



# Historical and future projections for variability in west Pacific subtropical high and its association with Indian summer monsoon by using CMIP6 simulations

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## Abstract

This study aims to analyse the historical and future projections of variability in zonal shift in west Pacific subtropical high and intensity of WPSH by using simulations of CMIP6 models. Based on the comparison of variability in WPSH which is analysed by using NCEP reanalysis data, total 8 models, AWI\_CM1, AWI\_ESM, BCC\_CSM2, BCC\_ESM, CAMS\_CSM, MPI\_ESM, NESM3 and IITM\_ESM are selected from out 25 models of CMIP6 over the period 1950-2014. The model AWI\_CM1 is well estimate the climatological location of WPSH around 20°N (location index) and intensity of WPSH well estimated by the IITM\_ESM models over the historical period which is approximately similar with NCEP reanalysis. The rainfall over ISM region during JA season is well estimate by the models are AWI\_CM1 and IITM\_ESM as compared to the observation (Aphrodite). In addition, there is a positive correlation between and westward shift of WPSH and AISMR during JA season over the historical period observed by using Aphrodite data and all the models estimate positive correlation expect that the NESM3 model. The pattern of spatial correlation between location index and rainfall over ISM region is well estimated by all models. At end of the 21st century, all models are predicting the westward shift in western plank of WPSH along with intensification expect CAMS\_CSM2 model projects is opposing with eastward shift and weakening of WPSH at end of the century. Future projections of All India summer monsoon rainfall from all the models are showing the increasing in amount of precipitation at end of the century. All 8 models are projecting that, there may be a strong positive relation between the westward shift of WPSH and precipitation over the AISMR

## Introduction

- The Indian summer monsoon rainfall (ISM) has peak interannual variability. Peak in monsoon rainfall occurs in the month of July and August.
- The behavior of ISM significantly influenced by large-scale forcing over Indo-Pacific region such as Sea surface temperature (SST), El Nino- Southern Oscillations (ENSO), West pacific subtropical high (WPSH) etc.
- Recent studies documented that extreme rainfall event over North-West Indo- Pak region during 2010 are well connected to the zonal displacement of WPSH. (Mujumdar et al.2012). And also there is increasing trend in westward displacement of WPSH (Preethi et al. 2017; Chaluvadi et al. 2021)
- Recent studies Chaluvadi et al. 2021 and 2023 documented that there is well association between the westward (eastward) shift of enhanced (weakened) WPSH is one the favorable (unfavorable) condition to the ISM on interannual and intraseasonal scales respectively over the period 1950-2020.
- However the future projections of WPSH variability and its relationship with ISM need to analyse based on easement of historical simulations on WPSH variability.

