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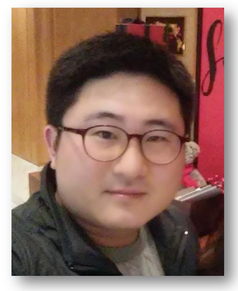
Understanding an intermodal diversity of the North Western Pacific SST in CMIP5 RCP scenarios



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Summary

The sea surface temperature (SST) in the North Western Pacific (NWP), where the air-sea interactions are quite strong, is significantly changing in the recent past. In addition, there are still large uncertainties in future SST change in a warming climate. We investigate why the SST trends in the NWP region differ in Coupled Model Intercomparison Project phase 5 (CMIP5). It is found that each CMIP5 model simulates various ranges of SST trends in spite of a same warming scenario from the present climate, indicating that there is an intermodal diversity of SST trends. The spread of SST trends appears significantly in the Kuroshio-Oyashio Extension (KOE) region. This suggests that the SST in the KOE region can be an important source to drive the intermodal diversity of SST trends in the NWP region in a changing climate. The strong connection between SST and latent heat flux is appeared in the KOE region associated with westerly wind along the latitude about 40°N. It also confirms that the models with larger/smaller warming trend tend to product weaker/stronger westerly wind in the North Pacific. This indicates that the magnitude of SST warming trend can be regulated by the strength of westerly wind.

1. Data and methods

- **Data** : CMIP5 model data sets with historical/*RCPs (RCP2.6,RCP4.5,RCP6.0,RCP8.5) runs regridded to 1°x1°. Only RCP2.6 run is used for the shown figures.
- **Period** : **1950-2016**, yearly.
- **Region:** North Pacific (NP, 120E-100W, 20N-60N)

*RCP: Representative Concentration Pathways

The period for the analysis

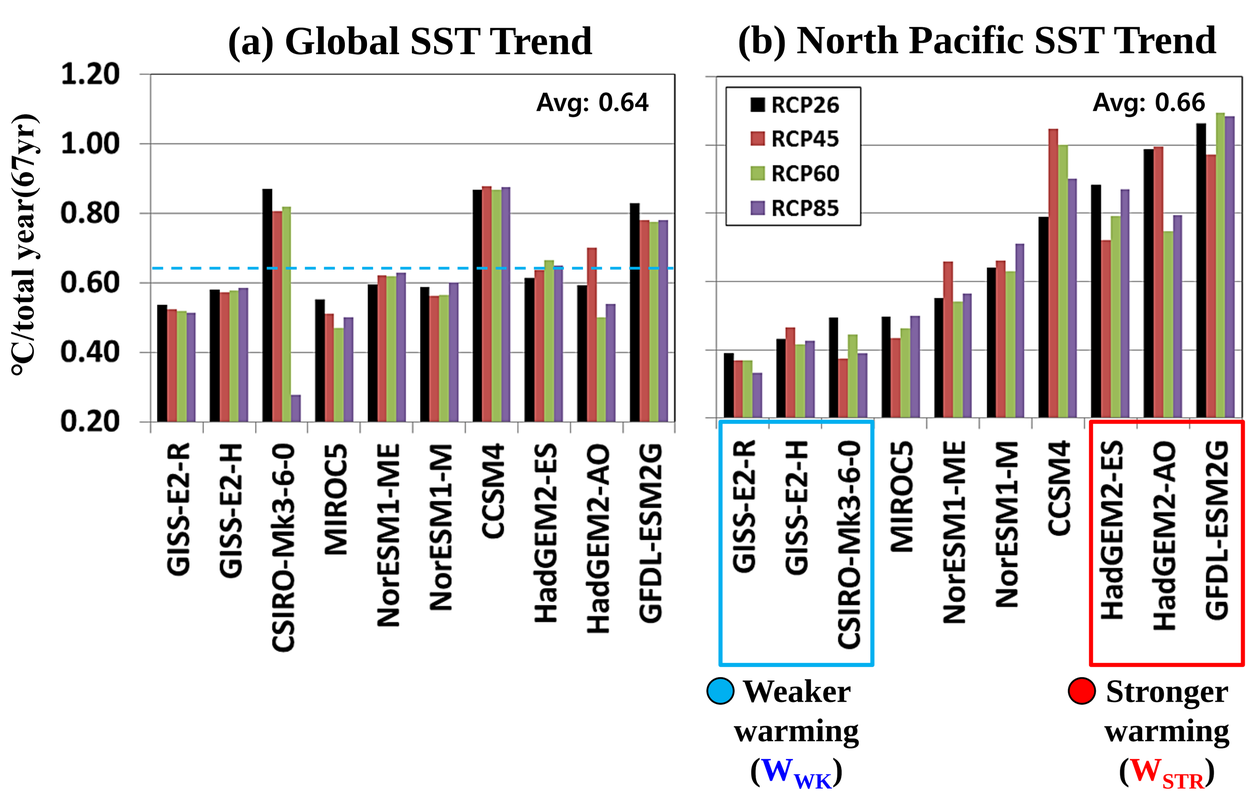
Historical [1950~2005]	RCPs [2006~2016]

	Model name
1	CCSM4
2	CSIRO-Mk3-6-0
3	GFDL-ESM2G
4	GISS-E2-H
5	GISS-E2-R
6	HadGEM2-AO
7	HadGEM2-ES
8	MIROC5
9	NorESM1-M
10	NorESM1-ME

CMIP5 model names for the analysis.

