



5th General Assembly, Queenstown, New Zealand

Decadal variability in the PV intrusion events over the tropics and its impact on convection from climate change perspective

DEBASHIS NATH

Contributors:

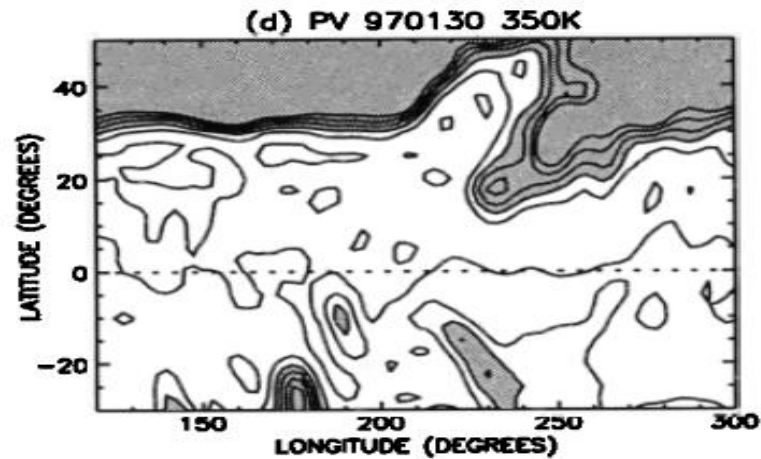
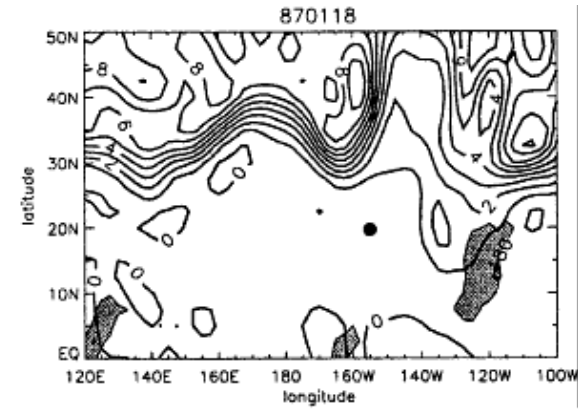
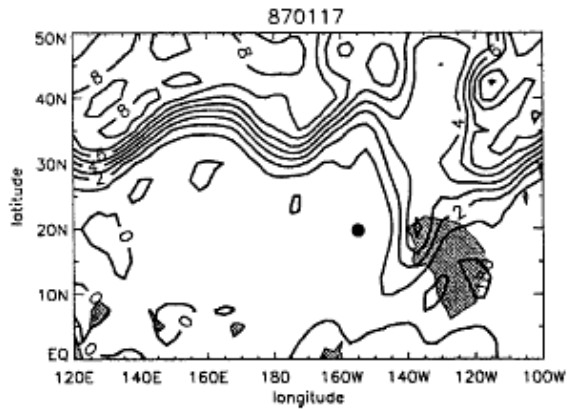
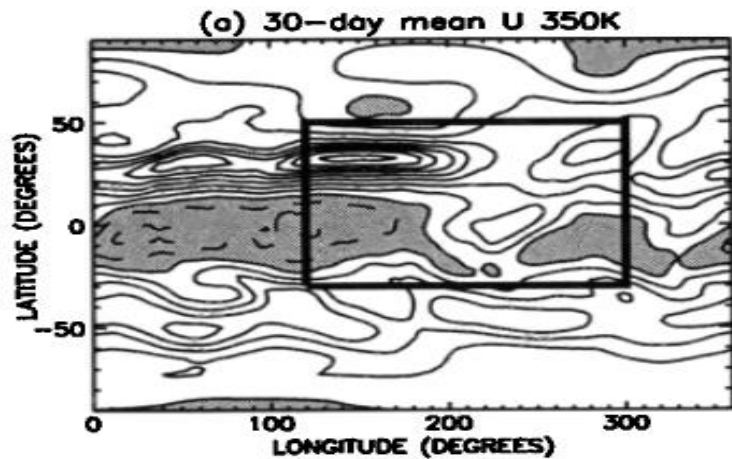
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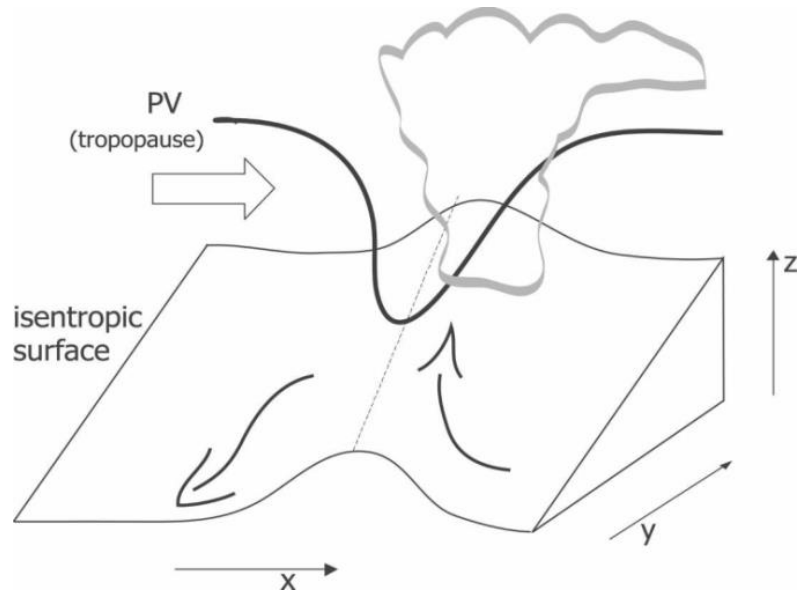
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Background



