



Supplement of

Unravelling the future role of internal variability in South Asian near-surface wind speed

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A assumption:

NSWS can be divide into **IPO-related NSWS component** and **IPO-independent NSWS component**

$$NSWS(i, t) = r(i)_{NSWS, IPO} \times IPO(i, t) + NSWS_{non-IPO}(i, t)$$

what we need:

$$NSWS_{non-IPO}(i, t) = NSWS(i, t) - r(i)_{NSWS, IPO} \times IPO(i, t)$$

Remove the NSWS component that is linearly associated with IPO index

$$r(i)_{NSWS, IPO} = \frac{\partial NSWS(i, t)}{\partial IPO(i, t)}$$

Equation used to calculate:

$$NSWS_{non-IPO}(i, t) = NSWS(i, t) - \frac{\partial NSWS(i, t)}{\partial IPO(i, t)} \times IPO(i, t)$$

Figure S1. Procedures for method used to remove IPO-related NSWS component.

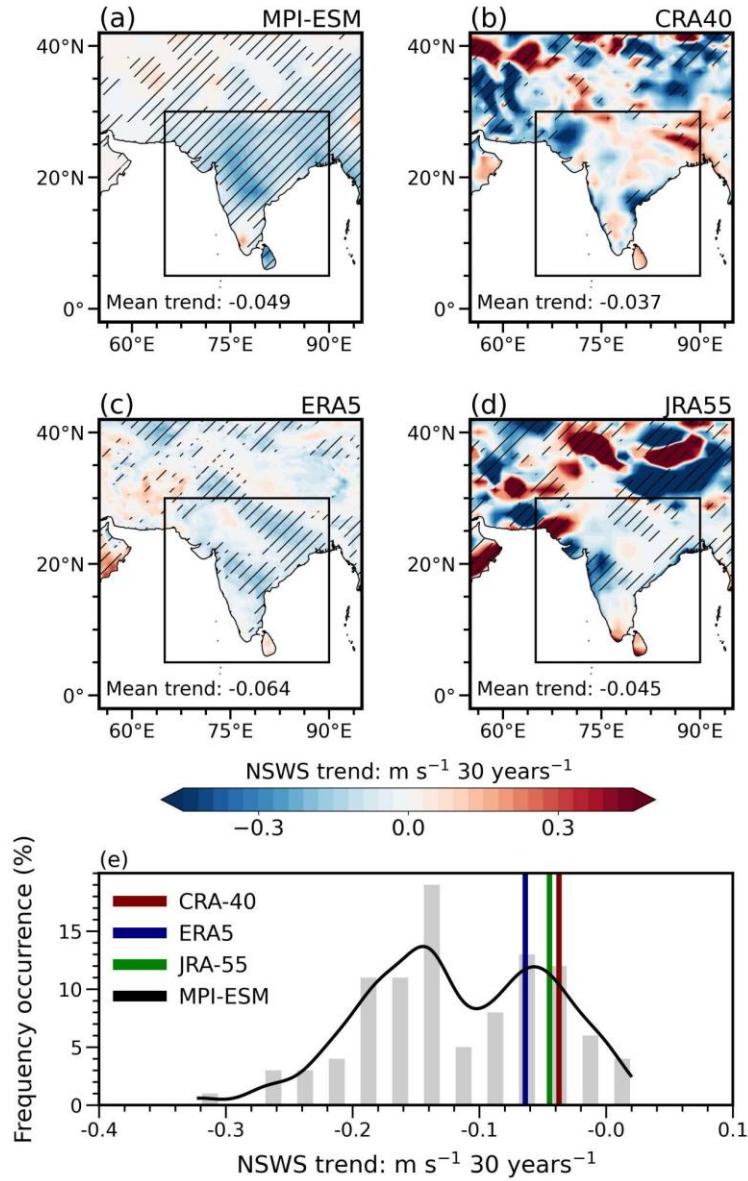


Figure S2. Evaluation of MPI-ESM in reproducing historical NSW trends over South Asia. (a–d) Spatial patterns of historical NSW trends from (a) the multi-member mean of MPI-ESM, (b) CRA40, (c) ERA5, and (d) JRA55. Trends are calculated over 