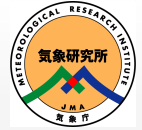




Future Change of Western North Pacific Typhoons: Projections by a 20-km-mesh Global Atmospheric model (J. Climate, In press)

Hiroyuki Murakami (JAMSTEC/MRI), Bin Wang (University of Hawaii), and Akio Kitoh (MRI) himuraka@mri-jma.go.jp



1. Motivation

IPCC-AR4 concluded in terms of future changes in tropical cyclones (TCs) that.....

Genesis Frequency Intensity

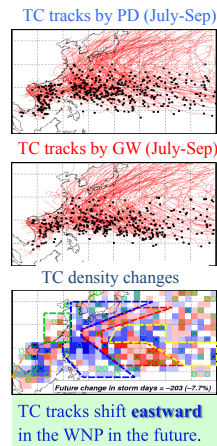
Less confidence in projections of global decrease in the frequency. It is likely that storm intensity will continue to increase.

Key question:
How do global warming affect TC tracks in the western North Pacific?

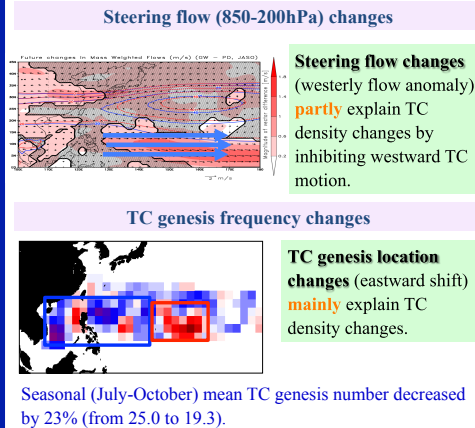
2. Models and settings

Model	20-km mesh MRI/JMA Atmospheric Global Model
Projection settings	Global warming run (GW): Present day run (PD): 1979-2003 (prescribed by the ensemble mean SST (under A1B scenario).

3. TC track changes



4. Why will the TC density change?



5. Genesis Potential Index

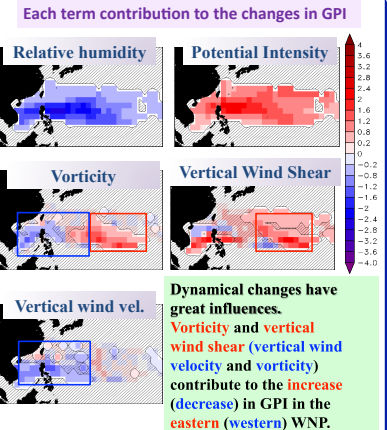
To determine the factors behind such genesis changes, we used a Genesis Potential Index (GPI) by Emanuel and Nolan (2004) with some modifications.

$$GPI' = |10^5 \eta|^2 \left(\frac{RH}{50} \right)^3 \left(\frac{V_{pv}}{70} \right)^3 (1 + 0.1 V_s)^2 \left(\frac{-\omega + 0.1}{0.1} \right)$$

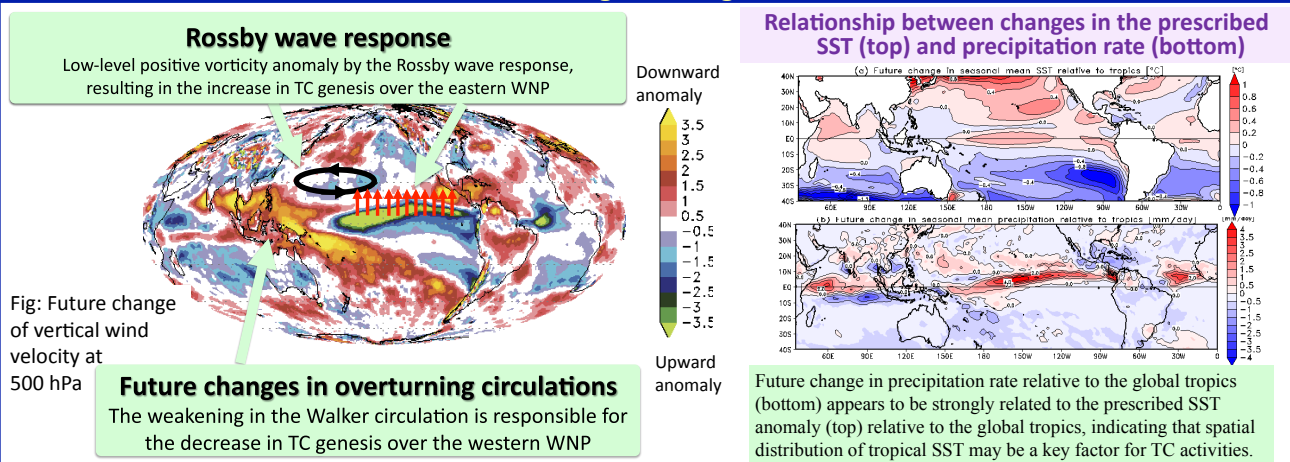
Absolute Relative Humidity Potential Intensity
Maximum Vertical Wind Velocity at 850hPa at 700hPa
Vertical Wind Shear (850-200hPa) at 500hPa

TC genesis changes GPI changes

GPI performs reasonably well in reflecting the changes in TC genesis density.



6. Mechanisms of future changes in TC genesis in the western North Pacific



7. Summary

- 1) The future (2075-99) projection indicates a significant reduction (by about **23%**) in **TC genesis number**.
- 2) A significant **eastward shift in the TC tracks** during the peak TC season (July-October).
- 3) **The changes in TC tracks** are due in part to changes in large-scale steering flows, but they are **due mainly to changes in the locations of TC genesis**.
- 4) Analysis of the genesis potential index (GPI) reveals that the **reduced TC genesis in the western WNP** is due mainly to in situ **weakening of large-scale ascent**.
- 5) Analysis of the GPI also indicates that **enhanced TC genesis in the eastern WNP** is due to **increased low-level cyclonic vorticity and reduced vertical wind shear**.
- 6) TC genesis changes appear to be **critically dependent on the spatial pattern of future sea surface temperature**; therefore, it is necessary to conduct ensemble projections with a range of SST spatial patterns to understand the degree and distribution of uncertainty in the future projections.