Stratosphere-Troposphere Interaction during Tropospheric Anticyclogenesis

Stephen J. Colucci
Department of Earth and Atmospheric Sciences
1116 Bradfield Hall
Cornell University
Ithaca, New York 14853
sjc25@cornell.edu

The development of a blocking, midtropospheric anticyclone during January 1987 over the Northern Hemisphere occurred beneath decreasing temperature and Ertel’s potential vorticity (EPV) in the upper troposphere-lower stratosphere (UTLS) layer. Conversely, temperature and EPV increased in this layer above the decaying anticyclone. The largest absolute temperature and EPV changes with time in the vertical direction through the blocking onset and decay regions were concentrated in the UTLS layer, roughly 300 – 100 mb. After the demise of the block, anticyclogenesis ensued in the upper stratosphere (10 mb), associated with a reversal of the zonal mean zonal wind at 10 mb and 60N and a stratospheric warming event. However, this anticyclone formed on the other side of the hemisphere from the earlier, midtropospheric anticyclone, so the connection between the two phenomena is not obvious but will be investigated. Whether the temperature and EPV changes in the UTLS layer are a cause or a consequence of the midtropospheric anticyclogenesis/lysis is being investigated with EPV inversion techniques.

A possible stratosphere-troposphere interaction during a more recent blocking anticylogenesis event in January 2009 is also being investigated. This anticyclone formed and reformed under middle stratospheric (20 mb) cooling, and dissipated under pronounced temperature increases associated with a major stratospheric warming event. Numerical experiments with the Weather Research and Forecasting model show that cooling the stratosphere over the anticyclone increases its longevity in the model.