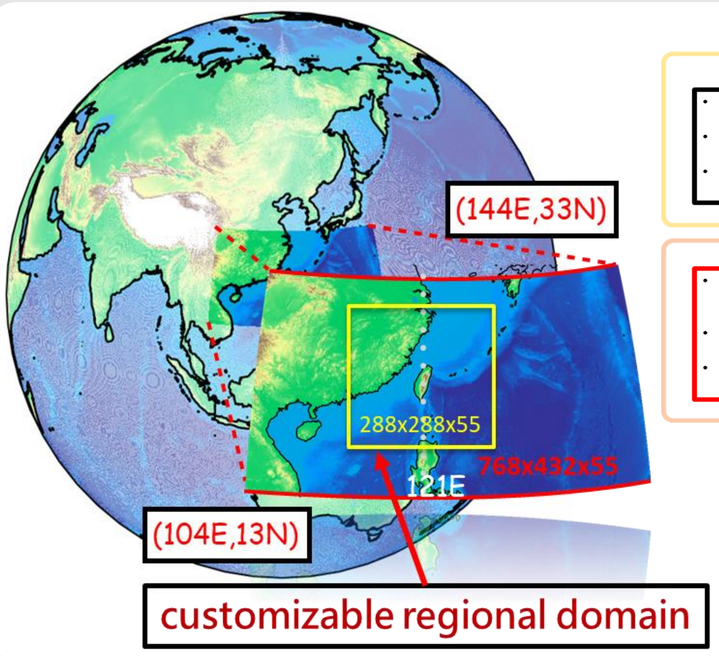
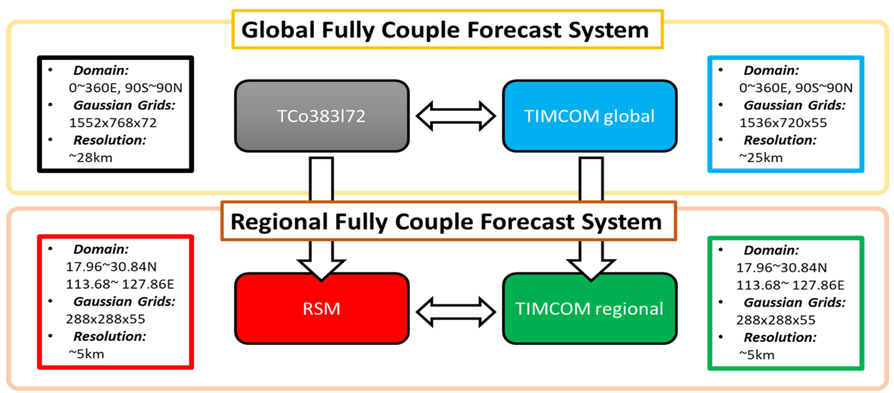
SYMPOSIUM OP'24 ADVANCING OCEAN PREDICTION SCIENCE FOR SOCIETAL BENEFITS

Evaluation of Taiwan Multi-scale Ocean-Atmosphere Coupled Modelling System

A novel Multi-scale Ocean and Atmosphere Coupled Modeling System (MUSOACS) has been recently developed to enhance the predictability of extended-range forecasts at the Central Weather Administration (CWA) in Taiwan. MUSOACS comprises four distinct components, seamlessly integrating global (23km resolution) and regional (5km resolution) ocean-atmosphere coupled models that run concurrently. The regional coupled model is online-driven by the global coupled model. Skill evaluations of the model predictability indicate that the global atmospheric forecast in MUSOACS surpasses the operational atmospheric forecast system at CWA up to 30 days under different variables below 200 hPa height. In addition, the MJO analysis shows that the forecast skill for several key variables at the equator significantly outperforms the operational atmospheric forecast system at CWA and regional forecasts generated by MUSOACS can accurately predict the intensity and signals of cold surge (CS) events up to 9 to 10 days in advance.

