A Northern Hemispheric Wave Train Associated with Fluctuations in Bermuda High During Boreal Summer

Haochang Luo[1], **Ángel F. Adames**[1] **and Richard B. Rood**[1]

[1]*Department of Climate and Space Sciences and Engineering, University of Michigan, Ann Arbor, MI*

email: hcluo@umich.edu, afadames@umich.edu

1. Abstract

The processes that lead to the spatial and temporal evolution of the Bermuda High during July and August (JA) are investigated using linear regression analysis. The analysis is based on a Bermuda high index (BHI).

Linear regression of the 200 hPa geopotential height reveals the existence of a Rossby wave train that extends zonally from the western-north Pacific to the eastern-north Atlantic.

The troughs and ridges associated with this wave train are spatially collocated with the climatological-mean jet stream, indicating that the jet serves as their waveguide.

2. Data and Methods

Data: Monthly reanalysis data from ERA5 and GPCP, 1979-2018.

Methods: To quantify the variability of Bermuda High we use Bermuda High Index **(BHI)** -- normalized sea-level pressure near **Bermuda** minus **New Orleans**.

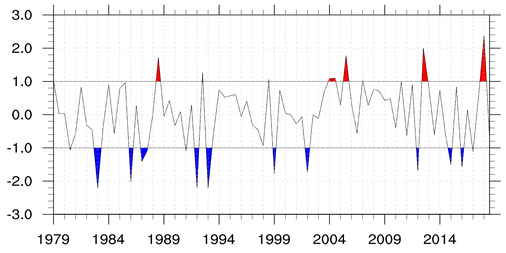

Fig. 1: Standardized time series of BHI.

3. Vertical composites

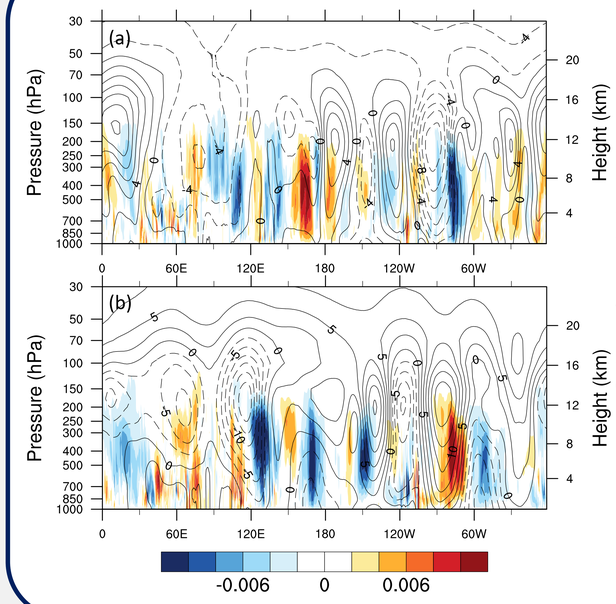

Fig. 2: Vertical cross section of 40°N-50°N averaged geopotential height anomalies (contour) and vertical wind anomalies (shaded) in positive (a) and negative composites (b).

4. Precipitation variability

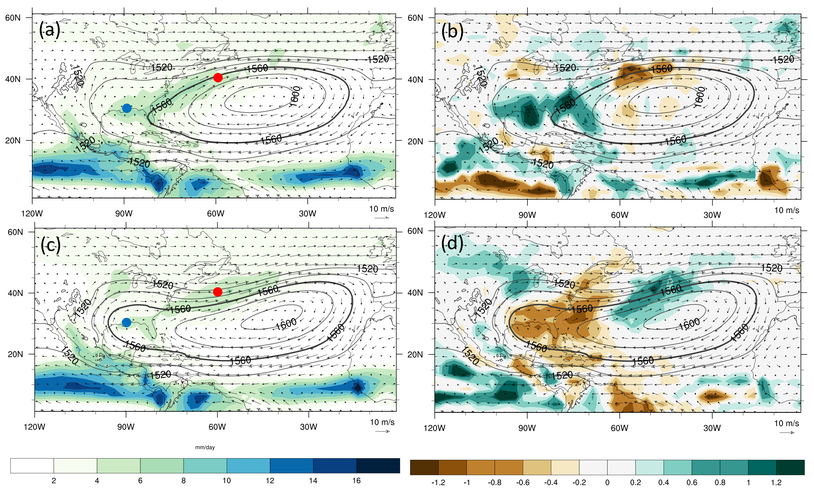

Fig. 3: JA composite maps of 850 hPa geopotential heights (contour),winds (vectors) climatological precipitation (a, c) and precipitation anomalies (b, d) in units of mm/day (shading) for BHI exceeding (a, b) 1 standard deviation and (c, d) -1 standard deviation . The 1560 gpm line , which is considered the border of Bermuda High is shown as a thick line.

