The Use of Red Green Blue (RGB) Air Mass Imagery to Investigate the Role of Stratospheric Air in a Non-Convective Wind Event

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The Problem

- Non-convective winds cause as many fatalities as thunderstorm straight-line winds
- Tropopause folds and the sting jet are responsible for non-convective winds, however the sting jet is only known to occur in North Atlantic Shapiro-Keyser cyclones
- The global distribution of sting jet cyclones is unknown and questions remain whether cyclones that impact the U.S. develop sting jet features
- Analyses of the new RGB Air Mass imagery, show the utility of future GOES-R products in forecasting non-convective wind events

Background

- Stratospheric intrusions and tropopause folds can be identified by high-potential vorticity, warm, dry, ozone-rich air
- 1.5-2 PVU represents the dynamic tropopause
- Abrupt folding of the tropopause is associated with a PV anomaly
- The sting jet is a mesoscale phenomena in Shapiro-Keyser cyclones where strong winds originate and descend from the tip of the comma head (see Figs. 10 and 12 inset)

Event Analysis

- A low pressure system over the Ohio Valley merged with a system off the East Coast by 0000 UTC 09 February 2013
- At 0900 UTC the low pressure system developed a bent-back feature analyzed as an occluded front (compare to II and IV in Fig. 2)
- Two distinct storms the previous day, circled regions on Fig. 6 represent possible stratospheric air
- Shapiro-Keyser Cyclone (Fig. 7) shows some high ozone values are classified as stratospheric air
- Anomalies were calculated as a percent of normal using AIRS Total Column Ozone and a satellite derived stratospheric ozone climatology
- Recent literature classifies stratospheric air as ozone values ≥125% of normal
- Positioning of the wind maximum relative to the conveyor belts in Fig. 10 is similar to the inert conceptual model
- The DCB traversed, upper-level dry air descended and contributed to the high near-surface winds. CCB winds were distinct from the sting-jet like wind maximum
- Cross sections (Figs. 11 and 12) show the connection between the tropopause fold, descent of dry air, and high near-surface winds
- By 0300 UTC 09 February a distinct sting-jet like wind maximum developed south of the low center (Fig. 8)
- The region of stratospheric air in Fig. 8 is confirmed by overlaying model PV (Fig. 9)

Summary

- AIRS ozone and model PV analysis confirm the stratospheric air in RGB Air Mass imagery
- Trajectories confirm winds south of the low were distinct from CCB driven winds
- Cross sections connect the tropopause fold, downwind motion, and high near-surface winds
- Comparison to conceptual models show Shapiro-Keyser features and sting jet characteristics were observed in a storm that impacted the U.S. East Coast
- RGB Air Mass imagery can be used to identify stratospheric air and regions susceptible to tropopause folding and attendant non-convective winds