Waugh & Funatsu, 2003



Waugh & Polvani, 2000

PV > 2PVU at 10N/10S, 10° longitude, 6 days
Rossby wave breaking

Dixon et al. 2003

Data Used

ECMWF Reanalysis products: Potential Vorticity, Zonal Wind

ERA 40 (1958-1978), ERA Interim (1979-2012)

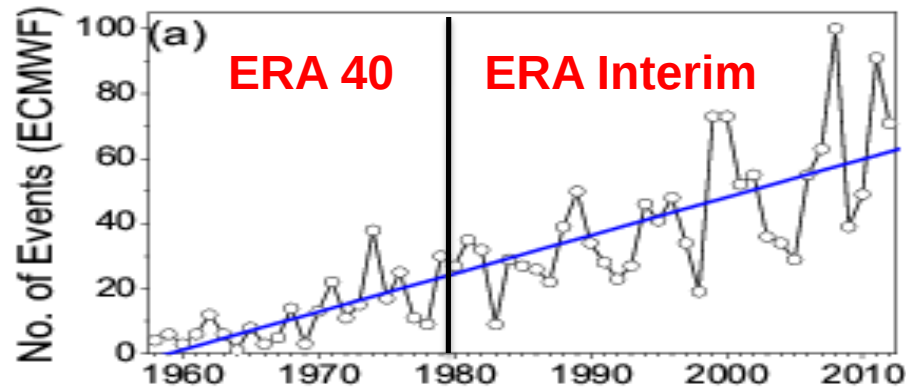
NCEP Reanalysis data (1977-2012), Isentropic Potential Vorticity (350 K), Zonal Wind

OLR data: NOAA Interpolated OLR data (1975-2012)

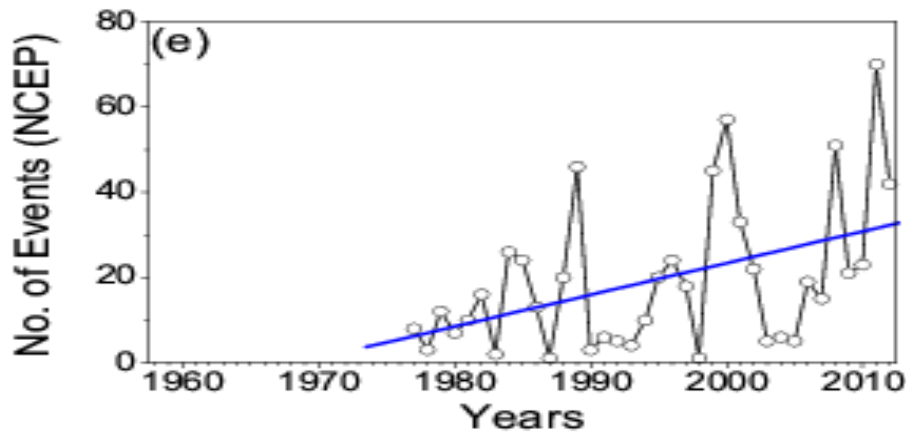
Sea Surface Temperature: HadISST (1958-2012)

ECHAM5 : 21 member Ensemble Model Run with HadISST as surface boundary conditions (AMIP)

