

Conveyor Belts, Poisonous Tails, and Sting Jets, Oh My!

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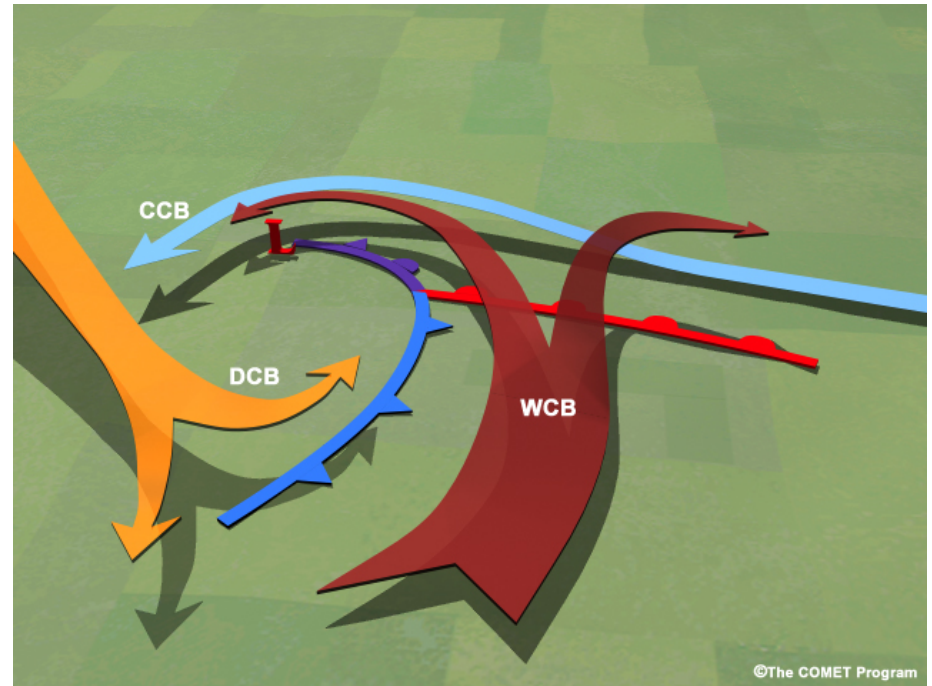
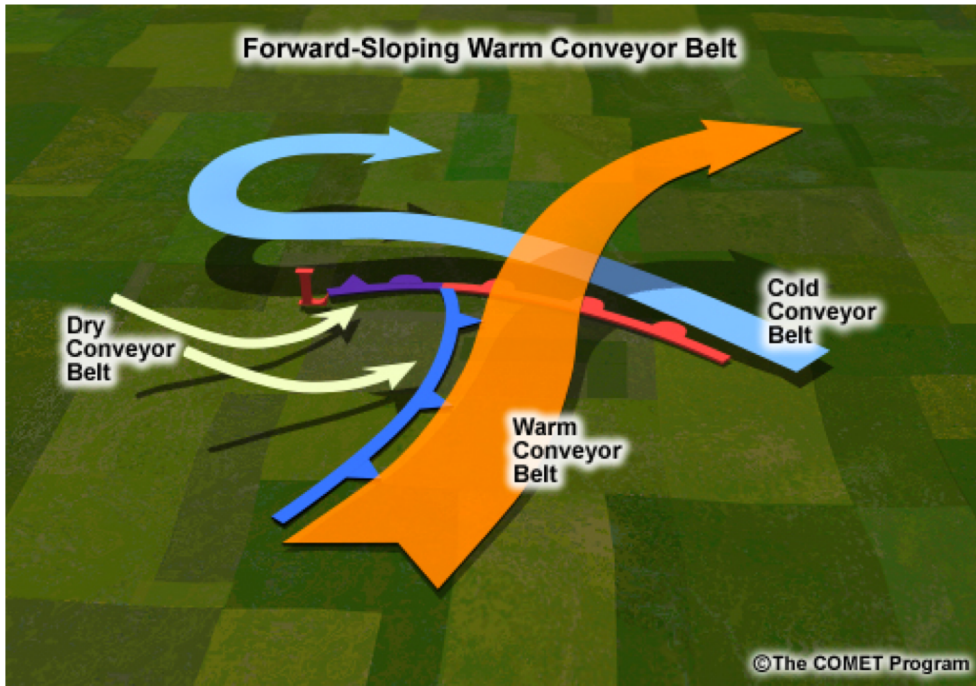
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Supplemental Reading: Schultz and Browning (2017)

