

Predictability of the Indian Ocean and North Atlantic European circulation anomalies during early winter

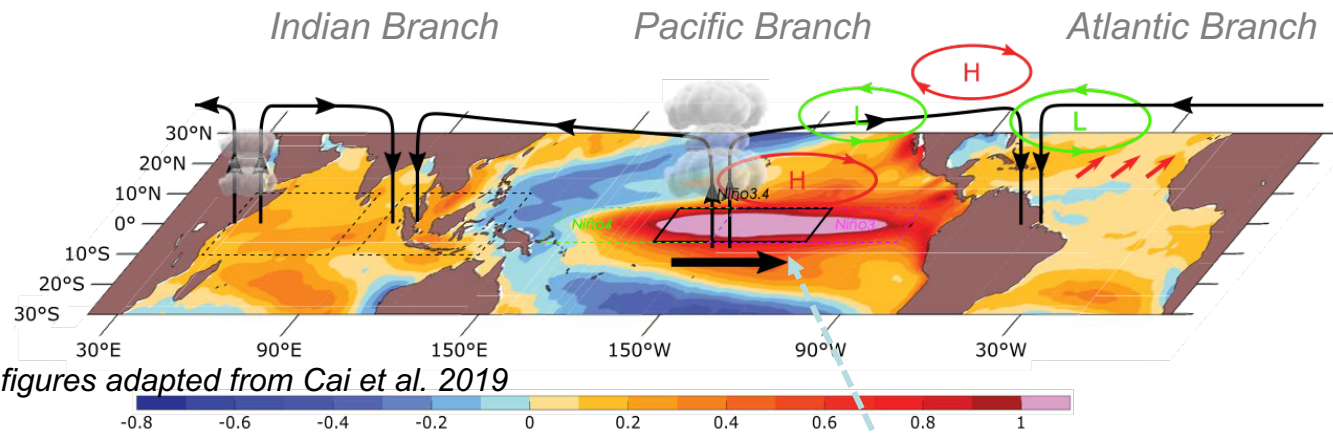
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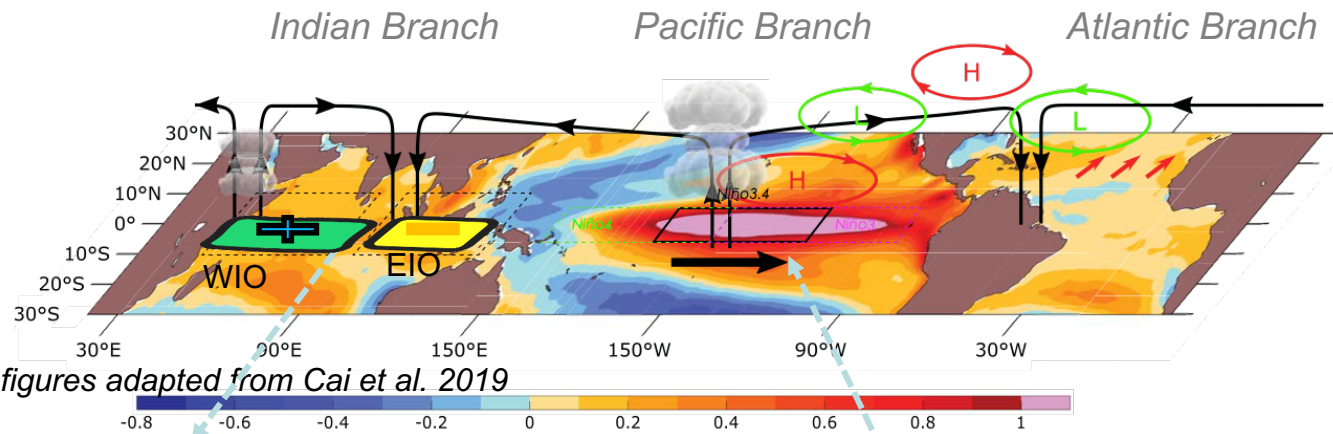
Contributed by: F. Kucharski (ICTP) and F. Molteni (ECMWF)

