

Application of the Local Southwest Monsoon Index in Forecasting Enhanced Monsoon Activity: A Case Study of Super Typhoon Gaemi (2024)

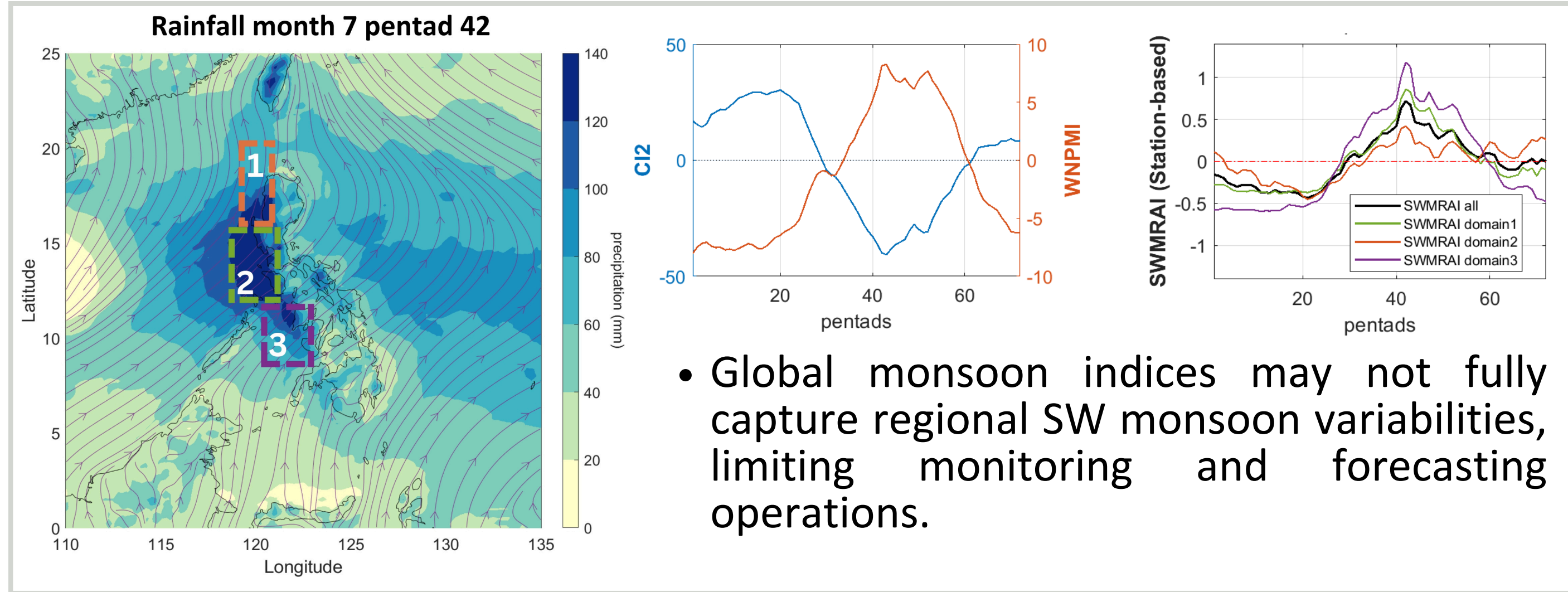
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Development of the Local SW Monsoon Index