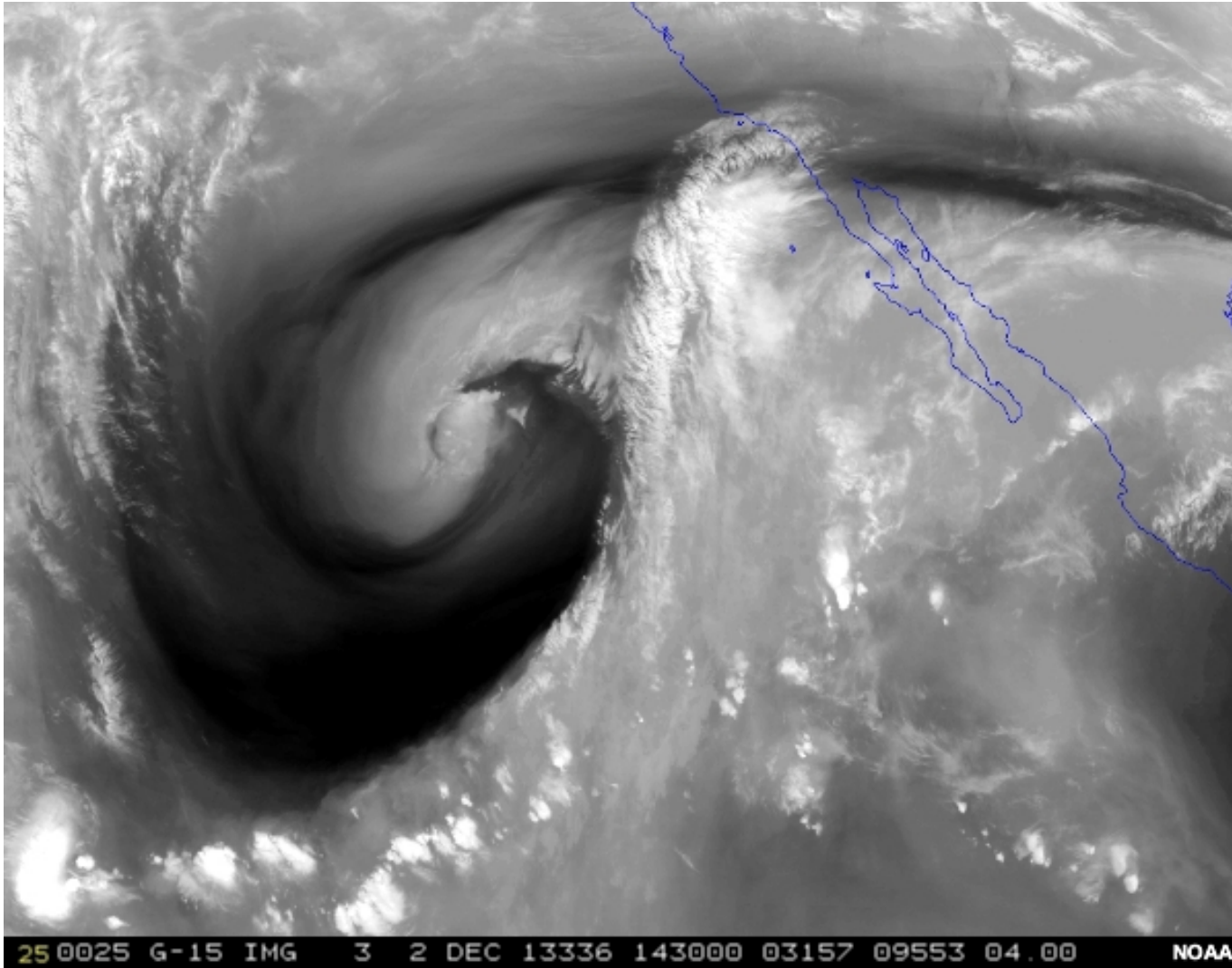
Conveyor Belts

- Simple depictions of the airflow associated with midlatitude frontal cyclones
- Warm Conveyor Belt – A coherent airstream originating in the warm sector that moves poleward, rises vigorously over the warm-frontal zone, and turns anticyclonically or fans out at upper levels
- Cold Conveyor Belt – A coherent airstream that moves toward the low center poleward of the occluded and warm fronts and splits into two branches, one that turns anticyclonically, ascends, and forms the comma cloud head, the other that wraps cyclonically around the low center, contributing to strong winds along the bent-back front
 - Anticyclonic branch may be thought of as a transition airstream between the cyclonic cold conveyor belt branch and the warm conveyor belt
- Dry Airstream – A coherent mid-level airstream of descended origin that forms the dry slot

