

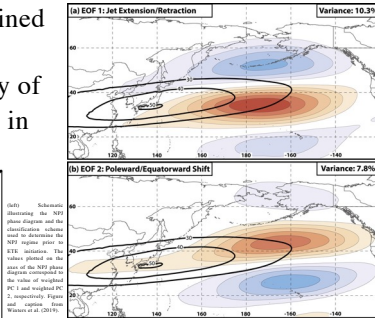
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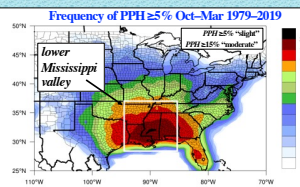
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Poleward NPJ Regimes: Tornado vs Null Comparison

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- A diagram showing the four quadrants of the climate system response to CO₂ forcing. The quadrants are defined by two diagonal lines intersecting at the 'Origin' (0,0). The quadrants are labeled as follows:
- Top-Right (Quadrant 1):** Poleward Shift (blue text)
 - Top-Left (Quadrant 2):** Jet Retraction (green text)
 - Bottom-Left (Quadrant 3):** Equatorward Shift (red text)
 - Bottom-Right (Quadrant 4):** Jet Extension (yellow text)
- The axes are labeled from -4 to 4. The 'Origin' is marked at the center (0,0).



- Tornado events identified using practically perfect hindcasts (PPHs)
- Stratified by the NPJ phase 3–7 days prior
- Define cool season as Oct–Mar 1979–2019
- NPJ phase data from Winters and Attard (2022)
- NPJ regime defined as phase lasting ≥ 3 days
- ERA5 reanalysis used for composite analysis
- Statistical significance is tested for anomalies (t-test) and difference plots (bootstrap resampling)



- Tornado events most frequent relative to climatology after poleward NPJ phases
- Favors W U.S. digging trough, S Plains cyclogenesis, and moisture return

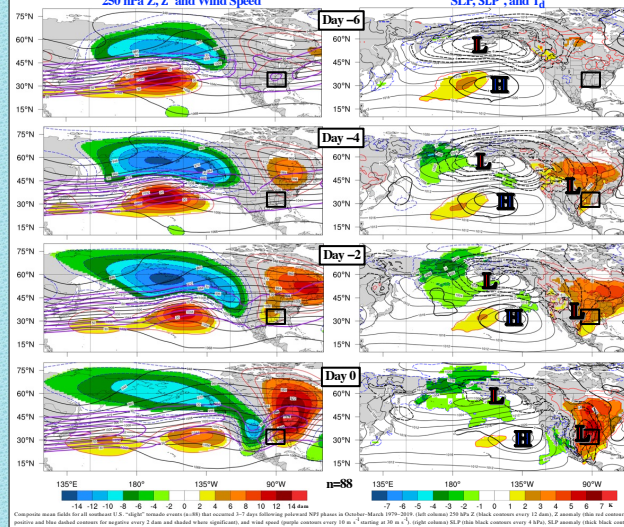
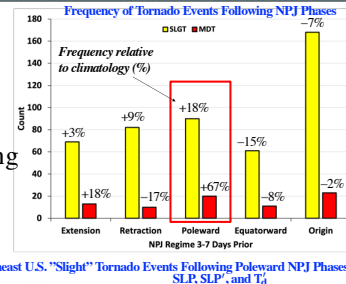


Figure 10 displays four maps of the tropical Pacific region (15°N to 75°N, 135°E to 90°W) showing atmospheric variables at 250 hPa and 500 hPa. The maps are arranged in a 2x2 grid. The top-left map shows 250 hPa Z, Z', and Wind Speed. The top-right map shows 500 hPa Z and Z'. The bottom-left map shows 850 hPa Z, Z', and T. The bottom-right map shows 850 hPa Z, Z', and T. Each map includes contour lines and shaded regions representing different variables. A color bar at the bottom indicates values from -14 to 12 for Z and Z', and -7 to 7 for T. A legend at the bottom right indicates 'n=133' and 'Day +4'.

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- Day +4**
- Composite mean ZP (thin black contours every 4 hPa), ZP anomaly (thick black contours every 2 hPa; negative dashed, positive solid, and wavy dashed), thin black contours for positive and blue dashed contours for negative every 1 hPa, and shaded where significant (solid, dashed, and wavy dashed for positive, negative, and significant negative respectively). Color bar at the bottom indicates Z difference values from -14 to 14 mm.
- Composite Flow Differences for Southeast U.S. "Slight" Tornado and Non-Tornado Poleward NPJ Regimes**
250 hPa Z and Z Difference
- Day 0**
- Day +2**
- Day +4**
- Day +6**
- 850 hPa Z and Z Difference**
- Composite mean difference Z (thin black contours every 4 hPa), ZP anomaly (thick black contours every 2 hPa; negative dashed, positive solid, and wavy dashed), thin black contours for positive and blue dashed contours for negative every 1 hPa, and shaded where significant (solid, dashed, and wavy dashed for positive, negative, and significant negative respectively). Color bar at the bottom indicates Z difference values from -14 to 14 mm.

- Tornado events in lower Mississippi valley are most frequent relative to climatology 3–7 days after poleward NPJ phases
- Poleward NPJ regimes support an amplified flow pattern across North America and cyclogenesis in the southern Plains, in addition to high-latitude warming
- Tornado-producing poleward NPJ regimes initiate with a deeper trough in the west Pacific and more robust downstream development compared to null poleward regimes