MESOSCALE SNOWBANDS PERSISTING DOWNSTREAM OF THE SOUTHERN APPALACHIANS DURING NORTHWEST FLOW UPSLOPE EVENTS

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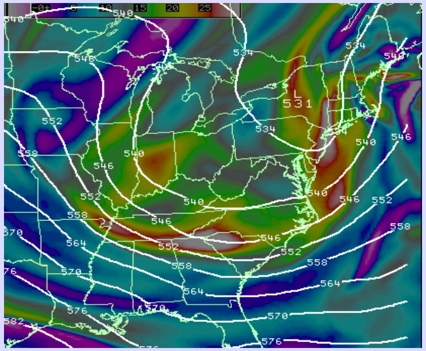
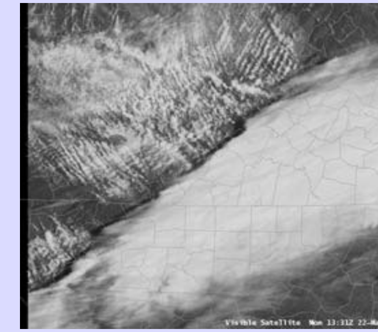
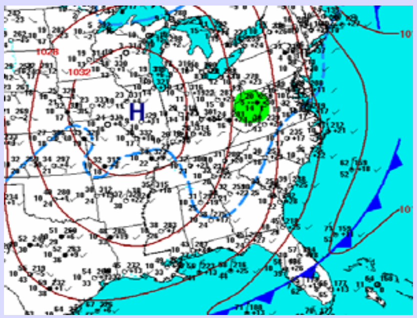
Period of study: 2003 – 2008 (Winter Seasons)



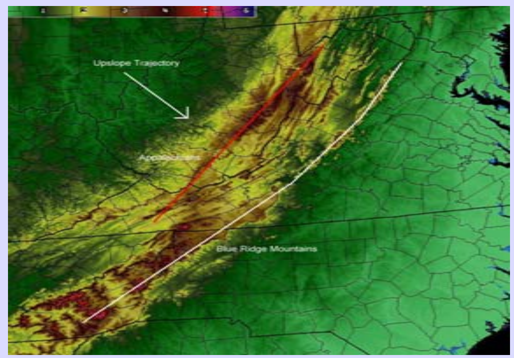
NAM 500 mb analysis (2/10/05) showing deep trough and rounding Shortwave during an upslope scenario and subsequent snowband event.



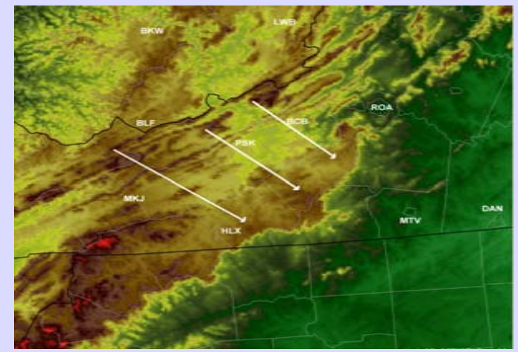
Horizontal roll clouds parallel to flow (perpendicular to ridges) with embedded deeper bands, due to unstable layer. Evidence of stable layer just above the unstable layer seen in the wave cloud bands parallel to ridges across northern part of image.



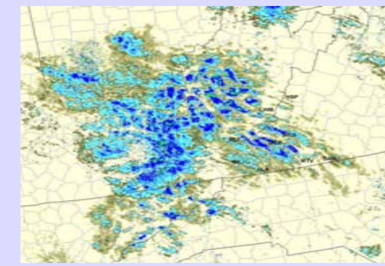
Surface chart (3/22/04) of typical pattern associated with snowband features.



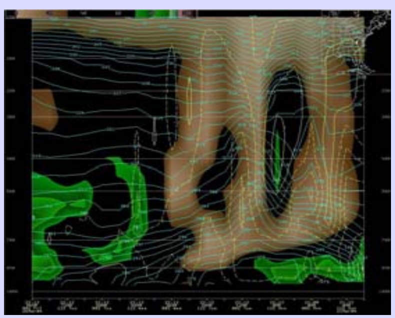
Area of study including topography in thousands of feet. Arrow depicts direction of upslope flow.