Conveyor Belts



Class Activity

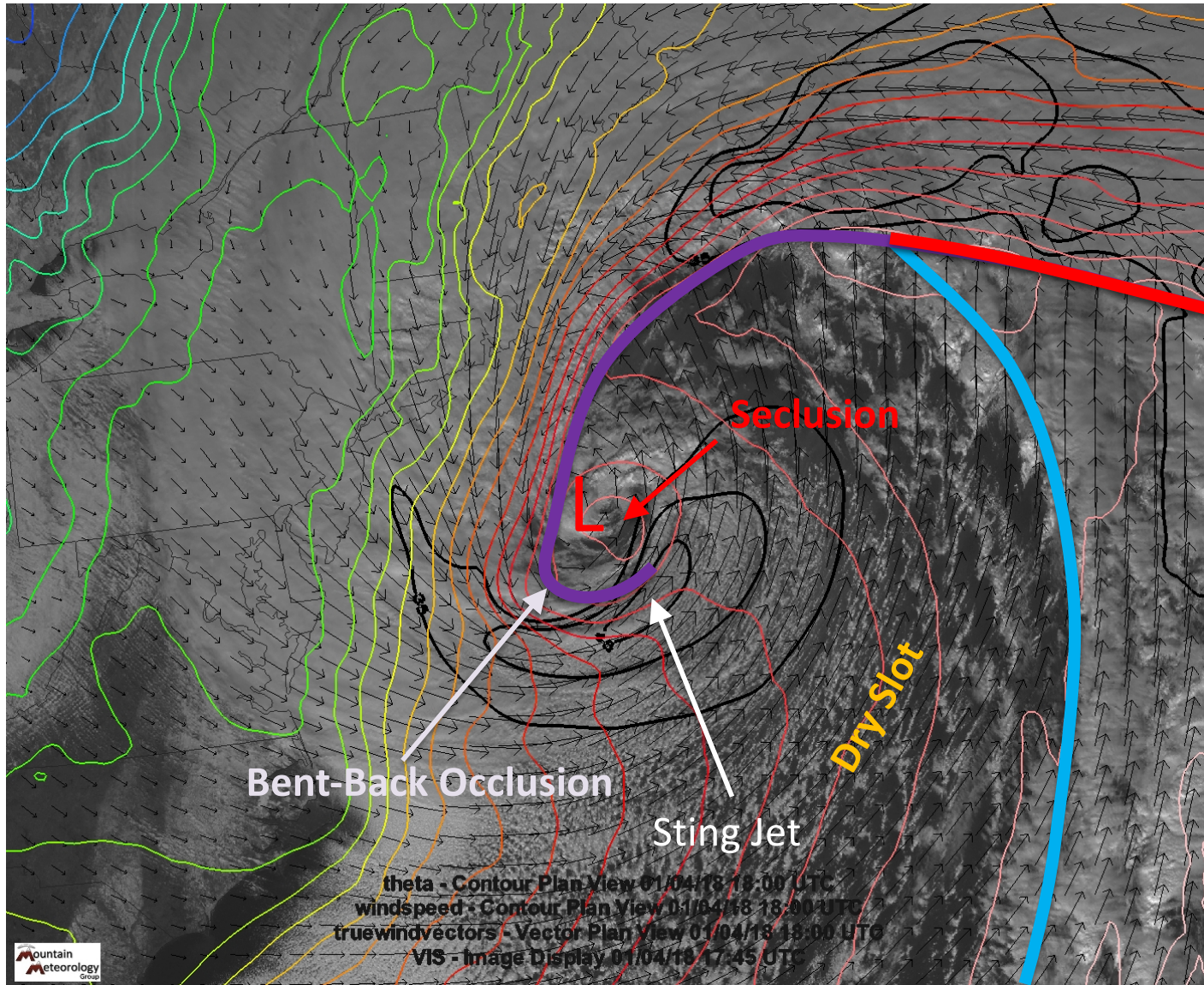


Annotate fronts and conveyor belts on this image and explain your analysis

Image Source: NOAA, COMET

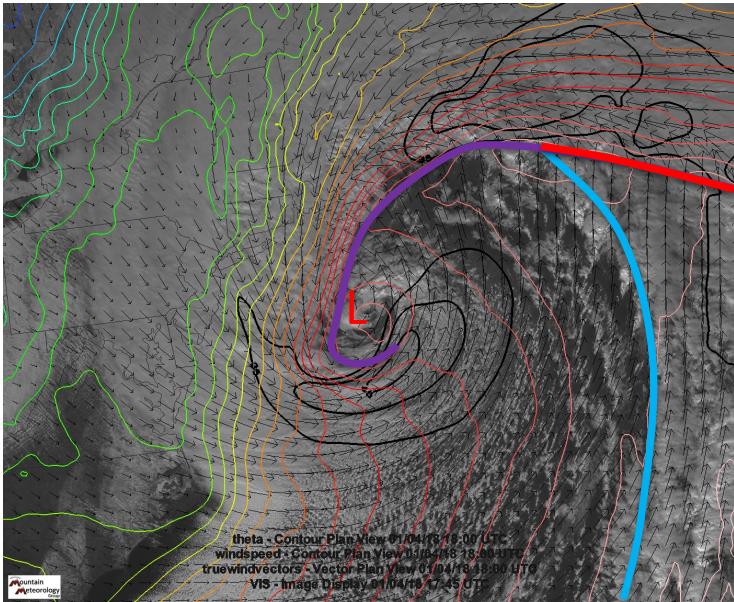


Intense Frontal Cyclone Inner Core



925-mb temperature, wind vectors, and wind speed with visible imagery

