EGU2013-8200 Z-38 AS1.11: The global monsoon system: variability and dynamics

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Interannual Variability in the Strength and Position of the East Asian Jet Stream and Its Relation to Large - scale Circulation

Duo Chan, Yang Zhang, and Qigang Wu
School of Atmospheric Science, Nanjing University E-mail: chanduo.as@gmail.com

1. Introduction

East Asian Jet Stream (EAJS) is characterized by obvious interannual variability in strength and position (latitude), with wide impacts on East Asian climate in all seasons.

In this study, two indices are established to measure the interannual variability in intensity and position of EAJS. Possible causing factors, including both local signals (transient eddy activity and meridional temperature gradient at 1000 hPa) and non-local large-scale circulation (Arctic Oscillation, Pacific/North American pattern, and North Pacific Oscillation), are examined using NCAP-NCAR reanalysis data to investigate their relations with jet variation.

2.1 EAJS Indices

EAJS Indices are defined as:

(1) EAJS Intensity **(INT):** Speed of the 200 hPa zonal wind (U200) averaged over the jet core.

(2) EAJS Latitude **(LAT):** Latitude where the maximum U200 occurs most.

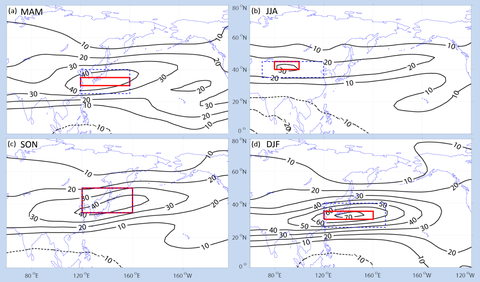

Fig 1. Climatology of U200 in a) MAM, b) JJA, c) SON and d) DJF. The solid lines denote westerlies while dashed lines denote easterlies. The red solid rectangular denotes ICD and the blue dashed rectangular denotes LCD.

Tab 1. Intensity calculation domain (ICD) & Latitude calculation domain (LCD) of **EAJS** during four seasons.

Season	ICD	LCD
Spring (MAM)	120-160ºE 30-35ºN	115-160ºE 25-40ºN
Summer (JJA)	80-100ºE 40-45ºN	70-120ºE 35-45ºN
Autumn (SON)	135-160ºE 35-50ºN	130-170ºE 35-50ºN
Winter (DJF)	120-160ºE 30-35ºN	120-170ºE 25-40ºN

2.2 Characteristics of U200 associated with EAJS Indices

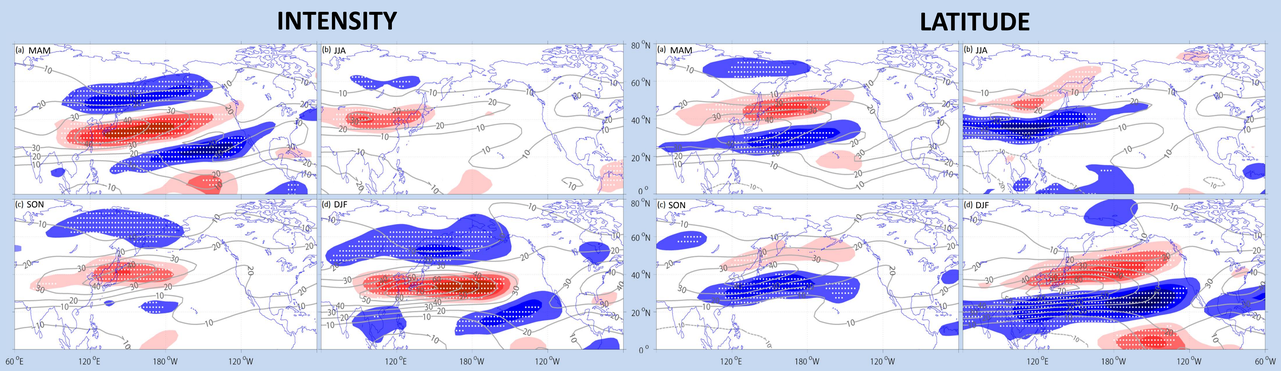

Fig 2.&3. Regression map of U200 based on INT (left) & LAT (right) in a) MAM, b) JJA, c) SON and d) DJF. The color shaded contour interval is 1m/s. Grey lines are the climatology of U200. White shaded areas pass a t-test at 99% confidential level.

