

A Climatology of Lower Stratospheric Fronts in North America

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The dynamically active mesoscale structure within the lower stratospheric portion of an upper-level jet-front (ULJF) system is known as a lower stratospheric front (LSF). LSFs are located above the mid-latitude jet core, or approximately 200 hPa, and are common features during the cold season. Recent case analyses of LSFs suggest that their dynamics play a non-negligible role in the evolution of midlatitude ULJF systems. As a result of their relationship with ULJF systems, LSFs have the potential to impact the life cycle of surface cyclones. The analysis presented here will highlight the interaction between LSFs and their tropospheric counterparts, upper tropospheric fronts (UTF), along with the downstream implications of such interactions.

Using twice daily NCEP/NCAR Global Forecast System (GFS) 1-degree analyses, a synoptic climatology of winter season LSFs was constructed. Similar in nature to tropospheric fronts, LSFs are discernable by locally enhanced areas of: potential temperature gradients, cyclonic vorticity, and static stability with respect to the mean background flow. Cases identified by the climatological analysis were categorized into their respective dominant upper level flow pattern (northwesterly, southwesterly, etc.) and used to construct composite analyses. The results of these composites reveal preferred regions of lower stratospheric frontogenesis and frontolysis. In addition, the analysis highlights some notable differences in climatological location, frequencies, and intensities of the upper tropospheric and lower stratospheric frontal portions of ULJFs.