1970–2005, except for CRA40, which spans 1979–2005. The text in the bottom-right corner indicates the area-averaged NSW trend over South Asia (units: $\text{m s}^{-1} 30 \text{ years}^{-1}$). (e) Histograms and fitted distribution lines of the area-averaged South Asian NSW trend derived from the 100 MPI-ESM ensemble members from 1970 to 2005. Vertical solid lines indicate the corresponding regional trend estimates from CRA40 (purple), ERA5 (dark-blue), and JRA55 (green).

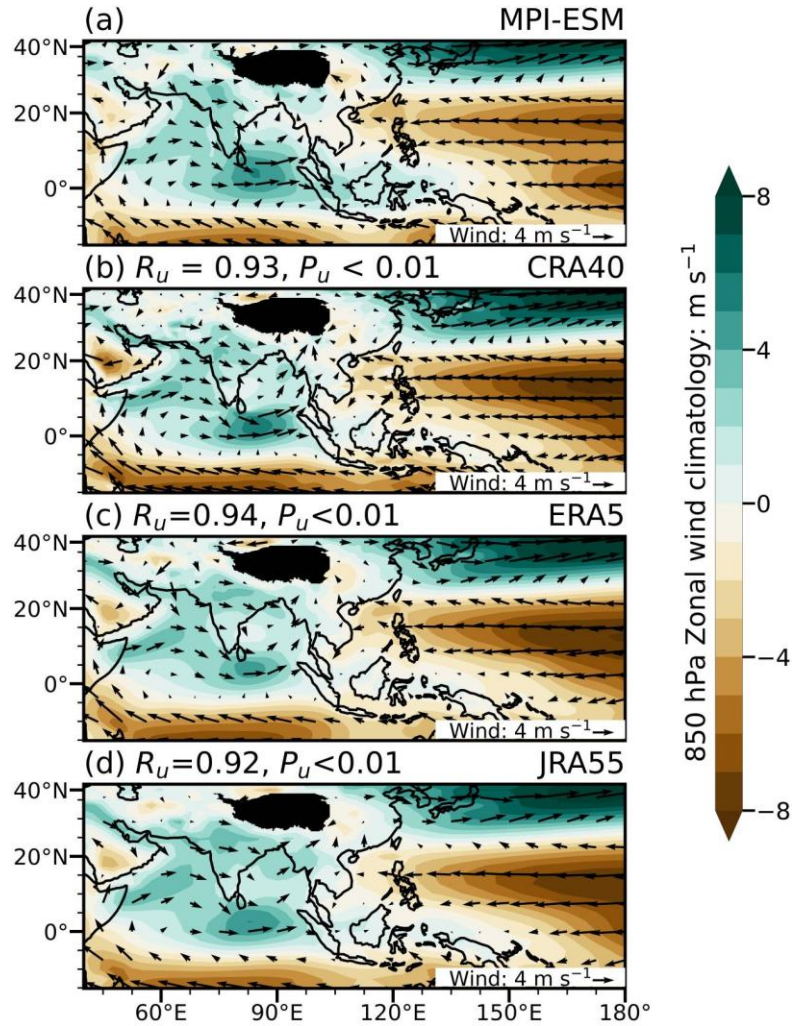


Figure S3. Climatological 850 hPa circulations during the historical period. Climatological zonal wind (shading) and horizontal wind vectors at 850 hPa for (a) the multi-member mean of MPI-ESM, (b) CRA40, (c) ERA5, and (d) JRA55. The climatology is computed over 1970–2005, except for CRA-40, which covers the period 1979–2005. For (b)–(d), R_u denotes the spatial correlation of the climatological zonal wind between panel (a) and panels (b)–(d), respectively. Values of $P_u < 0.01$ indicate that the correlation is statistically significant at the 99% confidence level.