

115年天氣分析與預報研討會 — Sep 2th 2026

應用自組織映射圖客觀辨識東亞地區之春夏季節演變 以2026年梅雨季為例

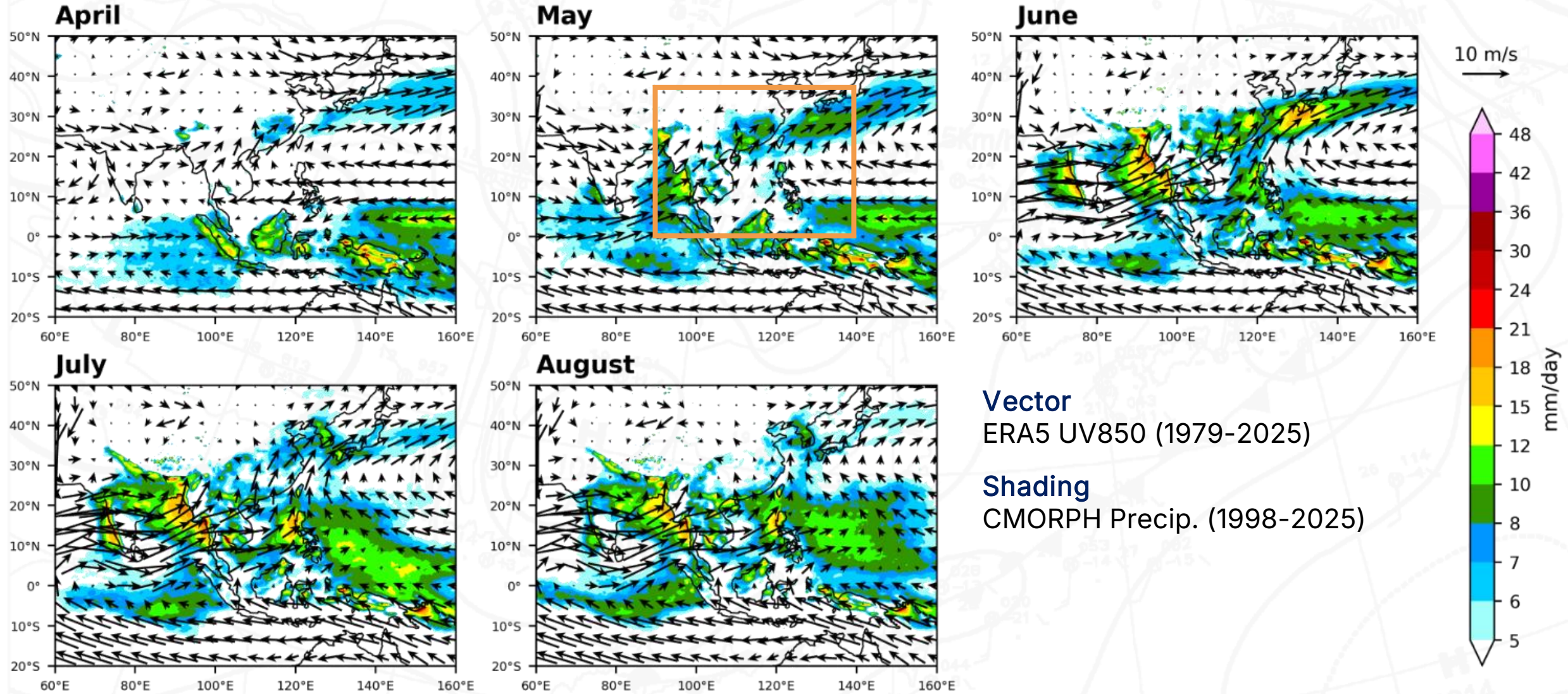
Identifying the East Asia Spring-to-Summer Transition
Using Self-Organizing Map: **An Application to the 2026 Mei-yu Season**

