A FULLY COUPLED HIGH-RESOLUTION OCEAN-ATMOSPHERE MODEL AROUND THE LOMBOK STRAIT

N.A Akram[1], M.D. Bitya[1], N.J. Trilaksono[2], A.R. Kartadikaria[3*]

[1] Study Program of Oceanography, Faculty of Earth Sciences and Technology, Bandung Institute of Technology (ITB), Jl. Ganesha 10, Bandung, Jawa Barat 40132, Indonesia

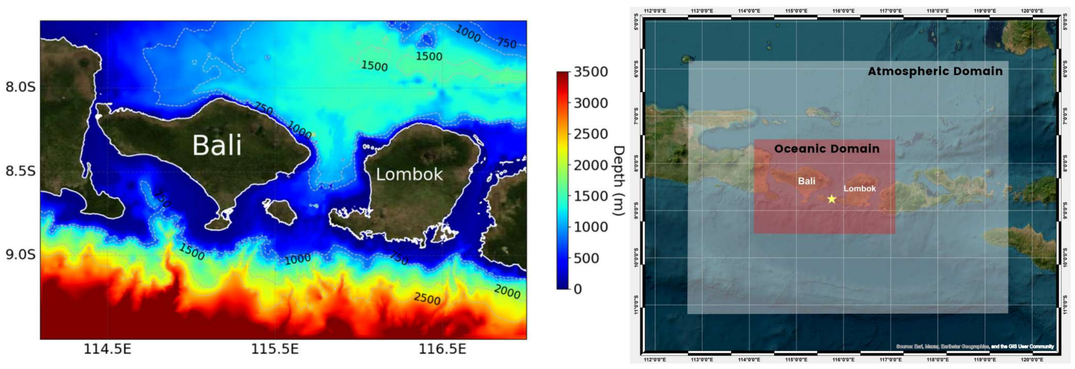
[2] Research Group of Atmospheric Science, Faculty of Earth Sciences and Technology, Bandung Institute of Technology (ITB), Jl. Ganesha 10, Bandung, Jawa Barat 40132, Indonesia

[3] Research Group of Environmental and Applied Oceanography, Faculty of Earth Sciences and Technology, Bandung Institute of Technology (ITB), Jl. Ganesha 10, Bandung, Jawa Barat 40132, Indonesia