3.1 Relationship with Transient Eddy (TE)

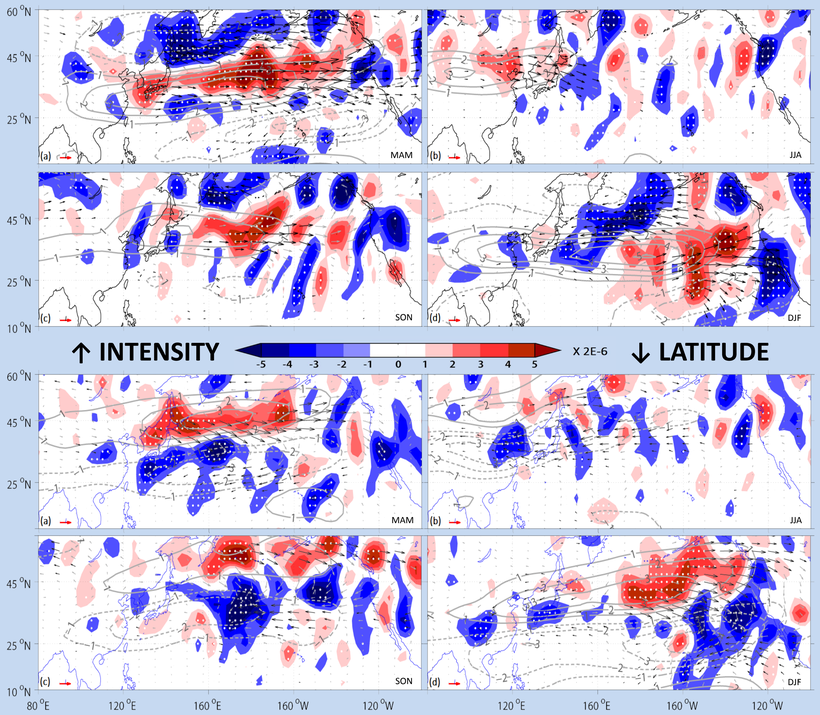

Fig 4.&5. Regression map of U200(grey contour), E-vector (quiver) and its divergence (color shaded contour) based on INT (left)) & LAT (right) in a) MAM, b) JJA, c) SON and d) DJF. The contour interval is 1 m/s for U200 and 2x10^{-6} m/s² for E-vector divergence. The red vector on (90° E , 12° N) denotes 10 m²/s². White shaded areas and black vectors pass a t-test at 95% confidential level. E divergence, red color denotes acceleration, blue color denotes deceleration.

3.2 Relationship with Temperature Gradient (TG)

Tab 2. Correlation between EAJS indices and corresponding TG indices during four seasons.

r	Spring	Summer	Autumn	Winter
INT	0.11	**0.76**	**0.60**	**0.40**
LAT	0.07	**0.40**	0.21	0.03

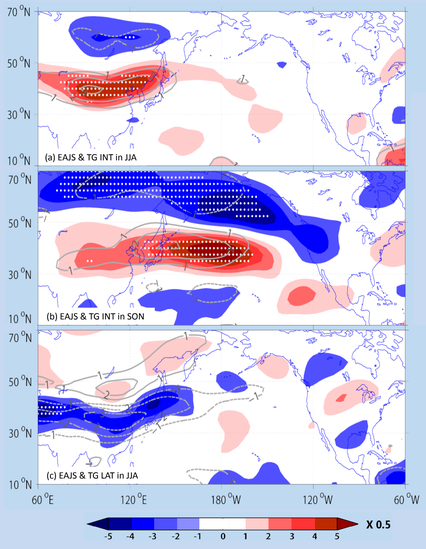

Fig 6. Regression map of U200 based on EAJS indices (grey contour) and corresponding TG indices (color shaded contour) a) INT in JJA, b) INT in SON, c) LAT in JJA. The grey contour interval is 1m/s, and the color shaded contour interval is 0.5m/s. White shaded areas pass a t-test at 99% confidential level.

