


Near-term Projection of the Indian Summer Monsoon Circulation Using CESM 1.5⁰C, 2.0⁰C, RCP4.5 and RCP8.5 Scenarios



Presented by

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Indian Summer Monsoon

The Indian summer monsoon is a major component of the global climate system, which is the manifestation of strong land-sea thermal contrast.

It is characterized by the seasonal migration of the Inter-tropical Convergence Zone and establishment of cross-equatorial surface flow resulting in north-south pressure gradient.

It is the major source of a substantial amount of water to the most densely populated regions of the world.

Therefore, near-term projection is an important topic for model evaluation, decision making & planning.

Data & Methods

The NCAR-CESM low-warming simulations are used under 1.5°C, 2.0°C warming targets, RCP4.5 and RCP8.5 scenarios.



This simulations produce for the first time stabilized global mean temperatures at 1.5°C and 2.0°C above preindustrial levels.

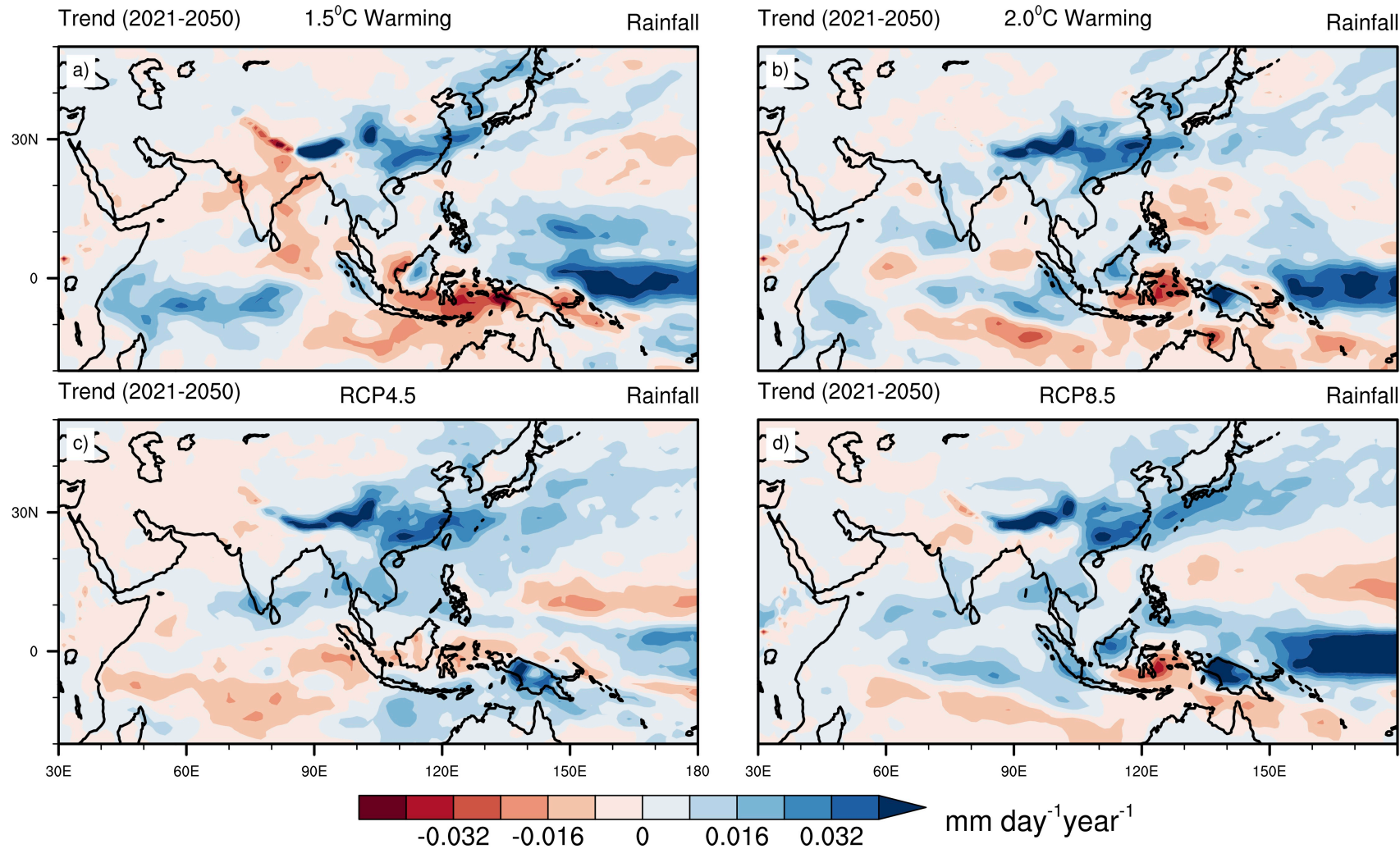


Global Precipitation Climatology Centre monthly dataset version 2018 1.0x1.0. Climatic Research Unit TS4.03, NOAA-CIRES 20th Century Reanalysis are used in our study. NCEP, ERA-40 and JRA-55 reanalysis dataset are taken for comparing wind analysis.



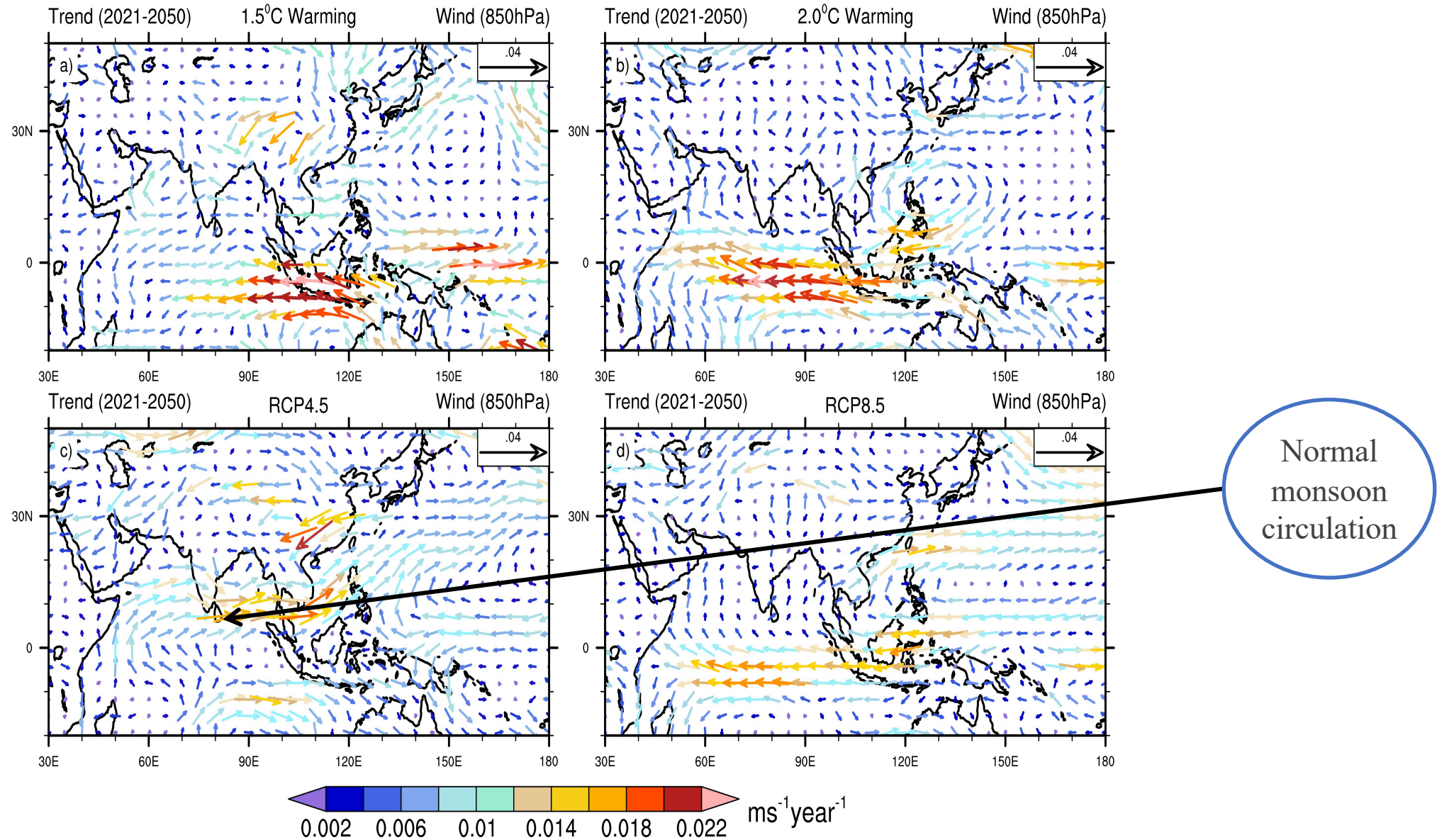
11 (1.5°C), 15 (2.0°C), 35 (RCP4.5&8.5) ensemble members are available to use.