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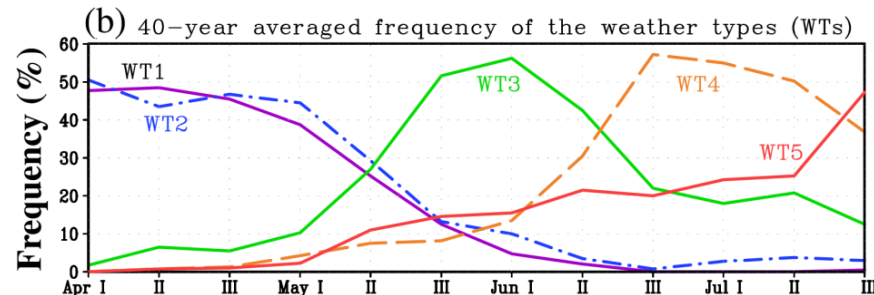
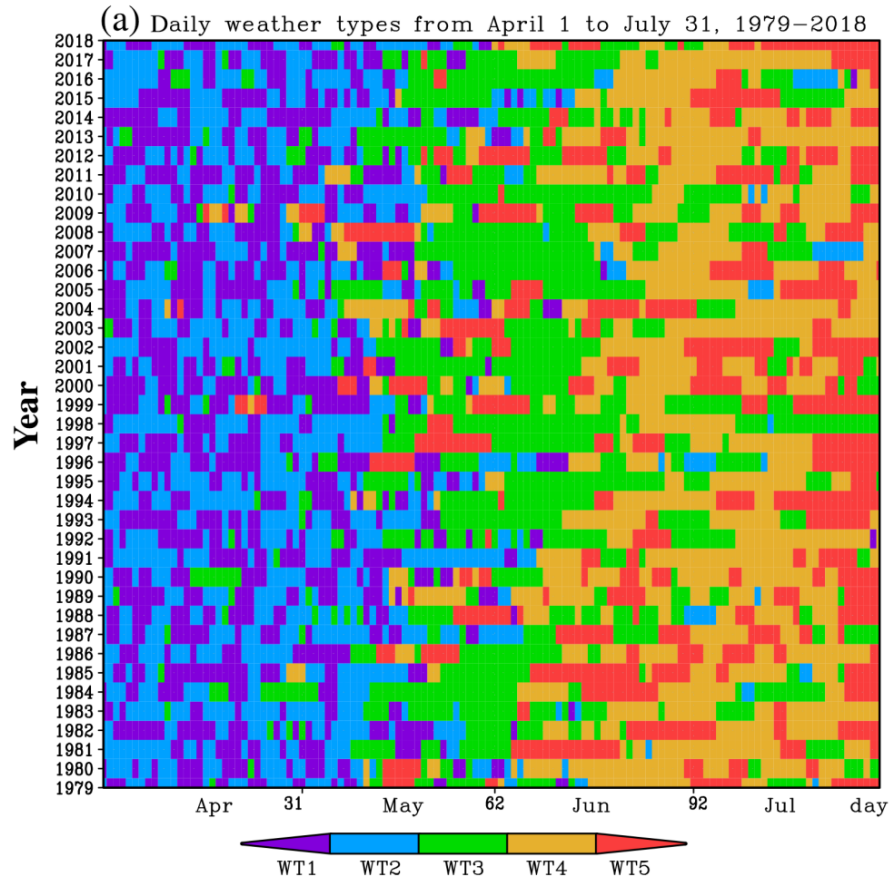
Introduction

Climatological UV850 & Precip. during Taiwan Mei-yu Season

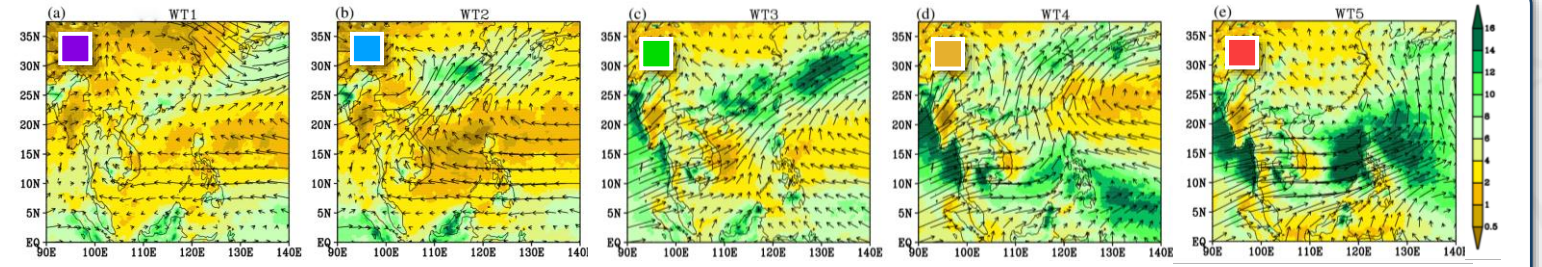


Introduction

Weather Type (WT) Analysis Framework



Composite UV850 & Precip. of WTs



- Qian et al. (2022) applied **K-means** clustering to analysis daily weather type over East Asia during **April-July**.
- ✓ Discuss climate in weather time scale
- ✓ Examine interannual climate variability

Reference

Qian, J. H., M. M. Lu, and C. H. Sui, 2022: Evolution of South China Sea and East Asian monsoon from spring to summer by the progression of daily weather types. *Int. J. Climatol.*, **42**, 3633-3647.

