



# The Stratospheric

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## Observed Average Surface Pressure Anomalies (hPa)

#### 60 days following sudden warmings



60 days following cold vortex events



Contours in hPa

From Baldwin et al., Science 2003

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- The surface pressure pattern associated with variations in the strength of the polar vortex looks like the NAM/NAO—the maximum surface response is near the North Pole.
- 2) The relationship between vortex strength and the NAM/NAO is linear, so the tropospheric effects last as long as those in the stratosphere.

![](_page_13_Picture_0.jpeg)

FIG. 4. Schematic of the bending of isentropic surfaces (labeled  $\theta_0$ ,  $\theta_1$ , and  $\theta_2$ ) toward a positive potential vorticity anomaly. The arrows represent winds associated with the potential vorticity anomaly, becoming weaker away from the anomaly.

Diagram from Ambaum and Hoskins J Climate (2002).

![](_page_14_Figure_1.jpeg)

Create an index of vortex strength as defined by PV at 600K (20-25 hPa).

![](_page_15_Figure_0.jpeg)

![](_page_16_Figure_0.jpeg)

![](_page_17_Figure_0.jpeg)

Correlation during winter (JFM) between the 600K PV index and zonal-mean temperature. The JFM daily correlation between PV index and polar cap tropopause T anomalies is **0.90**.

![](_page_18_Figure_0.jpeg)

Regressions on -PV530K (JFM): TP pressure (colors), sfc pressure (contours)

![](_page_19_Figure_1.jpeg)

![](_page_20_Figure_0.jpeg)

![](_page_21_Figure_0.jpeg)

![](_page_22_Figure_0.jpeg)

Tropospheric amplification

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- Zonal asymmetries? Souther Hemisphere? Details of jet shifts?.....