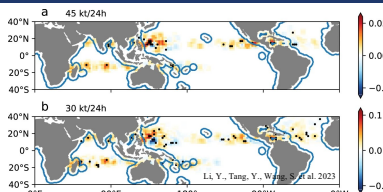
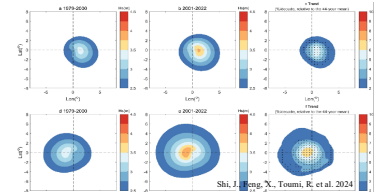


Tropical cyclones (TCs) are formed on the warm ocean surface and driven by the complex air-sea interaction process, their destructiveness is reflected in the strong winds, heavy rains and storm surges. In recent years, The upward trend in tropical cyclone rapid intensification has been confirmed, which is a greater challenge for typhoon intensity forecasting. This study focuses on the South China Sea region (SCS), and the coupled Weather Research and Forecast (WRF) model and Simulating Waves Nearshore (SWAN) model are used to forecast tropical cyclones “Talin” in 2023, to discuss the forecasting performance of different physical parameterization schemes (PPS) of the WRF, especially the sensitivity of the wind and wave fields.

Introduction



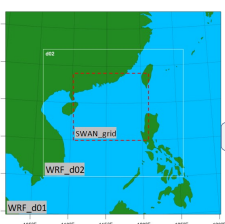
Rapid Intensification (RI) events of typhoons are on the rise globally and the threat of strong typhoons is increasing.



Extreme wave hazards under the influence of strong typhoons are an increased threat to coastal areas and the marine environment.

Methods

Domain & Experiment Design



WDM6-----Control

New Thompson-----M1

Goddard V5.1-----M2

CAM V5.1-----M3

ra_sw_physics-----RRTMG

ra_lw_physics-----RRTMG

cu_physics-----Tiedtke-----Control

-----Kain-Fritsch-----C1

-----Bets-Miller-Janjic-----C2

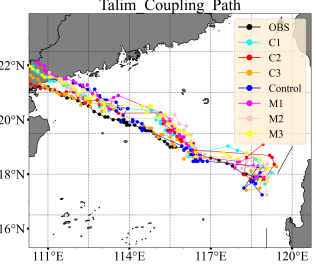
-----Grell-Devenyi-----C3

sf_surface_physics-----Noah Land

sf_sfcay_physics-----MM5

bl_pbl_physics-----YSU

Results: TC Center



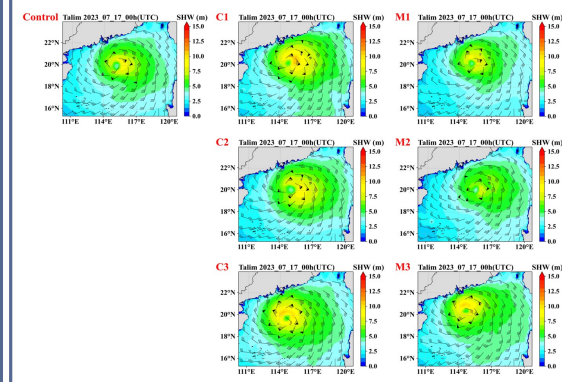
MSLP (hPa)

MWS (m/s)

Case	Path Bias (km)	MSLP		MWS	
		standard deviation	correlation coefficient	standard deviation	correlation coefficient
Control	103.7	1.52	0.95	1.33	0.85
C1	82.59	1.64	0.67	1.54	0.36
C2	93.86	1.71	0.69	1.40	0.4
C3	76.34	1.32	0.78	1.33	0.68
M1	87.22	1.77	0.75	1.66	0.44
M2	79.67	1.71	0.93	1.64	0.72
M3	98.14	1.70	0.65	1.84	-0.06

Results: Wind & Wave

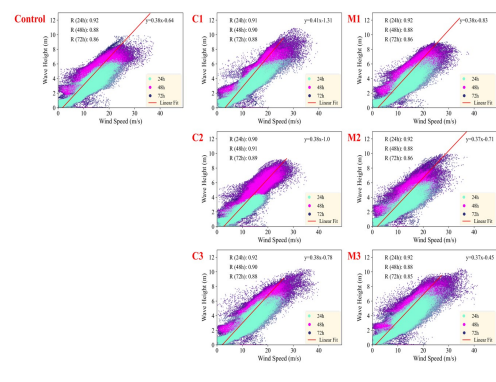
10m WindSpeed & Height of Wave



WRF-SWAN is able to capture the wind and wave intensity characteristics of the typhoon, and the high wind speed area and wave height area are basically the same.

The model performs well on the correlation between wind speed and waves, but there is an underestimation of wind and wave intensity

Correlation Prediction of Wind and Wave



Acknowledgement

This work was supported by Marine Economic Development Special Program of Guangdong Province (Six Major Marine Industries) : Research and Demonstration of Critical Technologies for Comprehensive Prevention and Control of Natural Disaster in Offshore Wind Farms , China (Grant No. 29 [2023]), the Numerical Modeling Team of Atmospheric Environment and Climate of the Institute of Environment and Climate Research, Jinan University, and the Dawning High Performance Computer Platform of Jinan University.

[1] Li, Y., Tang, Y., Wang, S. et al. Recent increases in tropical cyclone rapid intensification events in global offshore regions. Nat Commun 14, 5167 (2023)
[2] Shi, J., Feng, X., Toumi, R. et al. Global increase in tropical cyclone ocean surface waves. Nat Commun 15, 174 (2024).