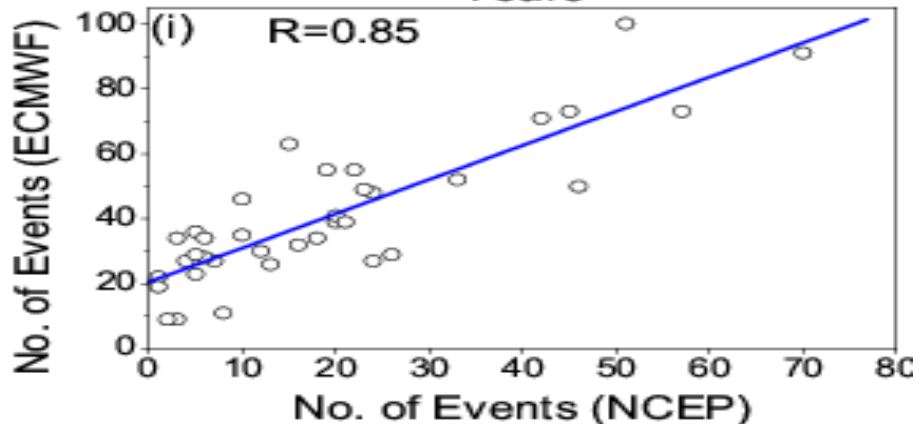
PVI Yearly Statistics



**ECMWF Reanalysis,
ERA 40 (1958-1978) &
ERA Interim (1979-2012)**

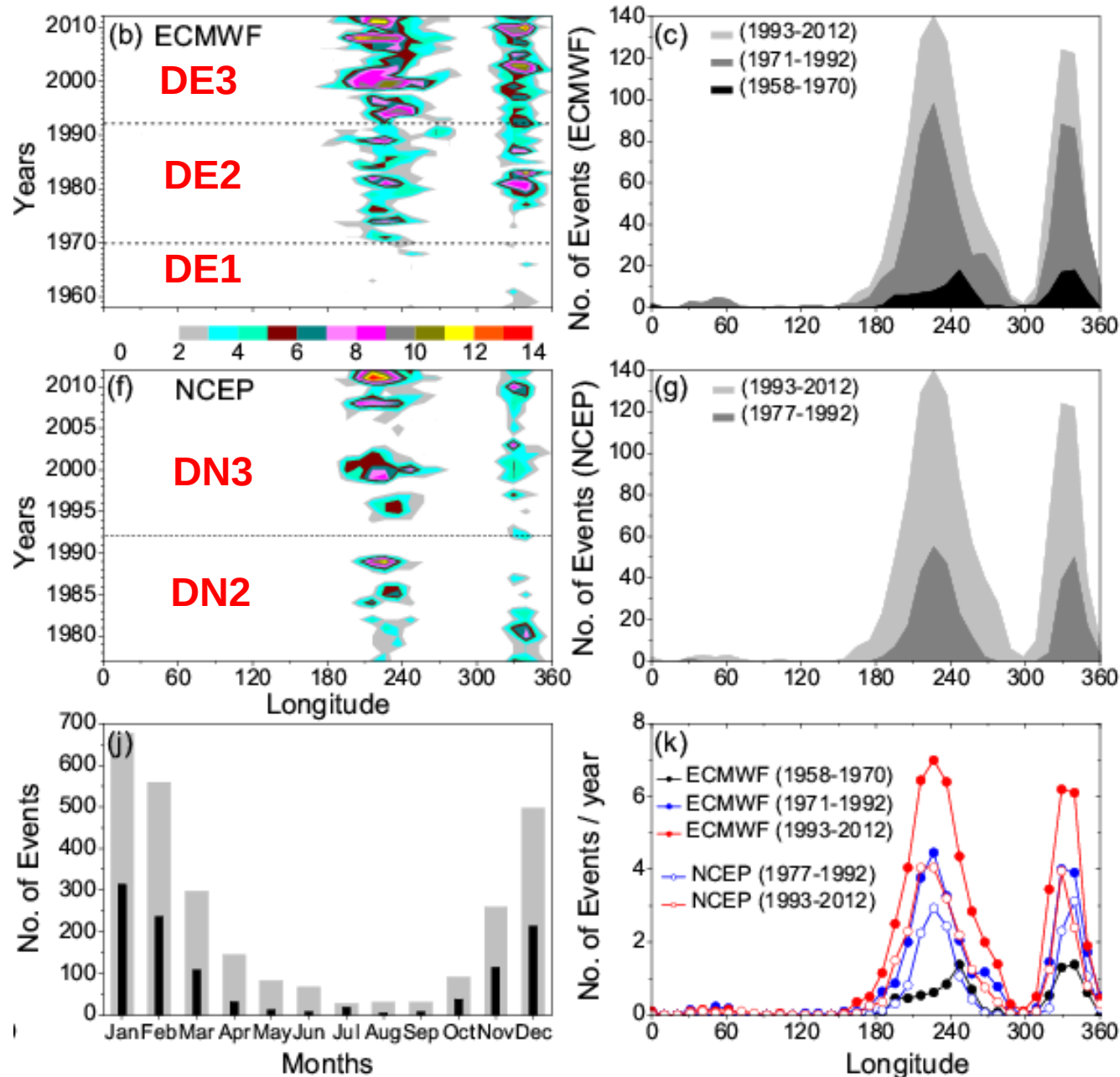


NCEP Reanalysis, (1977-2012)



