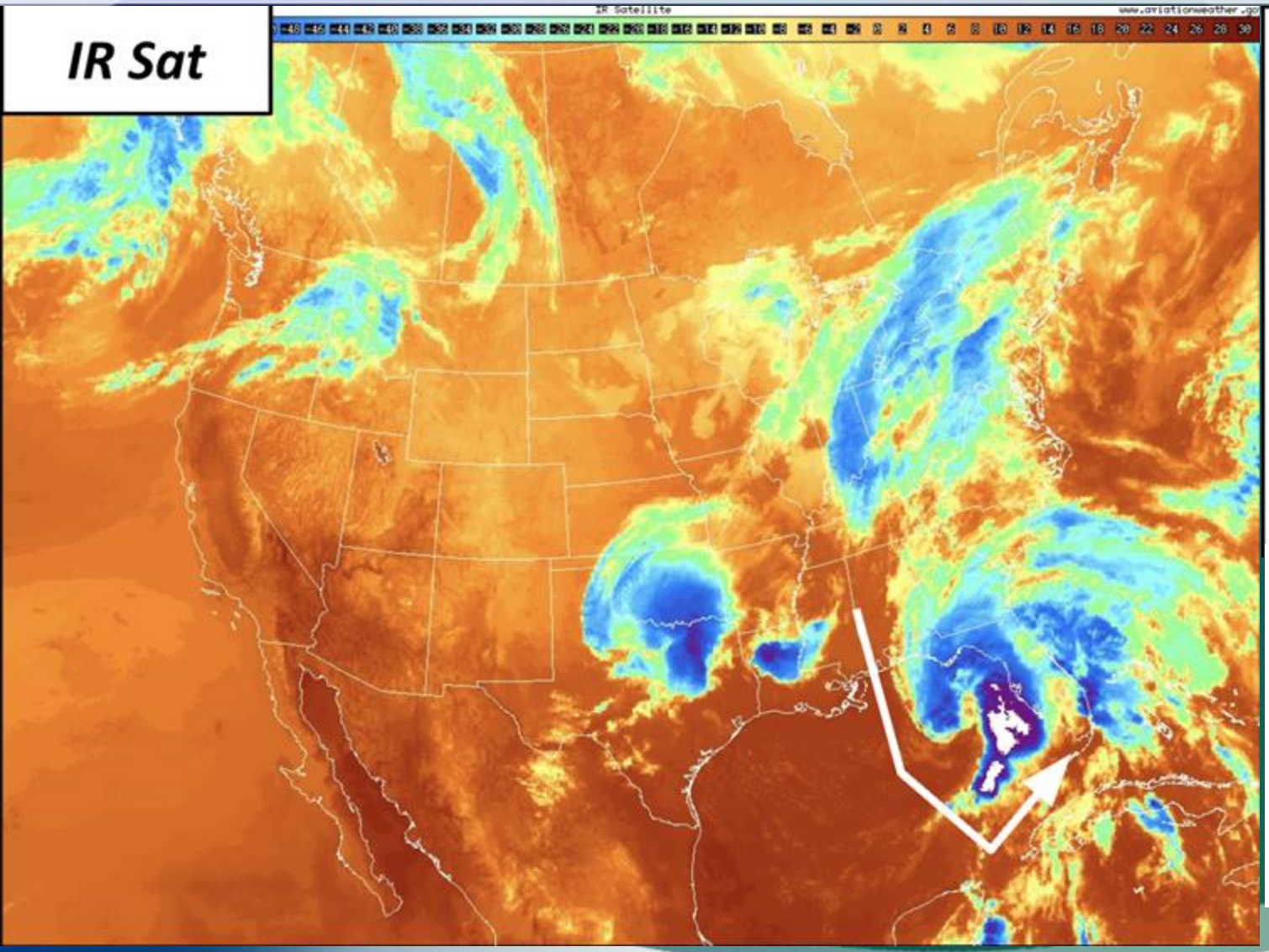
TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)



-Mid-level dry air (associated with aforementioned shortwave trough) cyclonically wrapping into the TC

-This allows for favorable breaks between convection and resulting potent/ non-overturned air to ingest into convective updrafts

TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)

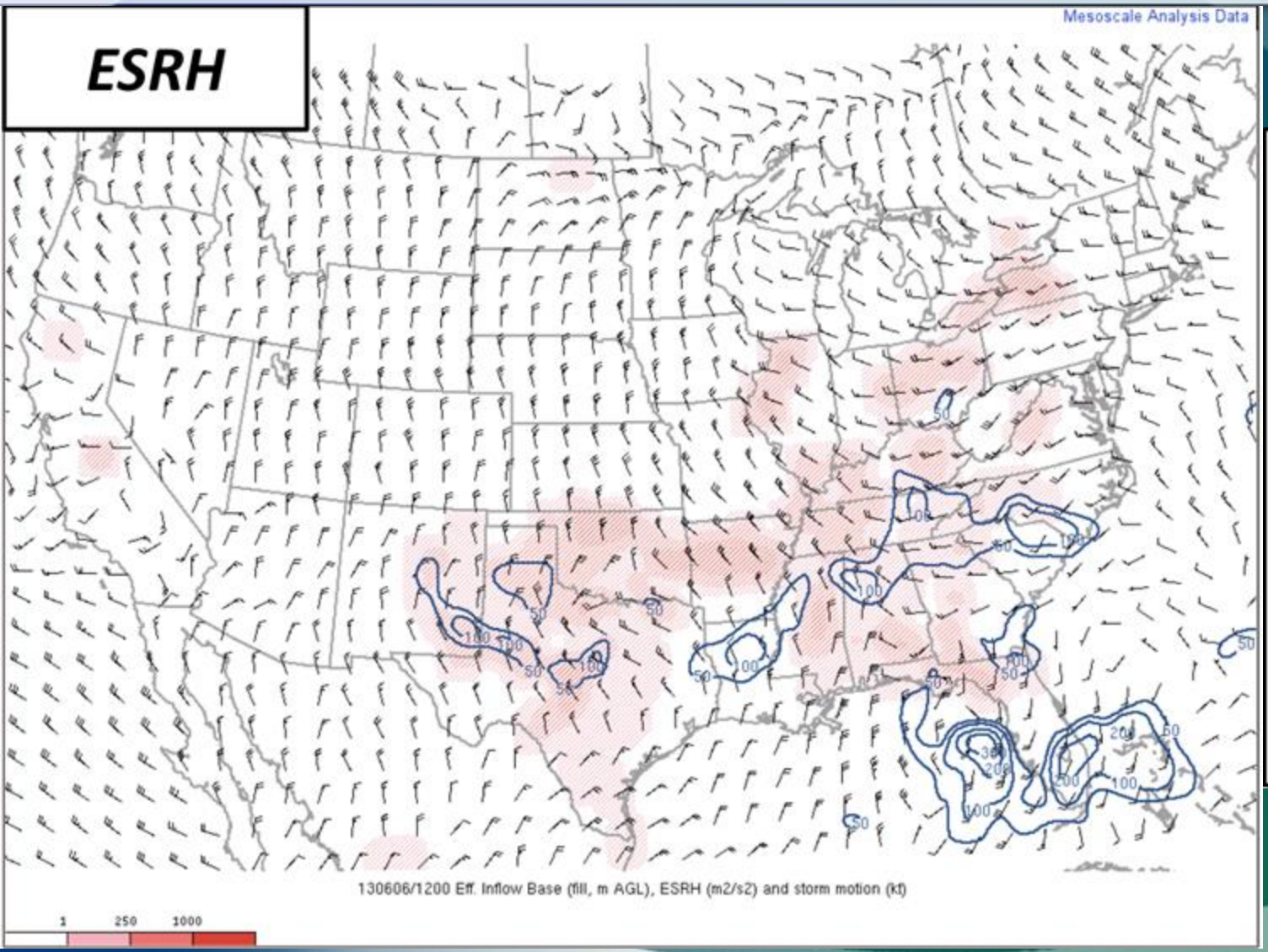


-Another depiction of dry air cyclonically enveloping the TC

- Mid-level dry air reduces mid-level theta-E values -- resulting in higher convective instability

-Dry slots can promote enhanced heating/ differential heating, setting up temporary baroclinic zones

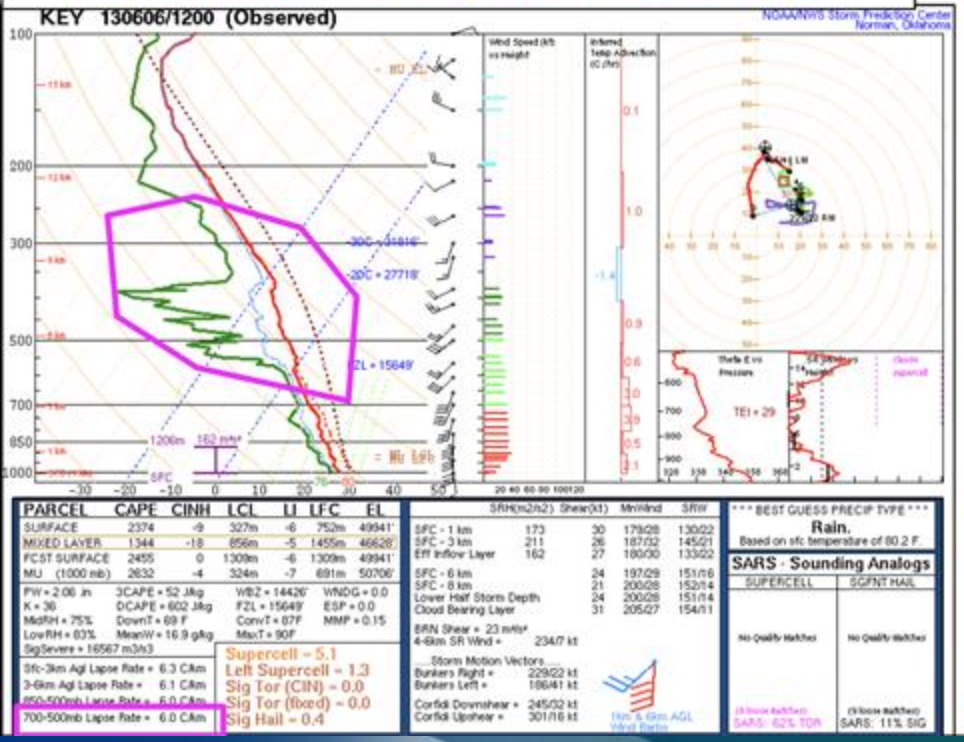
TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)

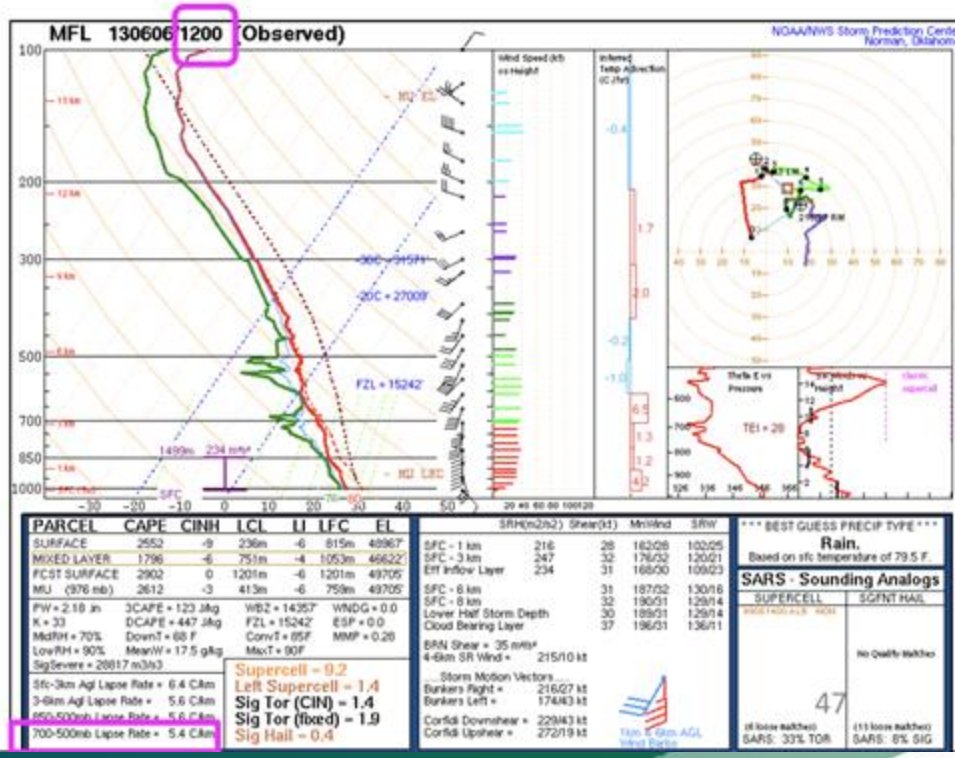


-Favorable environmental storm-relative helicity -- supportive of immediate updraft rotation -- owing to ingestion of air following helical trajectories into updrafts

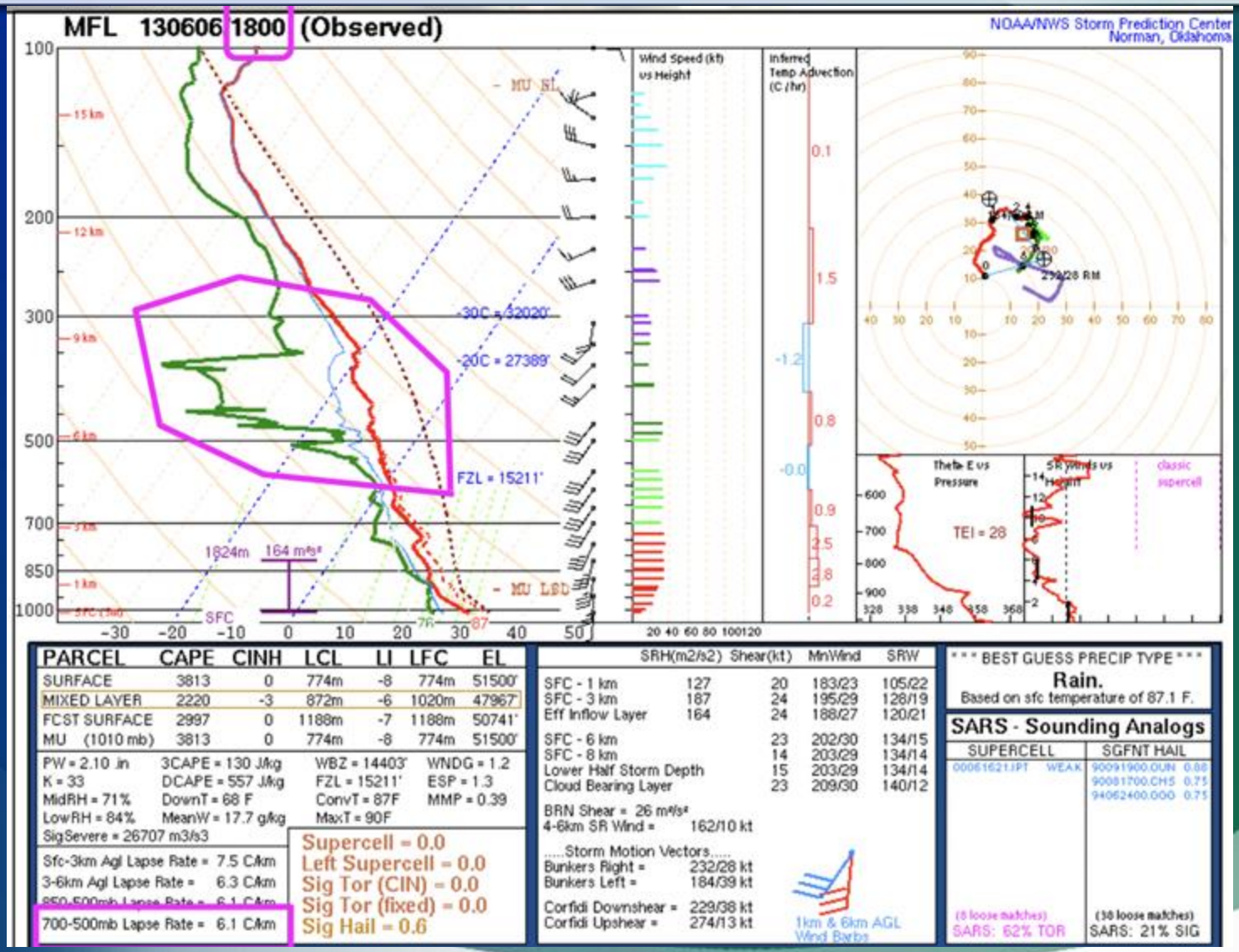
TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)

Upstream air mass at KEY depicts dry mid/upper-levels and steeper mid-level lapse rates (compared to downstream MFL data)