ENSO-Indian Interactions and North Atlantic Teleconnections



El Niño-Southern Oscillation (ENSO)

ENSO-Indian Interactions and North Atlantic Teleconnections



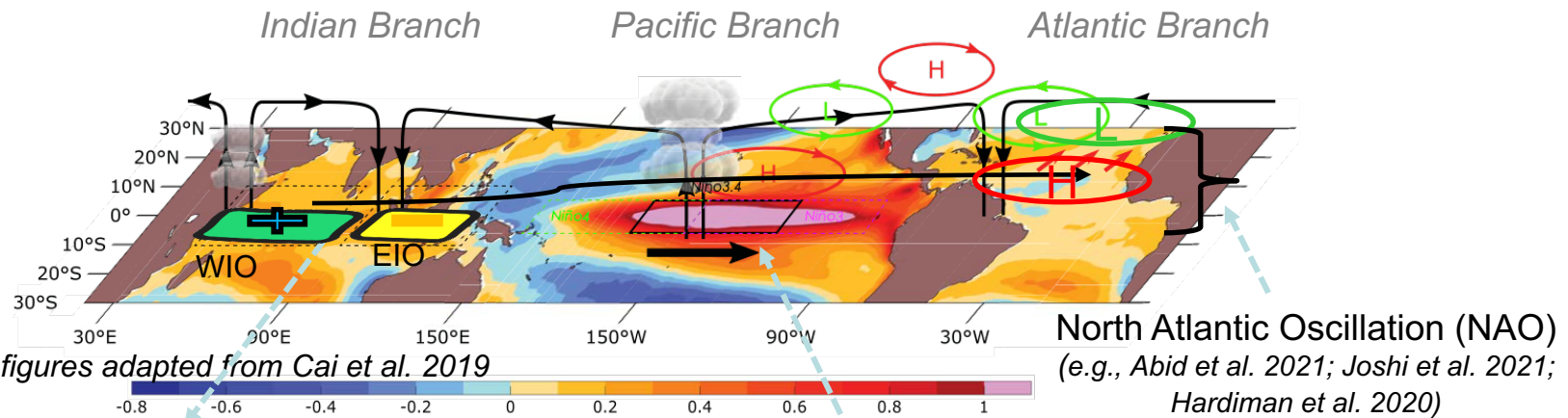
Source: Original figures adapted from Cai et al. 2019

Tropical Western-Eastern Indian Ocean (TWEIO) precipitation anomalies; [Abid et al. 2020 (GRL); 2021 (JCL)]

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Early Winter season (November- December)