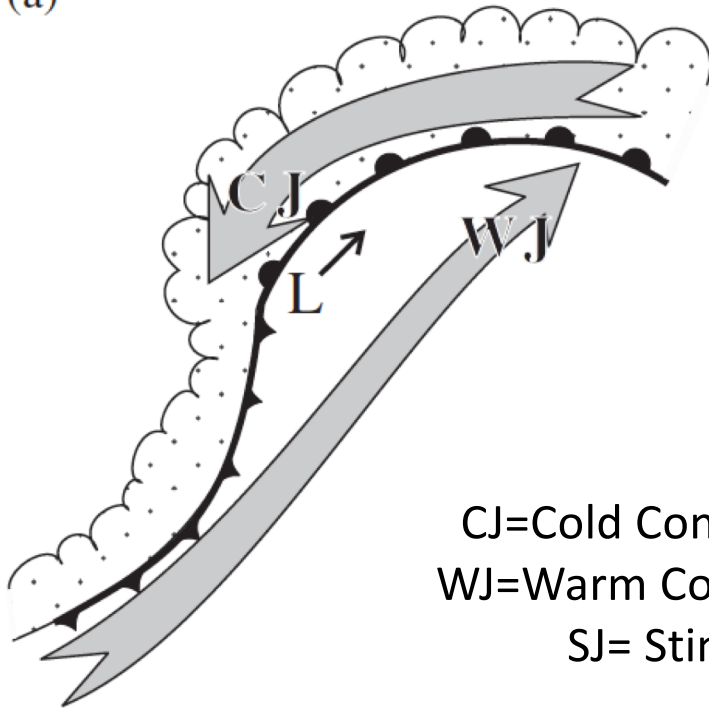
The Poisonous Tail



*“As a young forecaster in the late 1960s,
I was informed that the strongest winds ever
recorded in our region have been linked to backbent
occlusions. Such a structure has been
called **“the poisonous tail” of the back-bent occlusion.**”*
- Grønås (1995)