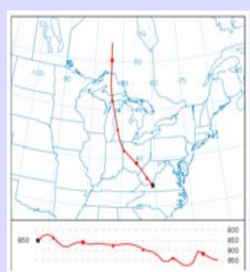
Possible locations (white arrows) of more frequent snowbands seen during the study.



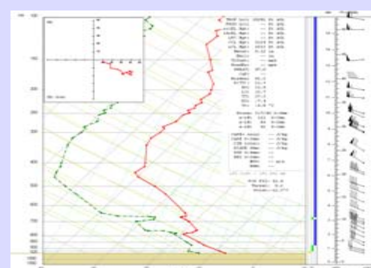
Typical radar mosaic of widespread late afternoon upslope snow showers that transition to a more isolated banded scenario below. Image from http://www.rap.ucar.edu/weather/radar/ on 2/10/05.



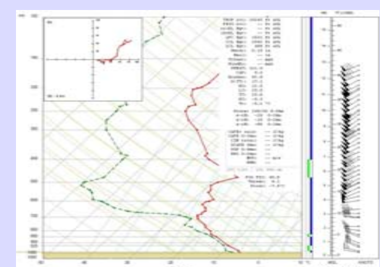
NAM 84 hour time section near RNK starting 03/21/04 shows deep stable dry layer over shallow adiabatic moist layer (sfc-800mb). Jet structure evident aloft with weak mid-level UVV.



Hysplit backward trajectory from EDAS for a parcel over BCB at 850 mb (3/22/05).



RNK raob showing a shallow layer of instability, but also saturated in the -15 to -20C zone. Also unidirectional wind shear.



BUF sounding from a classic lake effect event, for comparison.

Early morning snowbands off the KFCX radar with the heaviest across the New River Valley from near Blacksburg (BCB) to the KFCX radar site. Image from 03/22/04.

Prelim Findings

- Events linked to deep (2000 m) layer of unidirectional northwest flow trapped beneath a strong inversion.
- Low-level trajectories originating from the Great Lakes were present and acted to transport moisture and enhance instability.
- Moisture depths and instability keys to ice crystal growth and upright convection.
- Origination of snow bands appeared to occur across the higher ridges of the Appalachians and then moved downstream with the wind trajectory. This is similar to "Type III" lake effect bands which are wind-parallel bands that can allow snowbands to propagate well downstream and be enhanced upon encountering orographics.
- Usually late night or early morning timing of bands when latent heat fluxes over land were small and near the end of the 850 mb cold advection. This was most evident with the nocturnal horizontal rolls seen during banding in comparison to the more cellular upright daytime convective nature when heating and mixing were greater.
- Snowfall short lived, but high rates resulted in localized accumulations of 2+ inches in less than an hour.

Future Work

- Examine more events and look specifically at locations where snowbands originate such as ridges vs. gaps in the mountains and the trajectories associated with these.
- Look more closely at contribution of the Great Lakes and possible roles that the jet and wind shear play.
- Expand the area of research to include a wider region of the Appalachians which would help collaboration efforts with surrounding offices.
- Attempt to model the aspect of band locations and specific terrain features using the local WRF which will aid forecaster situational awareness prior to these events.

Key References

Perry, B.L., Konrad, C.E., Schmidlin, T.W., Antecedent Upstream Air Trajectories Associated with Northwest Flow Snowfall in the Southern Appalachians. *Weather and Forecasting*., Vol. 22, Nov 2005, p.334-352.

Kristovich, D.A.R., 2004: Diurnal Variations in Lake-Effect Precipitation near the Western Great Lakes. *Journal of Hydrometeorolgy.* AMS Online Journal, April 2004, p. 210-218.

Niziol, T.A., Snyder, W.R.,Waldstreicher, J.S., Winter Weather Forecasting throughout the Eastern United States. Part IV: Lake Effect Snow. *Weather and Forecasting*, Vol. 10, No. 1, March 1995, p 61-77.

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