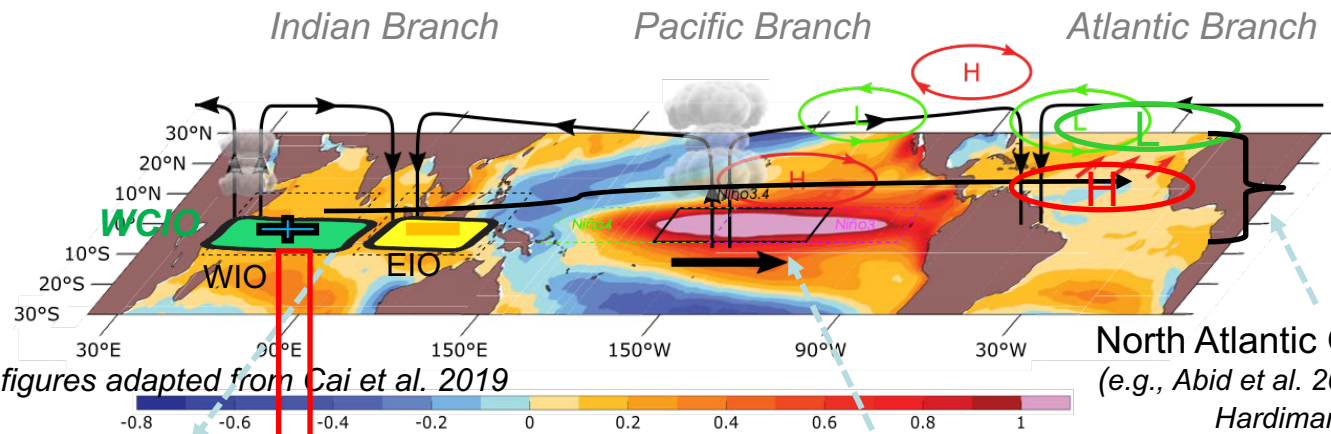


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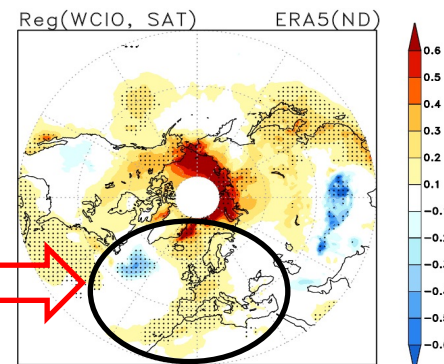
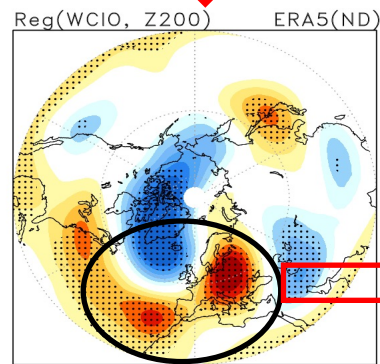


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North Atlantic Oscillation (NAO)
(e.g., Abid et al. 2021; Joshi et al. 2021;
Hardiman et al. 2020)

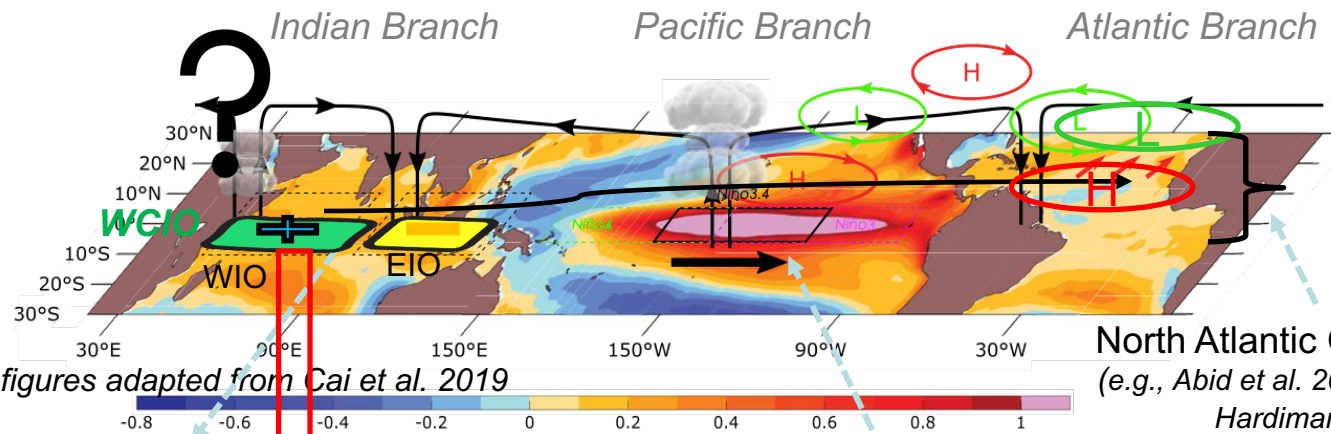
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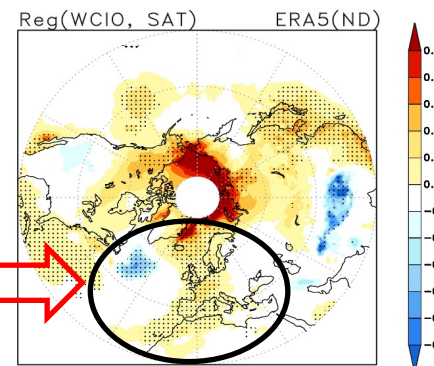
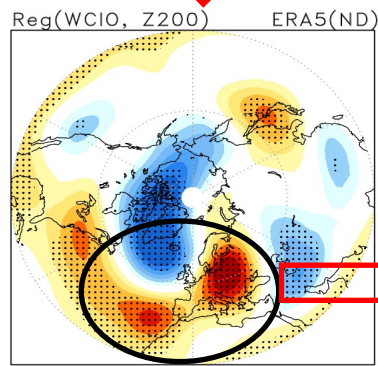