1 Motivation

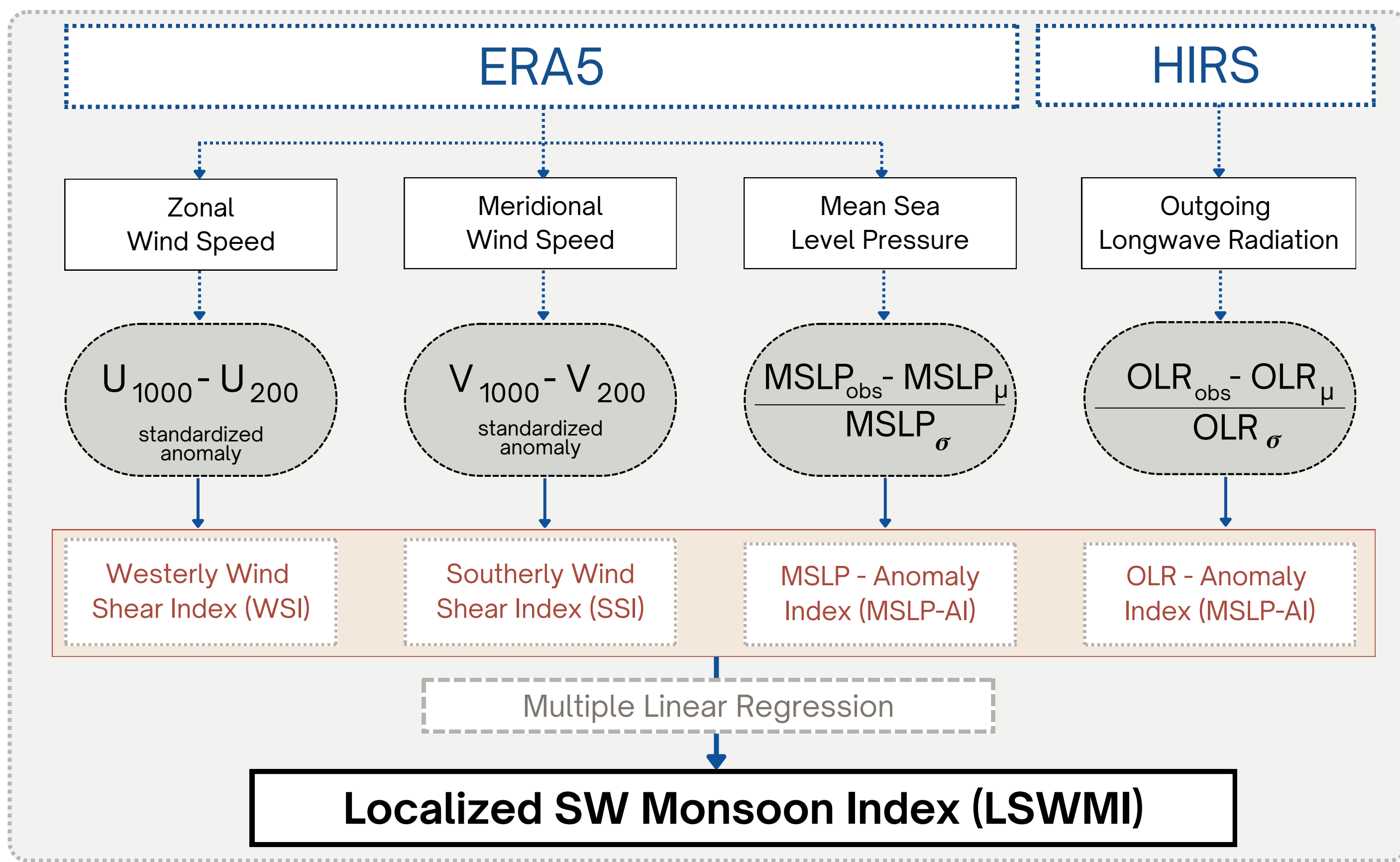
- The intensity and impacts of southwest (SW) monsoon varies in different subregions in the western Philippines.



- Global monsoon indices may not fully capture regional SW monsoon variabilities, limiting monitoring and forecasting operations.