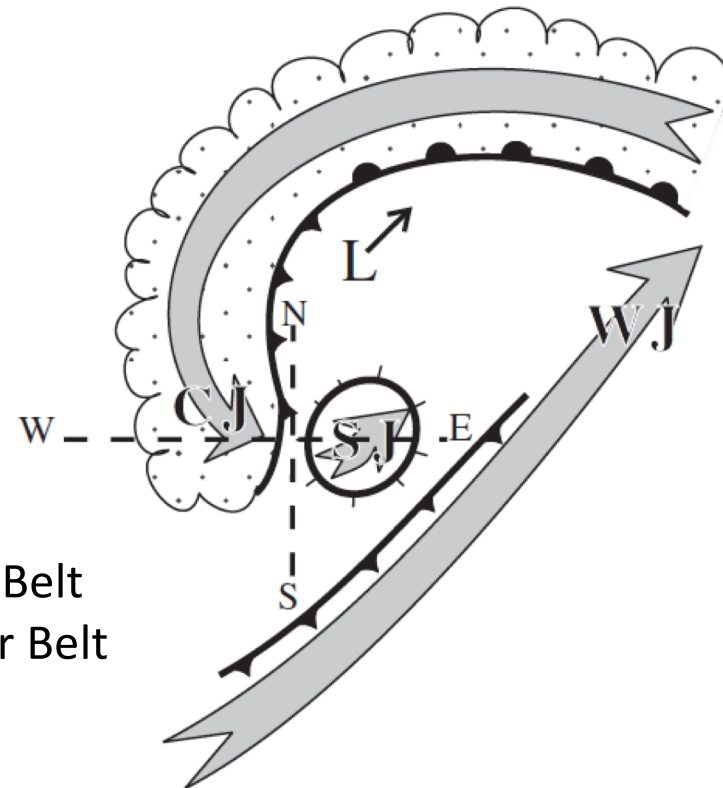
Conceptual Model

(a)



Open Wave Cyclone

(b)