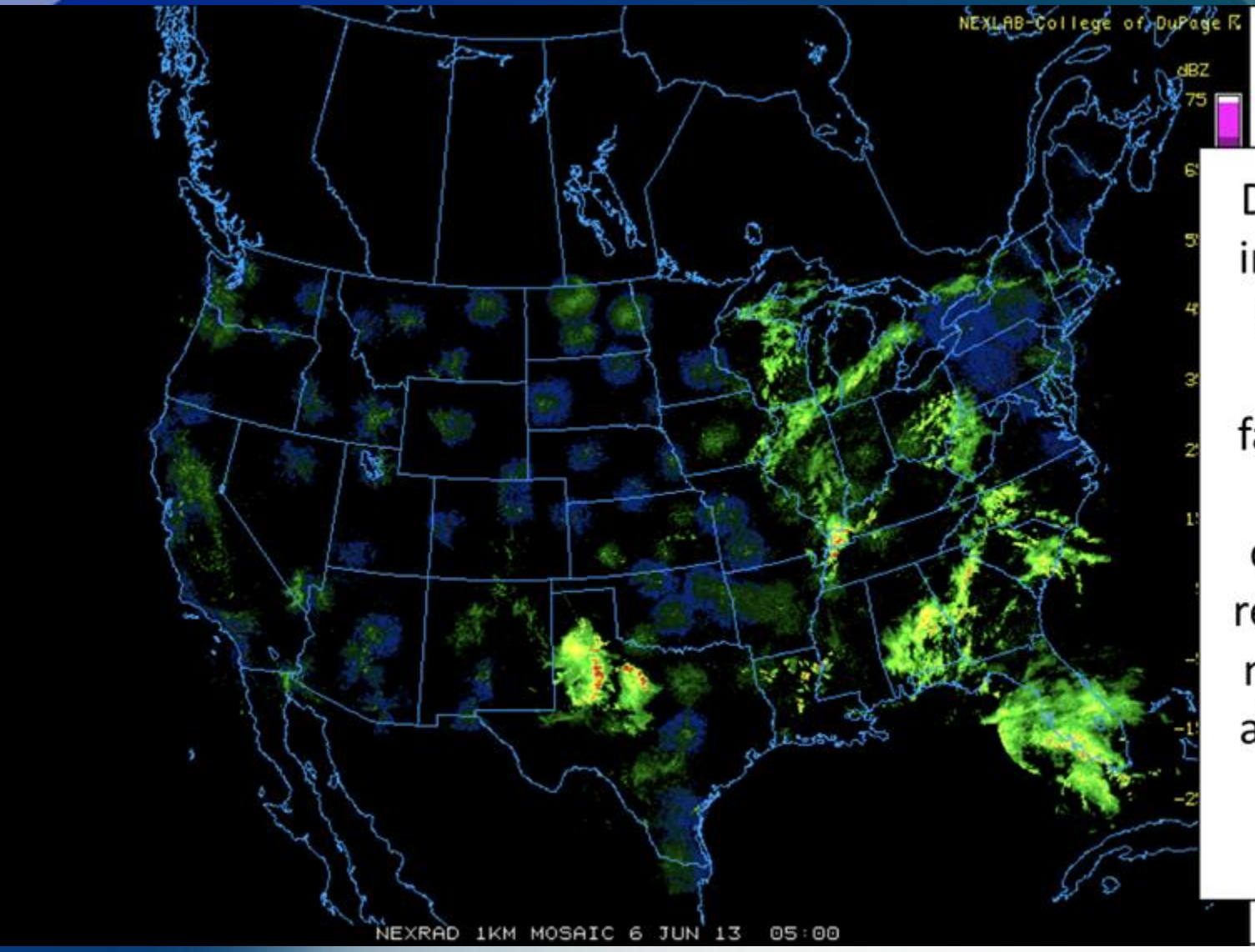




TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)

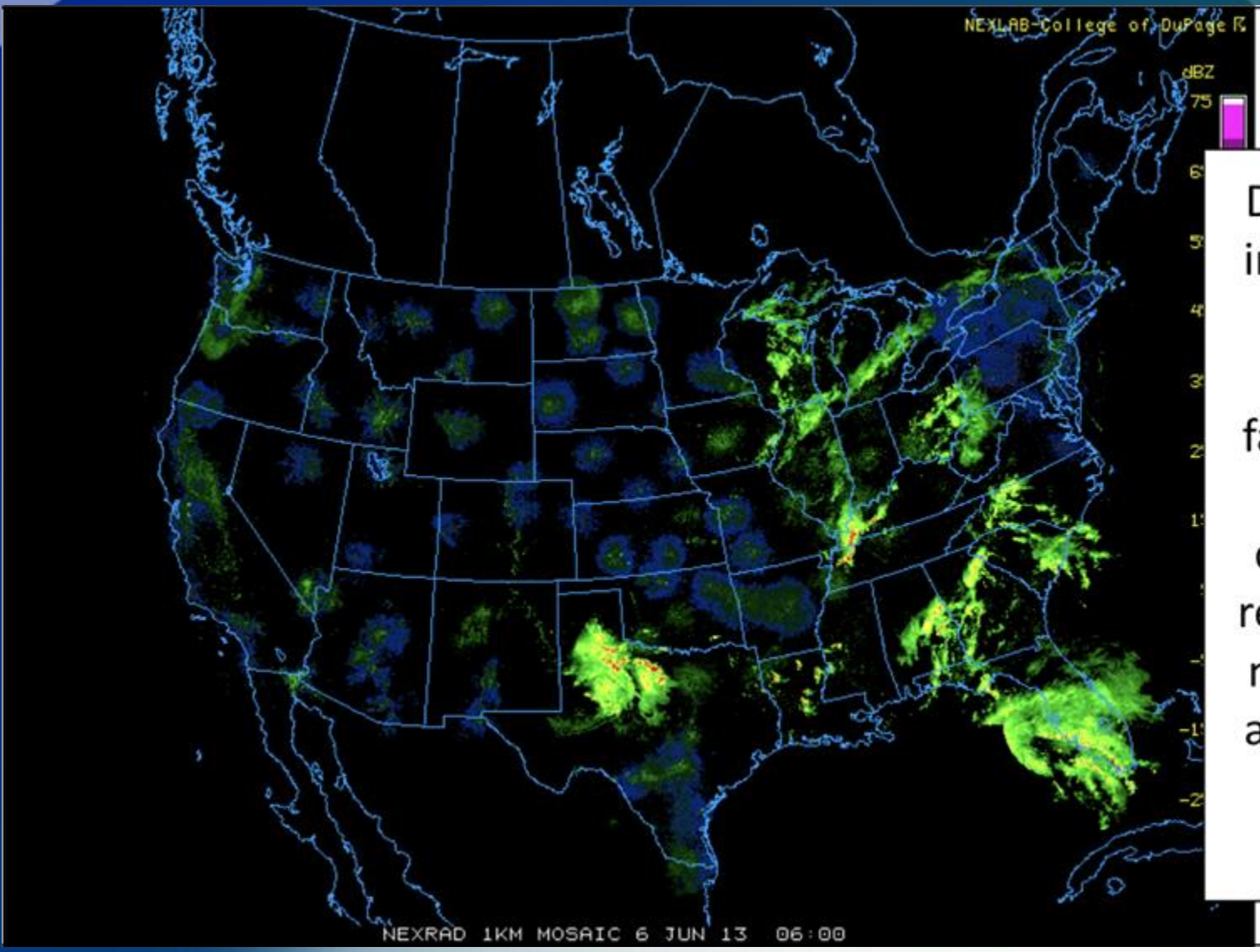


TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)



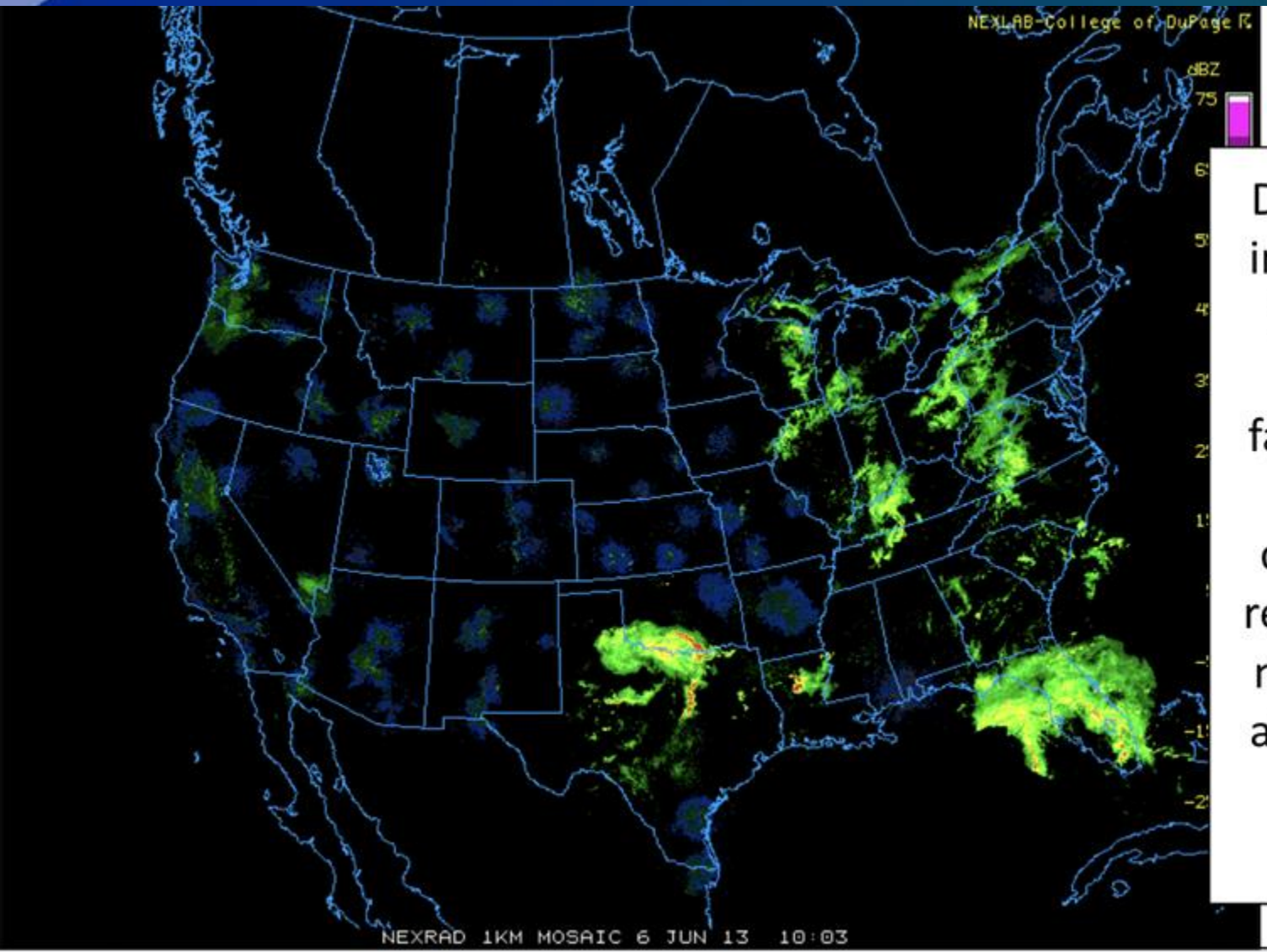
Dry air intrusion into the cyclonic flow envelope allowed for favorable breaks between convection and resulting potent/ non-overturned air to ingest into convective updrafts

TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)



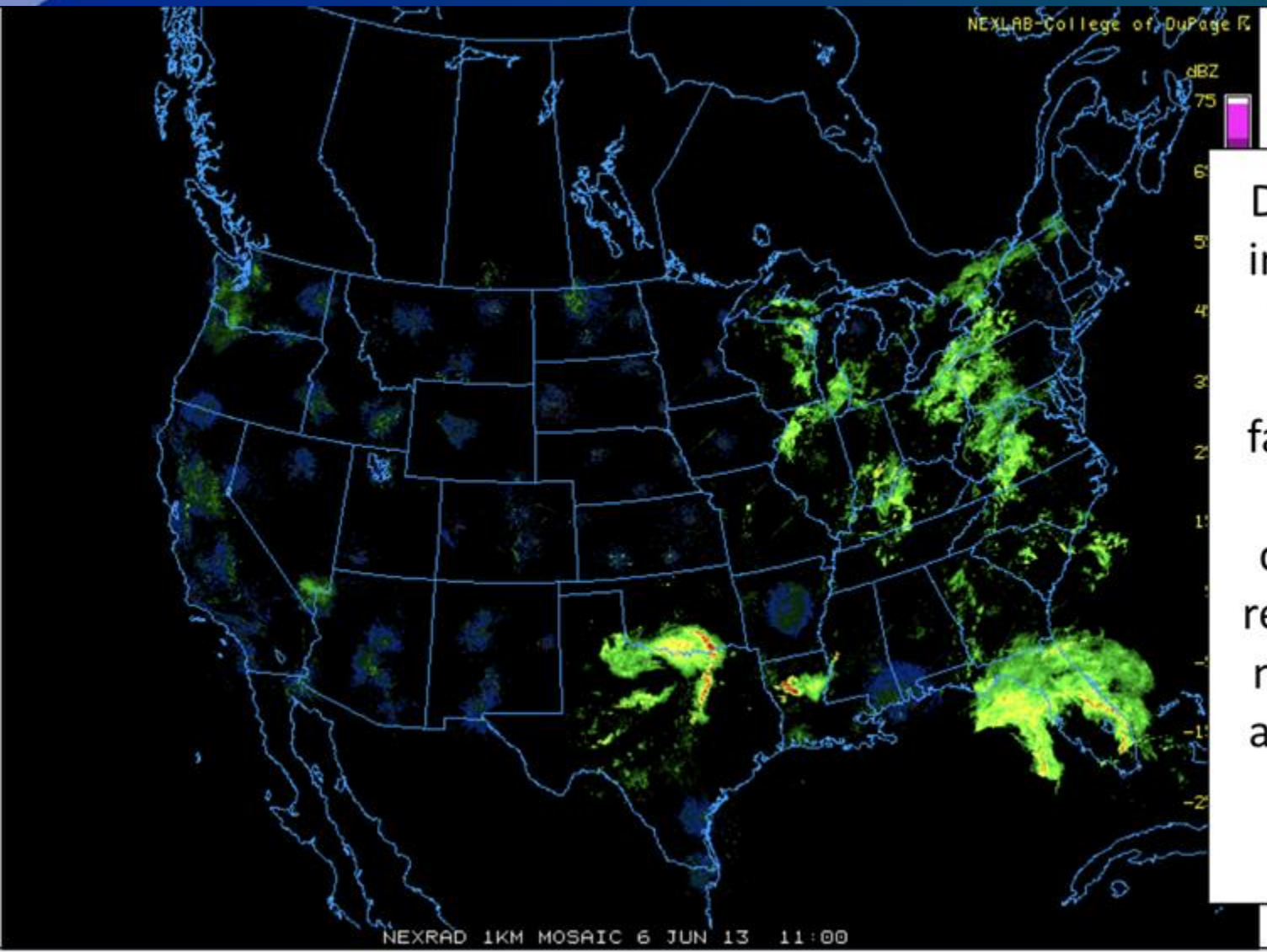
Dry air intrusion into the cyclonic flow envelope allowed for favorable breaks between convection and resulting potent/ non-overturned air to ingest into convective updrafts

TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)



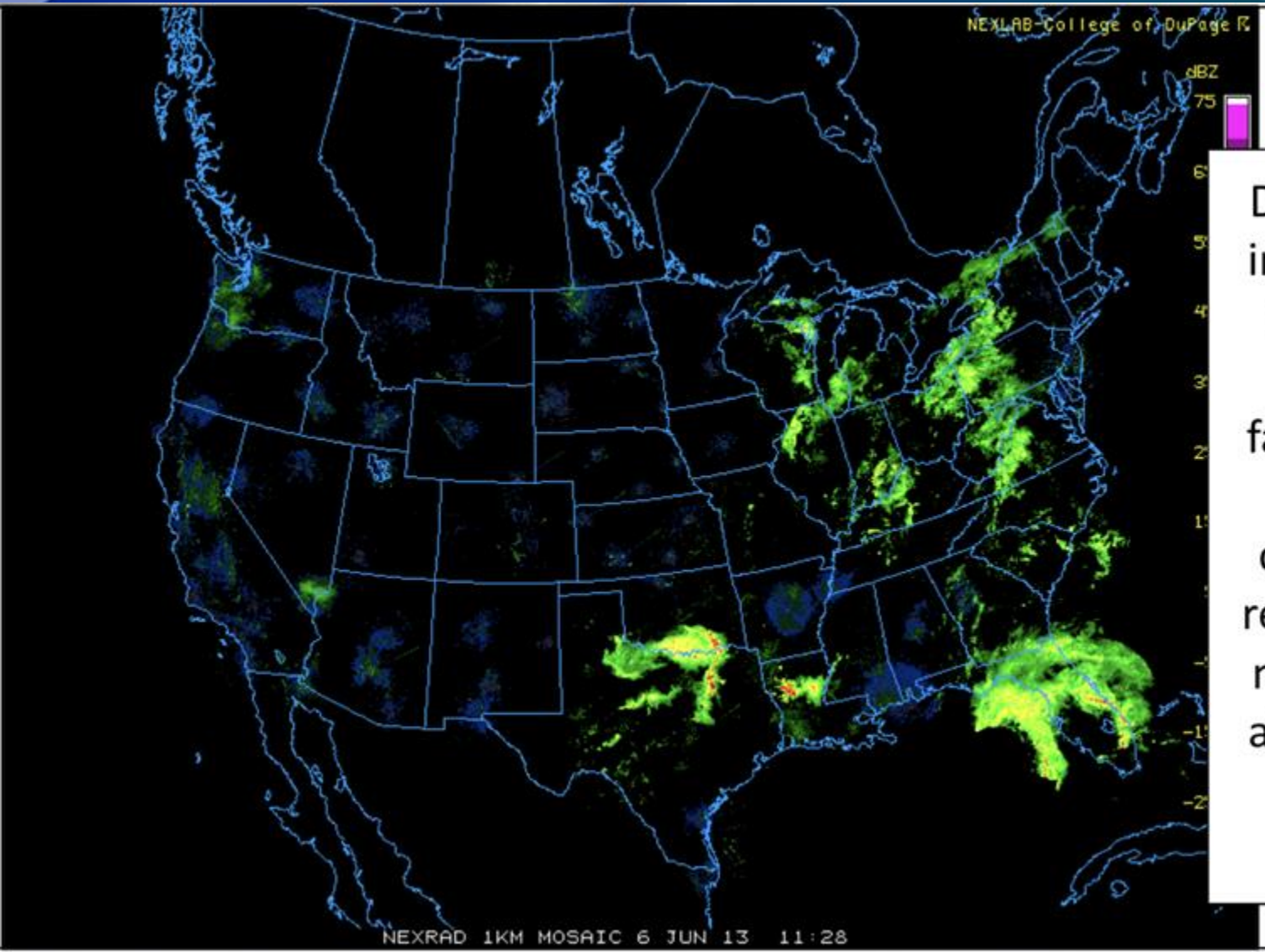
Dry air intrusion into the cyclonic flow envelope allowed for favorable breaks between convection and resulting potent/ non-overturned air to ingest into convective updrafts

TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)