2 Localization of the Monsoon Indices

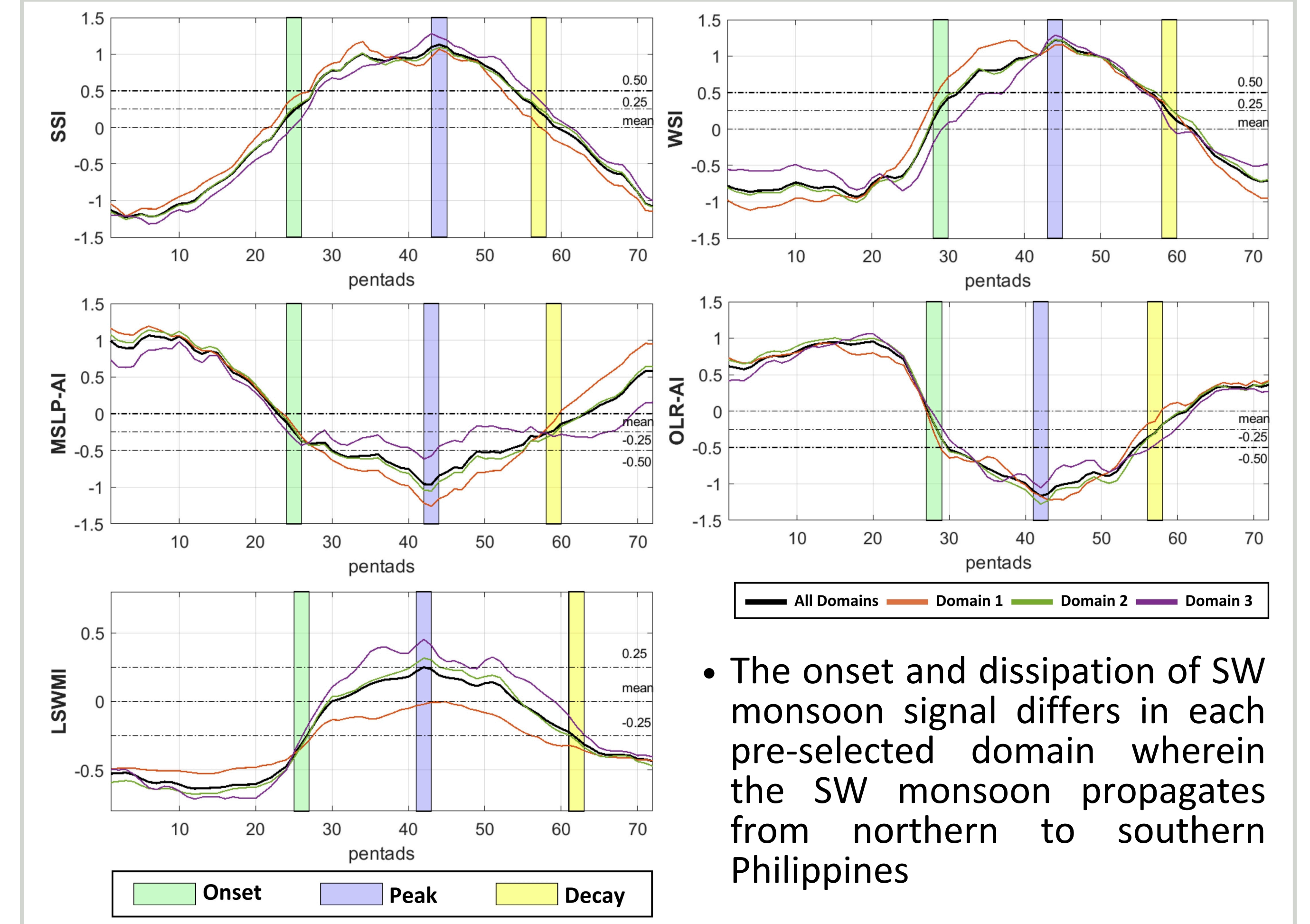
- We propose a framework for developing a localized monsoon index using reanalysis and satellite-based datasets on a pixel-wise basis and a set arbitrary threshold for the derived indices.



Threshold	WSI	SSI	MSLP-AI	OLR-AI	LSWMI
Onset	0.25	0.25	-0.25	-0.25	-0.25
Intense RF	0.50	0.50	-0.50	-0.50	0.25