4. Relationship with Large-scale Circulation

Tab 3. Correlation between EAJS and Large-scale circulation indices during four seasons.

R	INTENSITY				LATITUDE			
	Spring	summer	Autumn	Winter	Spring	Summer	Autumn	Winter
AO (Li)	0.09	0.04	0.02	0.15	0.13	0.01	0.21	**0.46**
AO (CPC)	0.11	0.11	0.15	0.20	0.07	0.24	0.19	0.25
PNA	**0.44**	0.24	**0.42**	**0.50**	0.18	**0.42**	0.19	0.15
NPO	0.19	0.15	0.15	0.31	**0.51**	0.14	**0.42**	**0.60**

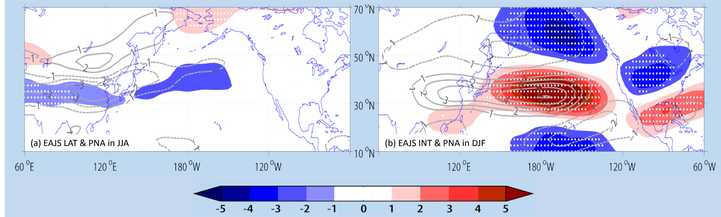

Fig 7. Regression map of U200 based on EAJS indices (grey contour) and PNA indices (color shaded contour) a) LAT in JJA and b) EAJS INT and PNA indices in DJF. Both grey contour and color shaded contour intervals are 1m/s. White shaded areas pass a t-test at 99% confidential level.

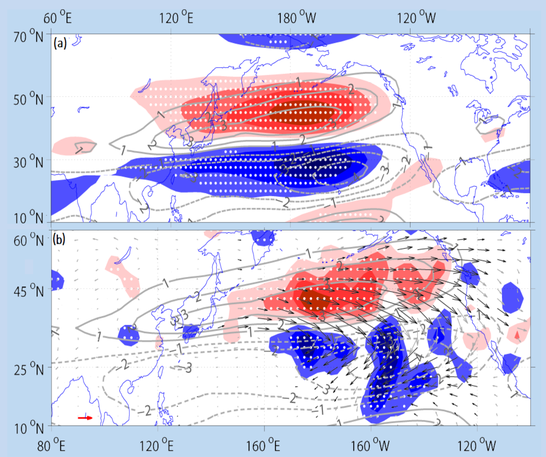

Fig 8. **a)** Regression map of U200 based on EAJS LAT (grey contour) and NPO (color shaded contour) in winter. White shaded areas pass a t-test at 99% confidential level. **b)** regression map of U200 (grey contour) based on EAJS LAT, E-vectors (quiver) and its divergence (color shaded contour) based on NPO in winter. The contour interval is 1m/s, while for filled contour is 3x10^{-6} m/s². Red vector on (90° E , 12° N) denotes 10 m²/s². White shaded areas and black vectors pass a t-test at 95% confidential level. E divergence, red color denotes acceleration, blue color denotes deceleration.

5.Conclusion

- The relationship between the interannual variations of EAJS and local or non-local factors depends on seasons.
- In the summer, both the intensity and position of EAJS are closely related to the meridional gradient of local surface temperature, but display no apparent relationship with the large-scale circulation.
- In cold seasons (autumn, winter and spring), both the local factor and the large-scale circulation (i.e. PNA), play important roles in the interannual variability of the jet intensity. The variability in the jet position, however, is more correlated to the North Pacific Oscillation (NPO), especially in winter.
- Transient eddy activity plays an important role in connecting the interannual variability of EASJ position with NPO.