Ensemble Trends of Rainfall (JJAS)

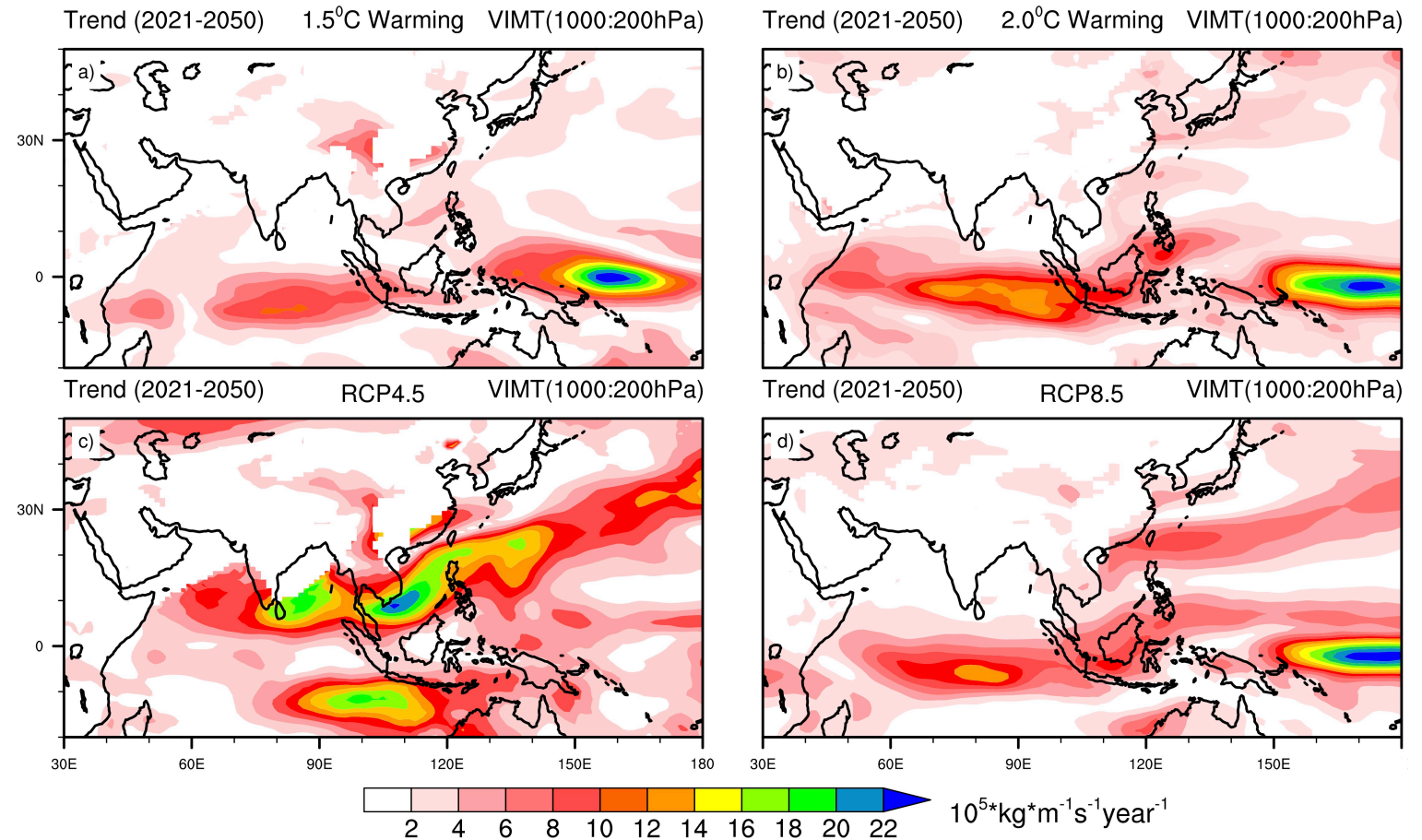


For all scenarios increasing Rainfall over East Asia is found, indicating A stronger East Asian Monsoon.