Part 1.

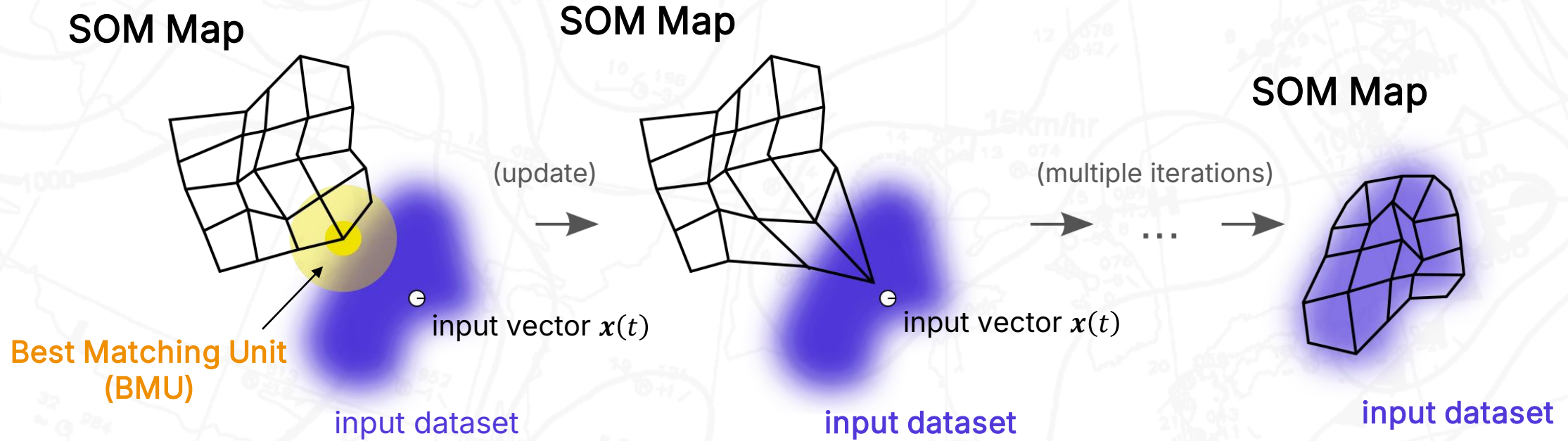
How do the 2026 WTs compare with those derived from the 3×3 SOM of daily low-level wind patterns during April–August 1979–2025?

Part 2.

Do the 2026 WTs reasonably represent the major observed weather characteristics over East Asia and Taiwan?

Dataset	Variables	Frequency	Grids	Periods
ECMWF ERA-5	UV850	daily	0.25° × 0.25°	1979-2025 AMJJA
NOAA CMORPH	Precipitation			1998-2026 AMJJA
CWA TaiSA	Precipitation		1 km × 1 km	1998-2025 AMJJA
3x3 SOM Weather Types (WTs)			-	1979-2025 AMJJA
Pre-trained 3x3 SOM weights				

- Research domain: **East Asia** (0-37.5N, 90-140E)



ERA5 UV850
(1979-2025 AMJJA, daily)

SOM
clustering

9 WTs

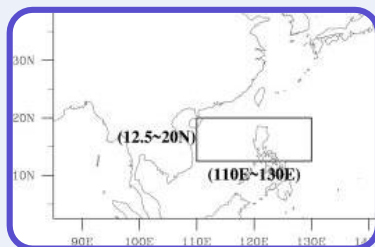
1979-2025 AMJJA
Monsoon Weather Calendar
(Unit A - Unit I)

vs.

