

# The association of West Pacific subtropical high variability with the Indian summer monsoon 2022

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## 1. Introduction

Apart from ENSO, the variability in the intensity and location of West Pacific Subtropical High (WPSH) is closely linked with the interannual and sub-seasonal rainfall variations over India (Chowdhary et al., 2013,2019; Huang et al., 2018; Chaluvadi et al., 2021). However, connection of WPSH with the daily variation of summer monsoon rainfall over India is still not examined. WPSH is an anticyclonic system in the lower troposphere over the northwestern Pacific, which is strongest during boreal summer. This study investigates the association between WPSH variability and daily summer monsoon rainfall variations during 25-30<sup>th</sup> June 2022.

## 2. Data

Datasets used are: (i) Global Precipitation Climatology Project (GPCP) daily precipitation (mm) ( $1^\circ \times 1^\circ$ ) (b) Daily wind (m/sec), Mean sea-level pressure (MSLP; hPa), specific humidity (g/kg) on ( $2.5^\circ \times 2.5^\circ$ ) at different vertical levels from National Centre for Environmental Prediction/National Centre for Atmospheric Research (NCEP/NCAR) Reanalysis (Kalnay et al., 1996).

## 3. Results

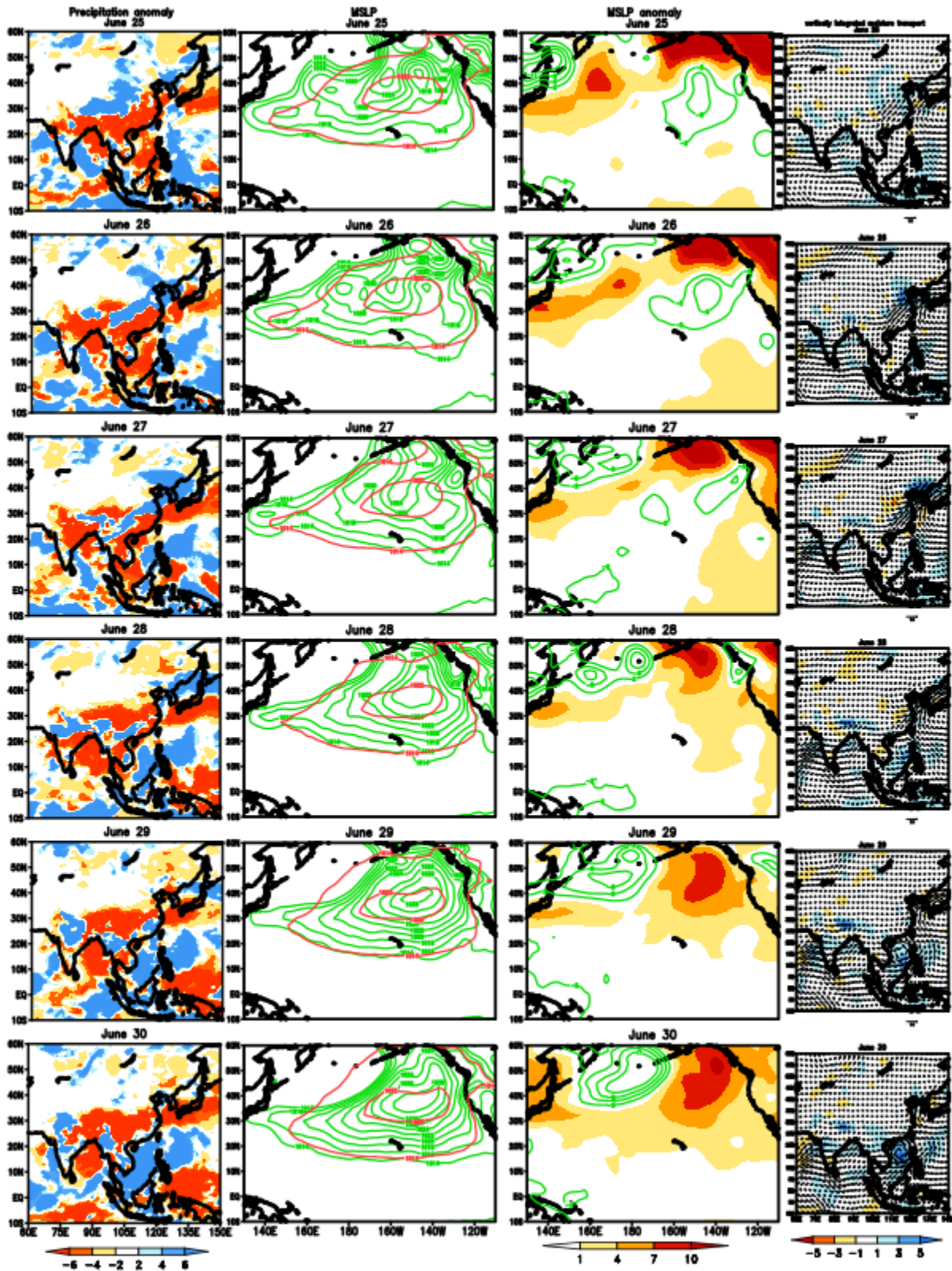
Daily precipitation anomaly over Indo-Pacific region during 25-30<sup>th</sup> June 2022 is illustrated in Figure 1(left column). MSLP overlaid by the climatology (Figure 1; 2<sup>nd</sup> column) and MSLP anomaly (Figure 1; 3<sup>rd</sup> column) over the Pacific Ocean for 25-30<sup>th</sup> June 2022 is illustrated. The centre of WPSH is shifted northward during 25-27<sup>th</sup> June 2022, while intensification and westward extension of western flank of WPSH is noted from 28-30<sup>th</sup> June 2022. Precipitation is enhanced over parts of west and central India (Chaluvadi et al.,2021), South China Sea extending to the Philippine Sea, whereas it is largely reduced over Bay of Bengal (BOB) (Chowdhary et al., 2013), coincident with the strong and