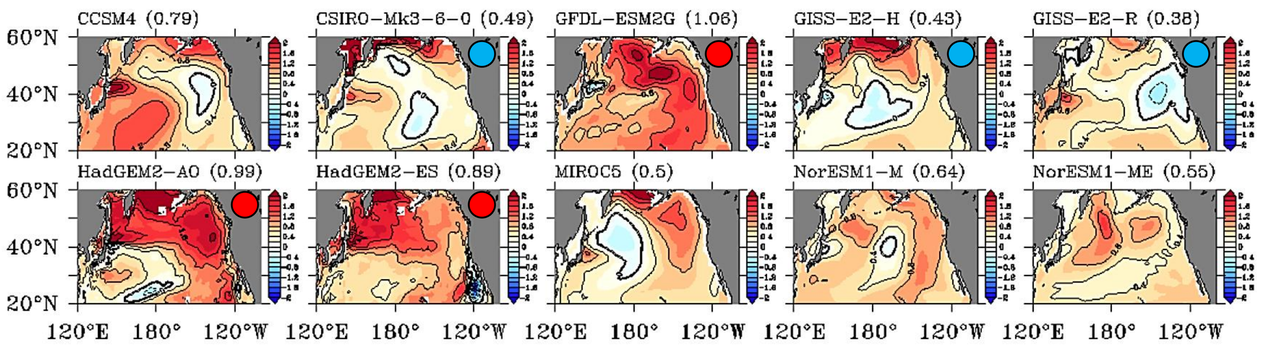
2. Results

2.1. Trend (1950-2016) in CMIP5 models

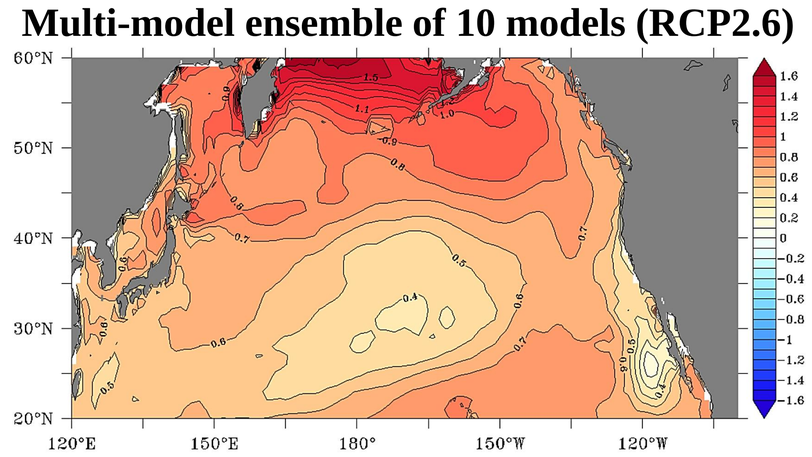


2.2. Structure of SST warming trend

Distribution of the trend in the North Pacific Ocean (RCP2.6)



Multi-model ensemble of 10 models (RCP2.6)