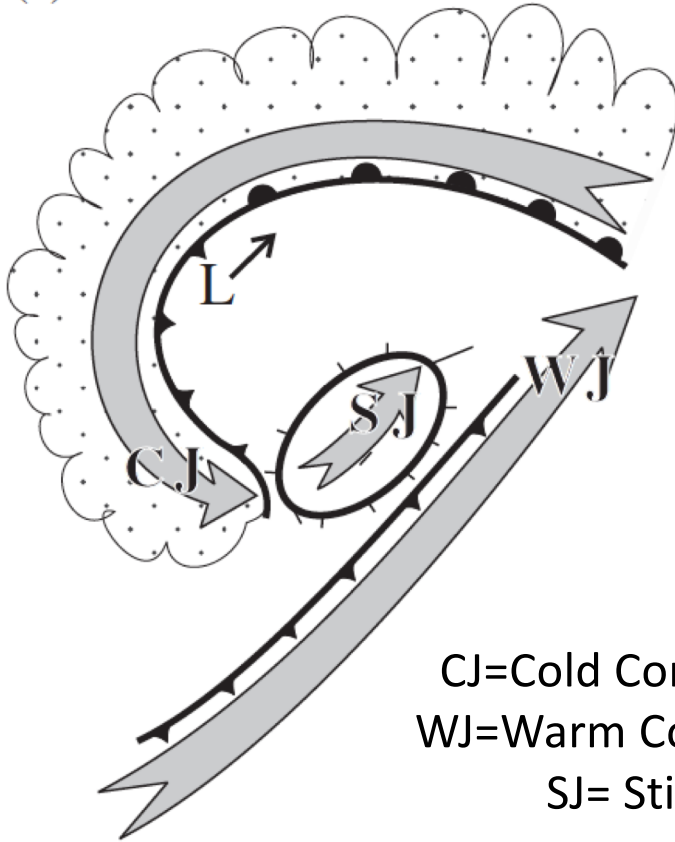


Frontal Fracture
Initial appearance of Sting Jet

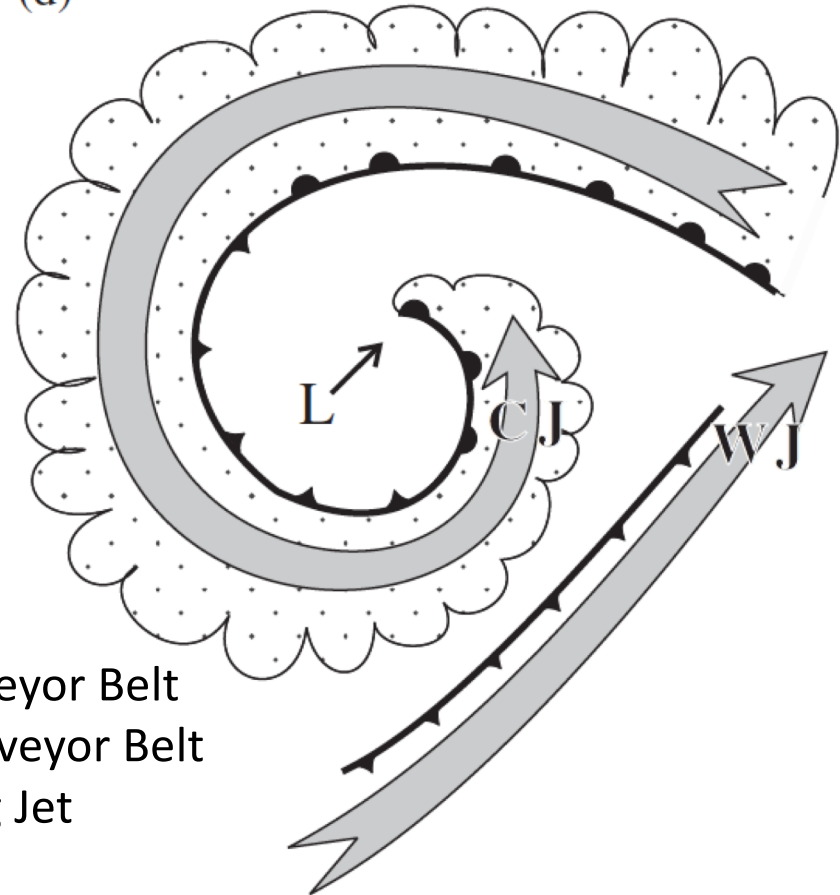
CJ=Cold Conveyor Belt
WJ=Warm Conveyor Belt
SJ= Sting Jet

Conceptual Model

(c)



(d)

