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Background

- 2018 saw annual record or near-record rainfall over the Mid-Atlantic States as 1500-2000mm fell, far exceeding the typical annual value of around 1000mm.

- The Bermuda-Azores high was centered some 30 degrees east of its typical summer position. This allowed for a month-long moist easterly integrated water vapor transport (IVT) directed towards the Mid-Atlantic States.

- Synoptic-scale and meso-scale perturbations then triggered excessive rainfall and widespread flooding as a very intense atmospheric river (AR), with roots deep into the tropics, formed from south to north over the east coast. Much of the event rainfall occurred 21-25 July 2018.

Key Findings

- GEOS Forward Processing (FP) medium and long-range forecasts highlighted the potential for a height pattern analogous to those which produced prior notable long-duration major Mid-Atlantic flood events.

- The position, timing, and intensity of the AR was well forecast up to a week in advance of the late July 2018 apex of heavy regional precipitation.

- Numerous locations experienced single and multi-day record-breaking rainfall, that tripled the 99th percentile for this time of year.

- Future work includes using Reanalyses and artificial intelligence to examine if AR's are becoming more frequent in the eastern United States. It has been established that the Mid-Atlantic and Northeast States are seeing more rainfall on an annual basis in general.
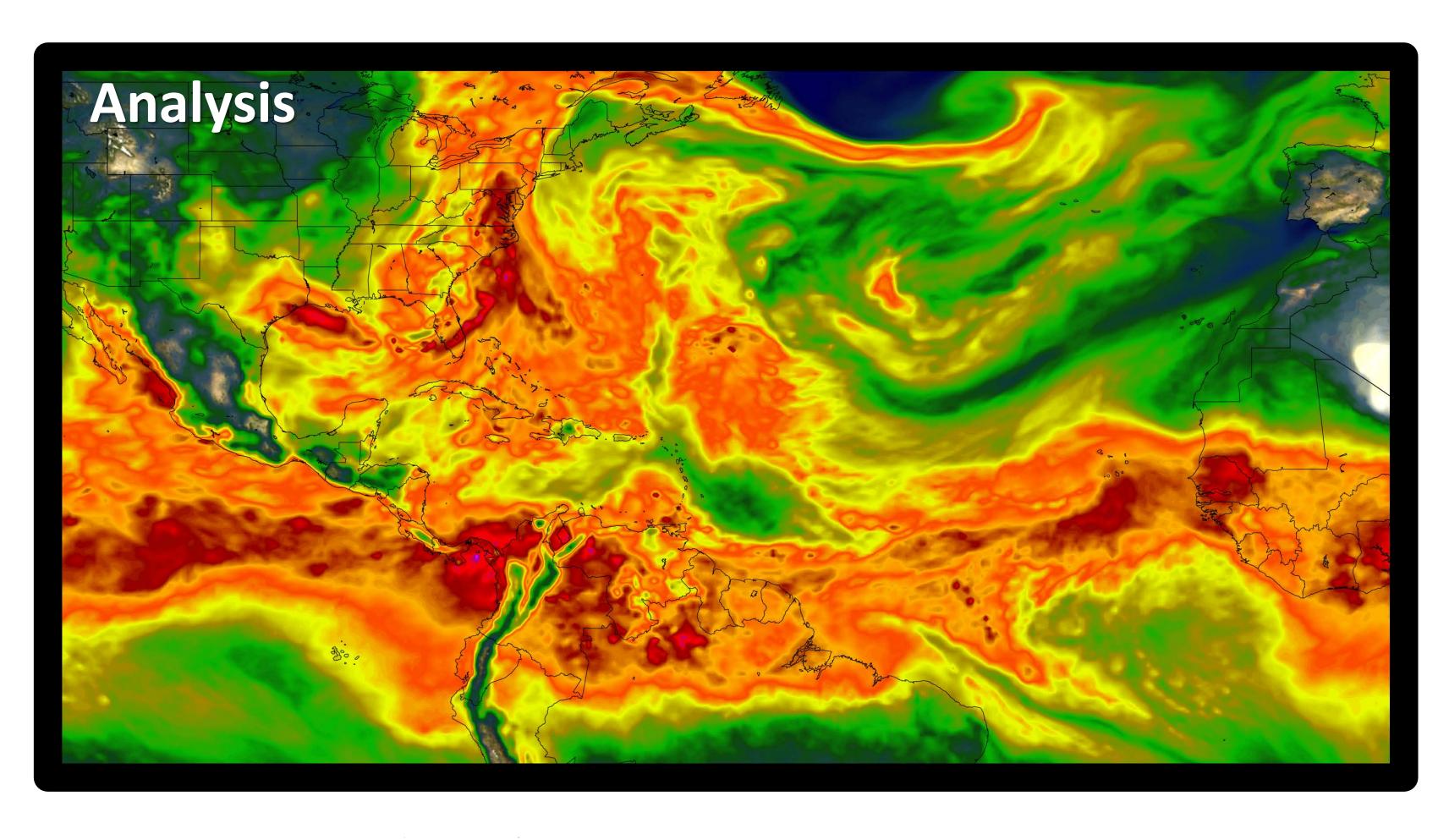
MORE INFO