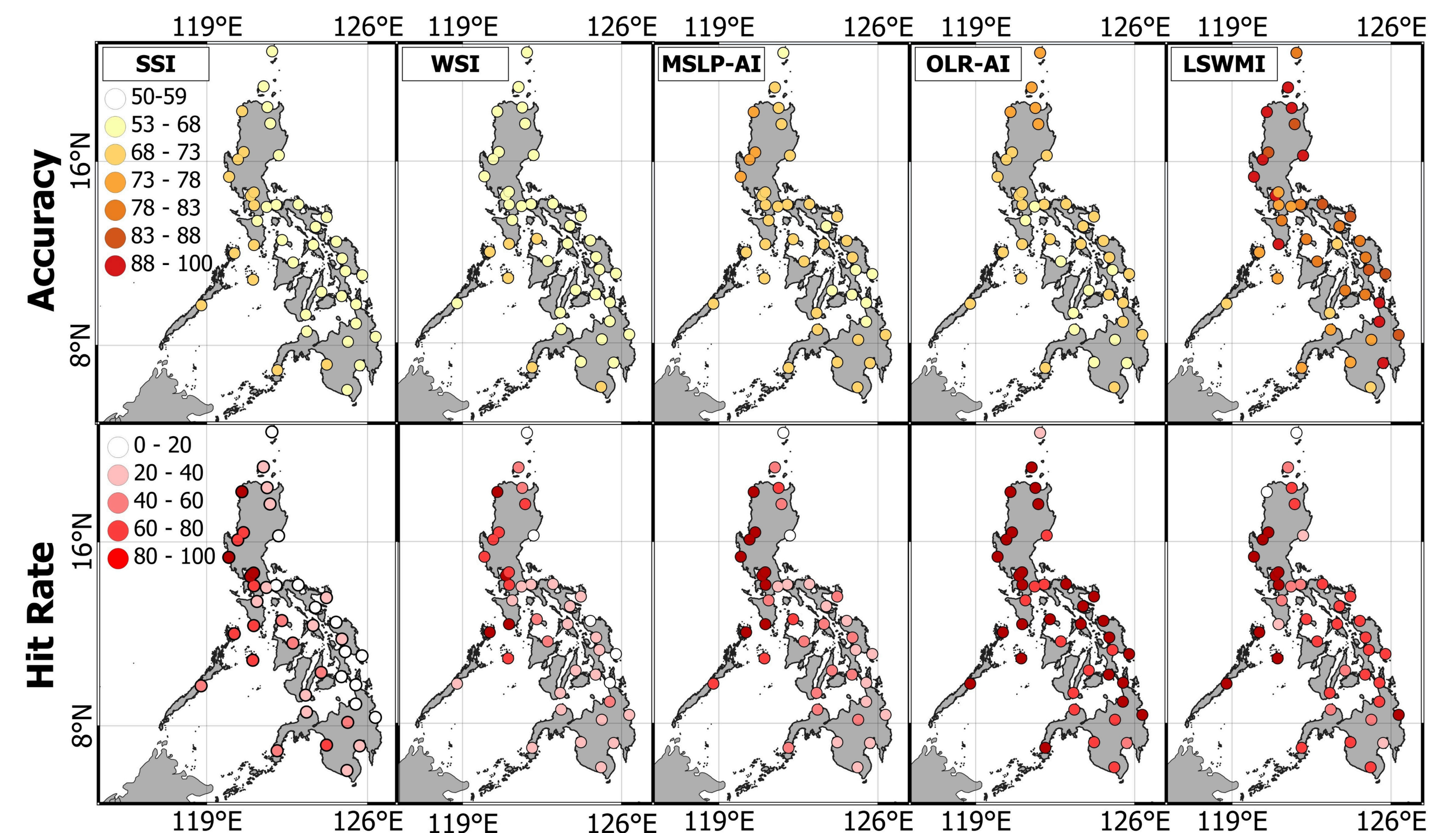
3 Spatiotemporal Dynamics and Validation of the Indices

- SW monsoon progression varies at different timelines and at different regions over the western Philippines