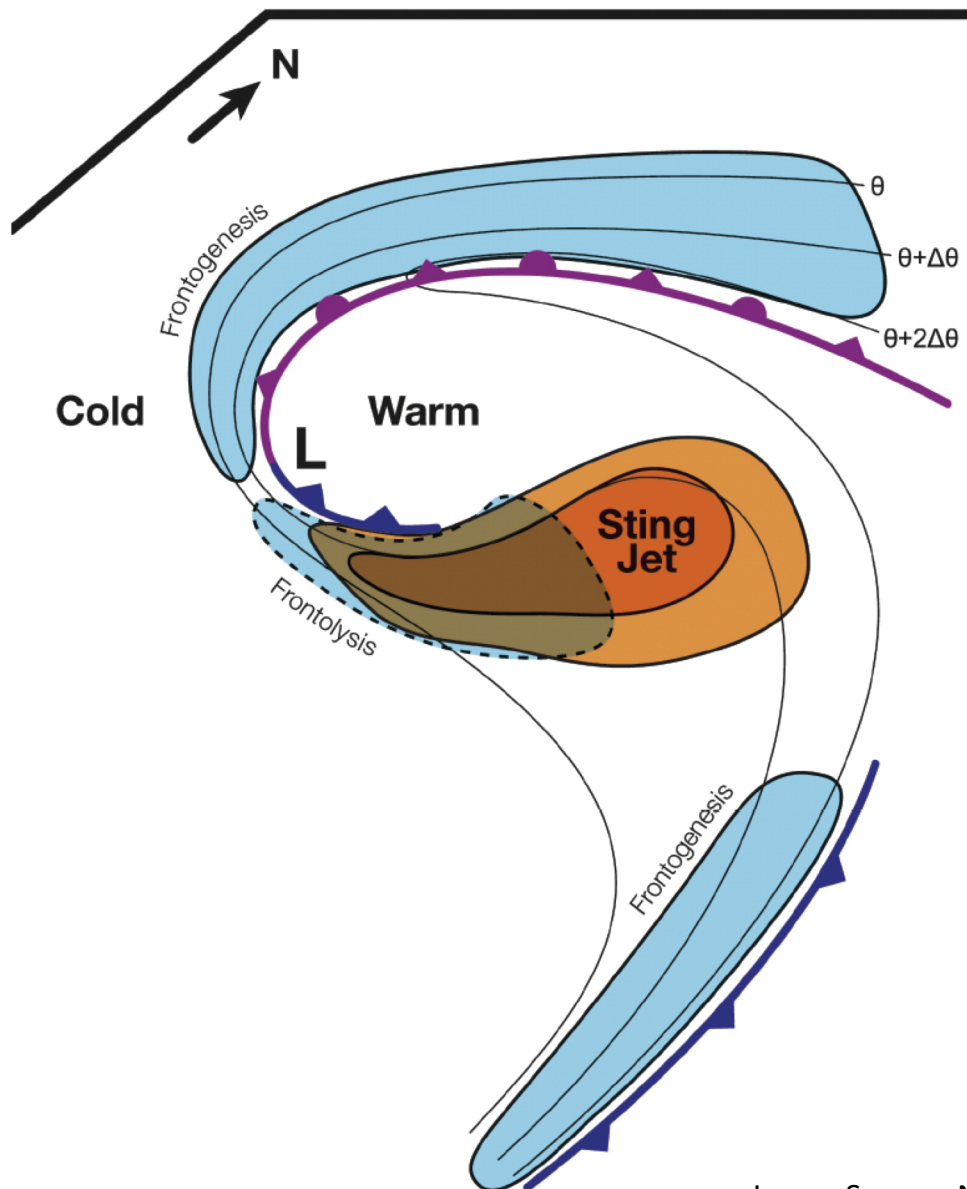


CJ=Cold Conveyor Belt
WJ=Warm Conveyor Belt
SJ= Sting Jet

Bent-back front and cloud head wrap
Sting jet extends

Sting Jet disappears
Cold Conveyor Belt dominates low-level winds

Conceptual Model

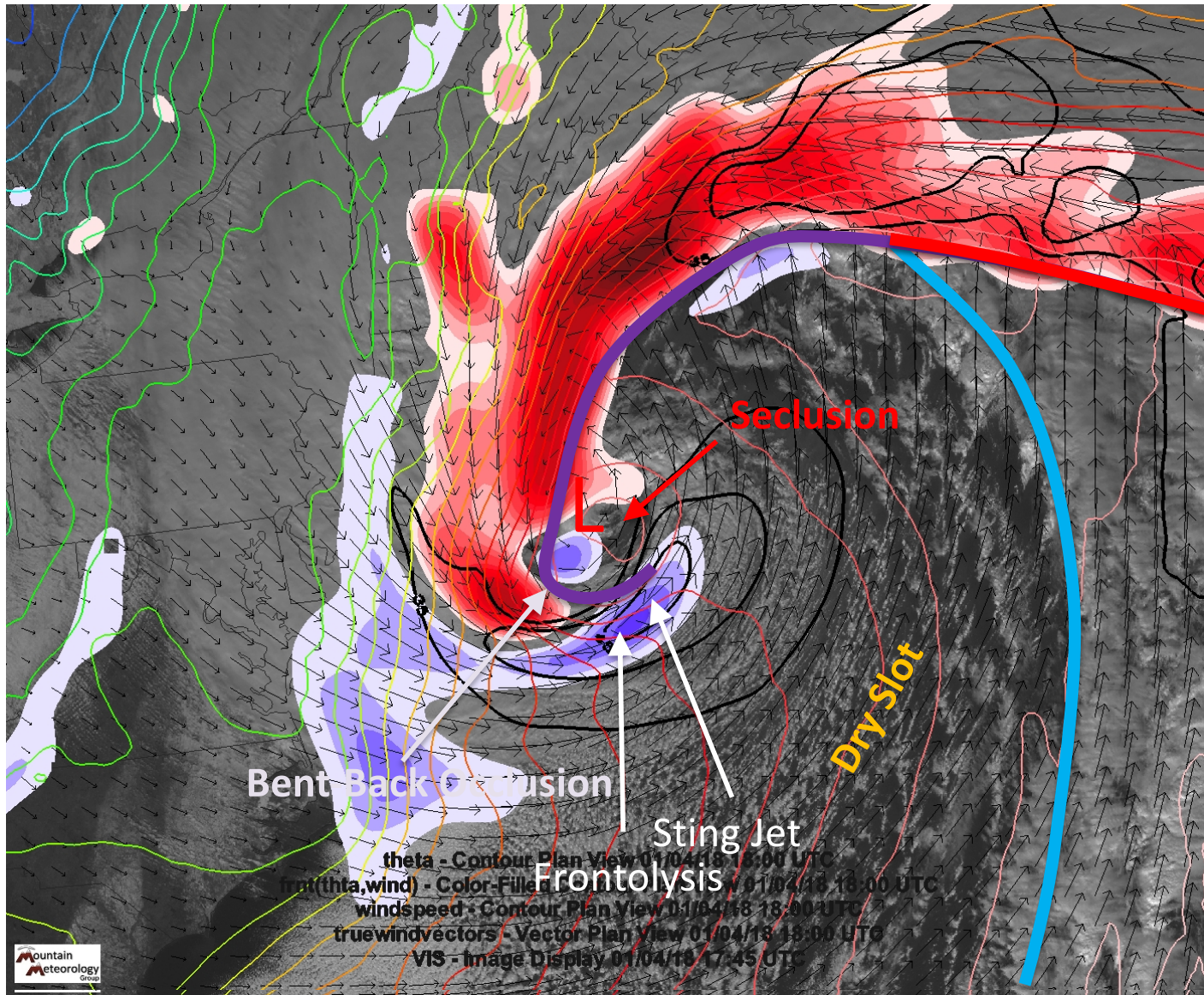


Sting Jet

Specifically describes the wind max near the tip of the cloud head at the end of the bent-back front in a region of descent from the mid troposphere driven by frontolysis

Overall wind maximum may be composed of air from the cold conveyor belt and sting jet

Intense Frontal Cyclone Inner Core



925-mb temperature, wind vectors, and wind speed with visible imagery

Class Activity

- Open the IDV bundle Bundles -> 5210 -> StingJet
- Get acquainted with the structure of the storm and answer the following questions
 - Relative to the frontal features and cloud structure, where do the strongest low-level 925 mb winds develop?
 - Relative to the frontal features and cloud structure, where do the strongest 10-m winds develop?
 - Compare the low-level wind maxima to the frontogenesis. Is this a case of a sting jet? If so, at what times?
 - Where does the occlusion/bent-back occlusion reach maximum intensity? Is this consistent with the frontogenesis analysis?
 - Examine the cross sections and wind speed isosurface at 1800 UTC 4 January. How deep is the warm-core occlusion? Is the sting jet an isolated low-level wind maximum?