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El Niño-Southern Oscillation (ENSO)



Are the circulation anomalies predictable in North Atlantic region ?

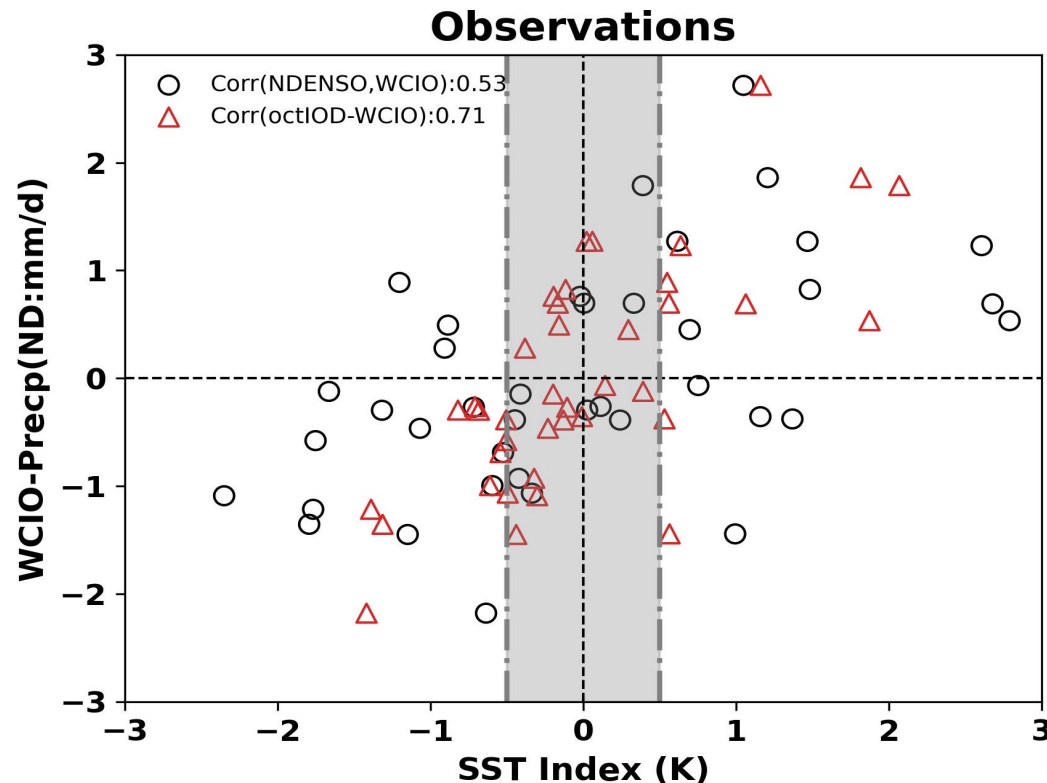


Questions

- Which tropical forcing (ENSO or Indian Ocean Dipole (IOD)) dominates the Western-Central Indian Ocean (WCIO) Precipitation anomalies variability in early winter?
- Are the WCIO precipitation anomalies predictable during early winter?
- Are the Indian Ocean (IO) forced NAO anomalies predictable during early winter?