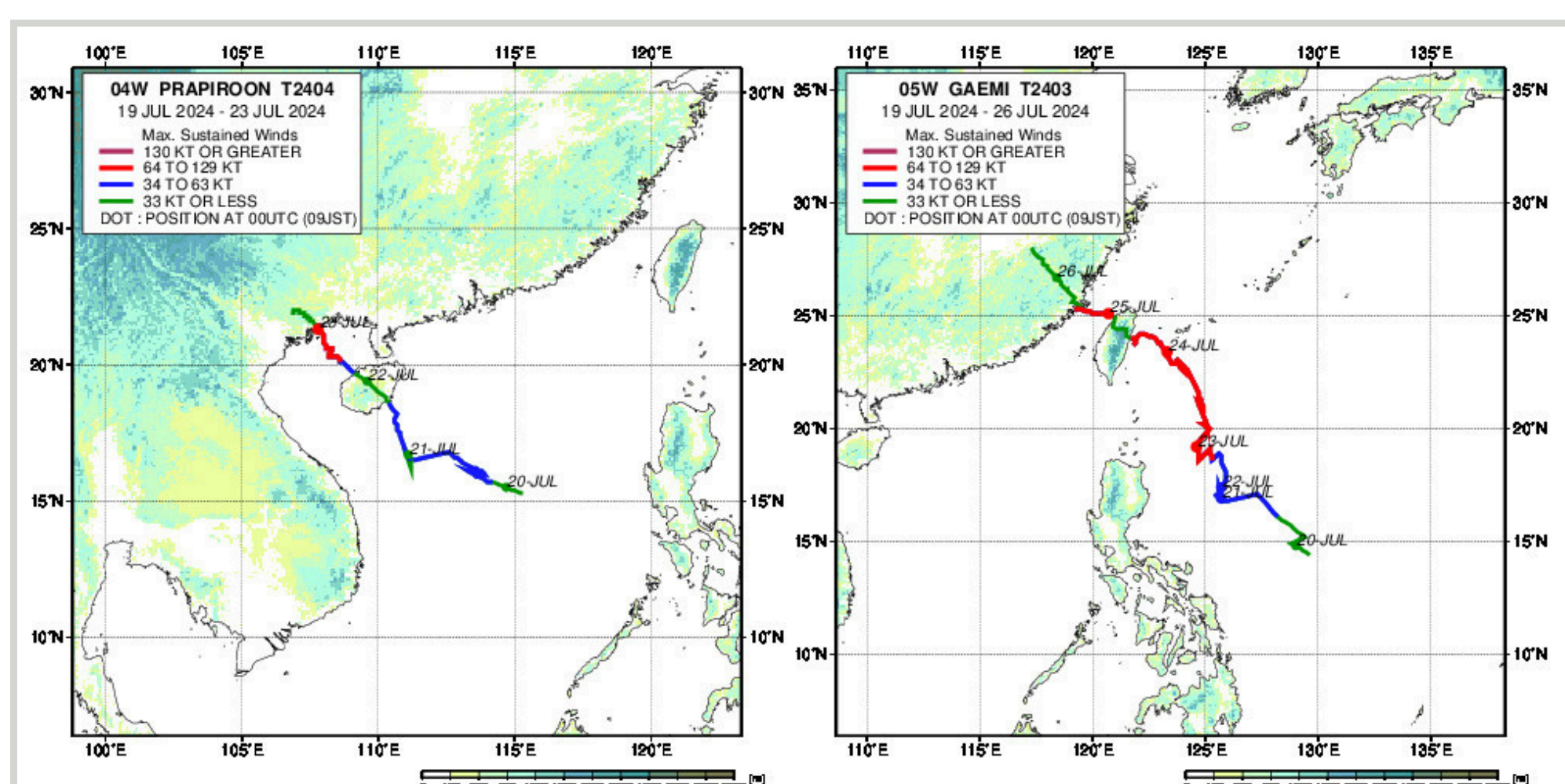
- The onset and dissipation of SW monsoon signal differs in each pre-selected domain wherein the SW monsoon propagates from northern to southern Philippines

- Varying capability of the indices in capturing excessive rainfall occurrences in terms of the 99th percentile rainfall

