

Anniston, Alabama) 3.04 inches on July 9).

were set or tied on July 10 in locations such as College Station (111°F) and

September 9, 2007). Later, heat again surged northward, after briefly retreating. In Nebraska,

boundary that had stalled in the vicinity of southwestern Virginia (red arrows). This satellite view uses the atmospheric water vapor channel on the GOES satellite to indicate areas of deep moisture in the troposphere. Along and south of that boundary pooled an exceptionally humid and unstable air mass (blue and white tones)—contrast this with exceptionally dry air just to the north of the boundary (yellow tones).

Within the humid and unstable air mass, winds flowing along the boundary triggered clusters of thunderstorms to continuously erupt on the evening of July 12. Moist winds flowing up steep mountain hillsides also likely helped to trigger additional storms (this process is termed “orographic rainfall”). The storm cells kept retriggering in the same location (the trigger point perhaps anchored to mountains, or an expanding pool of chilly downdraft air generated by the storms), just west of

Buchanan County. Embedded in strong midlevel winds blowing from the west, these cells traversed central Buchanan County one after another, over several hours. This process, called training, delivered torrent after torrent to the same locations. The rain rapidly accumulated in a narrow geographical zone, where narrow streams concentrated runoff into deep, fast-flowing currents.

The unusually intense lightning activity attested to the strength of storm updrafts. Lightning charge is generated in the middle portions of thunderclouds, where ice crystals, small ice particles, and raindrops commingle. As the mass of this so-called mixed-phase precipitation accumulates, charge grows. Vigorous lightning activity thus requires very large upward fluxes of moisture in cloud updrafts, to continuously nourish the charging zone. A large upward flux of moisture means high rates of cloud condensation and, hence, rainout. The combination of

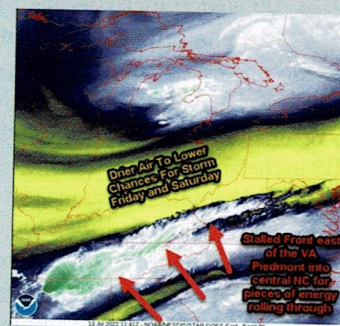


Figure 2. Satellite image showing upper-level moisture distribution and frontal boundary draped across southwestern Virginia early on July 13.

efficient rain-producing cells, heavy rain rates, and cell training was a certain and unfortunate recipe for a flood disaster.

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