WCIO Precipitation vs ENSO and Indian Ocean Dipole (IOD)

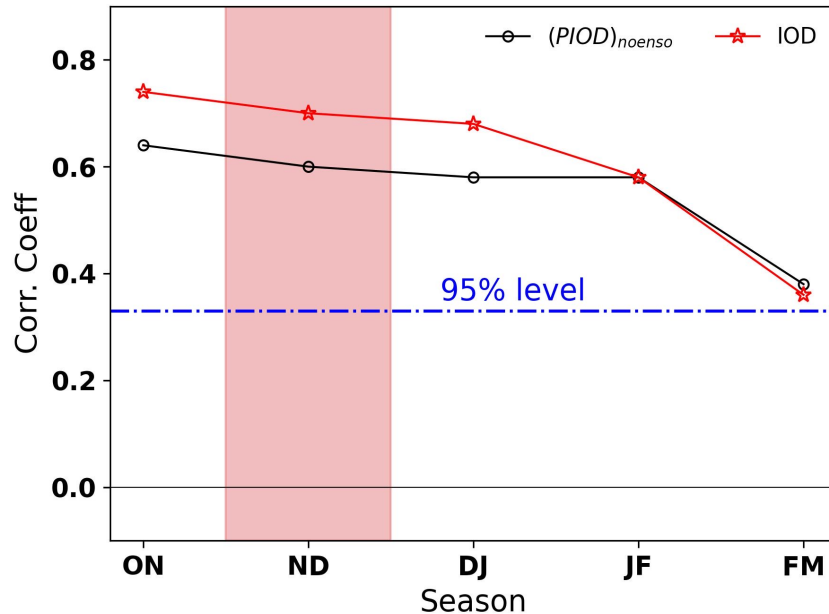


- WCIO Precipitation anomalies are strongly influenced by IOD compared to that of ENSO tropical SST forcings

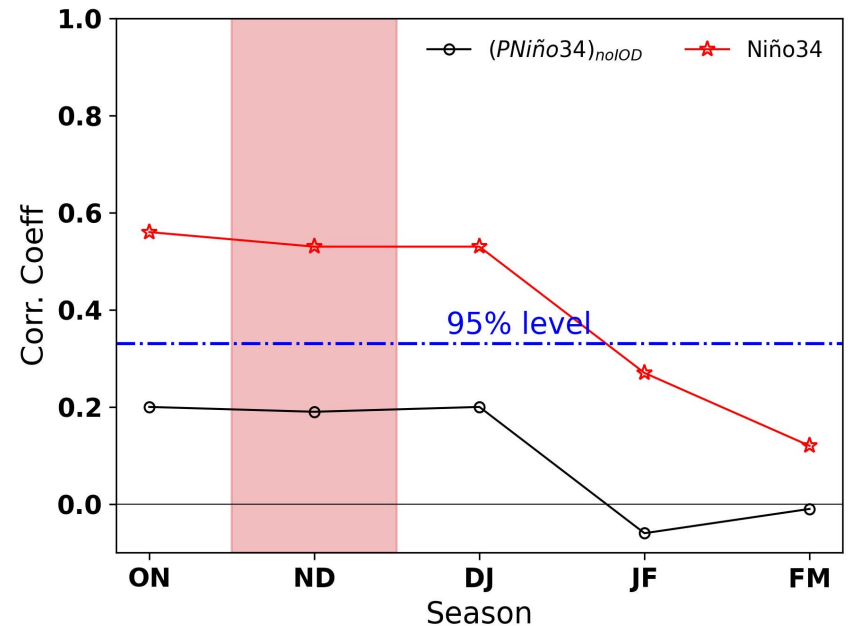
WCIO Precipitation anomalies (ENSO vs IOD)