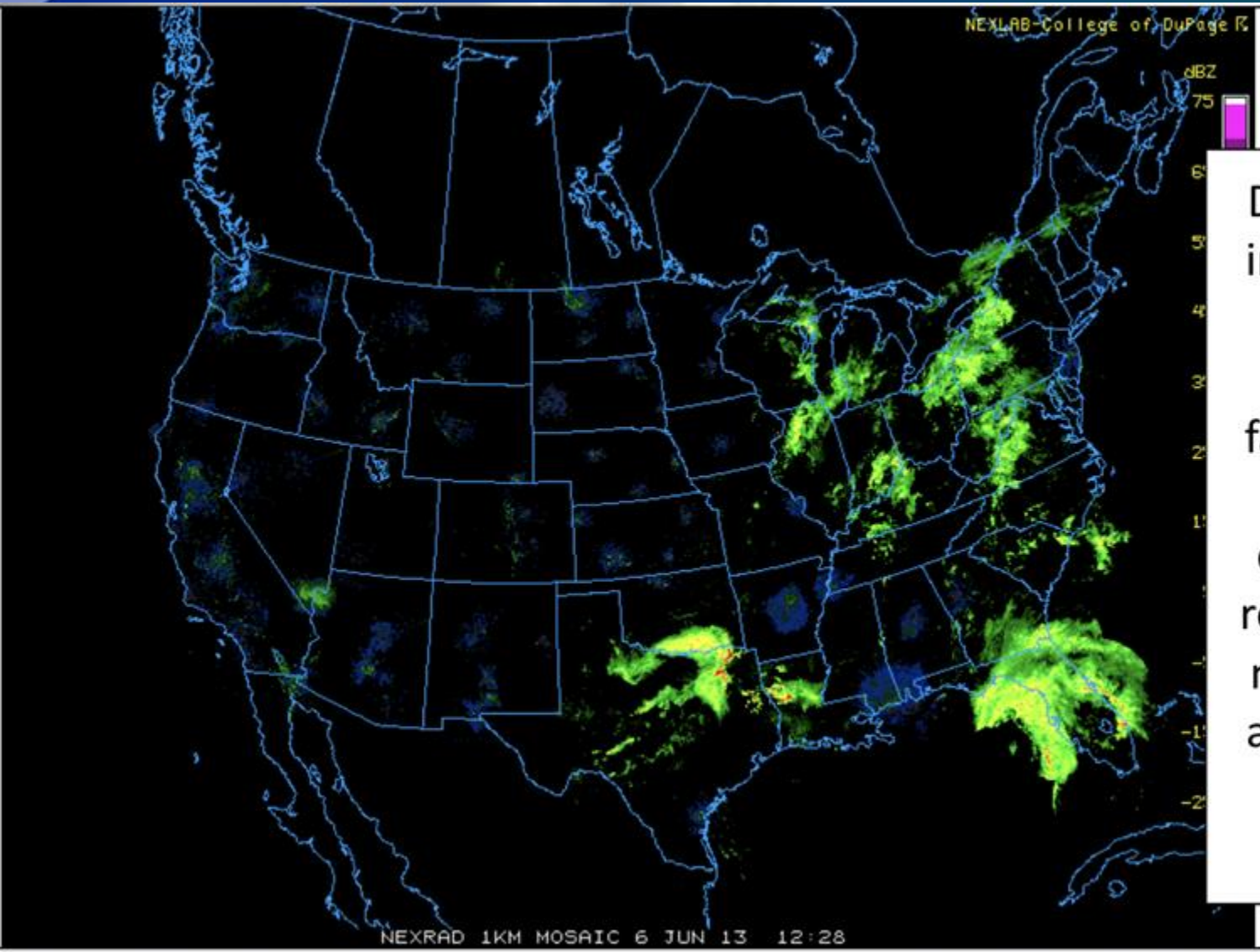
Dry air intrusion into the cyclonic flow envelope allowed for favorable breaks between convection and resulting potent/ non-overturned air to ingest into convective updrafts

TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)



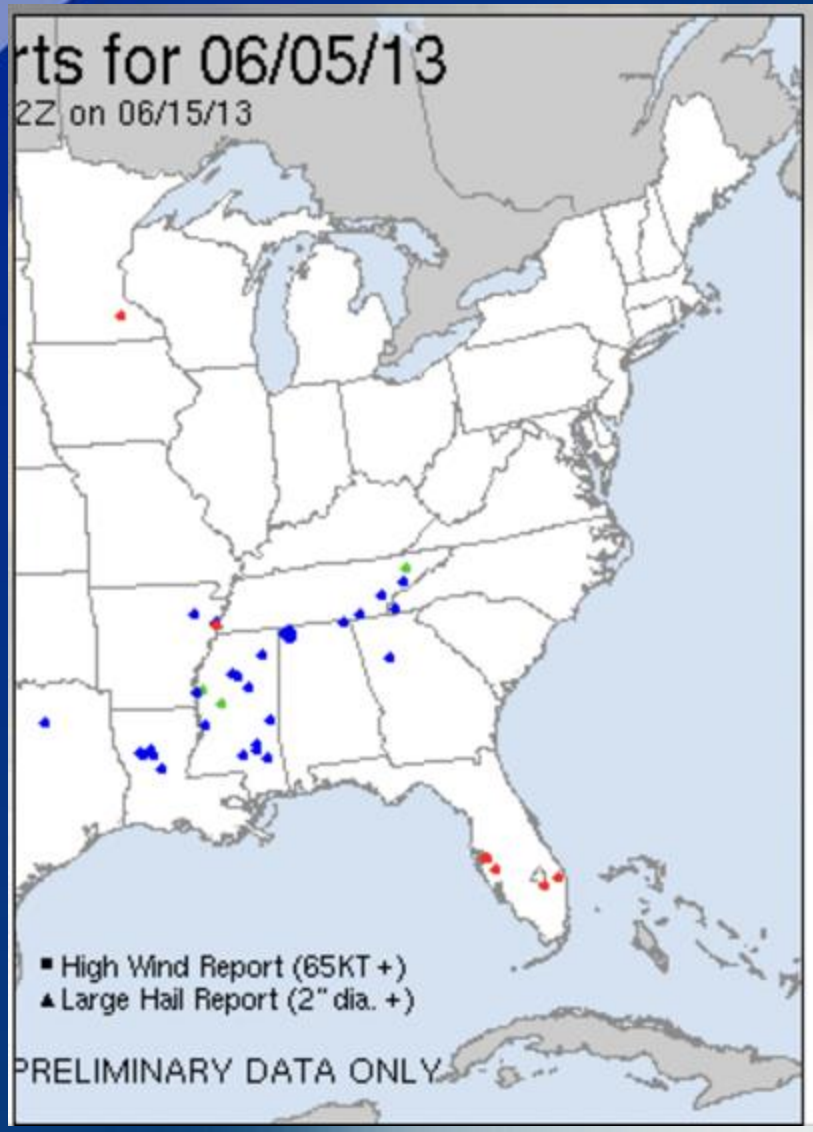
Dry air intrusion into the cyclonic flow envelope allowed for favorable breaks between convection and resulting potent/ non-overturned air to ingest into convective updrafts

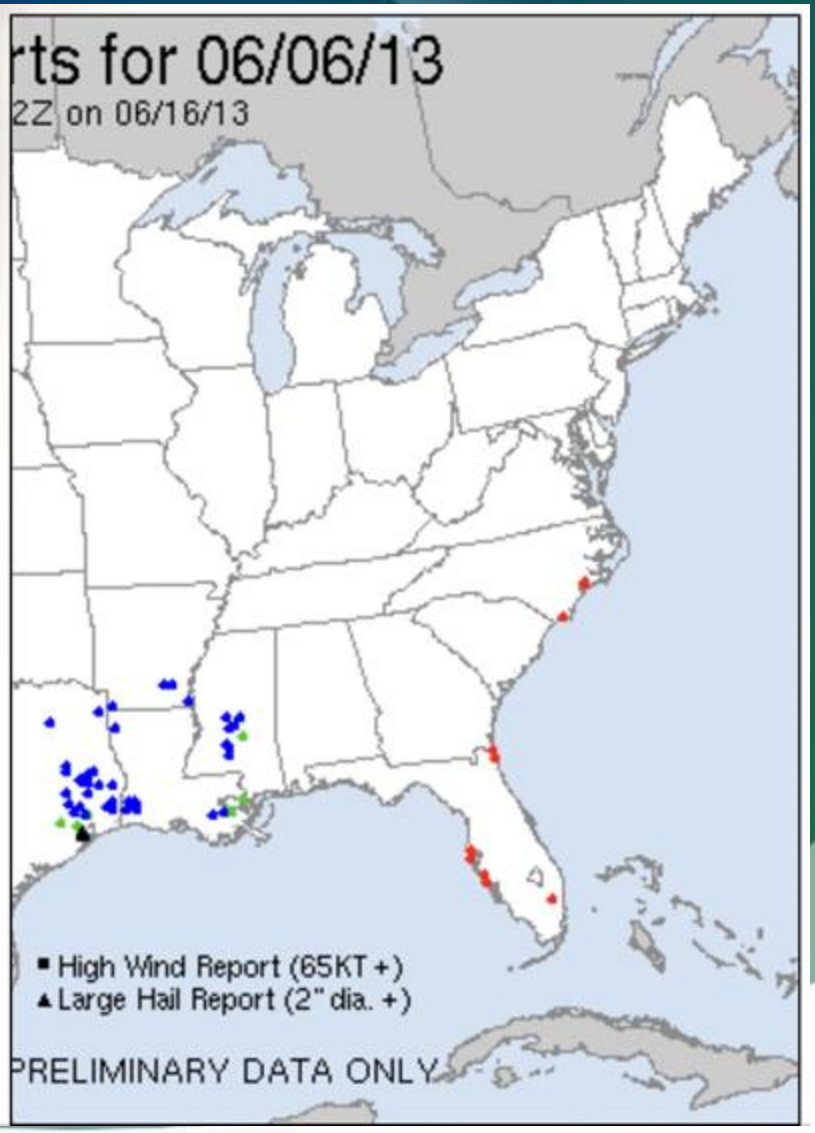
TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)



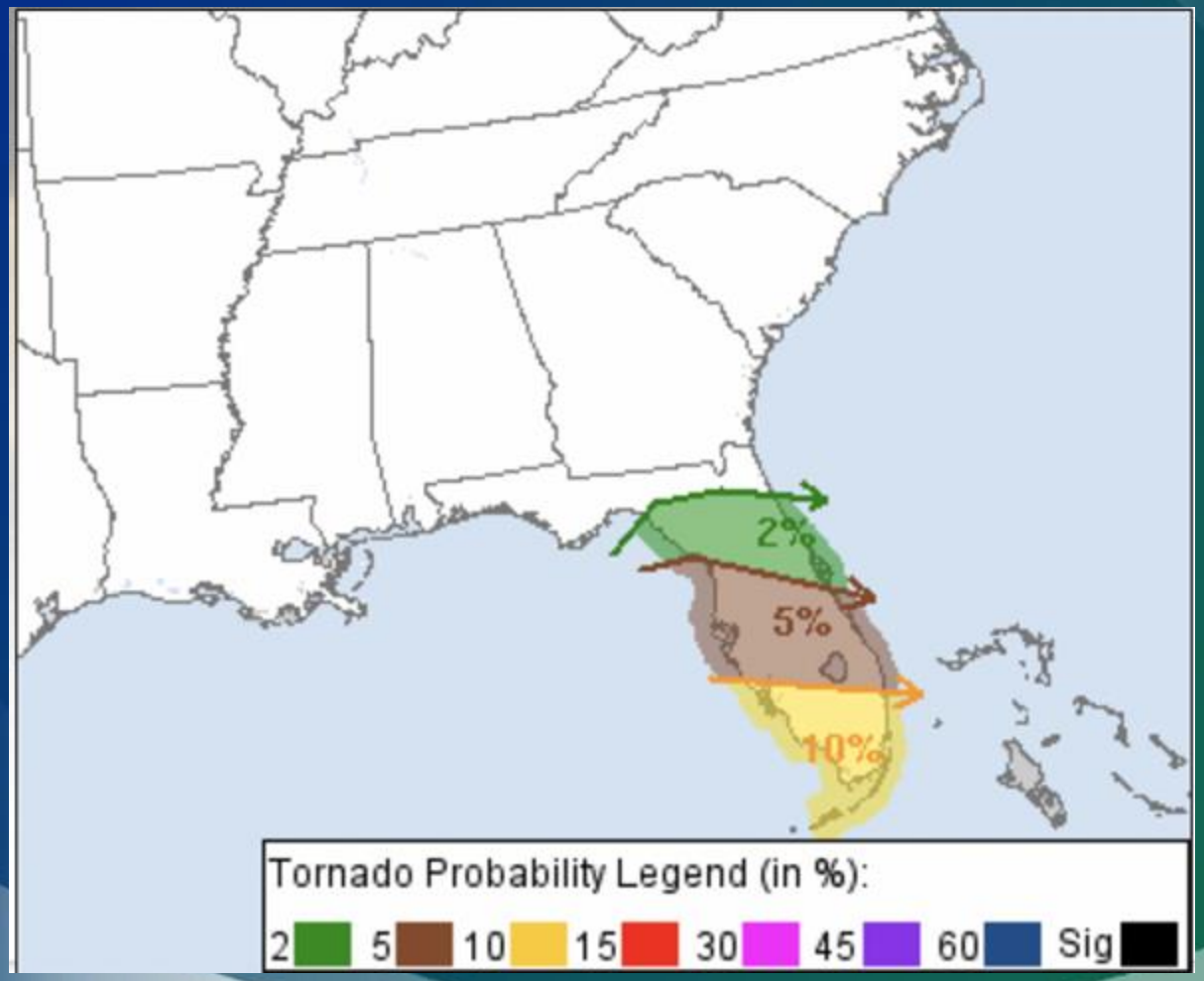
Dry air intrusion into the cyclonic flow envelope allowed for favorable breaks between convection and resulting potent/ non-overturned air to ingest into convective updrafts

TC TORNADO EXAMPLE CASES 1 (ANDREA 2013)





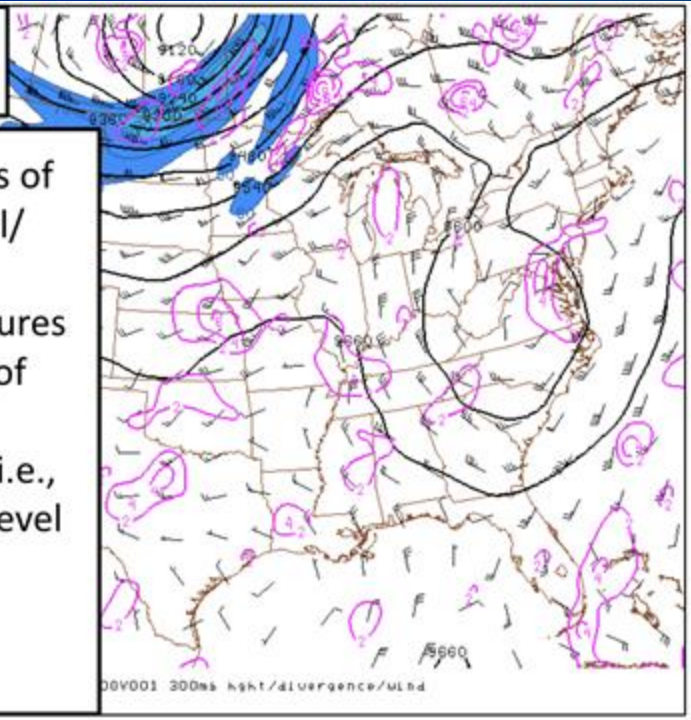
TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)



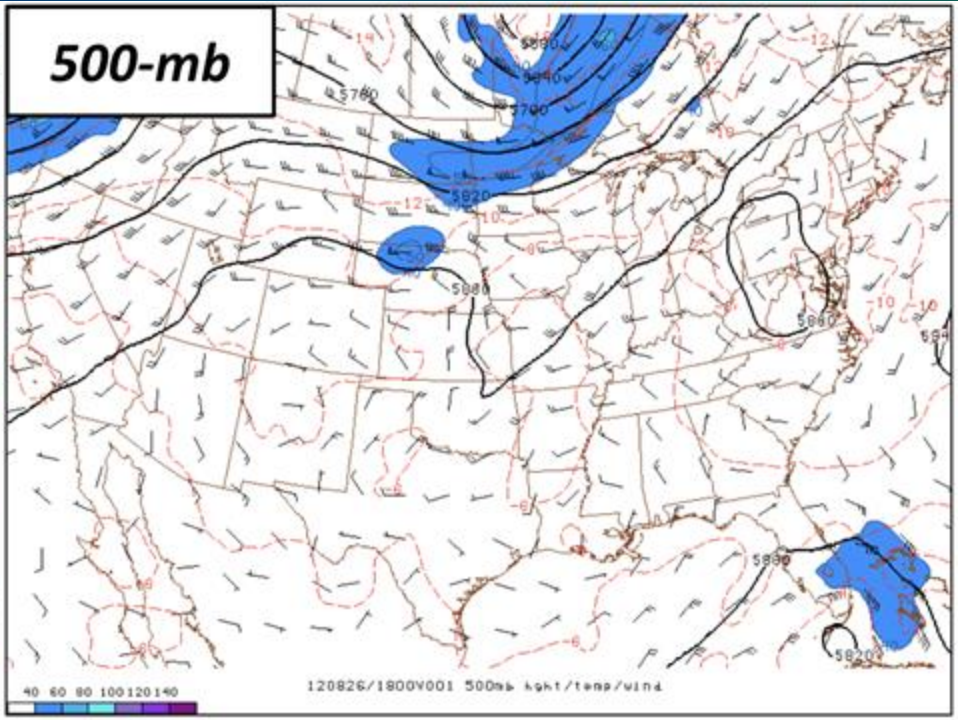
TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)

300-mb

-No indications of any substantial/ favorable baroclinic features in the vicinity of the TC environment (i.e., strong upper-level jet streaks, shortwave troughs, etc.)