westward expanded WPSH during 28-30<sup>th</sup> June 2022. On the contrary, northward shift of WPSH induced suppressed rainfall over most regions of India except eastern parts, during 25-27<sup>th</sup> June 2022. The large-scale circulation fluctuation owing to variation in WPSH results in the changes in moisture supply from the Arabian Sea, Bay of Bengal and west Pacific Ocean, thereby affecting large-scale precipitation (Chaluvadi, et al, 2021). Thus, to understand the link between WPSH and precipitation over India, vertically integrated (from the surface to 300 hPa) moisture transport overlaid by moisture flux convergence during 25-30<sup>th</sup> June 2022 is examined (Figure 1; 4<sup>th</sup> column). The supply of moisture from the southern flank of intense westward extended WPSH, besides strong cross equatorial flow across the Arabian Sea (figure not shown), lead to increased precipitation over west and central regions of India during 28-30<sup>th</sup> June 2022. On the other hand, changes in the large-scale circulation over Indo-Pacific region due to northward shift of WPSH may be unfavourable for precipitation over India from 25-27<sup>th</sup> June 2022, resulting in decreased precipitation over most parts of India. This analysis suggests the importance of the Western Pacific circulation associated with WPSH variability in daily rainfall variations over India.

## References:

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**Figure 1.** Spatial plot of daily precipitation anomaly (1<sup>st</sup> column), MSLP (green contours) overlaid by climatology (red contours of 1014hPa and 1022hPa) (2<sup>nd</sup> column), MSLP anomaly (positive: shaded, negative: green contours) (3<sup>rd</sup> column), vertically integrated moisture transport ( $\text{kg}\cdot\text{m}^{-1}\cdot\text{s}^{-1}$ : vector) overlaid by moisture flux convergence ( $\text{g}\cdot\text{kg}^{-1}\cdot\text{s}^{-1}$  order  $10^4$ : shading) from the surface to 300hPa (4<sup>th</sup> column), during 25-30<sup>th</sup> June 2022 from top to bottom respectively.