2026
WTs

Vshr 垂直風切指標

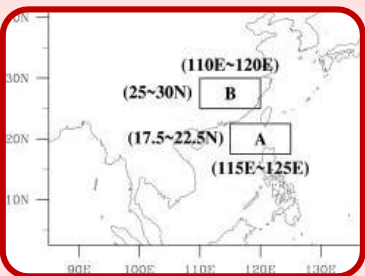
可描述大尺度季風環流變化，顯示夏季季風建立的時間



$$Vshr = [U850 - U200]$$

Hshr 低層水平風切指標

反映臺灣附近是否有低壓帶或梅雨鋒面等造成環境不穩定的因素存在



$$Hshr = U850[A - B]$$

指標變化意義說明：

梅雨季期間，當2組指標數值均轉為正值(+)時，臺灣地區降下豪大雨的機會明顯增加。

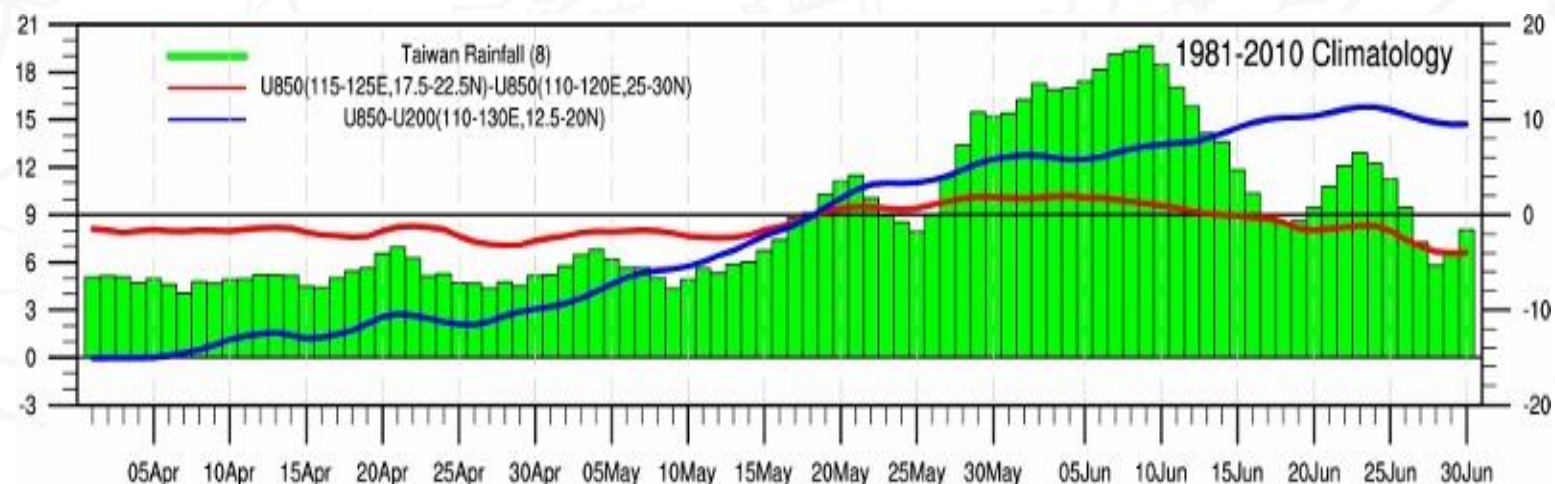
Vshr (- → +)

Hshr (反氣旋(-) → 氣旋(+))