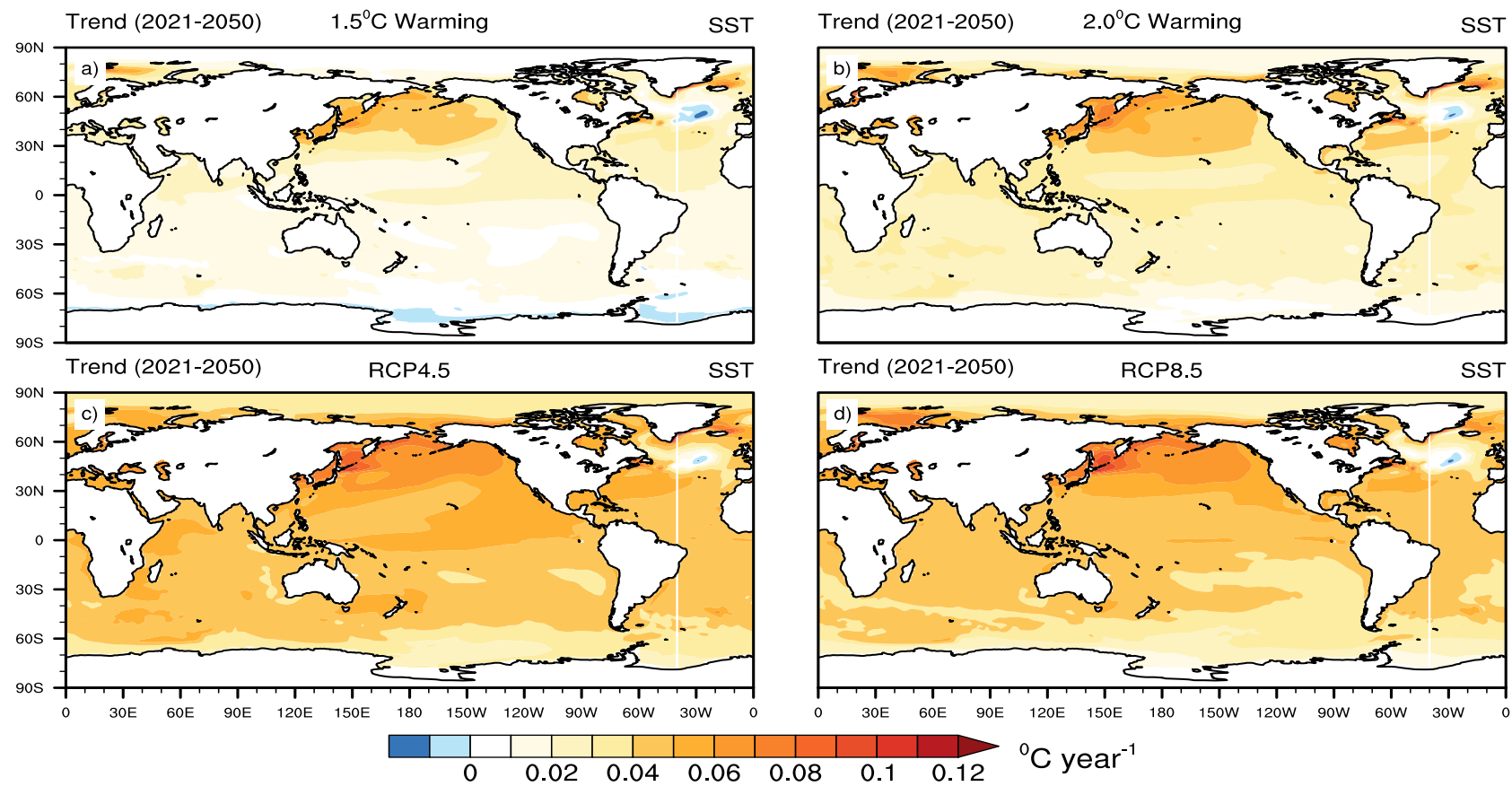
Ensemble trends in Wind (850 hPa) from 2021 to 2050