GEOS FP   **MERRA-2**
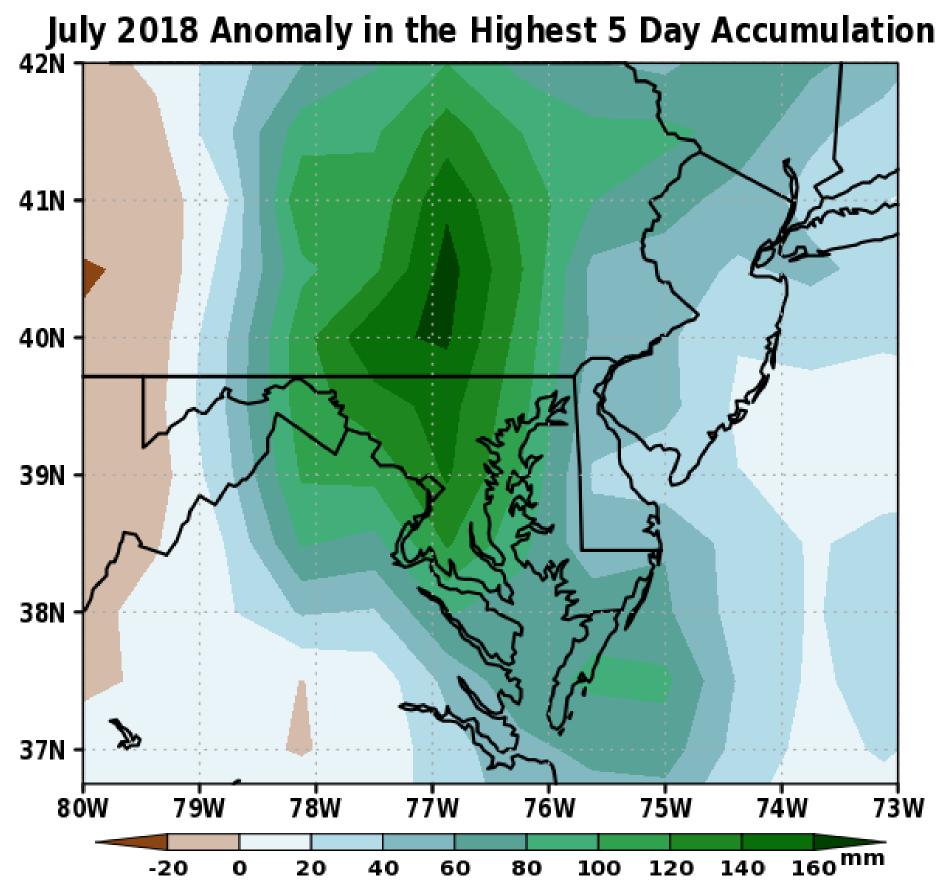
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Analyzing & Forecasting the Atmospheric River with GEOS FP

Figure 1: Total precipitable water (mm) analysis from GEOS FP at 14z 24 July 2018

Figure 2: Total precipitable water forecasts from GEOS FP valid 14z 24 July 2018 Initialized a) 1 day, b) 2 days, c) 4 days, and d) 7 days prior to valid time

