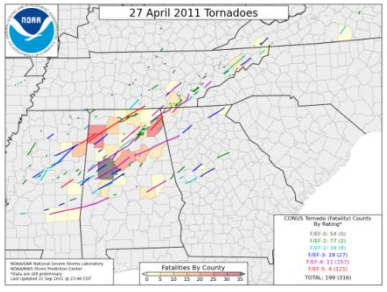
The Influence of Terrain during the 27 April 2011 Super Tornado Outbreak and 5 July 2012 Derecho around the Great Smoky Mountains National Park

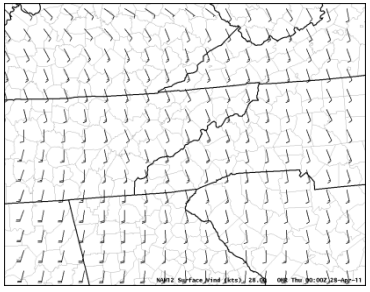
David M. Gaffin
National Weather Service
Morristown, TN

27-28 April 2011 Super Tornado Outbreak:

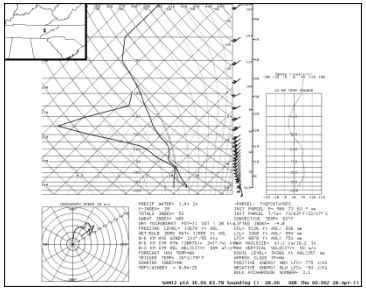
Several tornado tracks across east TN during the Super Outbreak appeared to have initiated near the openings of the many southeast-to-northwest oriented valleys located along the southern Appalachian Mountain range. Strong southeasterly boundary-layer winds observed on 27 April 2011 may have accelerated through these valleys (due to constricted flow), and may have encouraged tornadogenesis within the northeast-propagating supercells.



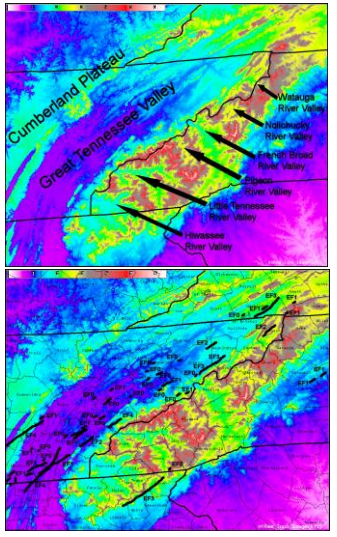
Tornado tracks from the 27-28 April 2011 Super Outbreak (tracks from the long-lived supercells became more fragmented over east TN)



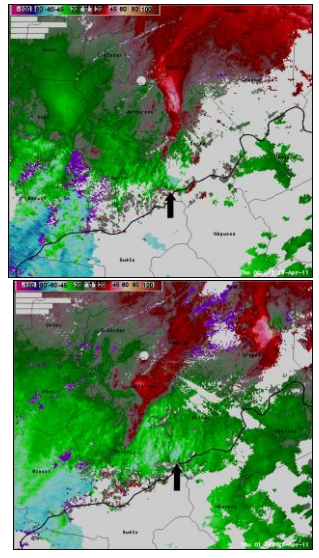
NAM12 model surface winds at 00 UTC on 28 April 2011



NAM12 model sounding in central east TN at 00 UTC on 28 April 2011



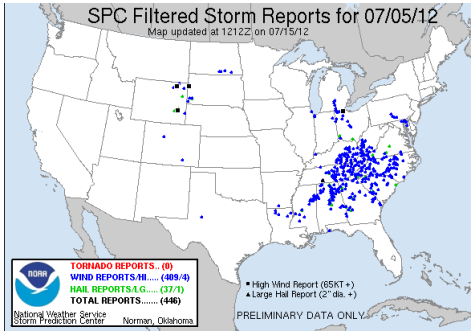
Map of the river valley names (top) and tornado tracks on 27-28 April 2011 (bottom) across the southern Appalachian region



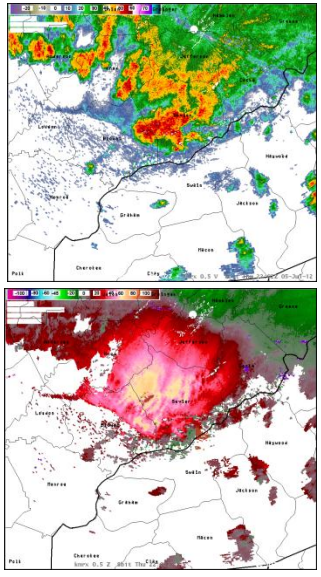
KMRX velocity images from 0025 UTC (top) and 0124 UTC (bottom) on 28 April 2011 showing persistent and stronger wind speeds near the opening of the Pigeon River Valley

5 July 2012 Derecho:

A significant blowdown of trees occurred in the Park on 5 July 2012, as a derecho (with winds around 60 mph) moved southwest across the Great Tennessee Valley. Northeasterly winds are an unusual direction to observe high wind in the southern Appalachian region, which may have contributed to the significance of the reported tree damage. The most significant tree damage occurred within the Laurel Creek Valley and near Cades Cove.

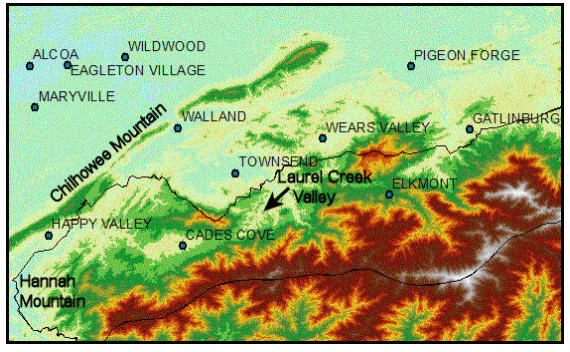


Pictures of Laurel Creek road after the 5 July 2012 derecho



KMRX radar base reflectivity (top) and base velocity (bottom) from 2202 UTC on 5 July 2012

On the Tennessee side of the Park, there are no mountain barriers to slow down or block northeasterly winds. Chilhowee Mountain usually blocks strong westerly winds from reaching the Laurel Creek Valley, while Hannah Mountain likely disrupts winds from the southwest (the predominant wind direction in the area). The strong northeasterly winds observed on July 5th likely flowed unimpeded (and possibly even accelerated due to constricted flow) into the northeast-to-southwest oriented Laurel Creek Valley.



Topography map of the Tennessee side of the Great Smoky Mountains National Park