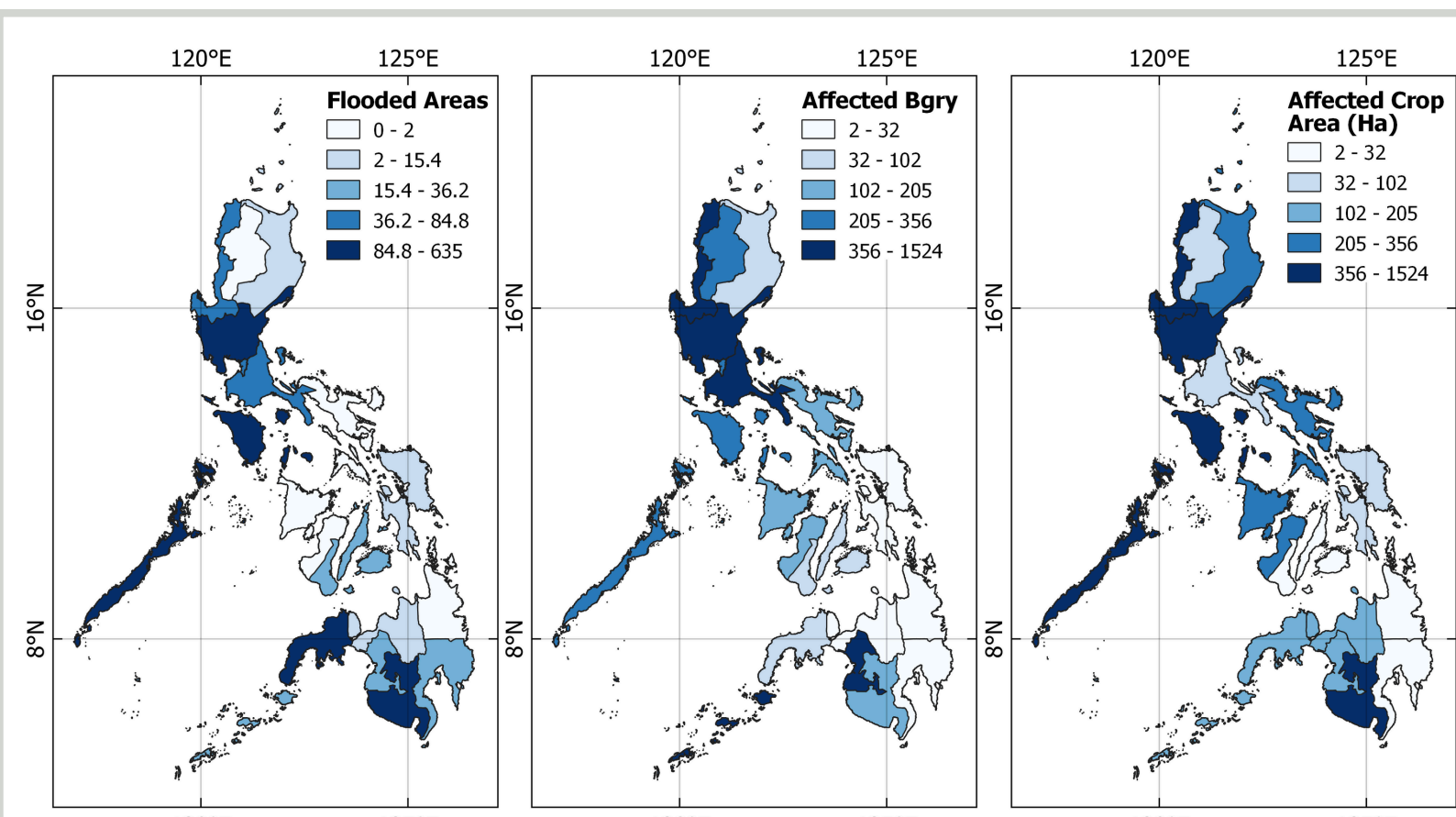


Super Typhoon Gaemi (2024)

- Enhanced SW monsoon season, driven by the combined effects of TY Prapiroon and the passage of STY Gaemi, has caused major agricultural and infrastructural damage in the Philippines.
- Rainfall intensification signal in the western regions of the Philippines were observed as early as two pentads before the passage of STY Gaemi.