Correlation ($> 95\%$), 1977-2012

Longitudinal and Seasonal Variation of PVI



DE1: 1958-1970

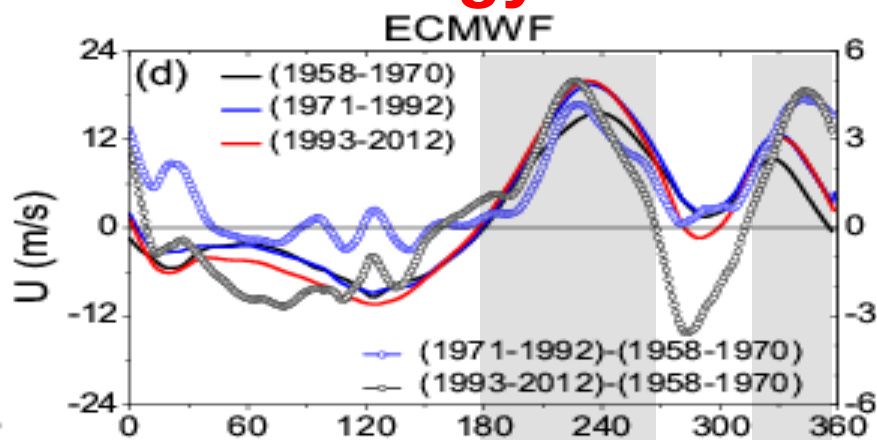
DE2: 1971-1992

DE3: 1993-2012

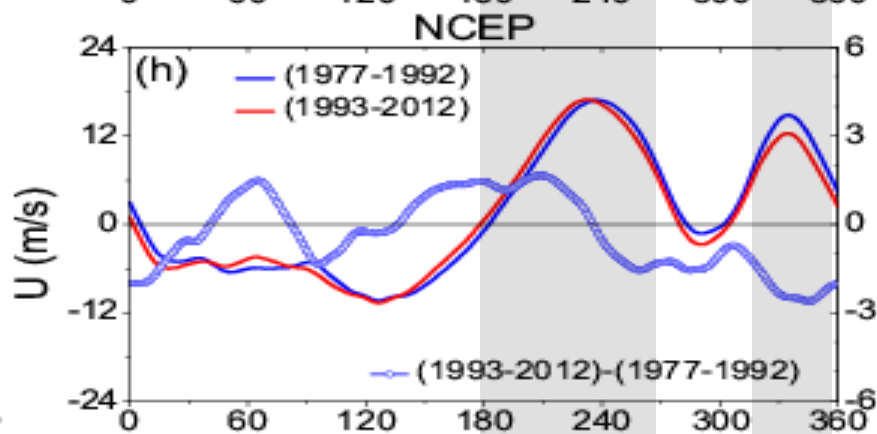
DN2: 1977-1992

DN3: 1993-2012

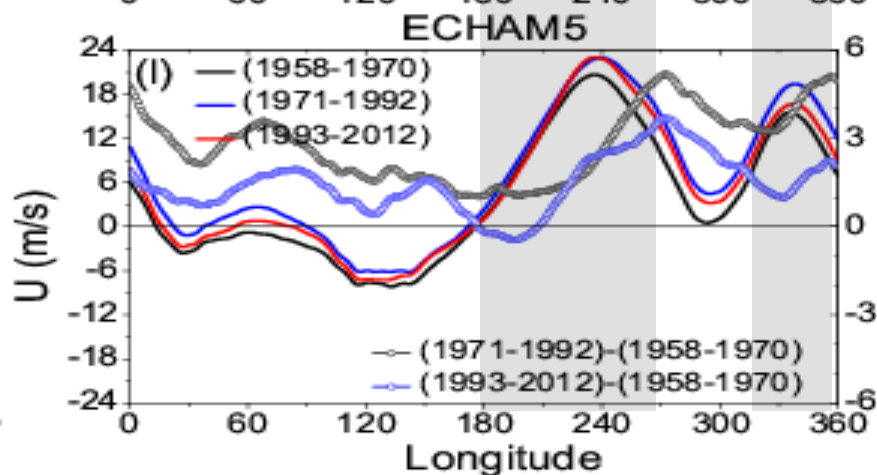
Climatology of Westerly Wind, 10S-10N, 200 hpa



The zonal wind speed increases by 4-5 m/s from **DE1** to **DE2** and persists in **DE3** also.