Ensemble
trends in
VIMT from
2021 to 2050



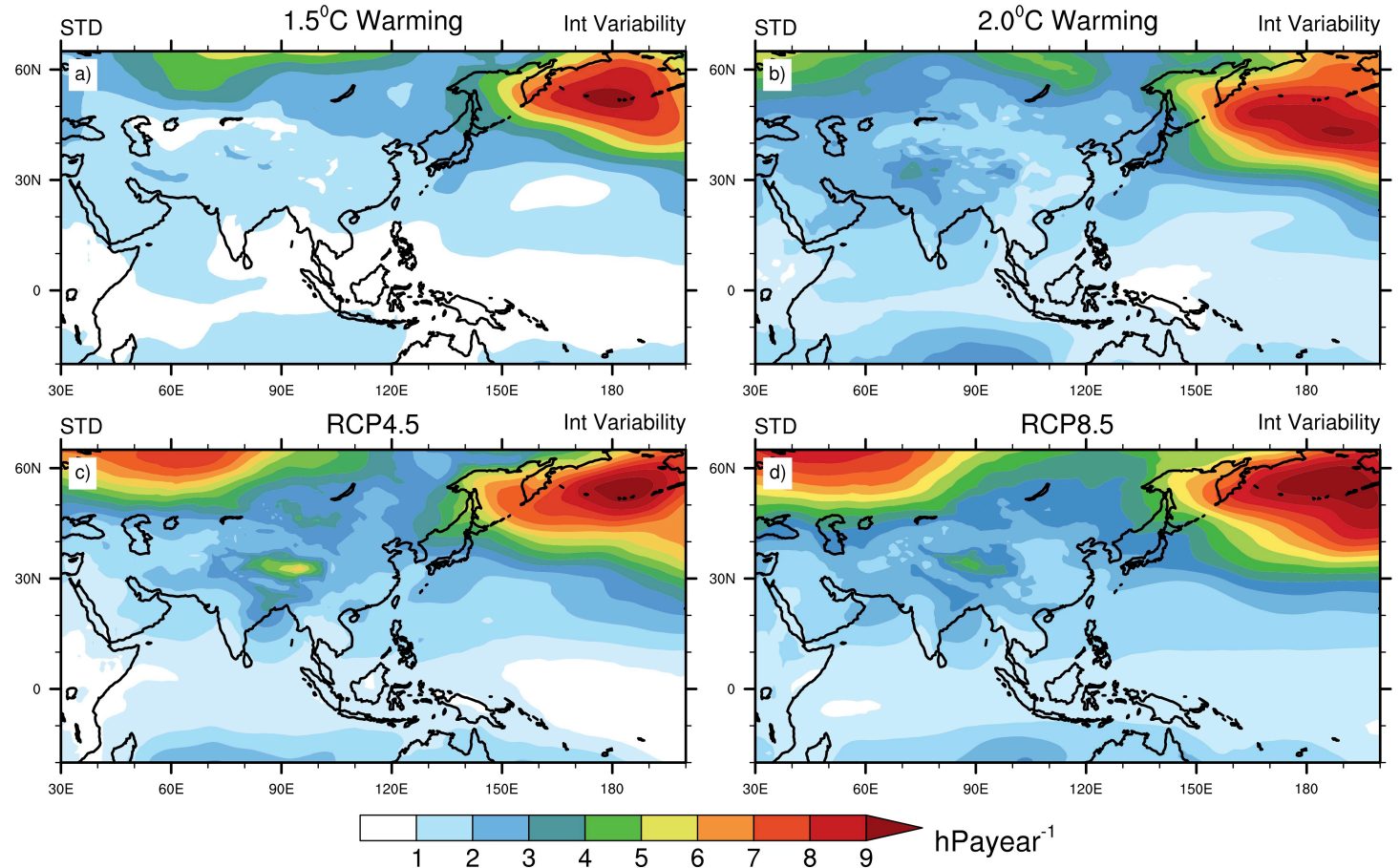
Ensemble Trends in SST from 2021-2050



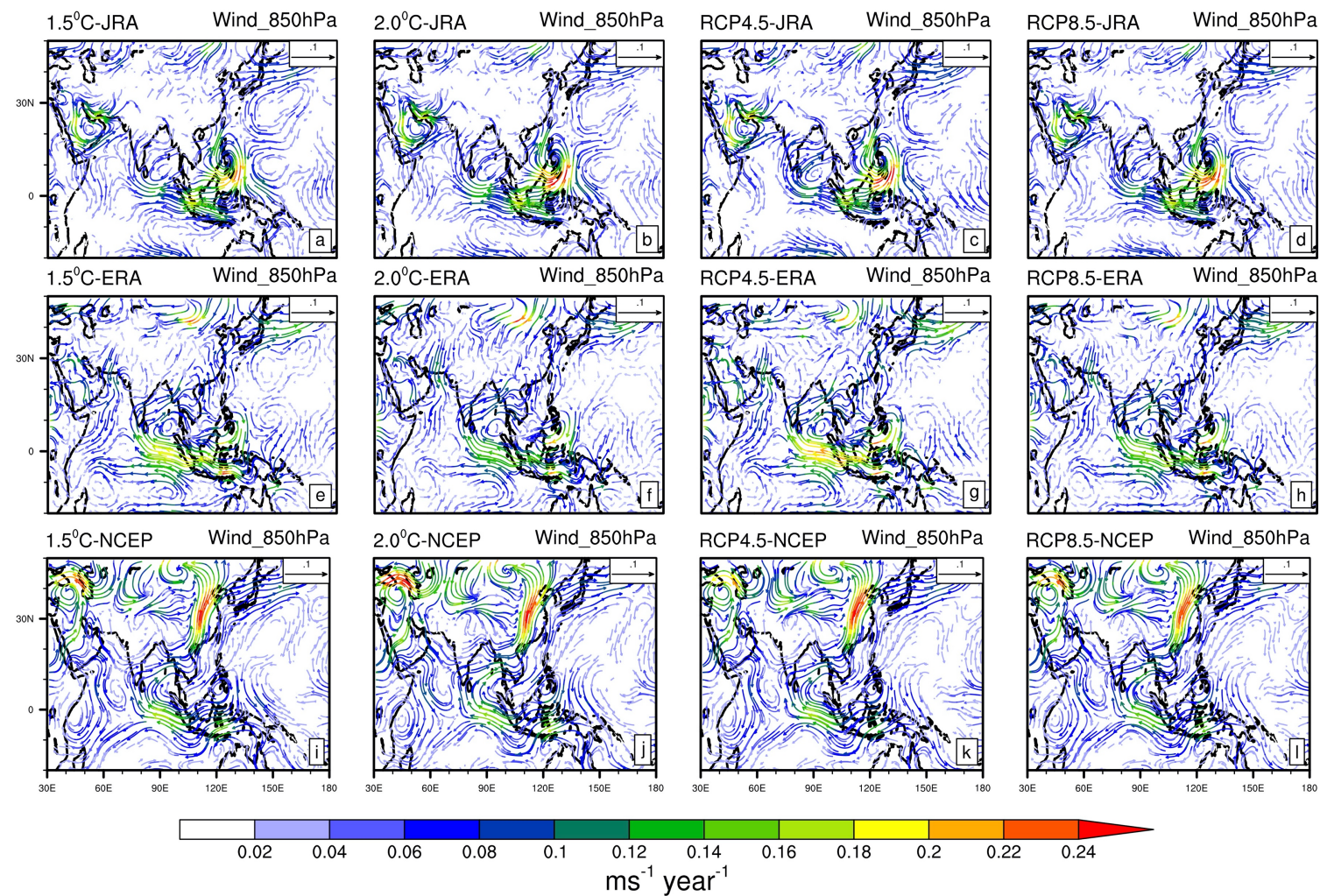
Warming of North Pacific is evident for all scenarios, and Indian Ocean are warming in both RCP scenarios.

Standard deviation of Internal Variability in SLP

- North Pacific is projected to dominate by its internal variability in near future. The internal variability will increase with more warming.



Comparison of Wind (850 hPa) with Observation



Summary

- With the increase in warming and radiative forcing likely to cause an enhanced monsoon precipitation over east Asia.
- In 1.5°C forced climate, a weak Indian Monsoon circulation is projected, while for 2.0°C warming monsoon circulation is likely to strengthen over the north Indian Ocean and intense easterlies from the equatorial Pacific are projected.
- Projection from the RCP4.5 scenario is associated with strong southwesterly monsoon wind over the entire Indian Ocean to the South China Sea and an intense easterly wind from the North Pacific to east Asia.
- The monsoon circulation over the north Indian Ocean is likely to weaken in the RCP8.5 forced climate.
- The importance of internal climate variability in SLP over the far North Pacific is clearly seen to influence the ASM projection pattern in the warming climate.

Conclusion

- Our results demonstrated that an increase in warming by 0.5°C , will enhance the monsoon precipitation over the Indian landmass, East Asia, and along the path of the Somali Jet over the equatorial Indian Ocean.
- Results demonstrate an increasing monsoonal rainfall over East Asia.
- It suggests an improved adaptation measure, particularly water resource planning will be required to cope with the projected increase in monsoon rainfall over East Asia and nominal decrease in South Asia.