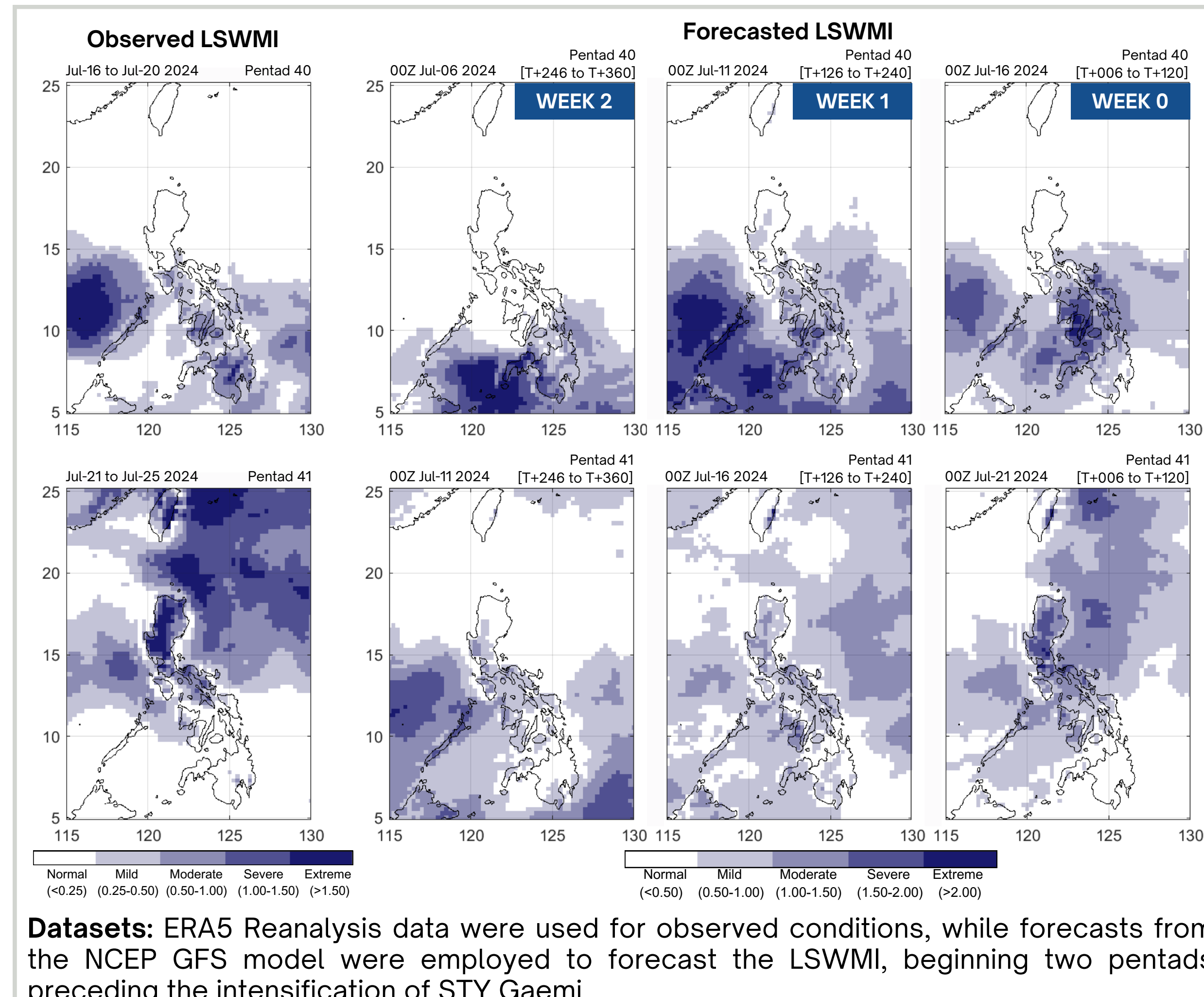


Left: Typhoon Prapiroon (loc. name - Tropical Depression "Butchoy"); Right: Typhoon Gaemi (loc. name - Super Typhoon "Carina"). Source: Japan Aerospace Exploration Agency Earth Observation Research Center JAXA/EORC



Source: National Disaster Risk Reduction and Management Council (NDRRMC) Situational Report No. 46 for the Combined Effects of SW monsoon and TY Gaemi and Prapiroon.

- Moderate to extreme rainfall patterns were observed in the western regions, varying in intensity and latitudinal extent.
- The latest forecast (Week 0) highlighted significant intensification in northwestern Luzon, corroborating the observed data.



Datasets: ERA5 Reanalysis data were used for observed conditions, while forecasts from the NCEP GFS model were employed to forecast the LSWMI, beginning two pentads preceding the intensification of STY Gaemi.

Conclusions

- Multiple indices (SSI, WSI, OLR-AI, MSLP-AI, LSWMI) were used to determine spatiotemporal characteristics, convective activities, atmospheric instabilities, and rainfall intensities during SW monsoon season as it propagates from northern to southern Philippines.
- LSWMI showed higher skill in capturing excessive rainfall, validated with ground-based data.
- LSWMI can serve as a predictive tool for identifying areas at risk of excessive rainfall during the enhanced southwest monsoon season associated with Super Typhoon Gaemi.

Acknowledgements

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