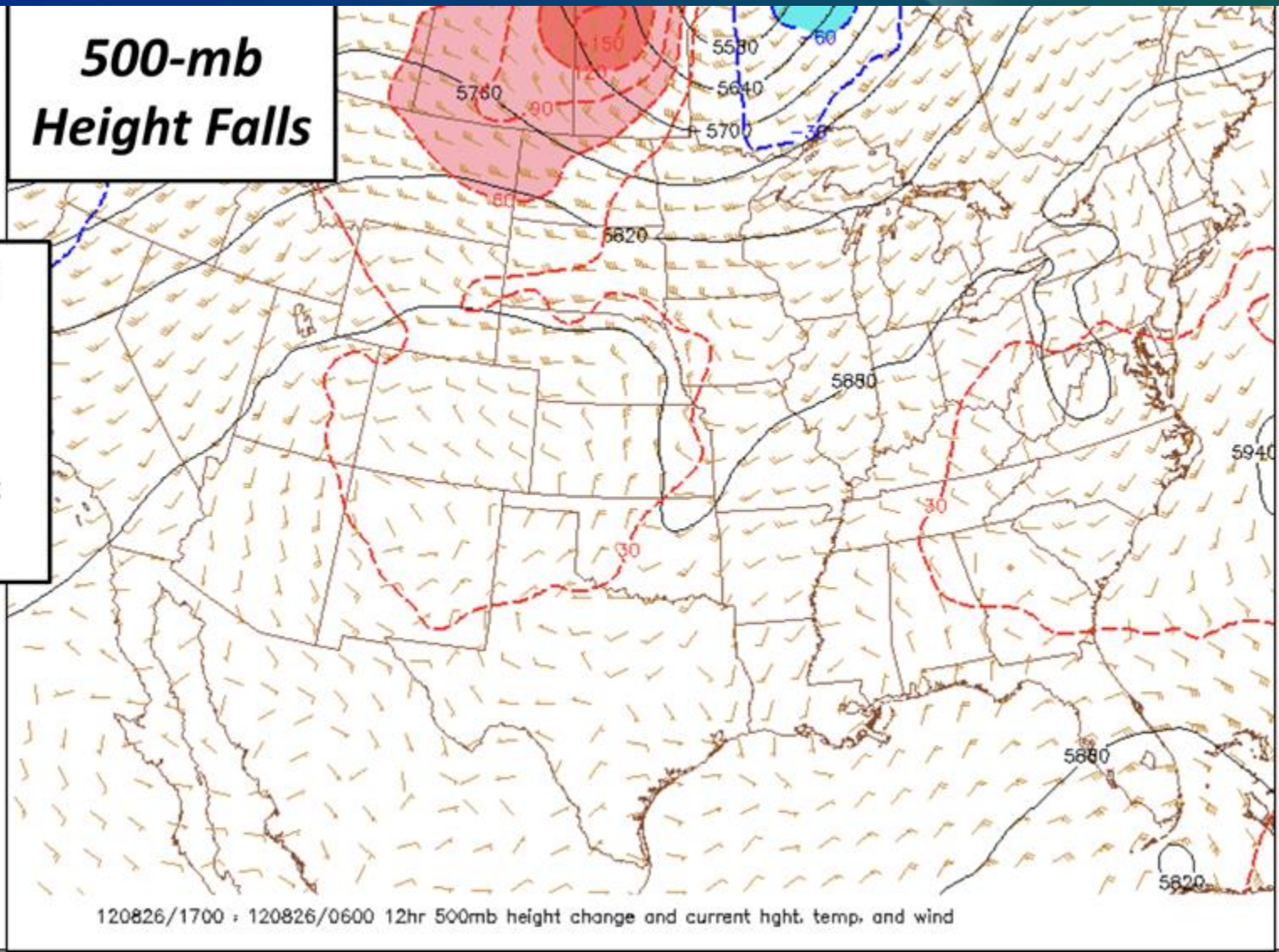


500-mb



TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)

-Lack of mid-level height falls corroborate previous notions (lack of baroclinic features)

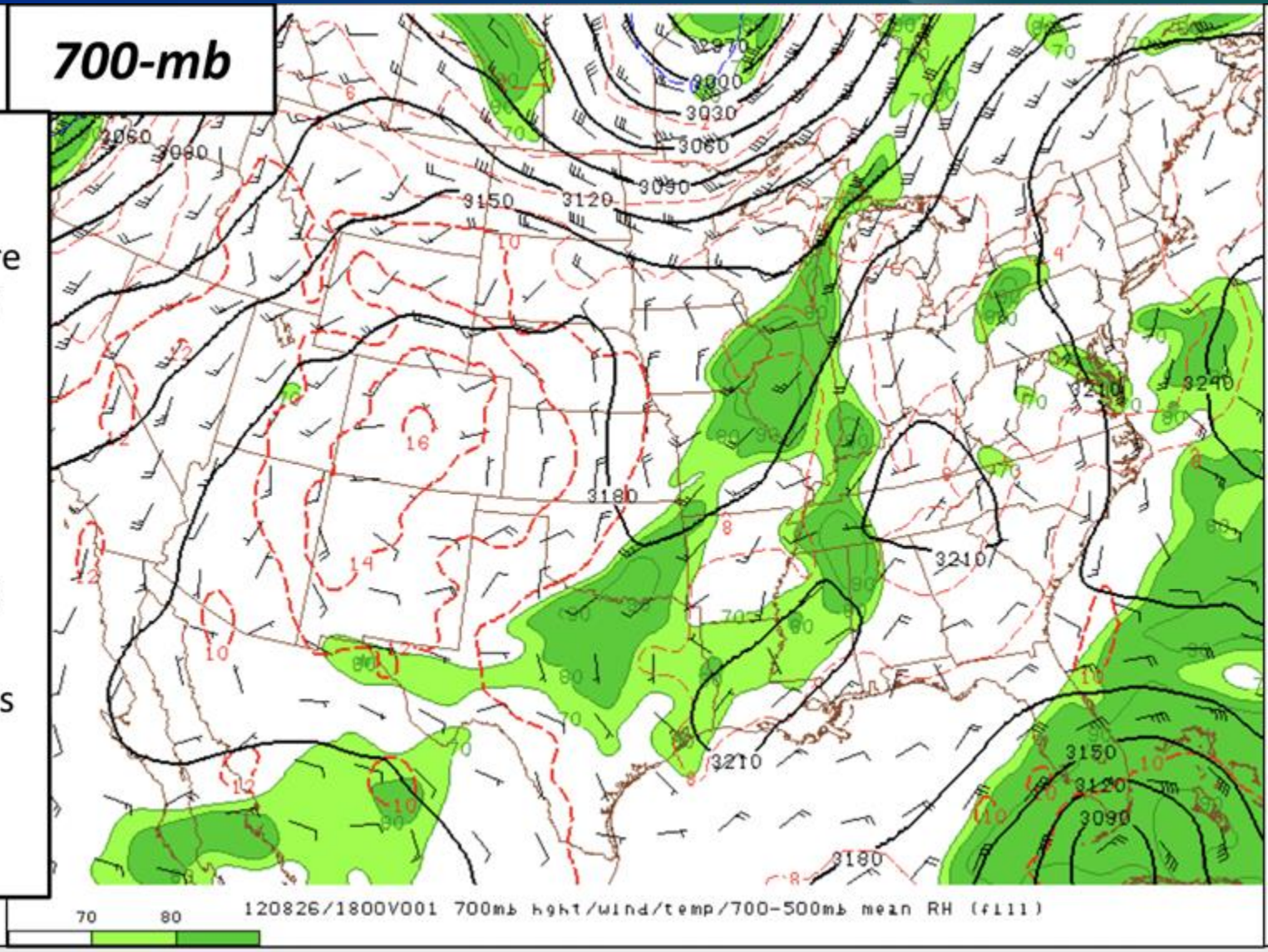


TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)

700-mb

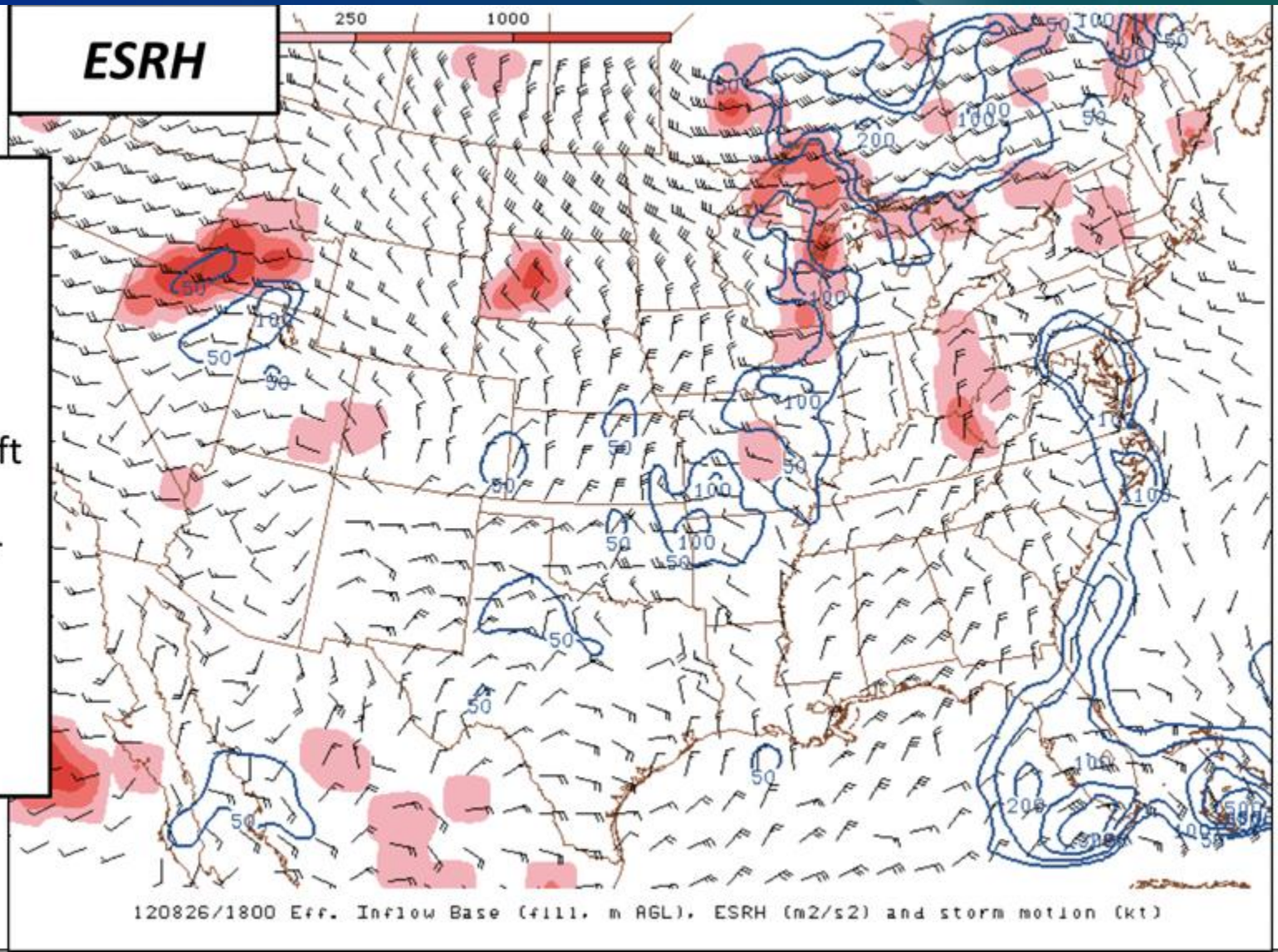
-Horizontal gradient in mid-level moisture is found over NW semicircle of cyclonic flow envelope

-Lack of baroclinic-related processes limits propensity for this dry air to cyclonically envelop the TC



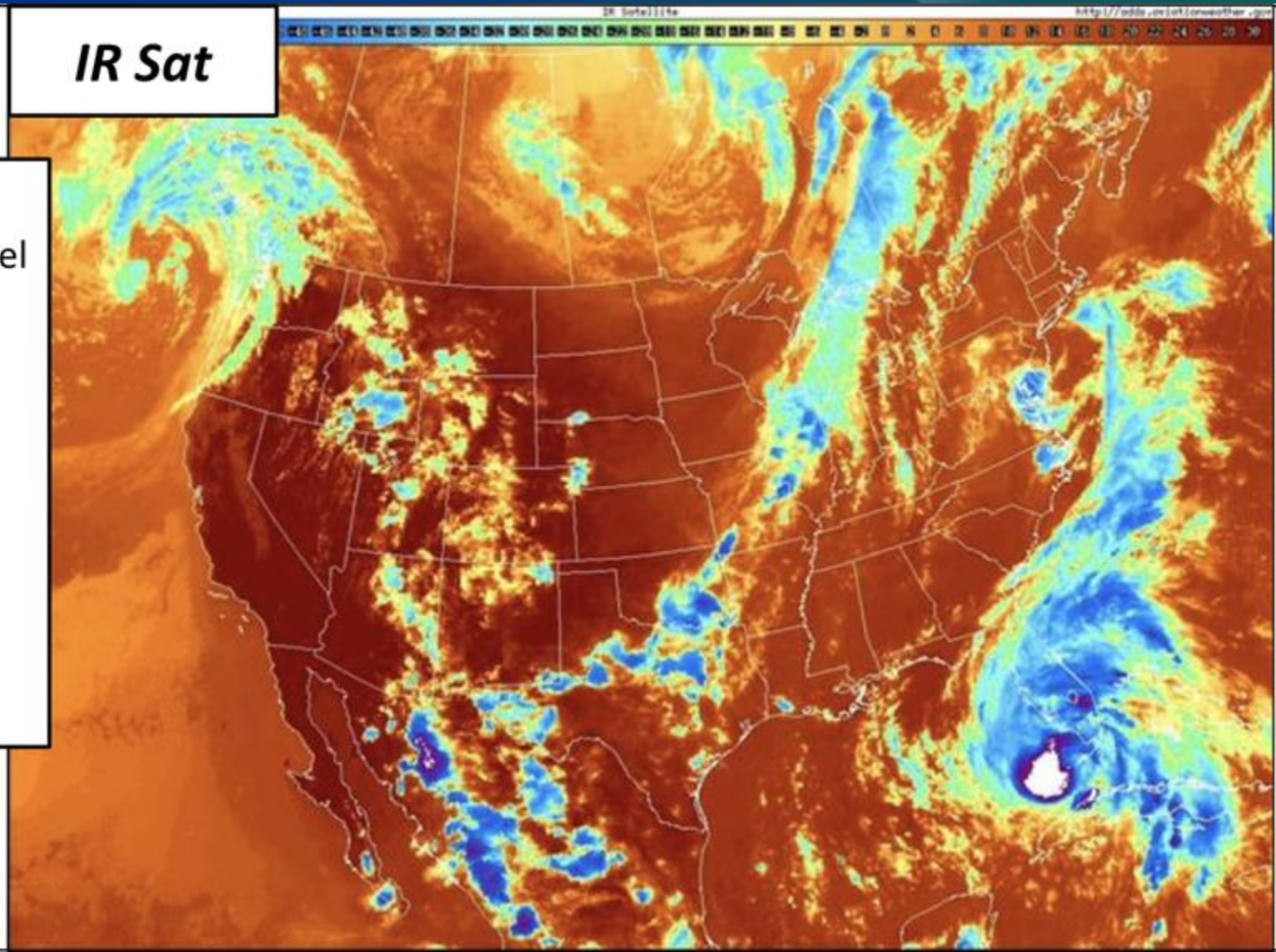
TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)

-Favorable environmental storm-relative helicity -- supportive of immediate updraft rotation -- owing to ingestion of air following helical trajectories into updrafts



TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)