風切
渦度 ↑

環境
不穩定 ↑

臺灣豪大雨
發生機會 ↑



▲上圖為梅雨季降雨指標及臺灣8站平均降水的30年(1981-2010)長期氣候平均狀態。資料經5日滑動平均處理。

Results

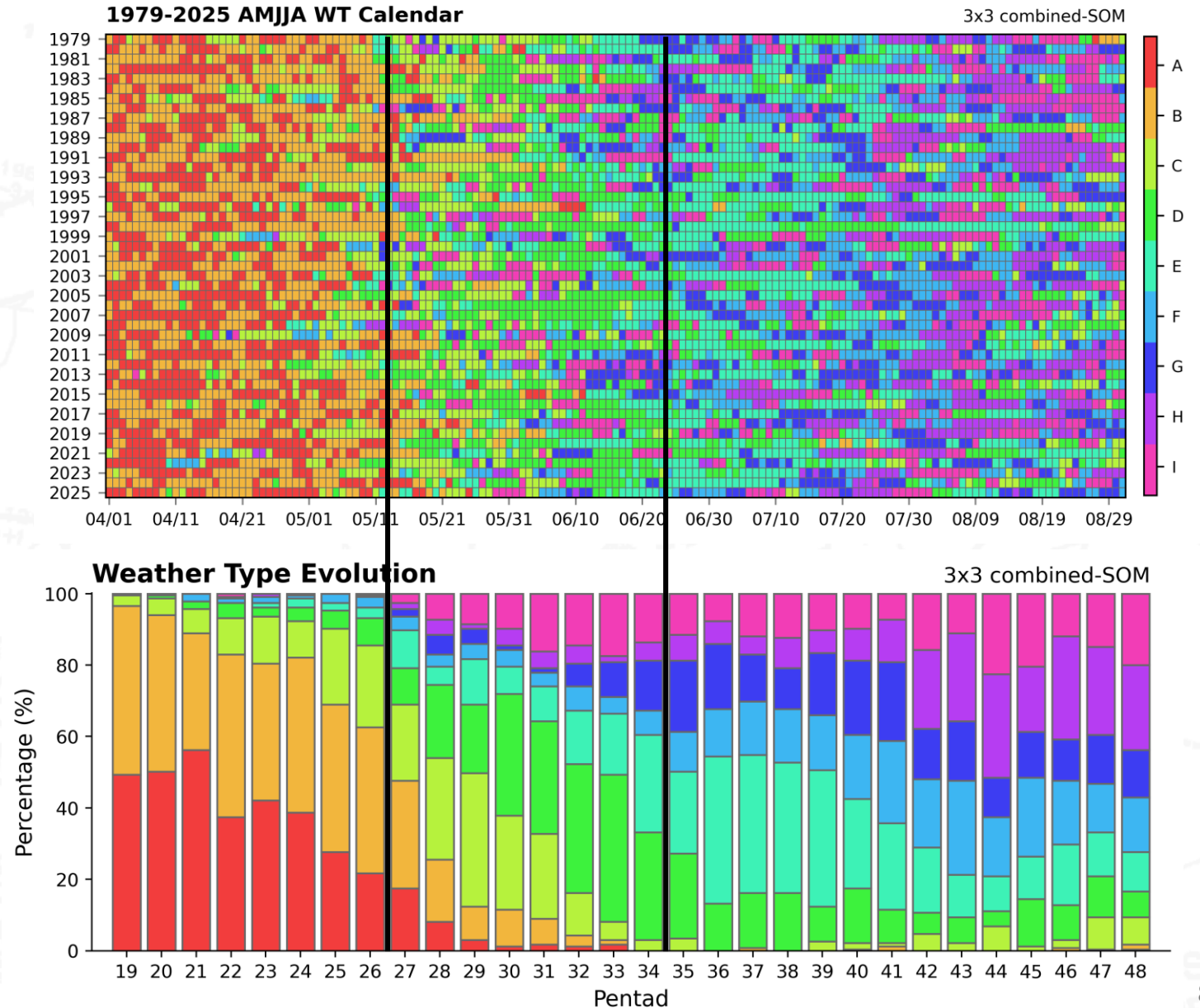
1979-2025 AMJJA WTs — Temporal Analysis

- Nine WTs show distinct temporal evolutions during April to August.
- The temporal distribution of WTs can roughly show different stages of seasonal transition from spring to summer.