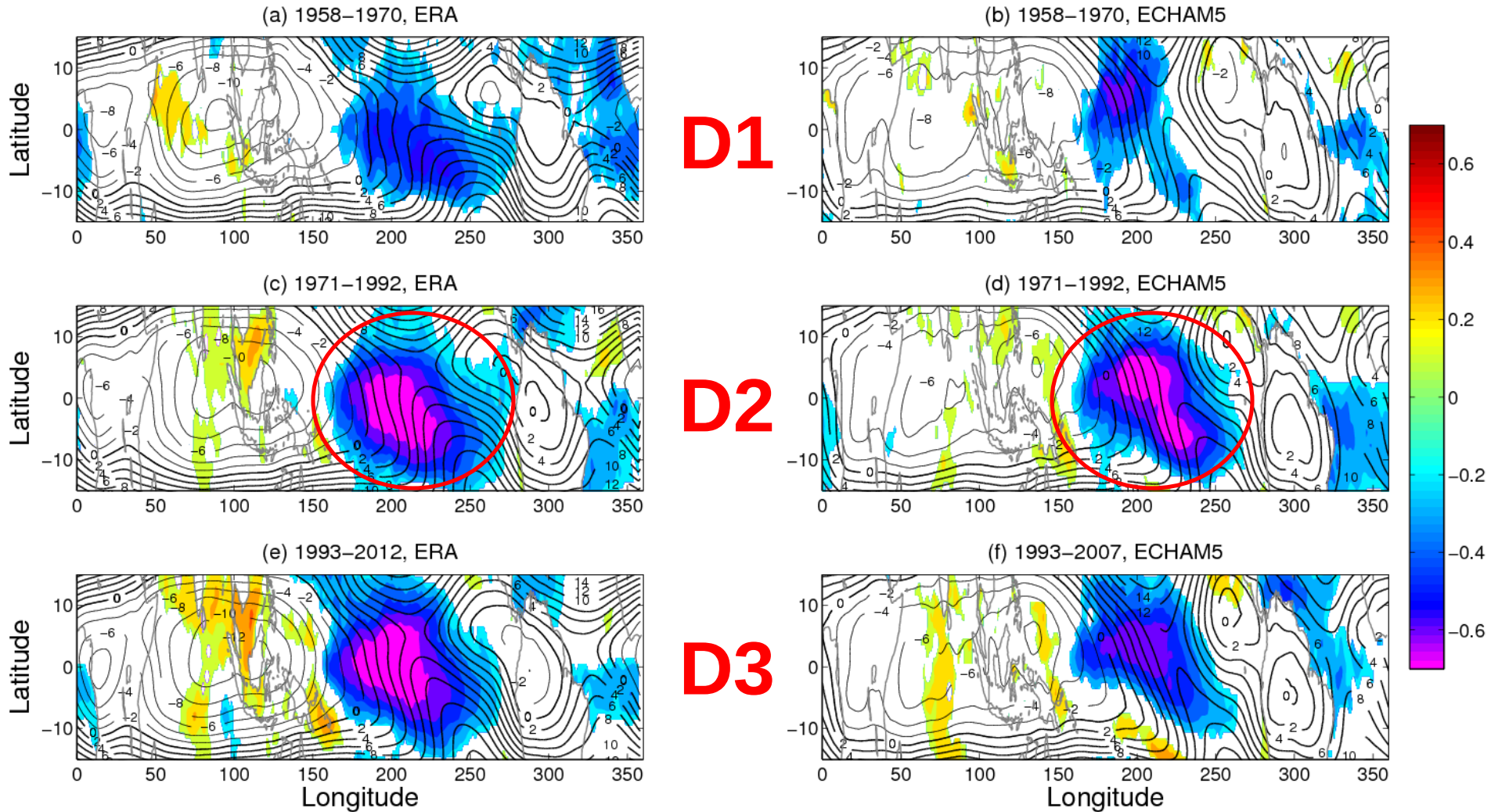


The zonal wind speed increases by 2 m/s from **DN2** to **DN3**.