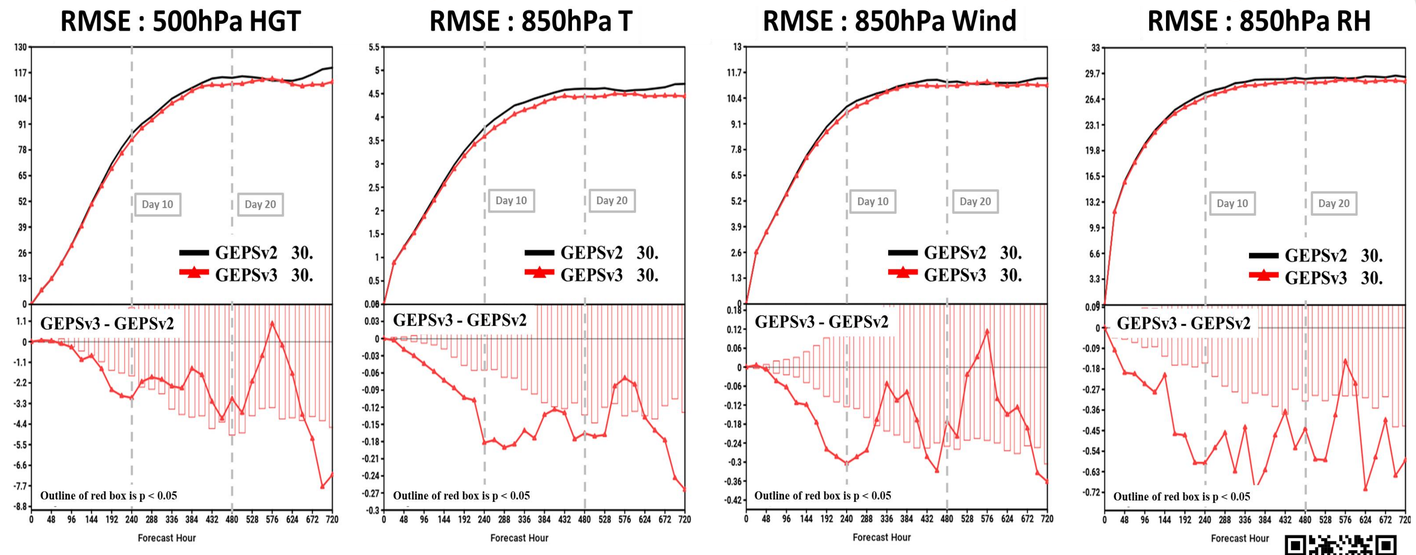


The Architecture of GEPSv3



- MUSOACS: Seamless global and regional coupled systems running simultaneously.
- Flexible regional domain with better consistent BCs.
- Can be run in global (2-cpl), regional (2-cpl) and global-regional (4-cpl) modes

Global Validation System: Summer 2024 (July 20 to August 19)

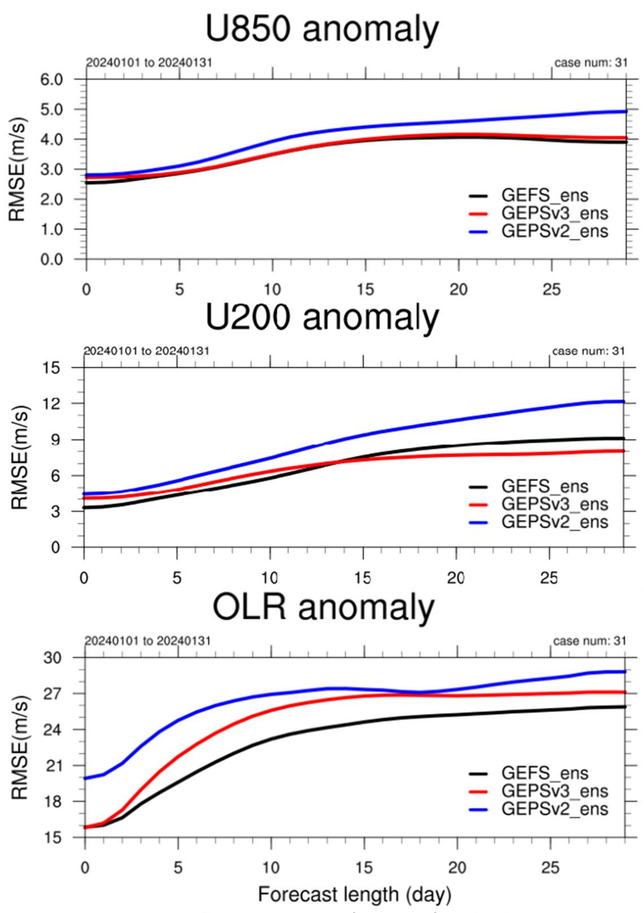


- Upper panels: Comparison of RMSE for each layer field.
- Lower panels: Results of GEPSv3 minus GEPSv2, with red boxes indicating statistical significance criteria.