Stage 1 April ~ early-May

Stage 2 Mid-May ~ mid-June

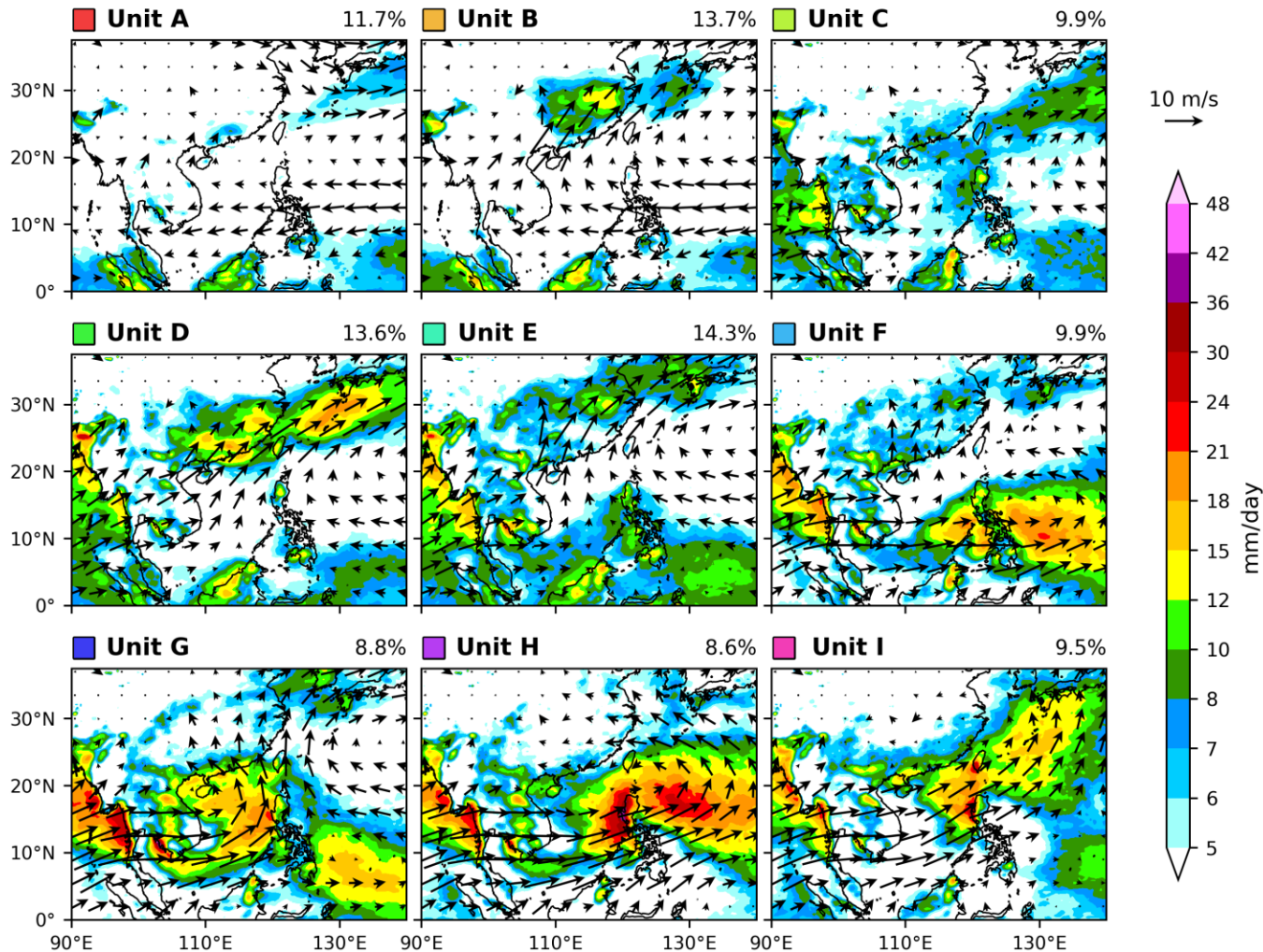
Stage 3 Late-June ~ August



Results

1979-2025 AMJJA WTs — Composite Analysis

ERA5 UV850 & CMORPH Precip.