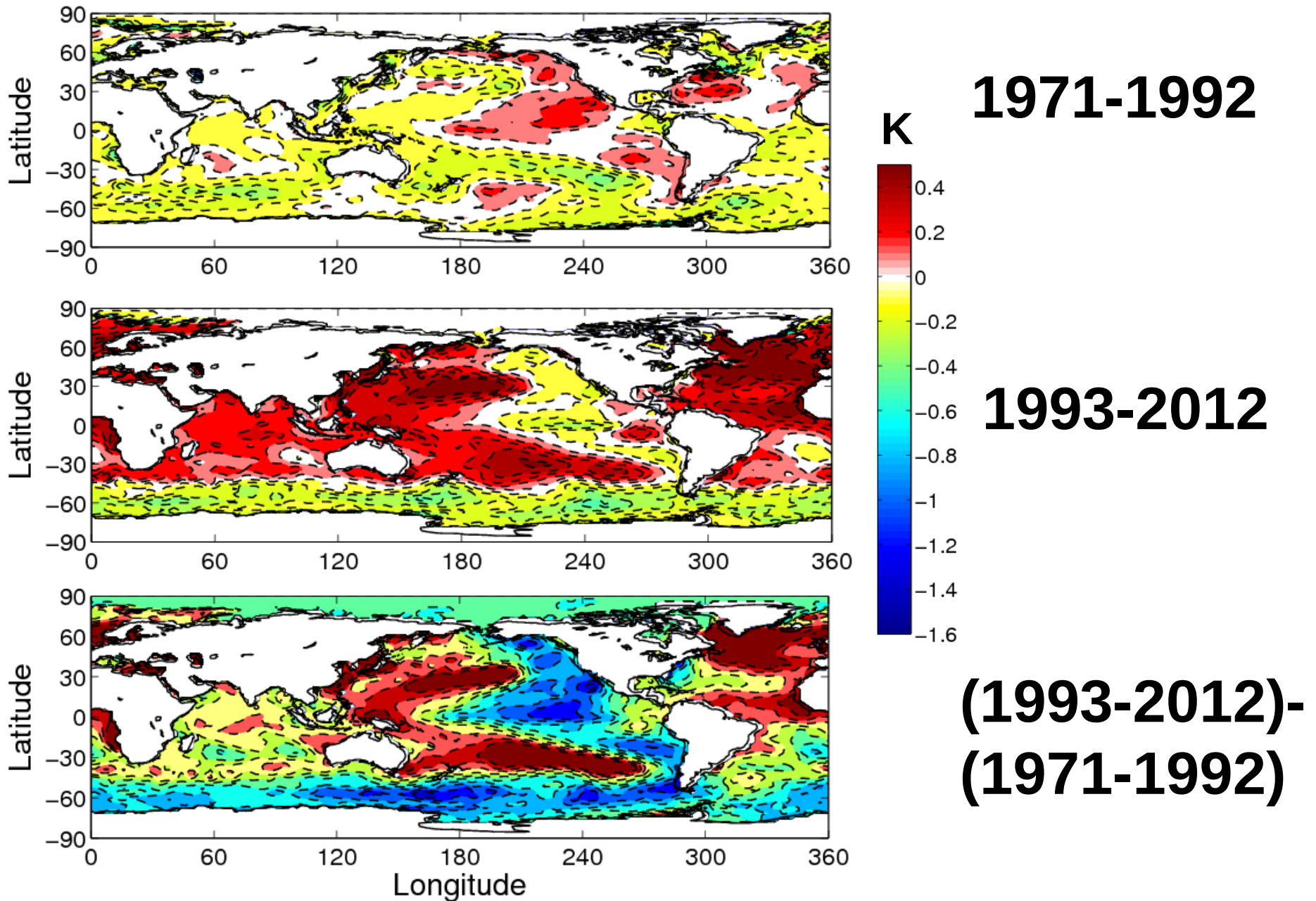
AMIP Run data

SST and U200 hpa correlation, ECMWF & ECHAM5 (DJFM)

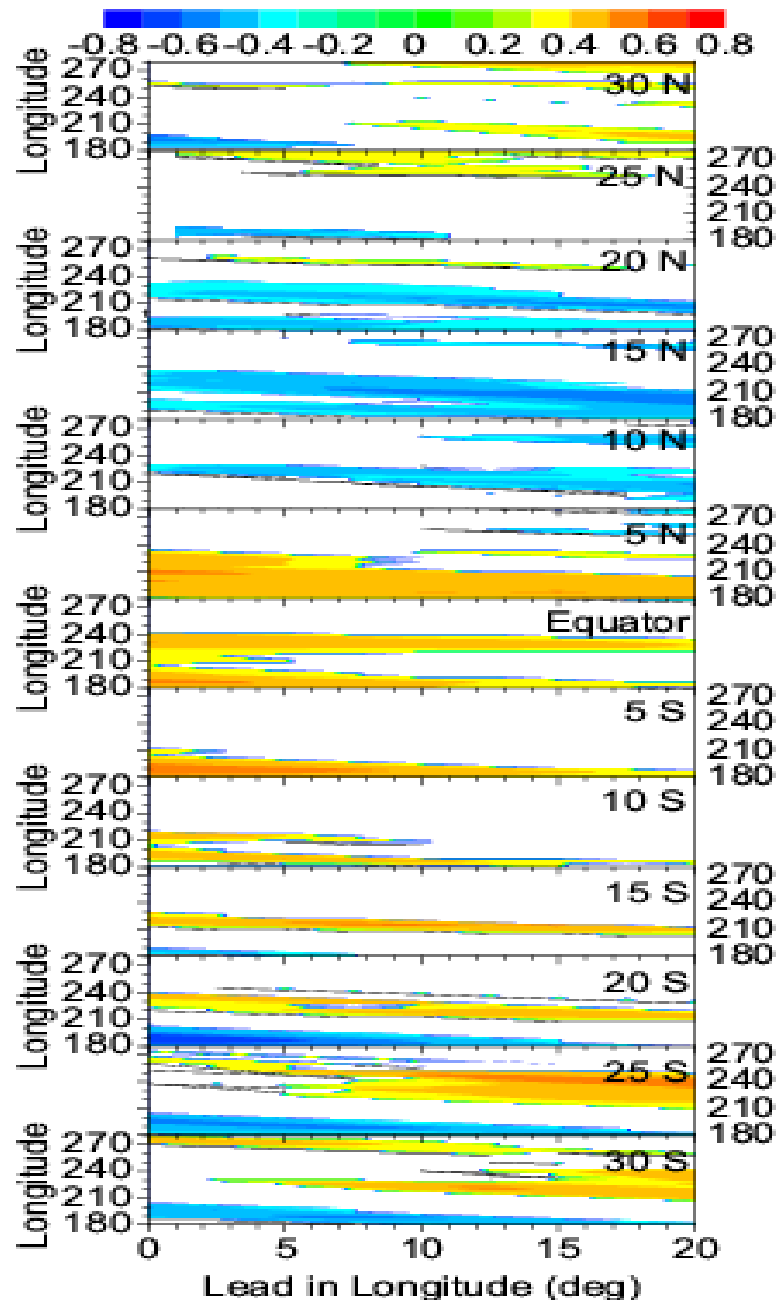


Significant increase in Correlation (>95 %) can be seen over Central Pacific in D2, but the feature is not clear over Atlantic Sector