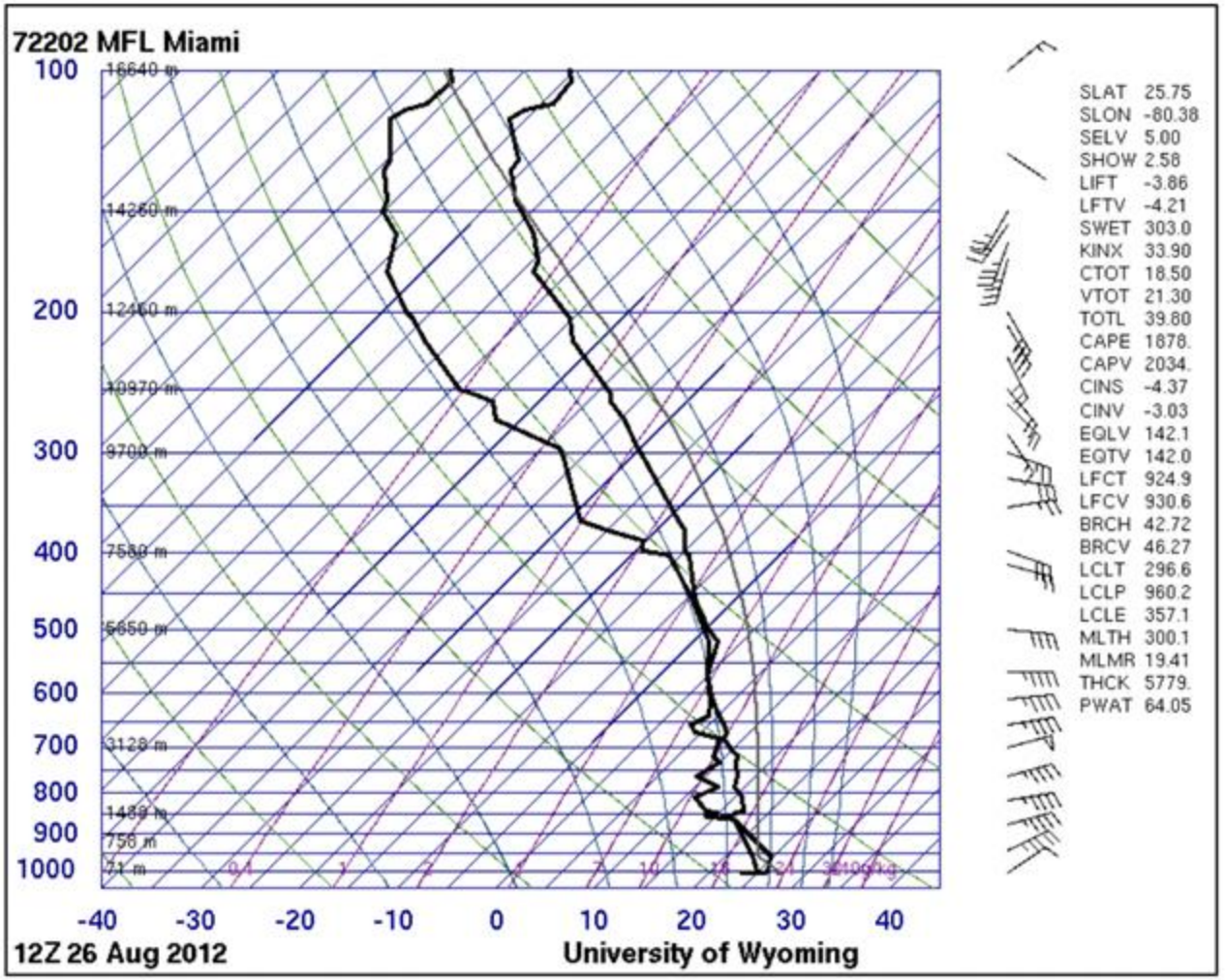
IR Sat



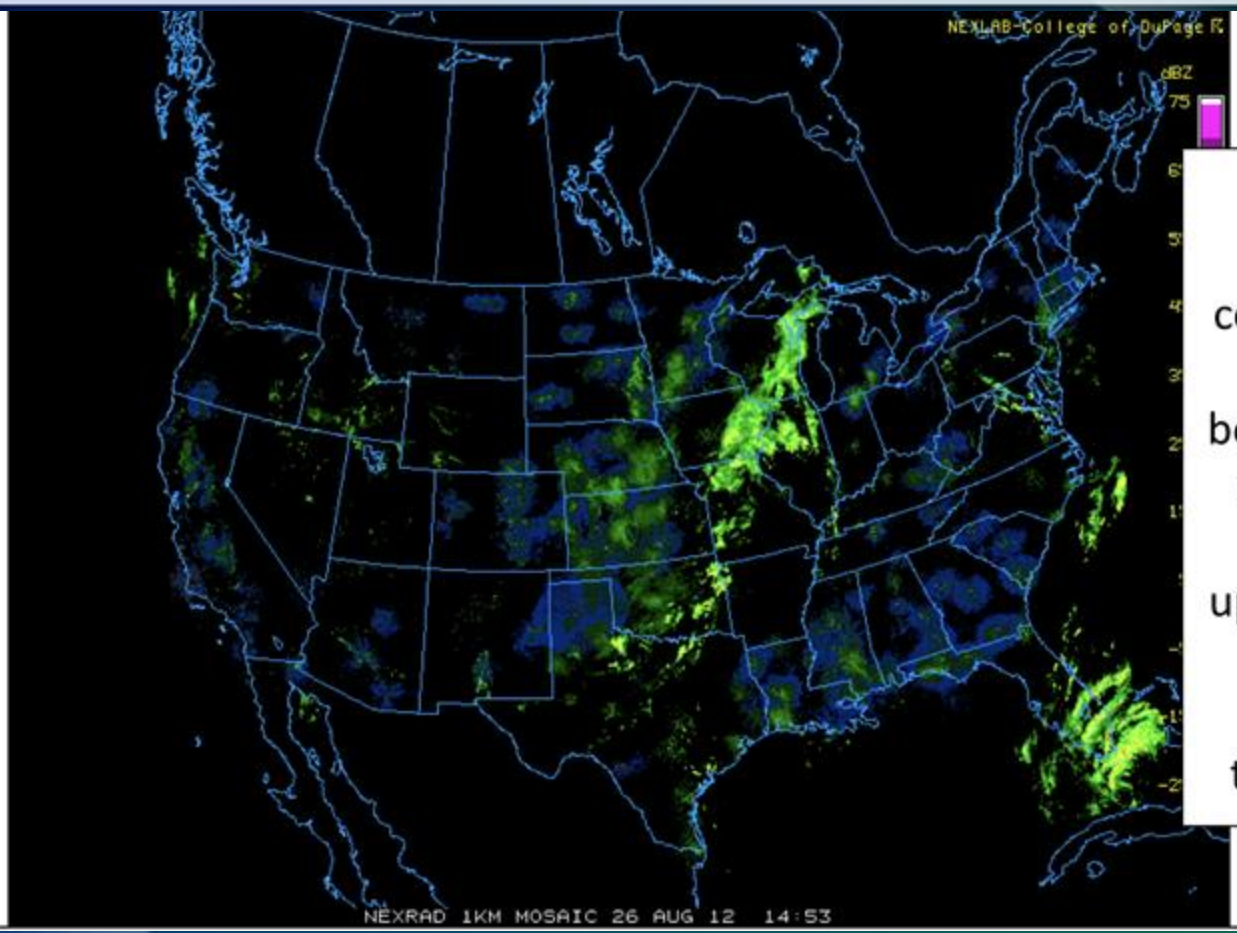
-No evidence of favorable mid-level dry air intrusions into the TC -- resulting in a generally unfavorable mesoscale environment for tornadogenesis

TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)

-Moist-adiabatic lapse rate environment with accompanying weak mid-level lapse rates -- no evidence of mid-level dry air intrusion into the moisture-rich TC environment

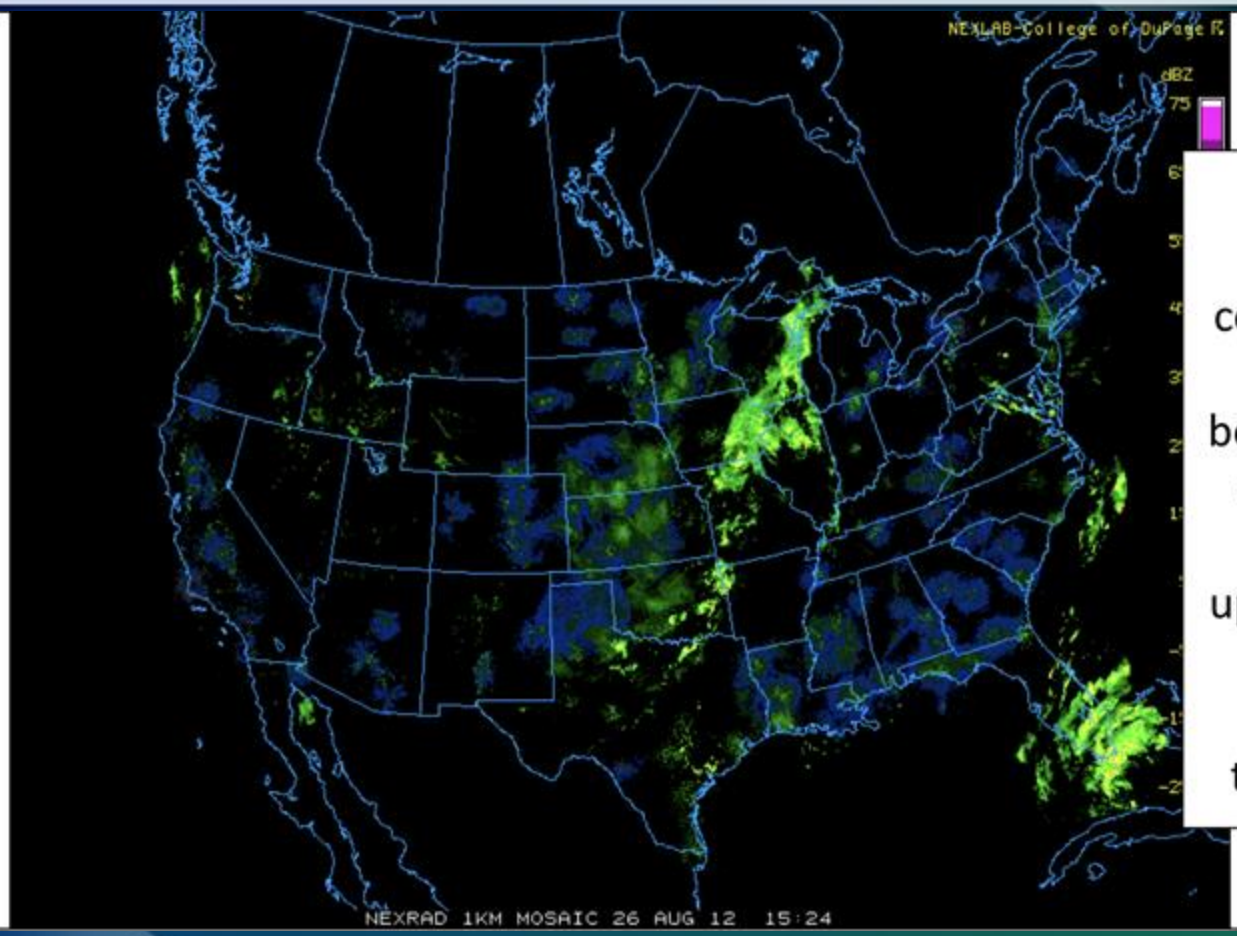


TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)



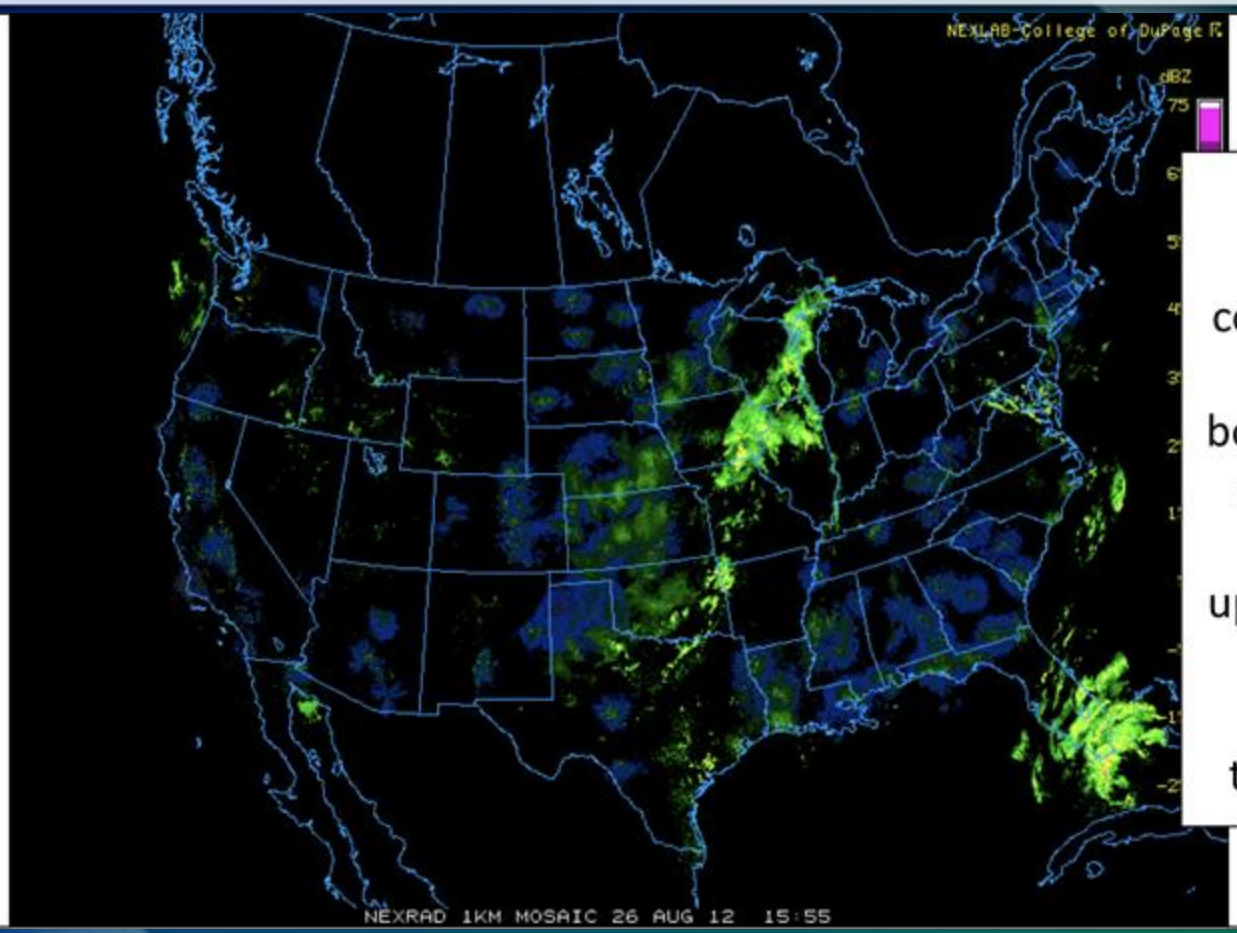
Large blob of continuous convection made it difficult for boundary layer to recover -- very little room for updrafts to ingest potent air supportive of tornadogenesis

TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)



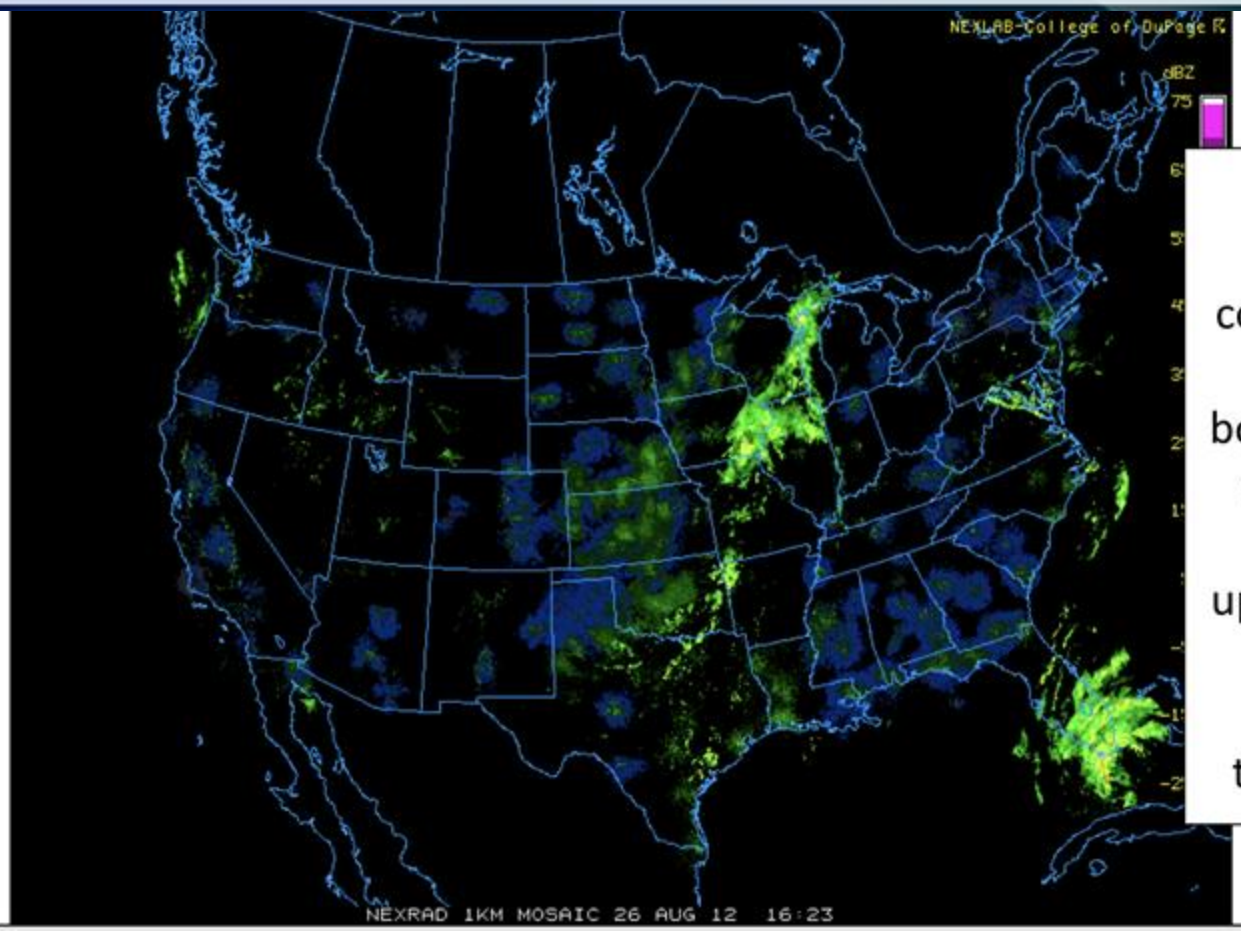
Large blob of continuous convection made it difficult for boundary layer to recover -- very little room for updrafts to ingest potent air supportive of tornadogenesis

TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)



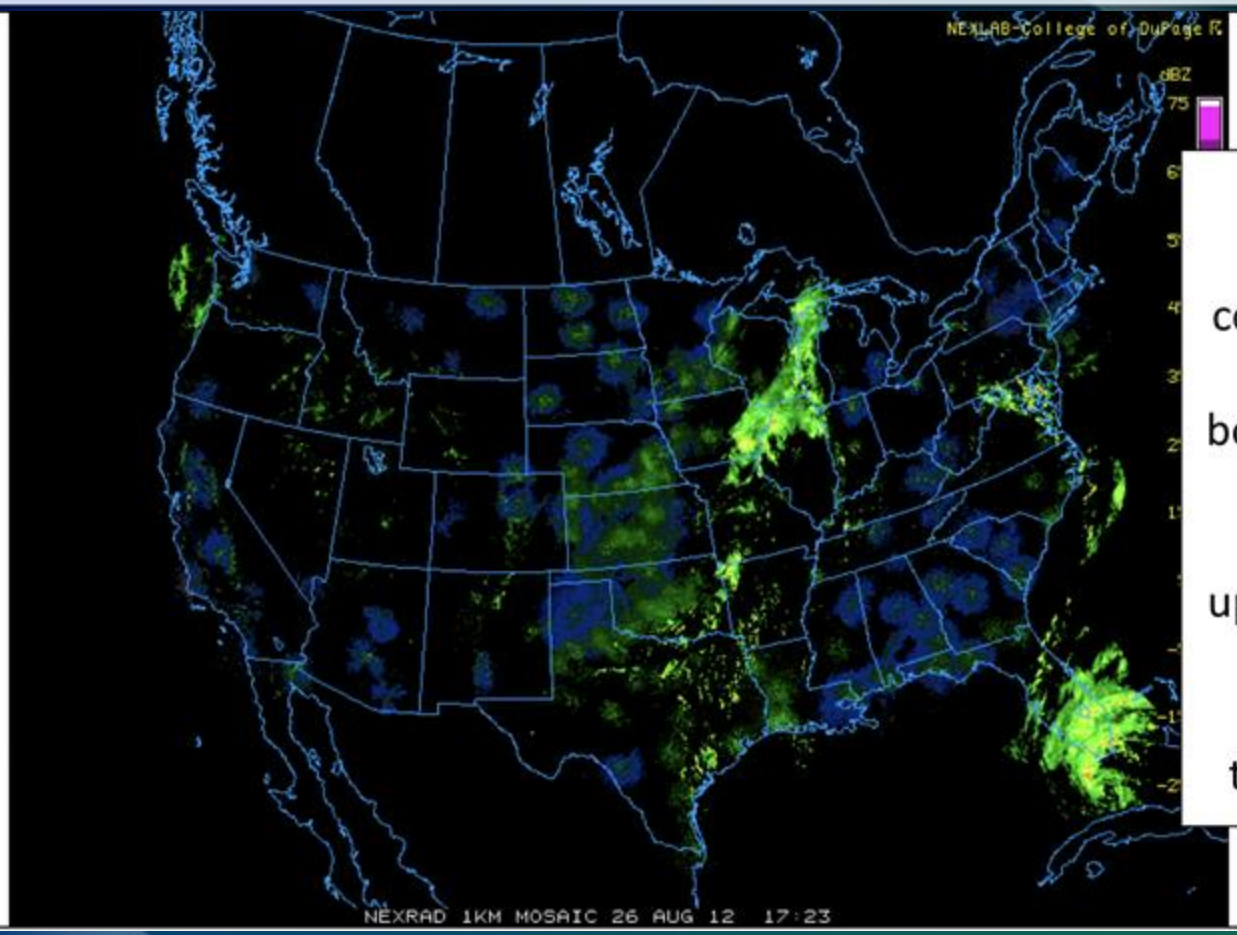
Large blob of continuous convection made it difficult for boundary layer to recover -- very little room for updrafts to ingest potent air supportive of tornadogenesis

TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)



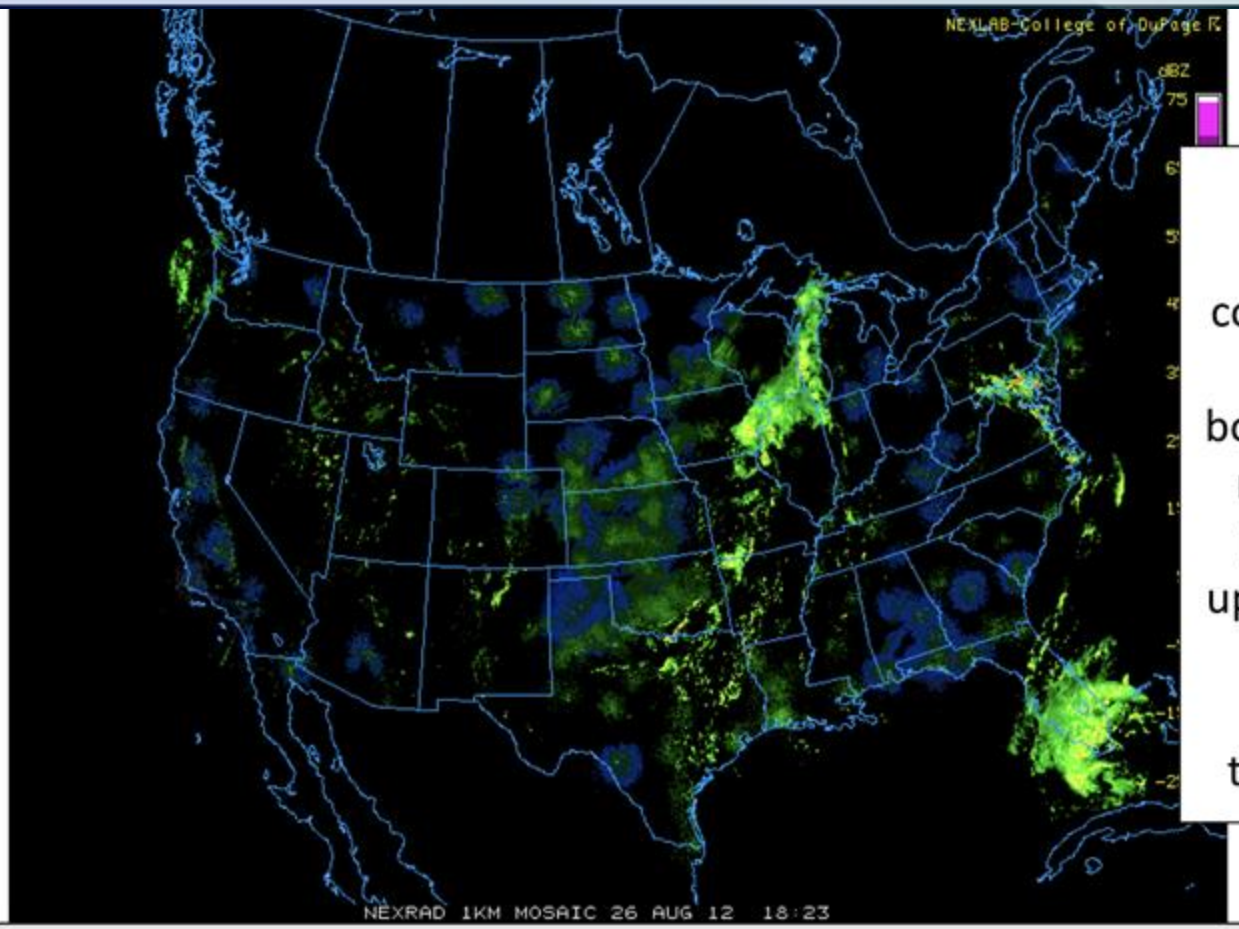
Large blob of continuous convection made it difficult for boundary layer to recover -- very little room for updrafts to ingest potent air supportive of tornadogenesis

TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)



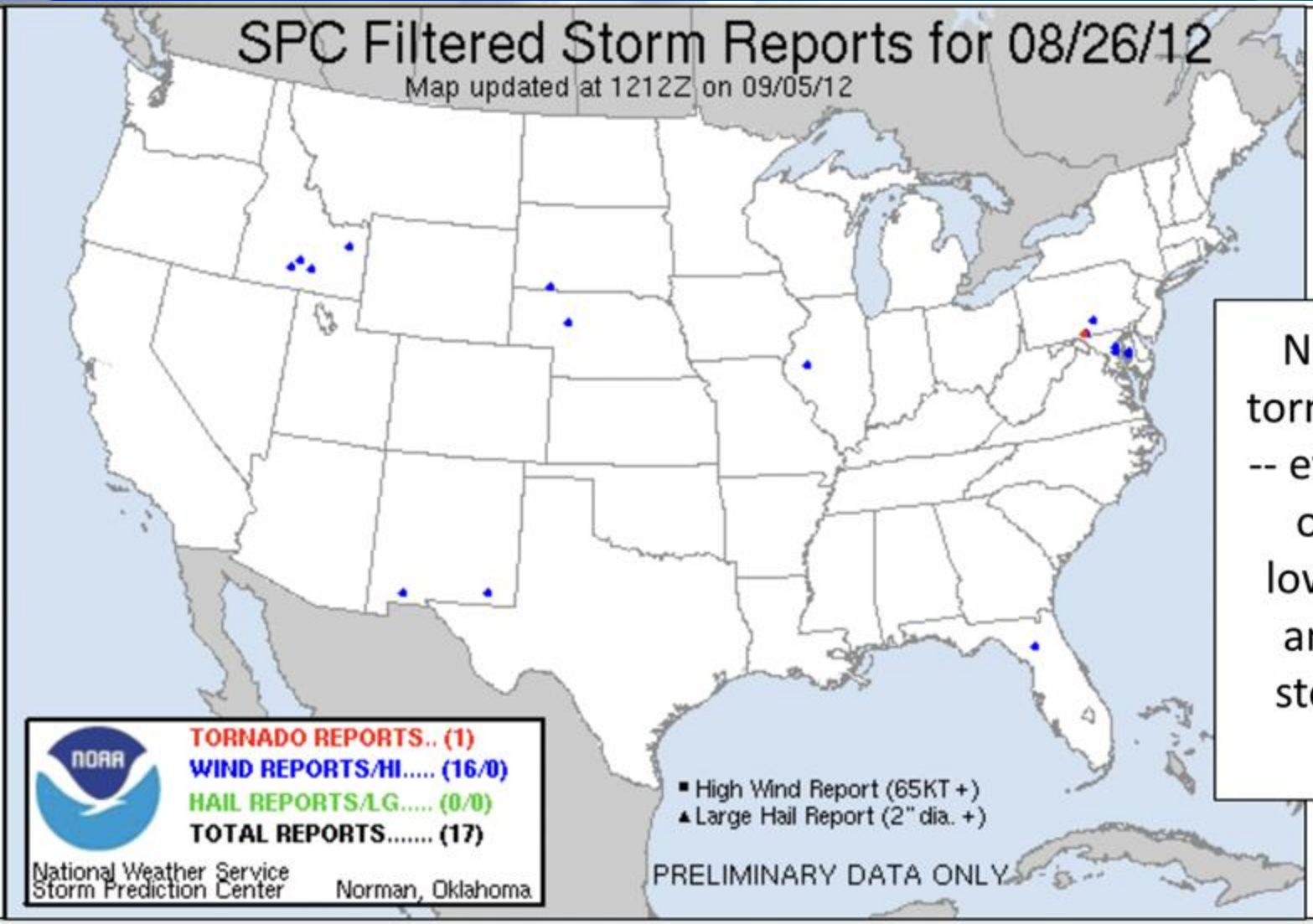
Large blob of continuous convection made it difficult for boundary layer to recover -- very little room for updrafts to ingest potent air supportive of tornadogenesis

TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)



Large blob of continuous convection made it difficult for boundary layer to recover -- very little room for updrafts to ingest potent air supportive of tornadogenesis

TC TORNADO EXAMPLE CASES 2 (ISAAC 2012)

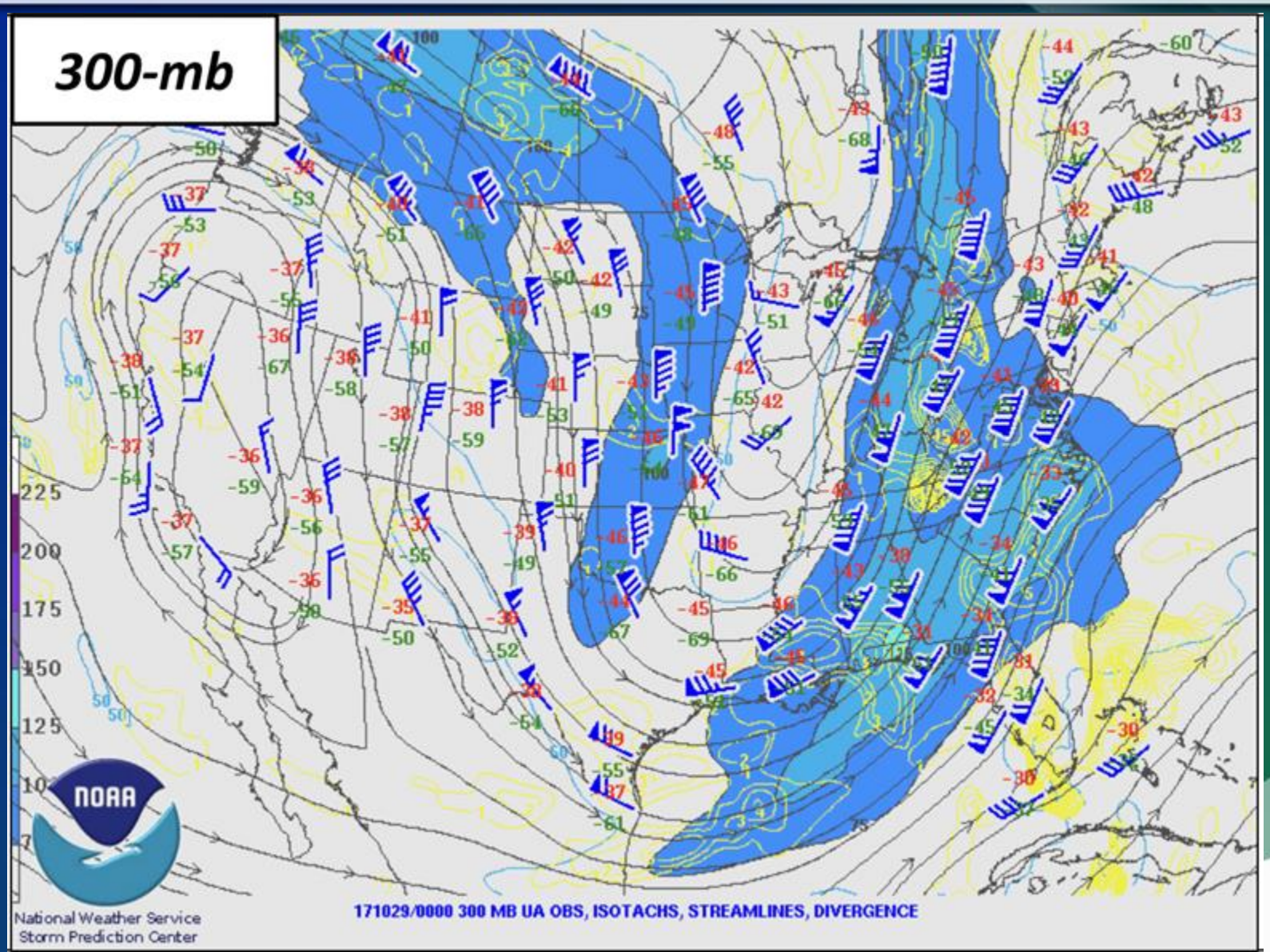


No reports of tornadoes in S FL -- even with tons of favorable low-level shear and resultant storm-relative helicity

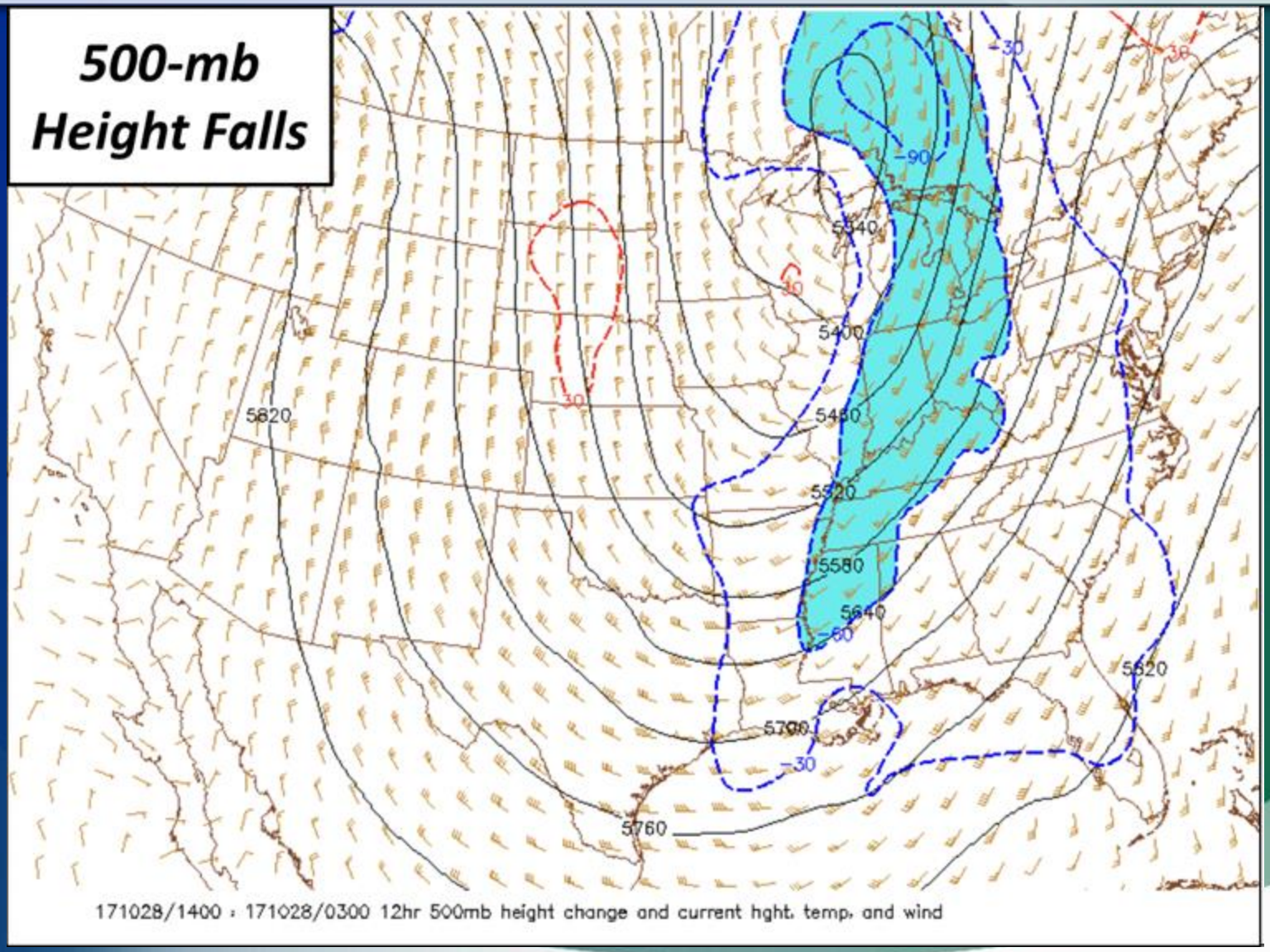
TC TORNADO EXAMPLE CASES 3 (NOW YOU TRY!)

Now you try! Does **Case 3** depict a favorable or unfavorable synoptic environment
for TC tornadoes?