Unit A~B

- Strong easterlies over the SCS
- Weak precipitation over East Asia

Unit C

- Westerlies from the BoB to SCS

Unit D~E

- Movement of Mei-yu rainband
- Anticyclonic circulation of WNPSH

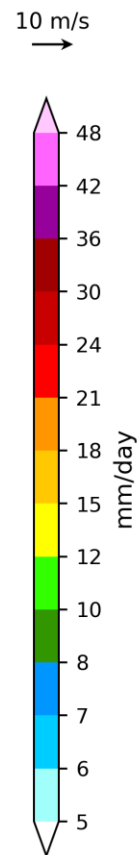
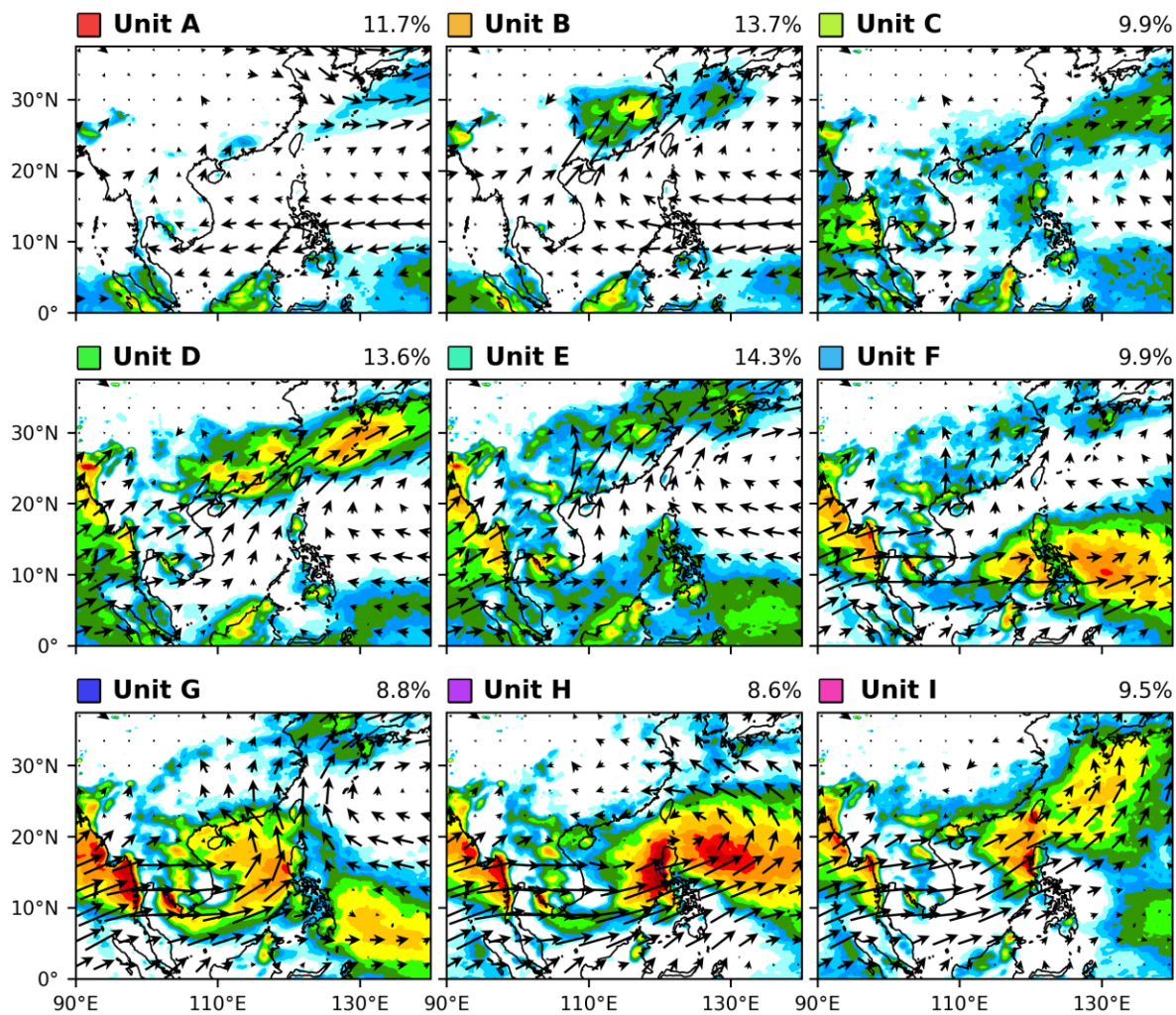
Unit F~I