Changes in SST anomaly Pattern



Impact on Tropical Convection



Perform sliding correlation along the Longitude

PVI events over Pacific Sector

180E 280E (1975-2012)

NOAA OLR anomaly

0 lead

5 lead

10 lead

15 lead

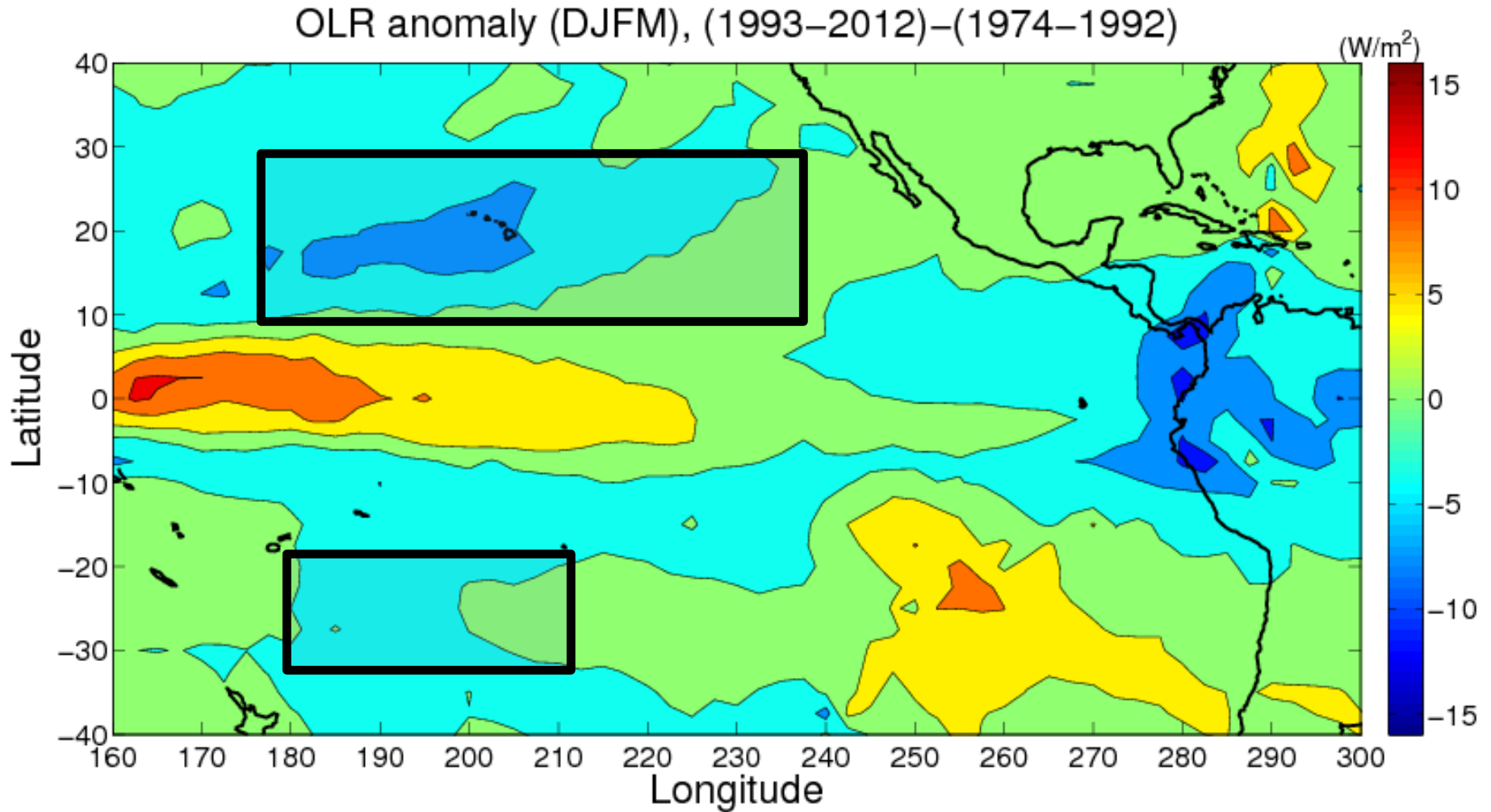
20 lead

Shifted by 2.5 deg eastward

Correlation coeff. >95% is considered

Similarly from 30S to 30N at an interval of 5 deg is plotted here

Decadal Change in OLR Anomaly (DJFM)



Possible Mechanism and Conclusion

SST warming pattern shifted westward from Eastern Pacific towards the warm pool i.e. Indian Ocean since 1970's and a cooling occurs over tropical Pacific Ocean.



