CICS-MD Science Meeting
November 12-13, 2014
College Park, MD

Katherine E. Lukens

1-7 On the Relation between North American Winter Precipitation and Storm Tracks

The aim of this research is to discern the relationship between precipitation events and the intensities and spatial patterns of Northern Hemisphere storm tracks in the boreal winter season with an emphasis on the North American continent. This diagnostic study is performed using the NCEP Climate Forecast System Reanalysis (CFSR) product at a horizontal resolution of 32 km. First, the Eulerian properties of the storm tracks at different heights are identified for unfiltered and filtered (2-6 day band pass) data, and related to precipitation structures. A Lagrangian approach is currently being tested to help identify track features that have the ability to separate cyclones and anticyclone tracks and thus provide detailed information of both high and low pressure systems. In the local approach, storm tracks are identified from different variables (e.g., winds and vorticity at different vertical levels). The average position of the Northern Hemisphere jet stream at 200mb primarily resides on the 45°N latitude line. Storm tracks at this level occur on the equatorward side of the jet stream.

Two regions of interest were identified for their largest values of storm track intensity, one towards the east and the other towards the west of North America. In both regions local diagnostics reveal an eastward-propagating wave with an average longitudinal extension of about 90 degrees. The upstream NNW-SSE tilt of the wave mirrors its downstream counterpart, which increases with the wave's evolution. The energy builds upstream, maximizing over North America on the early stages and displaces eastward over the Atlantic Ocean where its energy dissipates. This wave pattern leaves a signature in surface precipitation that resembles that of the low-level vorticity. For the western region, the precipitation pattern follows the northern edge of the 200mb storm track as it propagates eastward, flowing up to the northwestern part of North America and down the Rocky Mountains, downstream of which the wave's propagation appears to stall and its energy dissipate. The precipitation has a bow-like shape over the northwestern part of the continent mimicking the shape of the storm track's flow pattern in this area. For the eastern region, the precipitation pattern quickly develops into a wave-like shape with an average longitudinal extension of 50 degrees, strengthening upstream until it moves from the continent into the Atlantic Ocean. The precipitation pattern is in agreement with the zonal path of the 200mb storm track, narrowing as it approaches the eastern coast of North America and propagating eastward over the ocean.