* Email: a.r.kartadikaria@itb.ac.id

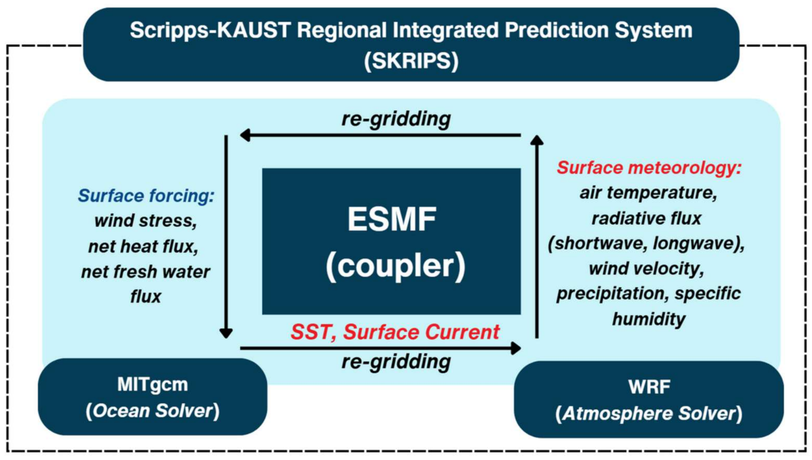
S5-P-04

1 Introduction



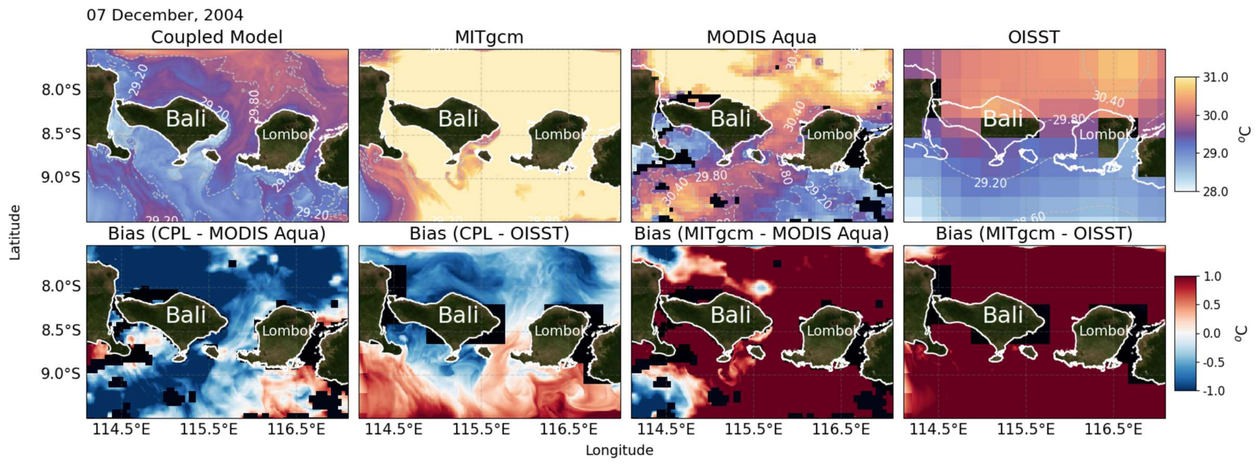
A coupled ocean–atmosphere model integrates oceanic and atmospheric components, enabling two-way interactions and providing a more realistic representation of physical processes compared to stand-alone models. Despite these advantages, applications in Indonesian waters, particularly the Lombok Strait, remain limited. This study develops a coupled system by combining **MITgcm** (ocean) and **WRF** (atmosphere) through the Earth System Modeling Framework (**ESMF**).