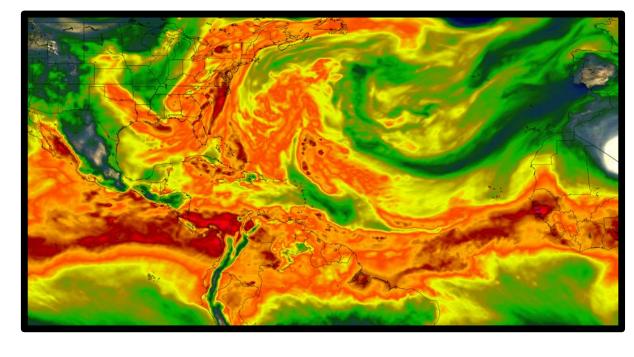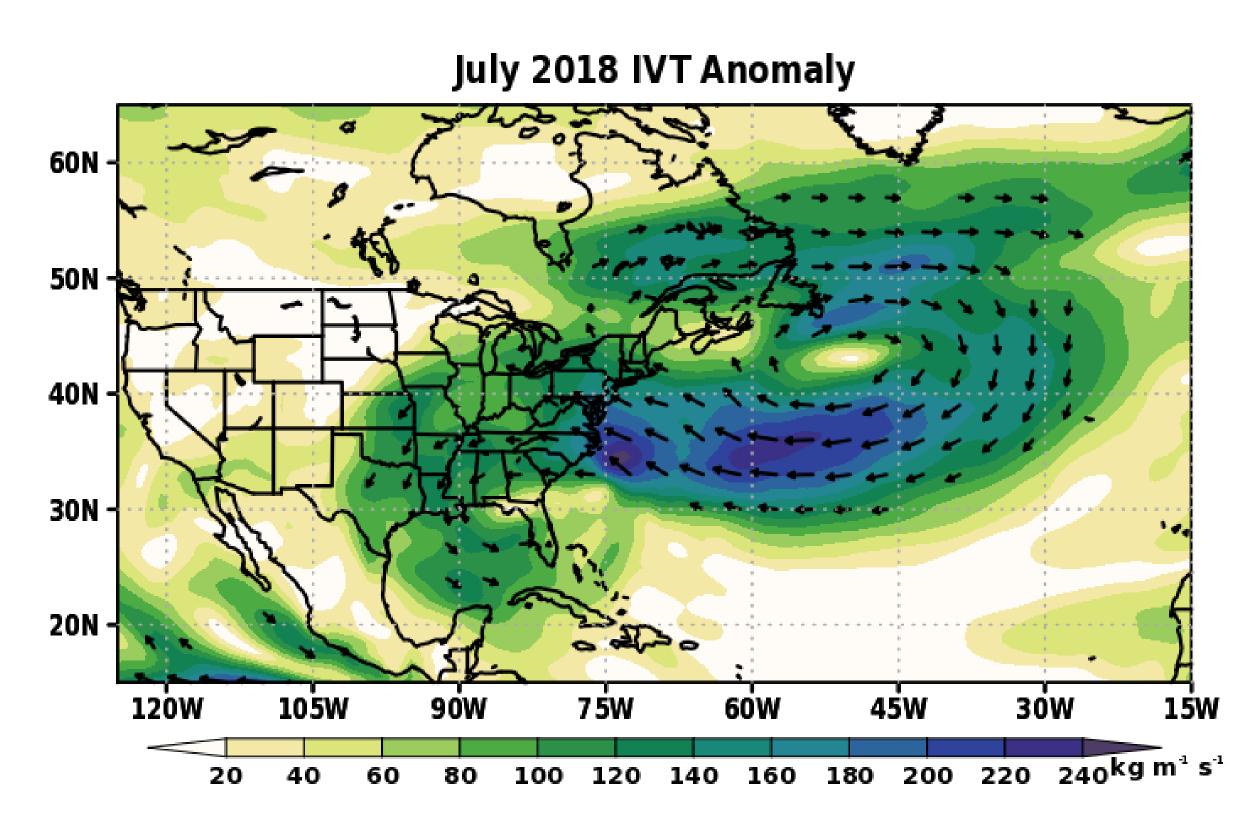# Evaluation with Respect to the Recent Climate using MERRA-2

Figure 3: Rx5Day represents the maximum 5-day accumulation in precipitation within a month. This figure shows the anomaly of Rx5Day using the observation corrected precipitation from MERRA-2 for July 2018 with respect to all other Julys since 1980.
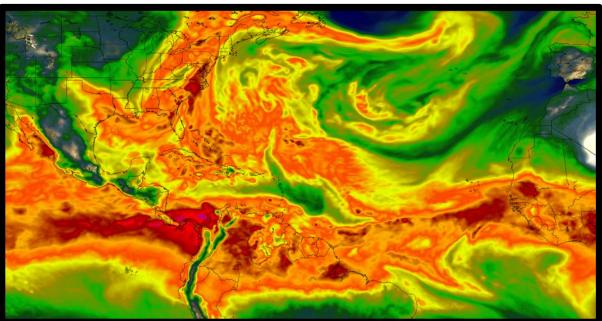

Figure 4: The anomaly in the integrated water vapor transport during July 2018 with respect to other Julys for the climatology period of 1981 through 2010.
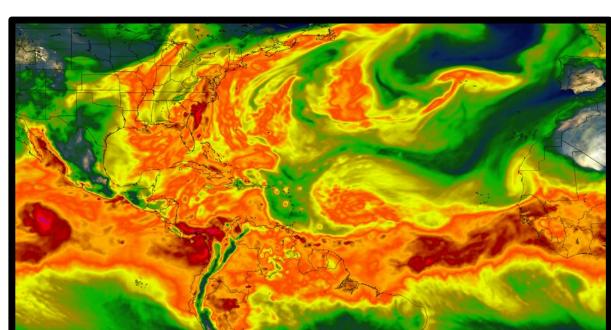
National Aeronautics and Space Administration