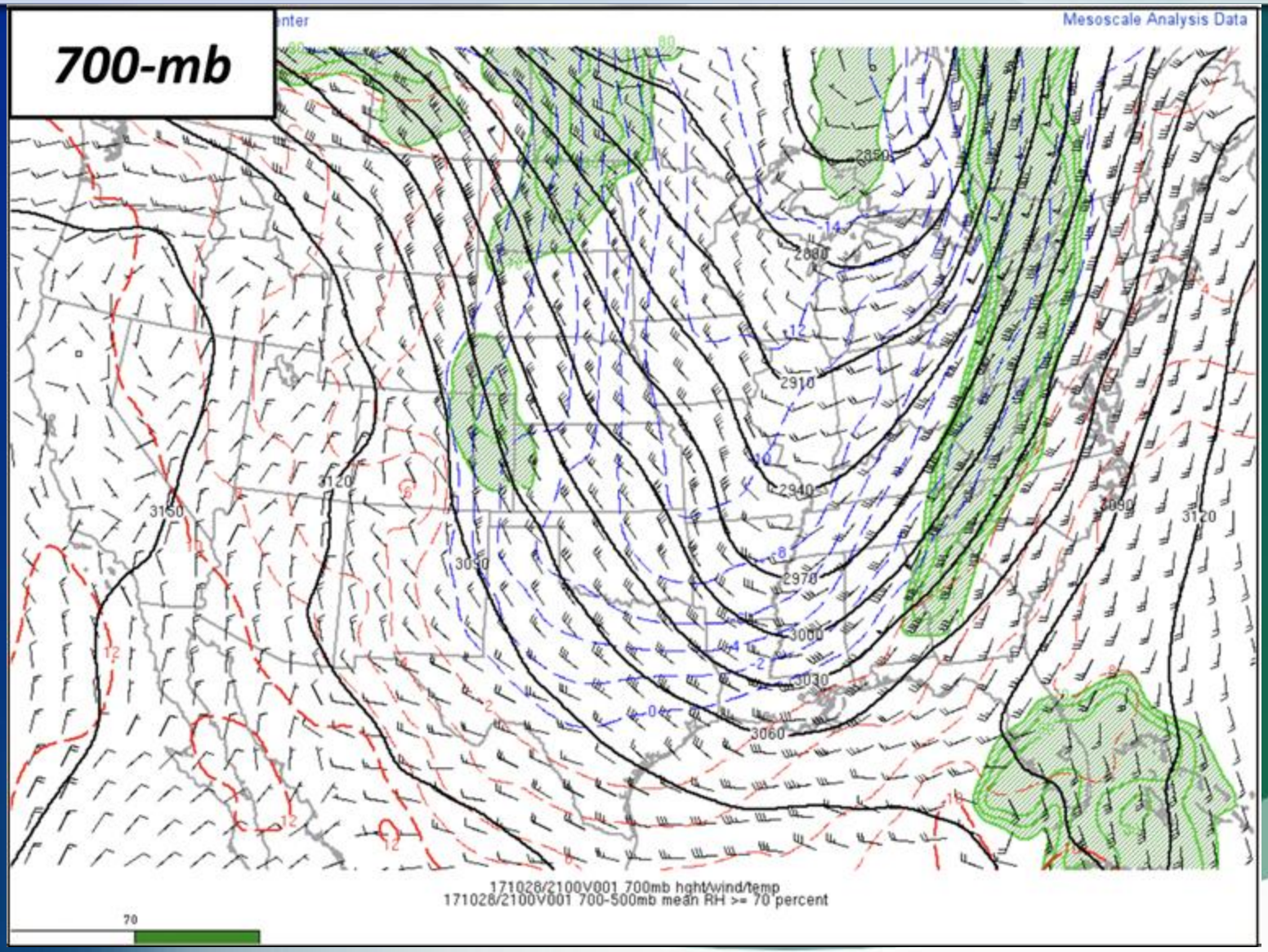
TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



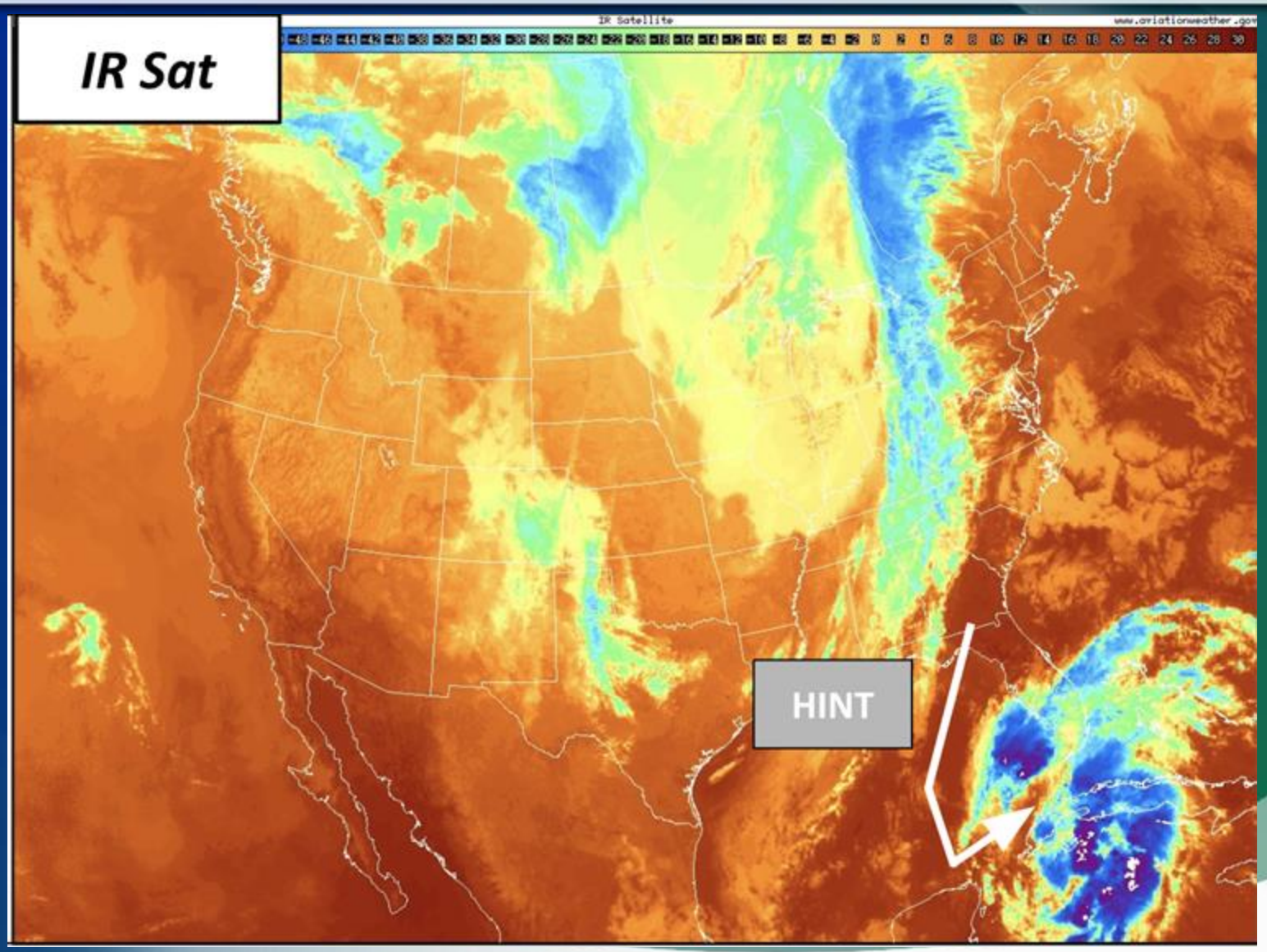
TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



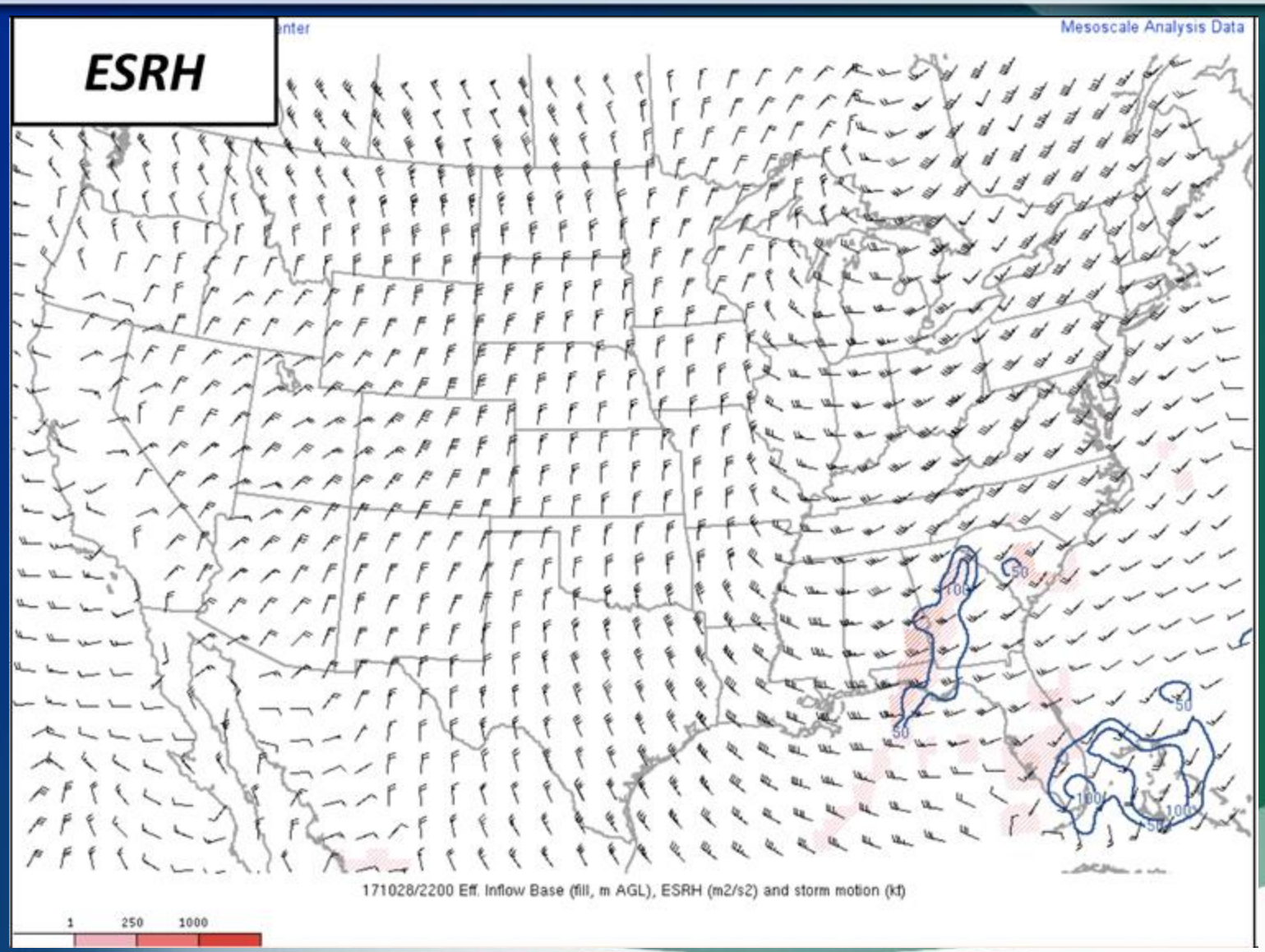
TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



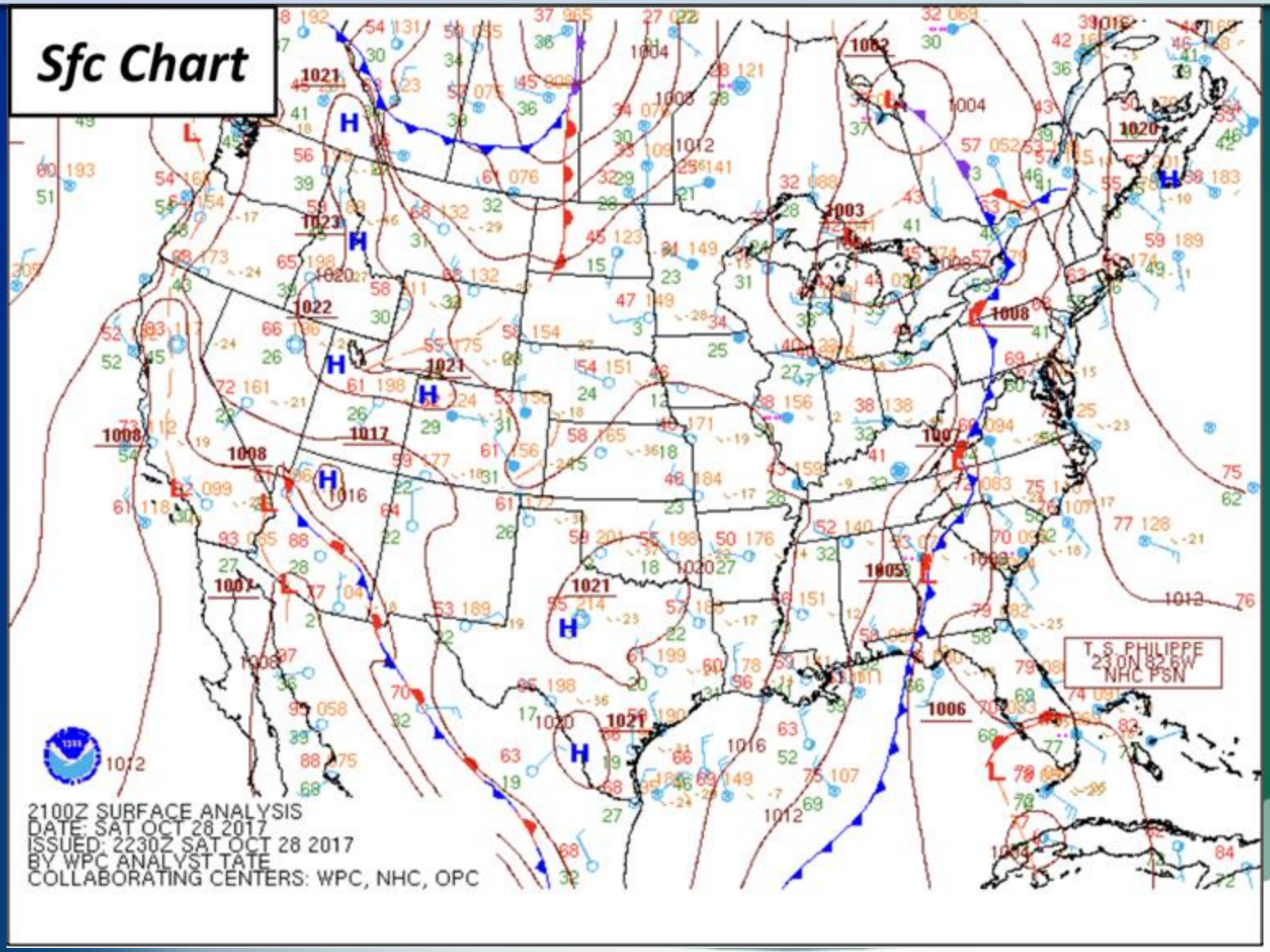
TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



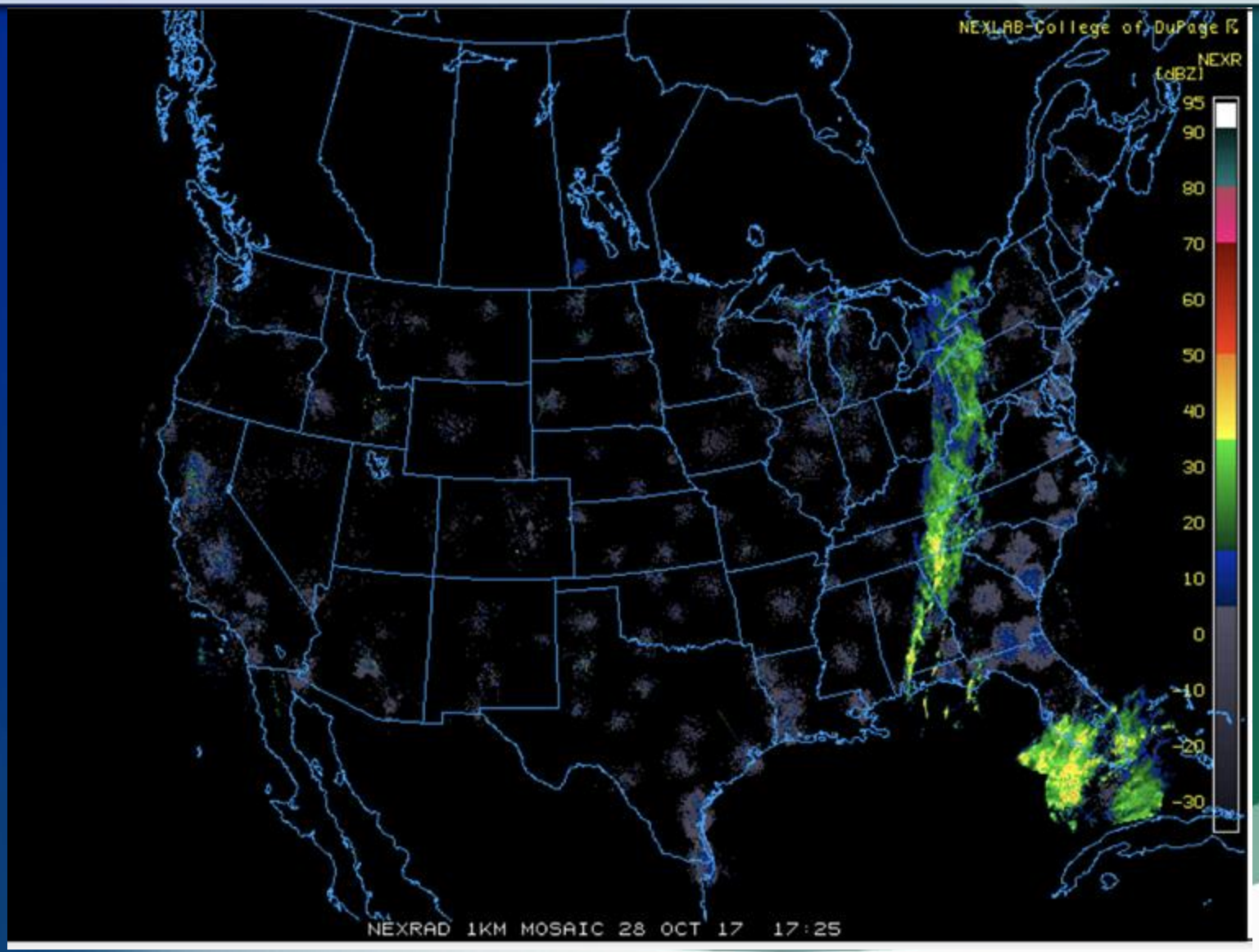
TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