The spots which are used to calculate BHI near Bermuda and New Orleans are marked by the dots in the corresponding colors in a and c.

5. Surface temperature variability

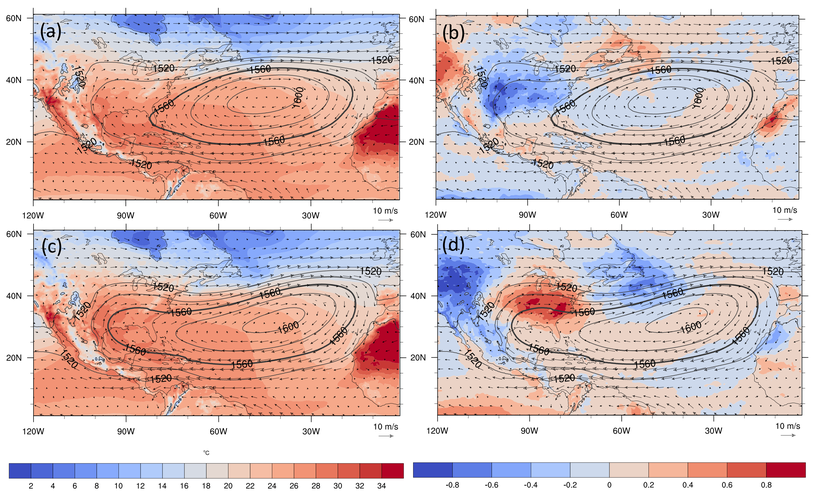

Fig. 4: Same as **Fig. 3**, except the shaded fields are surface temperature (a, c) and surface temperature anomalies (b, d), with a unit of °C .

Both precipitation and surface temperature are affected by Bermuda High, and their anomalies show opposite phases in the contrary composites.

6. Wave train patterns

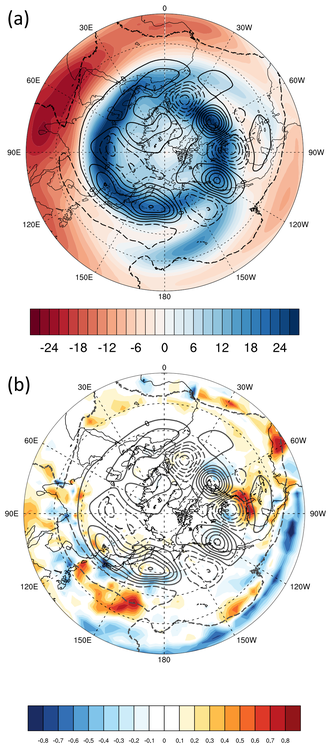

Fig. 5: 200 hPa geopotential height anomalies (contour) regressed onto BHI. The contour interval is 3 gpm Pa^{-1}.

(a) The shading depicts the 200 hPa JA-mean zonal wind (m s^{-1}).

(b) The shading is precipitation anomalies regressed onto BHI, with a unit of mm $(day\ Pa)^{-1}$.

(c) The shading is surface temperature anomalies regressed onto BHI, with a unit of K Pa^{-1}.

7. Robustness test and conclusions

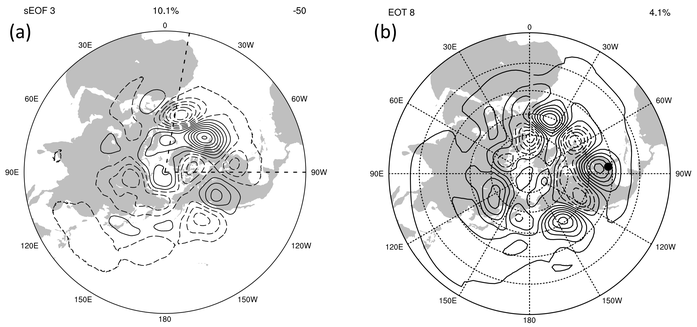

Fig. 3: Sectorial EOF (a) and EOT (b) of geopotential height anomalies. The central longitude of sEOF is 50°W. It explains 10.1% of the variance and its correlation with BHI is 0.42. EOT explains 4.1% of the variance and its correlation is -0.54.

The Rossby wave train pattern is a natural variability. It may be triggered by the large scale precipitation activities in the Pacific, for example, East Asia Summer Monsoon.

The mid-latitude westly jets serve as the waveguide, transporting the energy from north Pacific to north Atlantic, where the Bermuda High locates, and modifying the precipitation and surface temperature in southeastern US.