$$X_{res}(t) = X(t) - b(x, y) \times X(t)_{rm}$$

IOD-WCIO precipitation



ENSO-WCIO precipitation

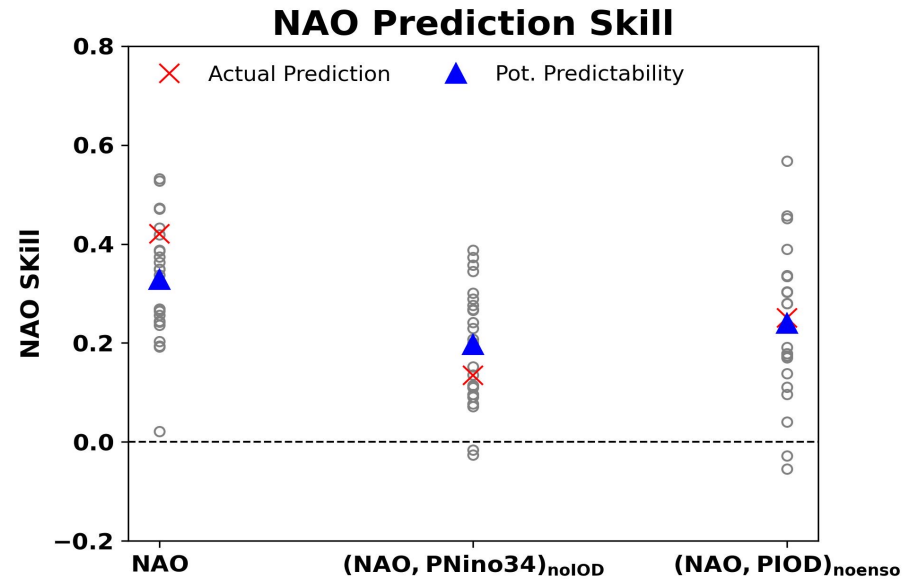
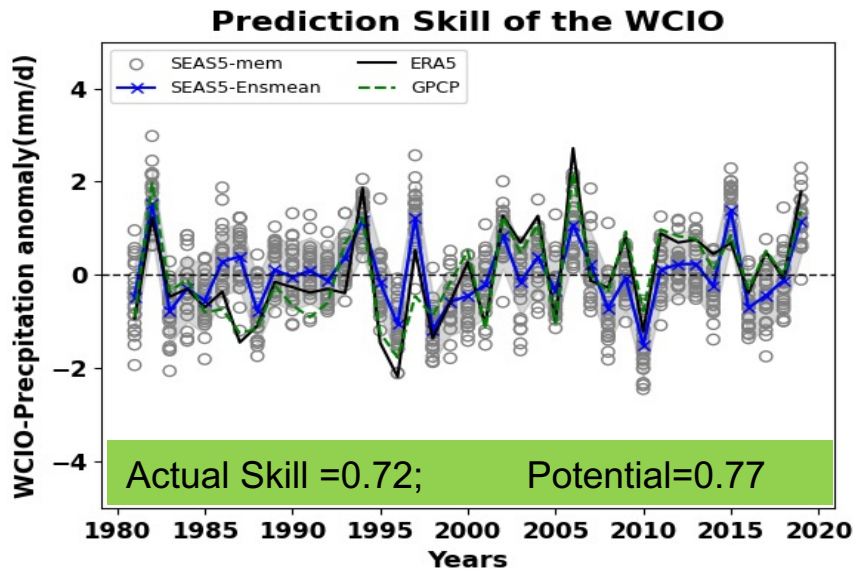


- ✓ Autumn IOD dominates the early winter precipitation anomalies in the Western-Central Indian Ocean (WCIO).

Abid et al. 2022; in preparation



Prediction skill of the TWClO Precipitation and NAO



- ✓ WCIO precipitation anomalies are prediction skill during early winter (Nov-Dec) with a reasonable prediction skill in the ECMWF-System5 (SEAS5).
- ✓ For, NAO, a reasonable prediction skill is noted in ECMWF-SEAS5, which is mainly dominated by the IO teleconnections in early winter.

Abid et al. 2022; in preparation

Summary

- Pre-conditioning of the Indian Ocean Dipole (IOD) in boreal Autumn modulates the WCIO precipitation anomalies during early winter.
- ENSO through the atmospheric bridge favours the Indian Ocean precipitation anomalies. In-phase response of both tropical basins (i.e., ENSO & Indian) enhances the WCIO precipitation anomalies.
- A reasonable prediction skill of the WCIO and NAO is noted in ECMWF-SEAS5 prediction system.
- Indian Ocean holds a key for the sub-seasonal to seasonal prediction skill of the North Atlantic and European (NAE) circulation anomalies during early winter. This can also explain some extremes (e.g., blocking events) over the NAE region.



THANKS