This might have affected the Walker Circulation and increase the strength of equatorial westerlies over Central Pacific.



Act as a Strong wave guide for the high PV air from the midlatitudes due to Rossby Wave Breaking.



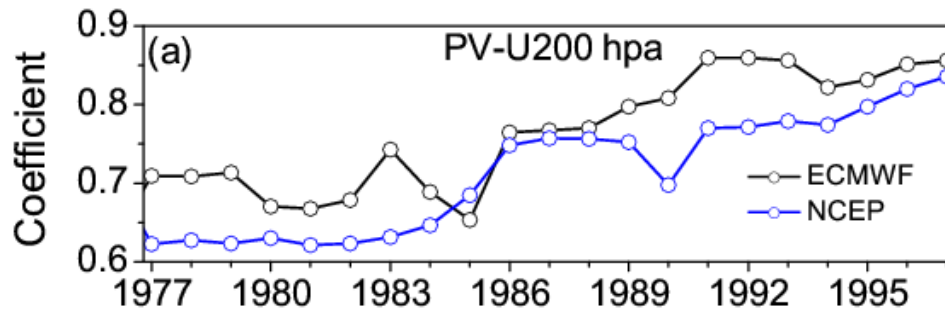
Increase in the number of PV intrusion events



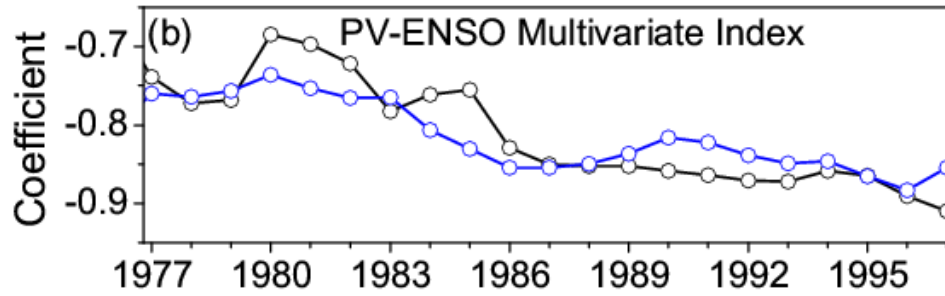
Enhanced the convective activities over the Tropical Pacific Sector and affect the dynamics over the Tropics.

Thanks for your Attention

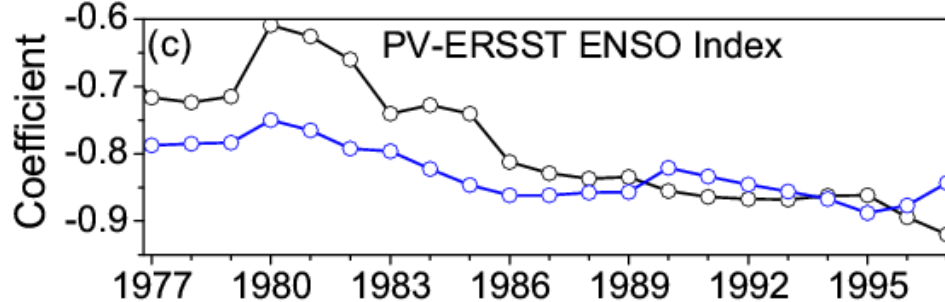
PV-ENSO 3.4 correlation, Dec-Jan-Feb-Mar



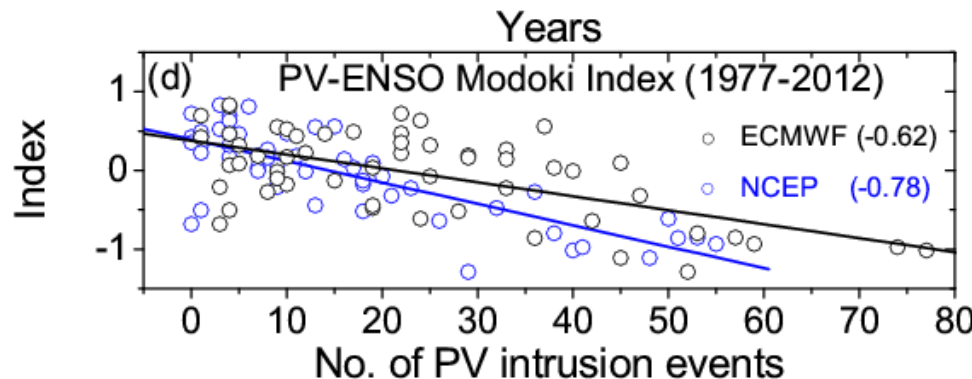
15 year running correlation



15 year running correlation



15 year running correlation



Ashok, 2007, since 1978, ENSO-Modoki is more dominant and might be related with recent global warming trend