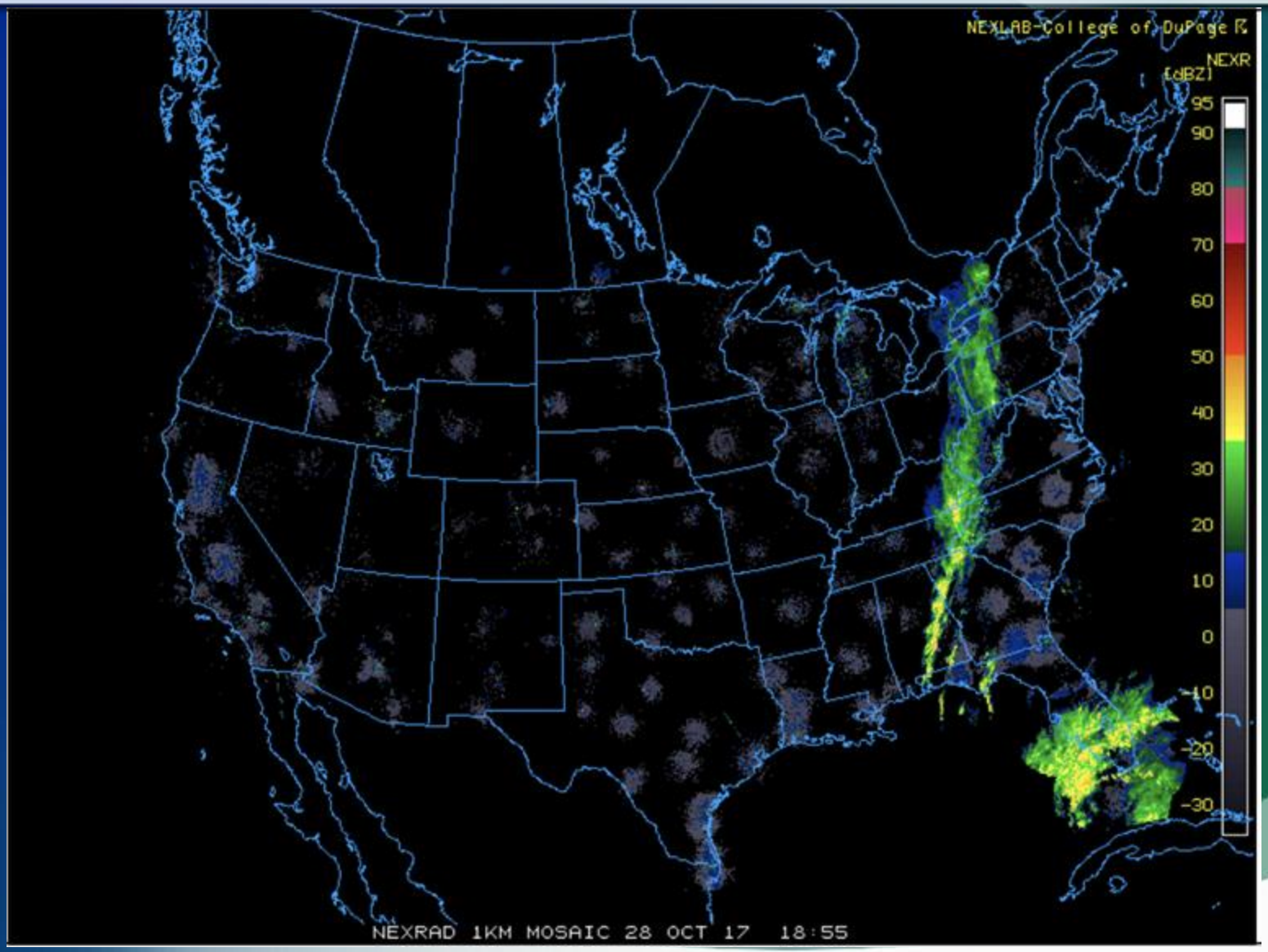
TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



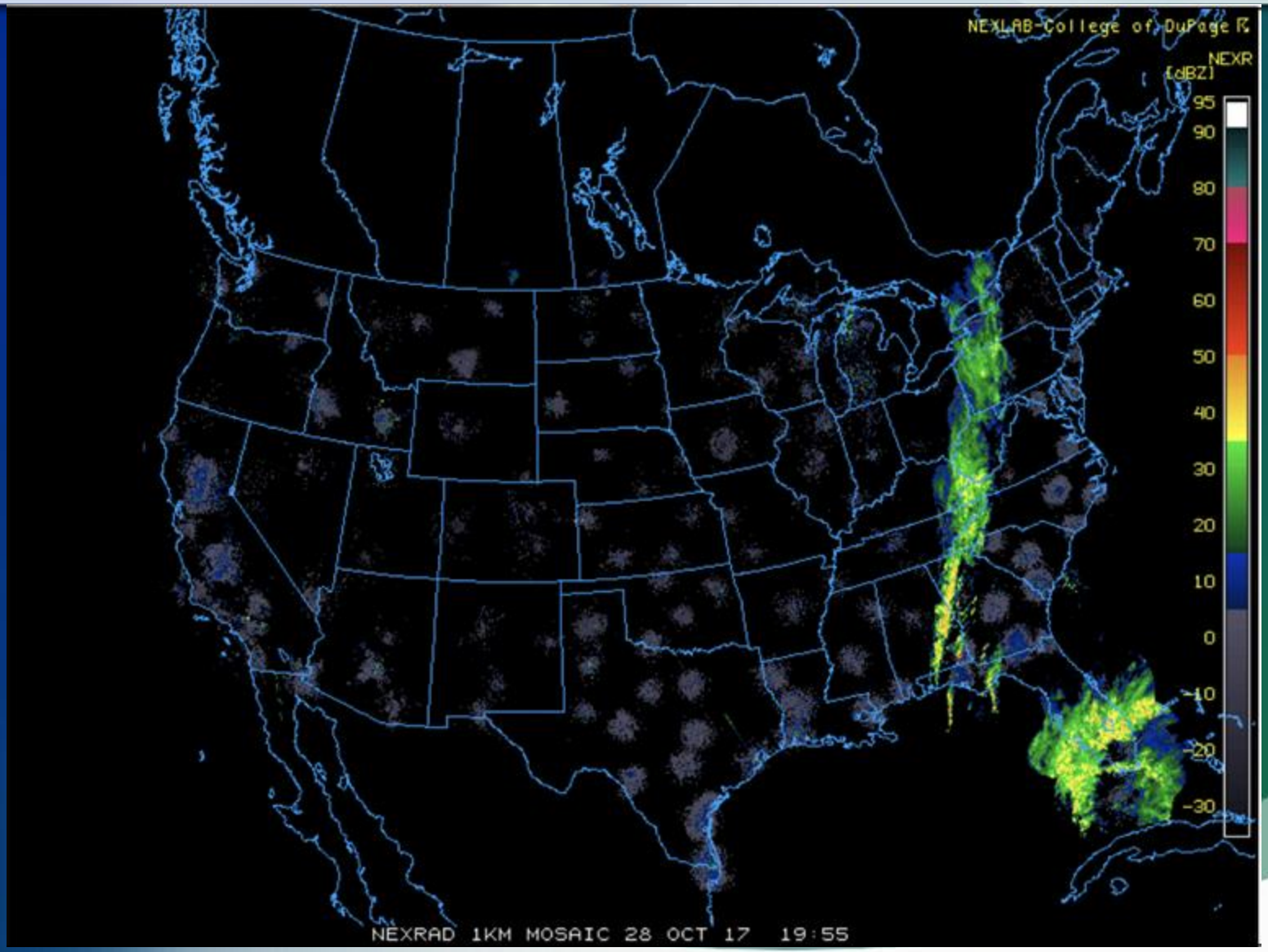
TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



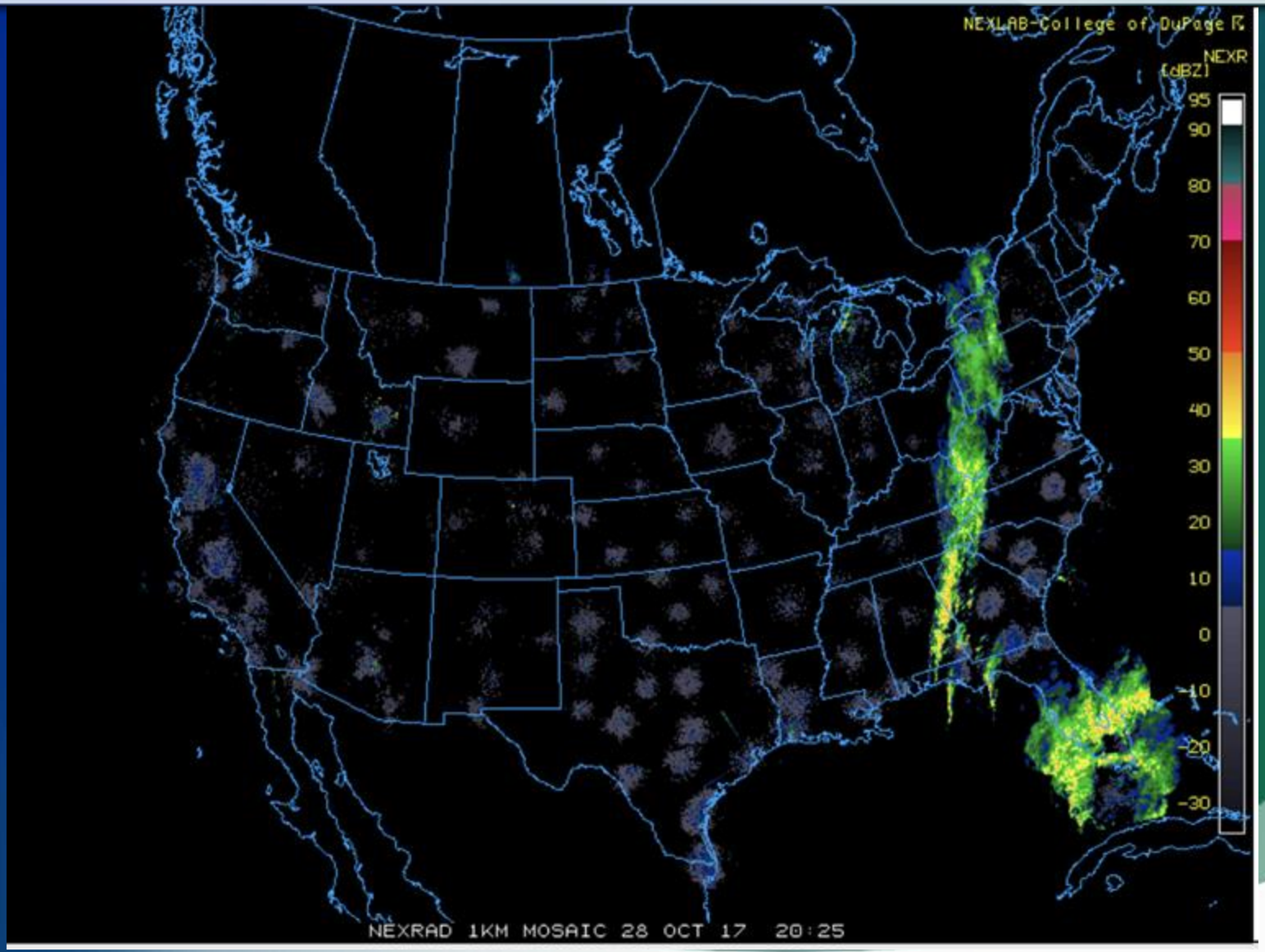
TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



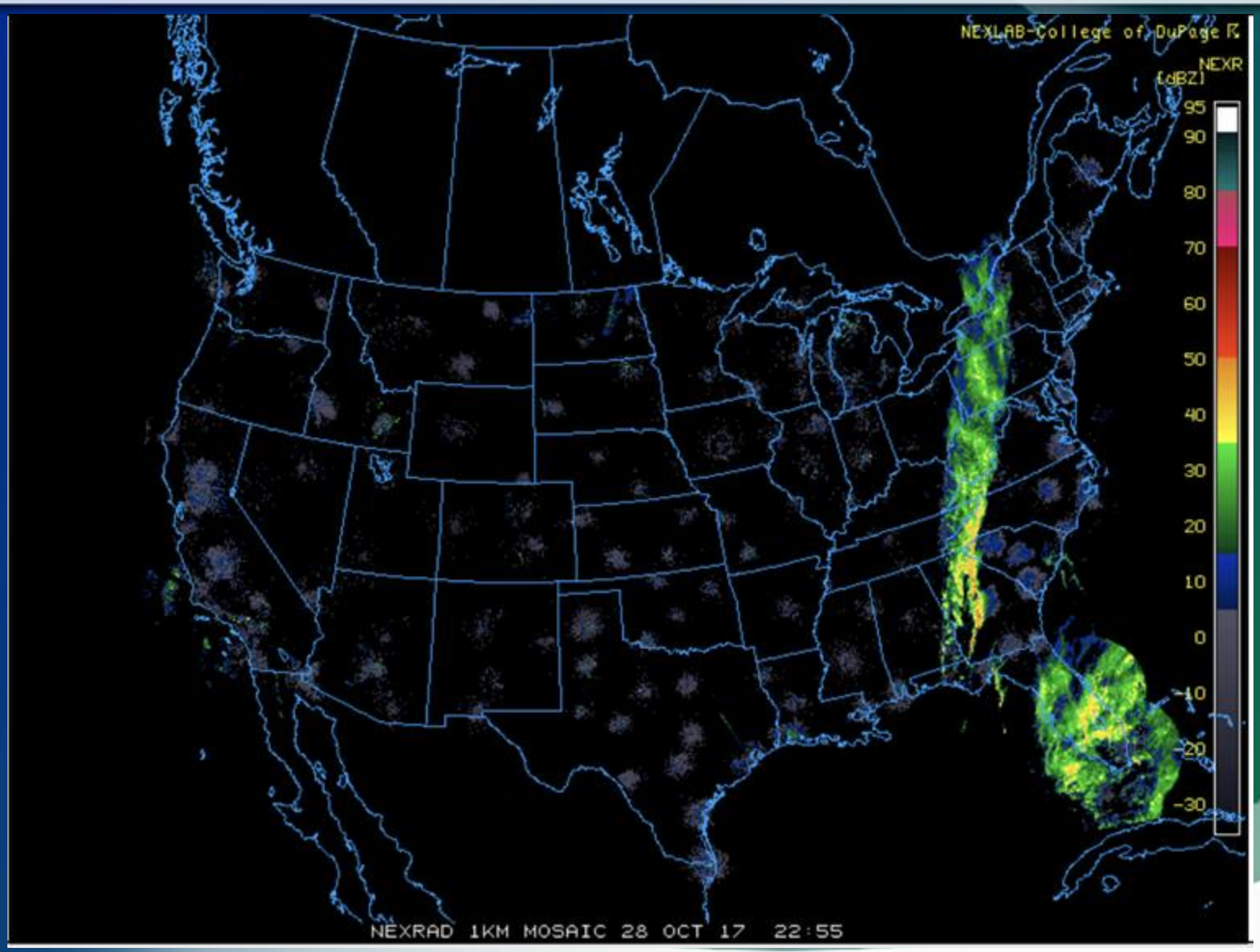
TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



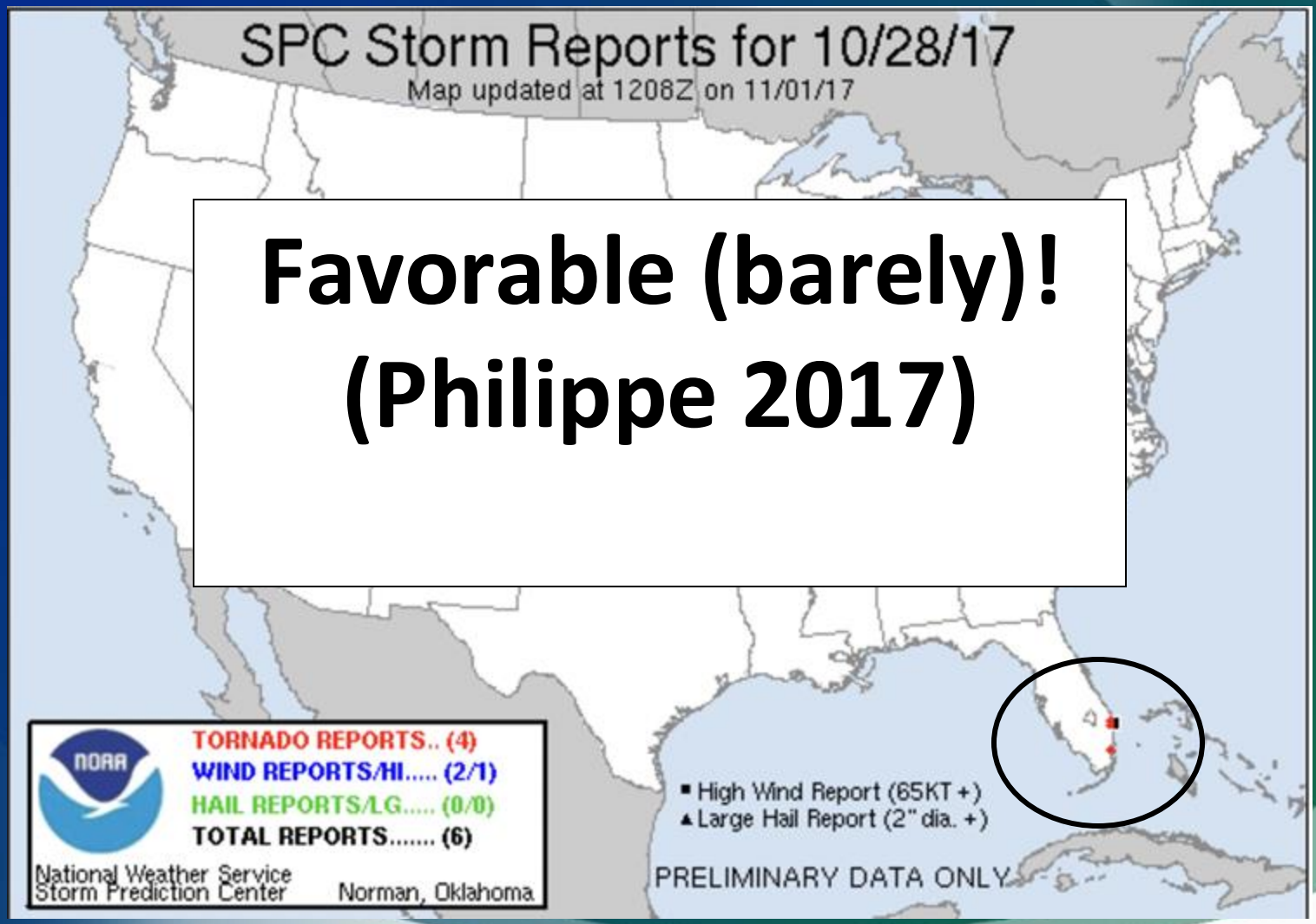
TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



TC TORNADO EXAMPLE CASES 3 (FAVORABLE OR UNFAVORABLE?)



DATABASE and DOCUMENTATION ONLINE:

www.spc.noaa.gov/publications

Contact: Harry.Weinman@noaa.gov
Tornado.Specialist@gmail.com