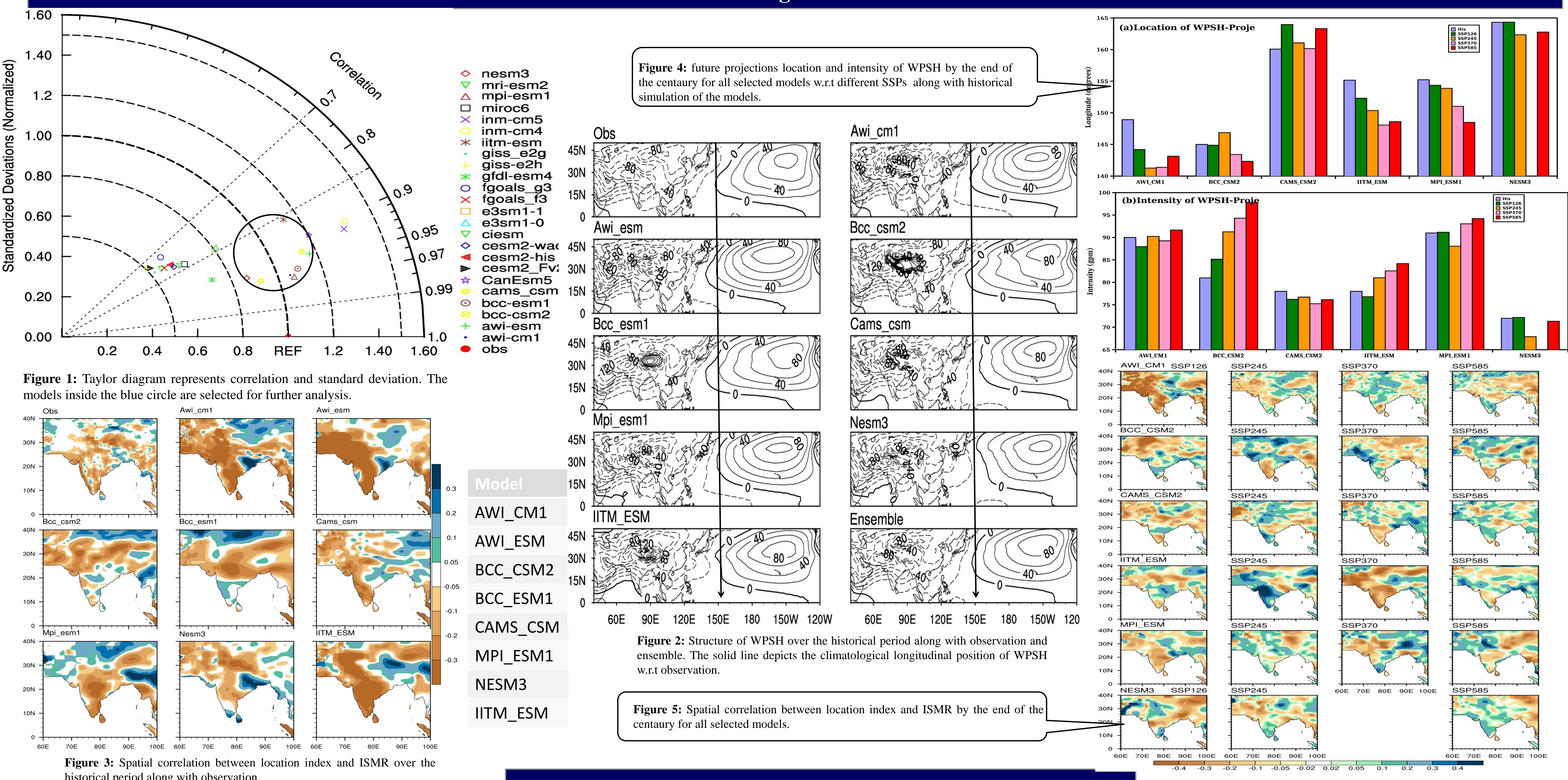
## Data

- The historical and future projections of WPSH is analysed during peak monsoon season [July and August] in historical period (1950-2014) and in end of the century (1969-2099).
- To relate the Indian summer monsoon rainfall with variability of the WPSH we use APPRODITE (Asian-precipitation – Highly Resolved Observational Data Integration Towards Evaluation of water resources) gridded data of resolution is 0.5° x 0.5°.
- The National Center for Environmental Prediction and National Center for Atmospheric Research (NCEP/NCAR) reanalysis datasets (Kistler et al., 2001) are used to represent the WPSH field at geopotential height on a 2.5° x 2.5° grid resolution.
- Taylor analysis employed for selection of models from 23 CMIP6 with condition is that the pattern correlation of WPSH over the northern Pacific Ocean (above 0.85) along with standardized ratio is 0.9 to 1.1 (Taylor 2001).

## Results

- The model AWI\_CM1 is well estimate the climatological location of WPSH around 20°N (location index) and IITM-ESM estimate intensity of WPSH approximately similar with NCEP reanalysis.
- There is a positive correlation between and westward shift of WPSH and AISMR during JA season over the historical period observed by using Aphrodite data and all the models estimate positive correlation.
- At end of the 21<sup>st</sup> century, all models are predicting the westward shift in western plank of WPSH along with intensification expect CAMS\_CSM2 model projects is opposing with eastward shift and weakening of WPSH at end of the century.
- All 5 models are projecting that, there may be a strong positive relation between the westward shift of WPSH and precipitation over the AISMR.

## Figures



## References & Acknowledgment

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