Extreme precipitation accumulations over Middle Tennessee resulted in catastrophic flooding

- A quasi-stationary pattern combined with anomalous atmospheric moisture created an environment favorable for high-intensity and long duration precipitation over parts of central Tennessee
- Efficient warm-rain processes as well as favorable storm cell trajectory produced as much as 17 inches of precipitation on top of already moist soils produced by the remnants of tropical storm Fred a few days prior
- The Piney River near Vernon, TN rose to 32 feet on the 21st, 18 feet over flood stage and nearly 12 feet higher than the previous record at this gauge
- While this particular event is not characterized as an atmospheric river, it is one example of the many meteorological features that can lead to flood producing precipitation in Tennessee

Middle Tennessee Flooding: 21 August 2021

A stationary front in western/central TN, combined westerly surface flow allowed for extremely moist air parcels to rise over central TN, initiating thunderstorm and heavy precipitation.

Once the convection was initiated the upper-level flow propagated the storms from the northwest to the southeast along the frontal boundary, resulting in the “training” of storms over the same location for several hours.

The long duration and high-intensity precipitation combined with the precipitation produced by remnant tropical cyclone Fred a few days earlier resulted in total 7-day accumulations >15 inches over north-central Tennessee.
At the time of the flooding, portions of western Tennessee were experiencing precipitable water anomalies of +2–2.5 standard deviations above normal.

The Stationary front that was oriented northwest to southeast over the Ohio River Valley provided the lift necessary to produce the extremely efficient and slow-moving thunderstorms over western to central Tennessee.
While there was considerable moisture (>50 mm) and southwesterly moisture transport (300–400 kg m⁻¹ s⁻¹) overrunning the stationary front, this particular event was not an atmospheric river. This event was an example of one of the many meteorological scenarios that can lead to extreme precipitation and flooding over Tennessee.
Middle Tennessee Flooding: 21 August 2021

- While the event that produced the extreme rainfall and flooding on 21 August 2021 was not an atmospheric river, ARs are yet another important phenomena that can lead to flood producing precipitation over Tennessee.
- An atmospheric river over the Eastern U.S. in late March 2021 resulted in heavy precipitation and flooding near Nashville, Tennessee.
- This particular AR in late March produced a large swath of precipitation accumulations >6 inches over Central Tennessee.

- Additionally, the physical processes of an AR that produced heavy flooding rainfall in Nashville in early May of 2010 were studied in a paper published by Moore et al. 2011.