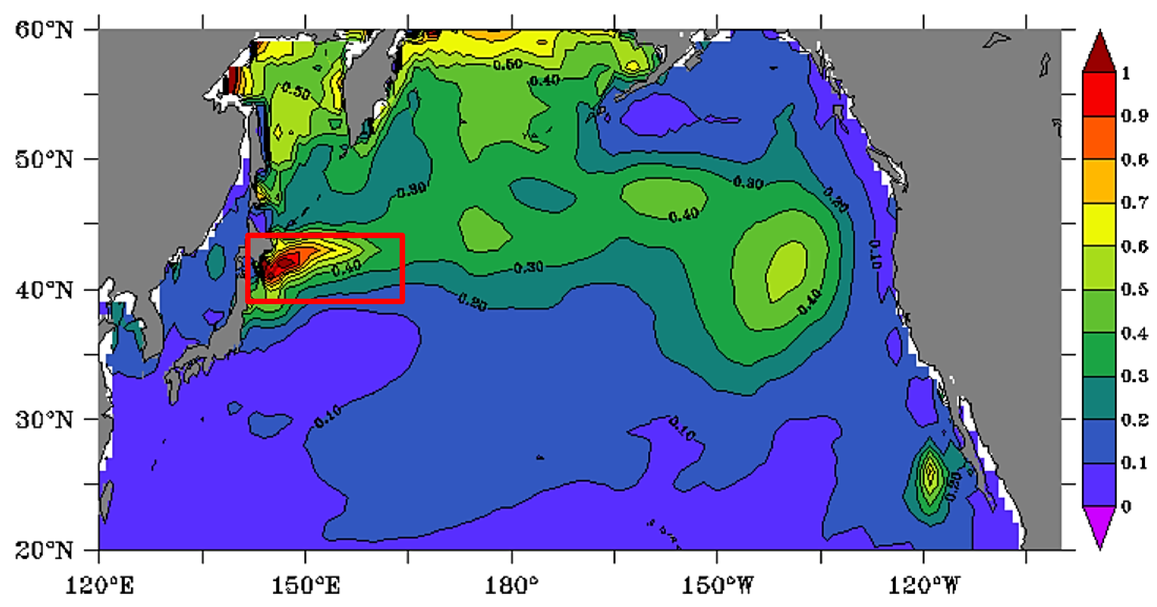


Dipole structure

Stronger/Weaker warming in the northern/ southern region above the 40°N

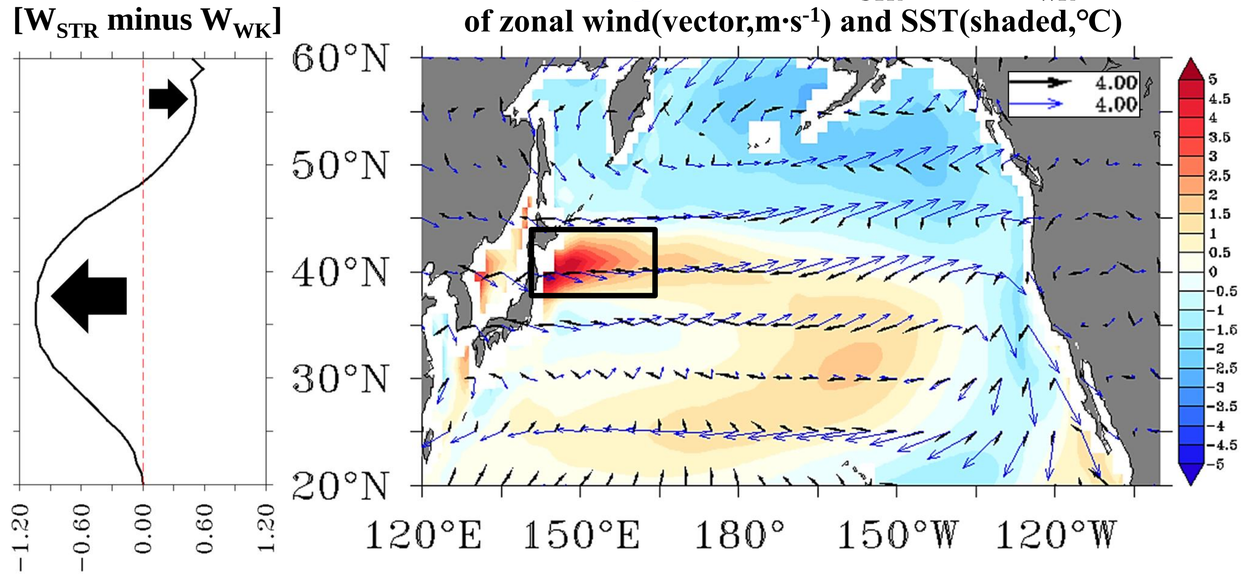
2.3. Relationship between zonal wind and SST

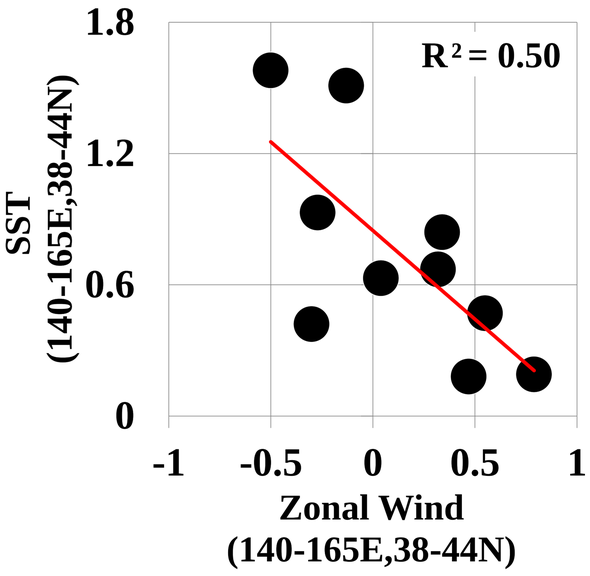
Inter-model spread of trends among CMIP5 models (RCP2.6)



Zonal wind difference [W_{STR} minus W_{WK}]

Climatology/Difference[W_{STR} minus W_{WK}] of zonal wind(vector,m·s^{-1}) and SST(shaded,°C)





The relationship of trends between SST and Zonal wind

The tendency of SST warming at the KOE region is associated with zonal wind along 40°N.

[Possible mechanisms]

Larger Warming

Weaker westerly Around 40°N → ? → Increase heat accumulation → Large SST Warming

Smaller Warming

Stronger Easterly Around 40°N → ? → Decrease heat accumulation → Small SST Warming