Score card (V3 vs V2)

MJO Validation for January 2024

Ensemble forecast results (20 members; 31 case)



- ***Dynamic Field***

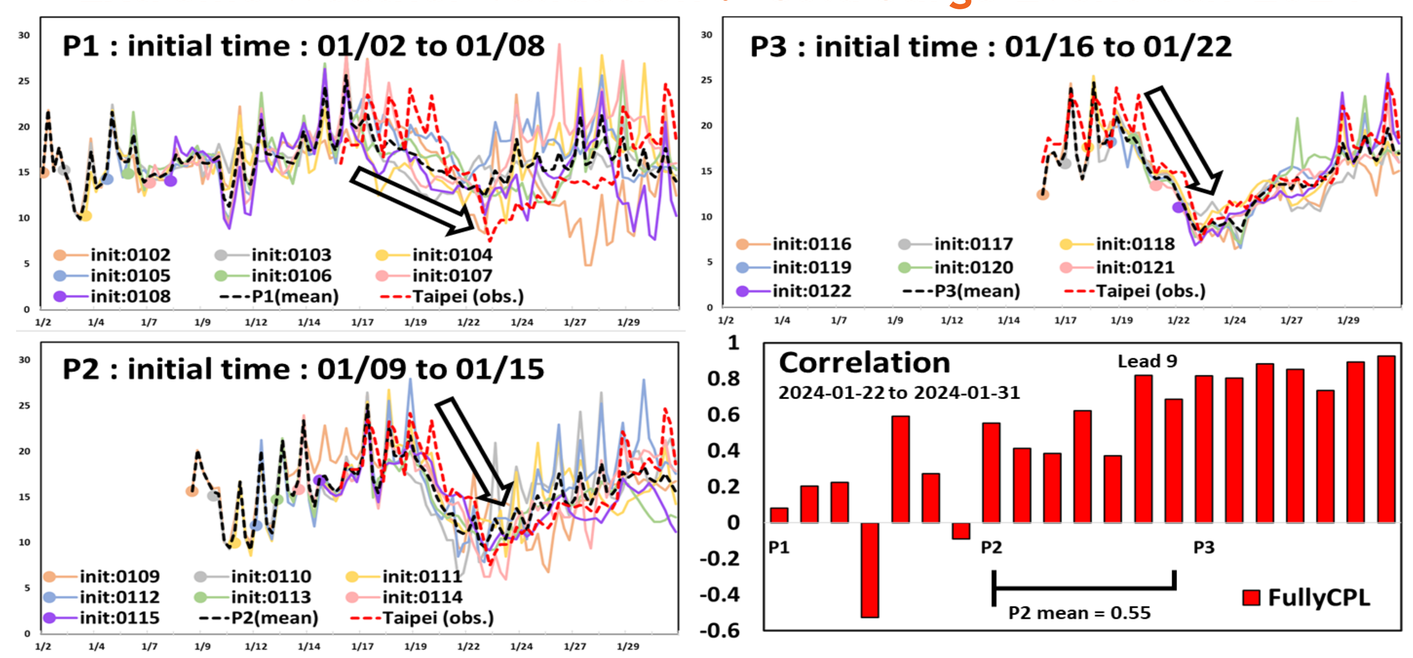
GEPSv3 performs better than GEFS forecasts and significantly outperforms GEPSv2.

- ***Thermal Field***

GEPSv3 is better than GEPSv2 but worse than GEFS forecasts.

Initial time : 2024/01/08
Forecast : 720 hours
RMM phase diagram
(V3 vs V2 vs GEFS)

Extreme Weather Validation : Cold Surge Event Jan-2024



- P1(weak signal) ; P2(signal arise) ; P3(accurately predict)
- Lead 9 correlation is 0.82, Lead 14 correlation is 0.55

In summary, the MUSOACS significantly enhances extended-range weather forecasting at the CWA in Taiwan. By integrating global and regional models, MUSOACS achieves superior predictive skill, outperforming existing operational systems for up to 30 days. Its ability to accurately capture phenomena such as the MJO and predict CS events up to 10 days in advance highlights its effectiveness. Overall, MUSOACS not only improves forecast accuracy but also supports better decision-making in weather-sensitive sectors, representing a significant advancement in operational meteorology in Taiwan.

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