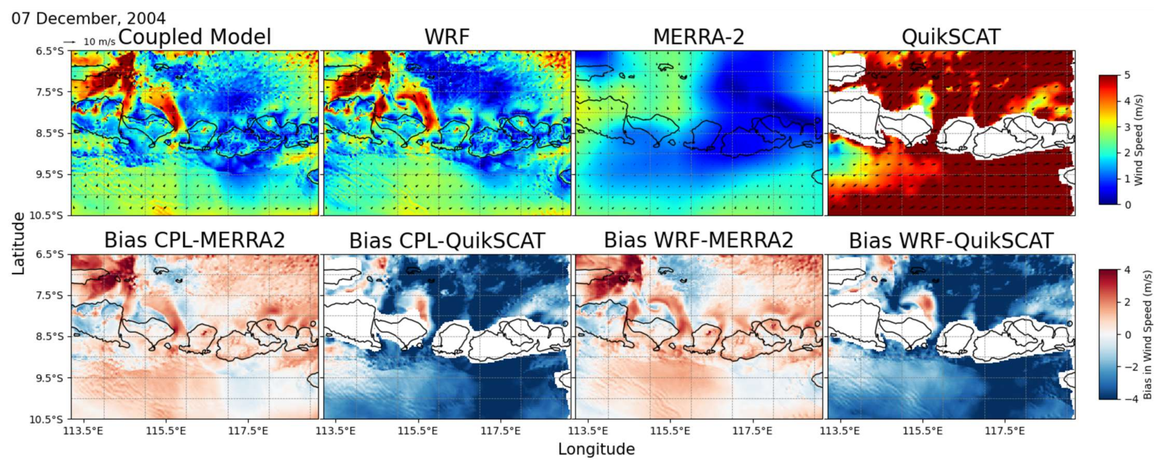
2 Methods

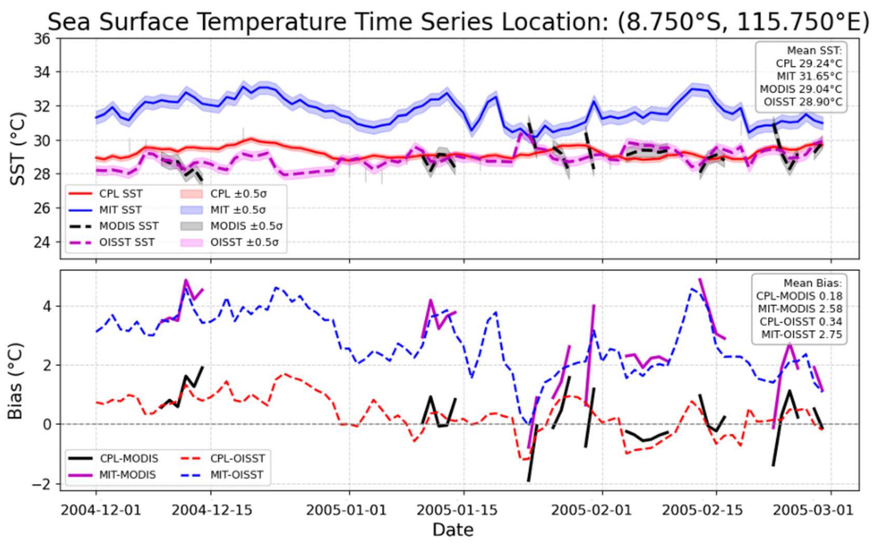


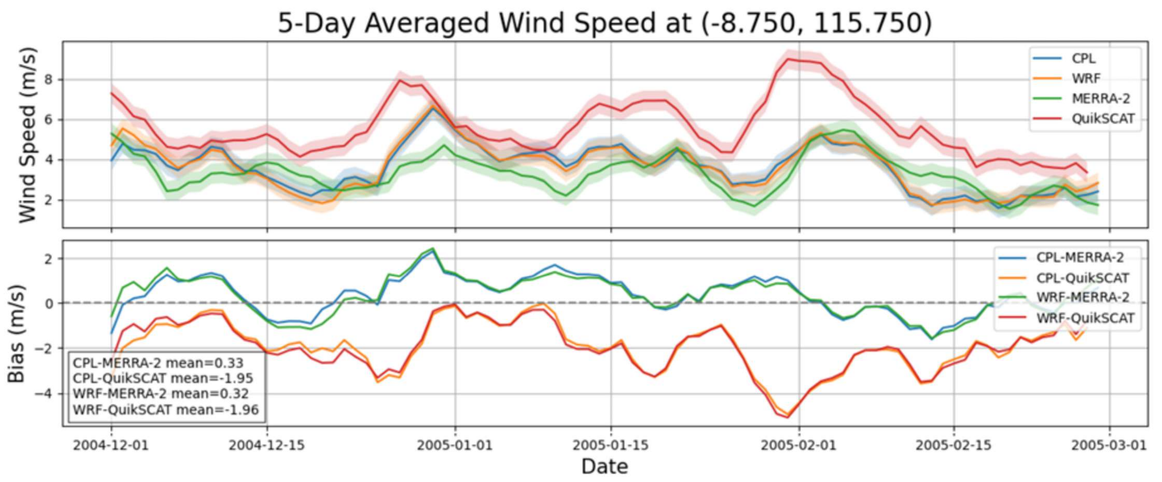
- Study area: Lombok Strait, simulation period January 2004 – February 2005 (focus on 2005 west monsoon).
- Ocean model: MITgcm with high-resolution setup.
- Atmospheric model: WRF driven by ERA5 reanalysis.
- Coupling framework: MITgcm–WRF integrated via ESMF with two-way exchanges.
- Simulation design: continuous and synoptic (7-day) runs with Δt = 15 seconds and variable exchange every Δt = 60 seconds.
- Verification: compared with MODIS Aqua, OISST, MERRA-2, QuikSCAT, CMEMS using bias and RMSE.

3 Results









4 Discussion

- Coupled model reduced SST bias by up to ~2°C compared to stand-alone MITgcm.
- 10m wind fields showed minor differences over sea and with no differences over land.
- Minor difference between synoptic and continous coupling. However, synoptic coupling tended to behave like stand-alone WRF.

Future Work

- An analysis of different input data can be conducted to determine its influence on the parameters produced by the model.
- Models with different resolutions can be used to examine the outputs produced when coupling.

Acknowledgments

Support: We gratefully acknowledge BRIN Mahameru HPC for computational resources. We also thank the providers of the oceanographic datasets used in this study: BIG, BATNAS, HYCOM, and Mercator Copernicus.

5 Conclusion

- A coupled MITgcm–WRF system was successfully developed for the Lombok Strait using ESMF.
- The coupled model provided better accuracy than stand-alone models, especially for SST.
- The system effectively captured key processes during the 2005 west monsoon, including signals of coastal upwelling south of Bali and Lombok.

6 Reference

- Aldrian, E., Sein, D., Jacob, D., Gates, L. D., dan Podzun, R. (2005): Modelling Indonesian Rainfall with a Coupled Regional Model, Climate Dynamics, 25(1), 1–17.
- Sun, R., Subramanian, A. C., Miller, A. J., Mazloff, M. R., Hoteit, I., dan Cornuelle, B. D. (2019): SKRIPS v1.0: A Regional Coupled Ocean–Atmosphere Modeling Framework (MITgcm–WRF) using ESMF/NUOPC, Description and Preliminary Results for The Red Sea, Geoscientific Model Development, 12(10), 4221–4244.