- Activity of tropical disturbance
- Monsoon trough
- Southwesterly flow

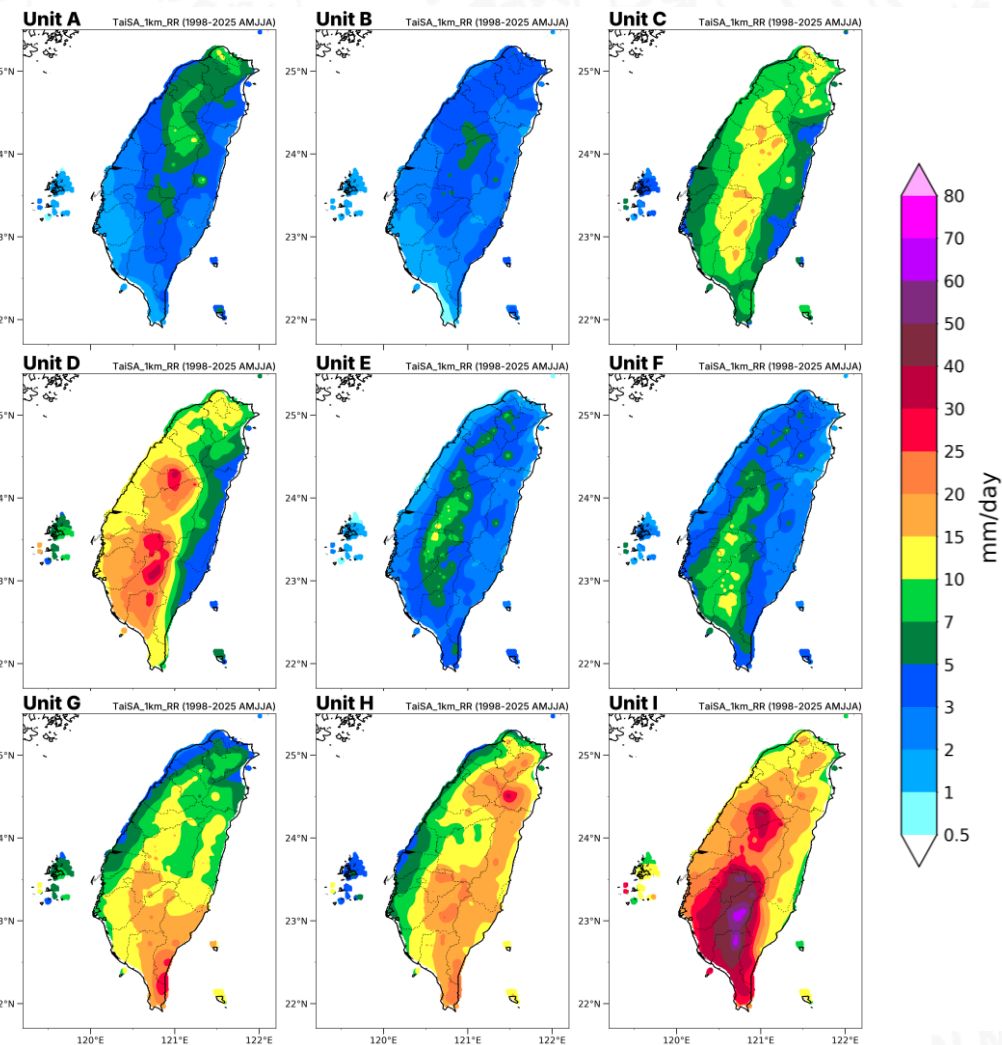
Results

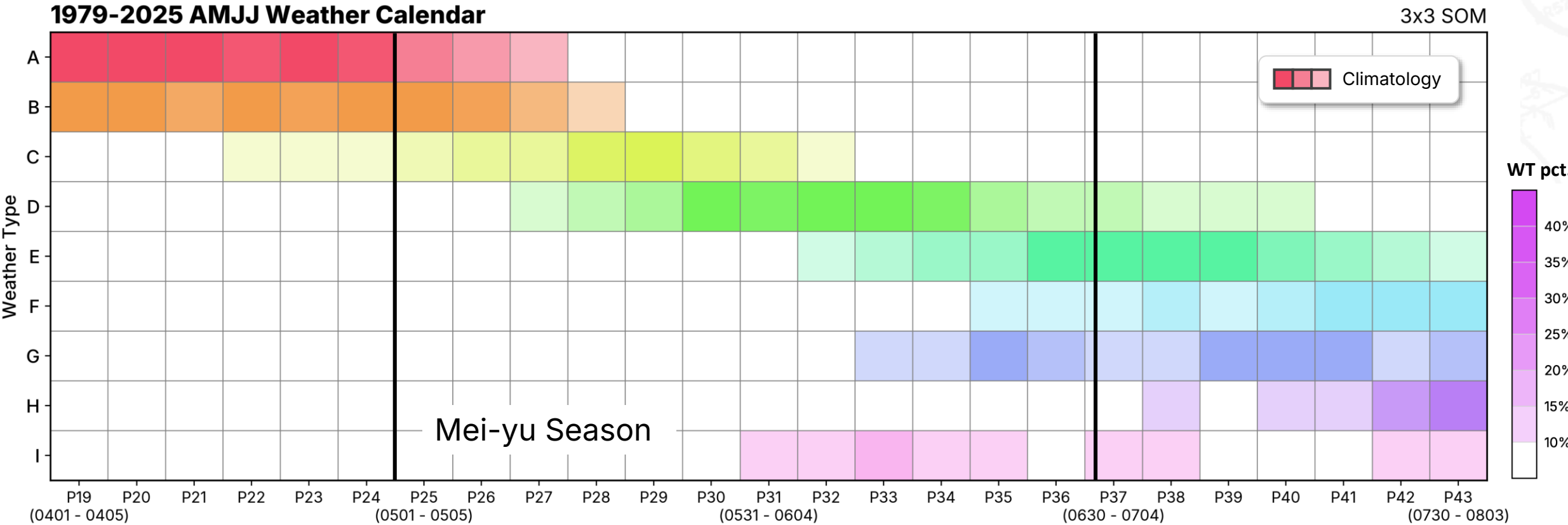
1979-2025 AMJJA WTs — Composite Analysis

ERA5 UV850 & CMORPH Precip.



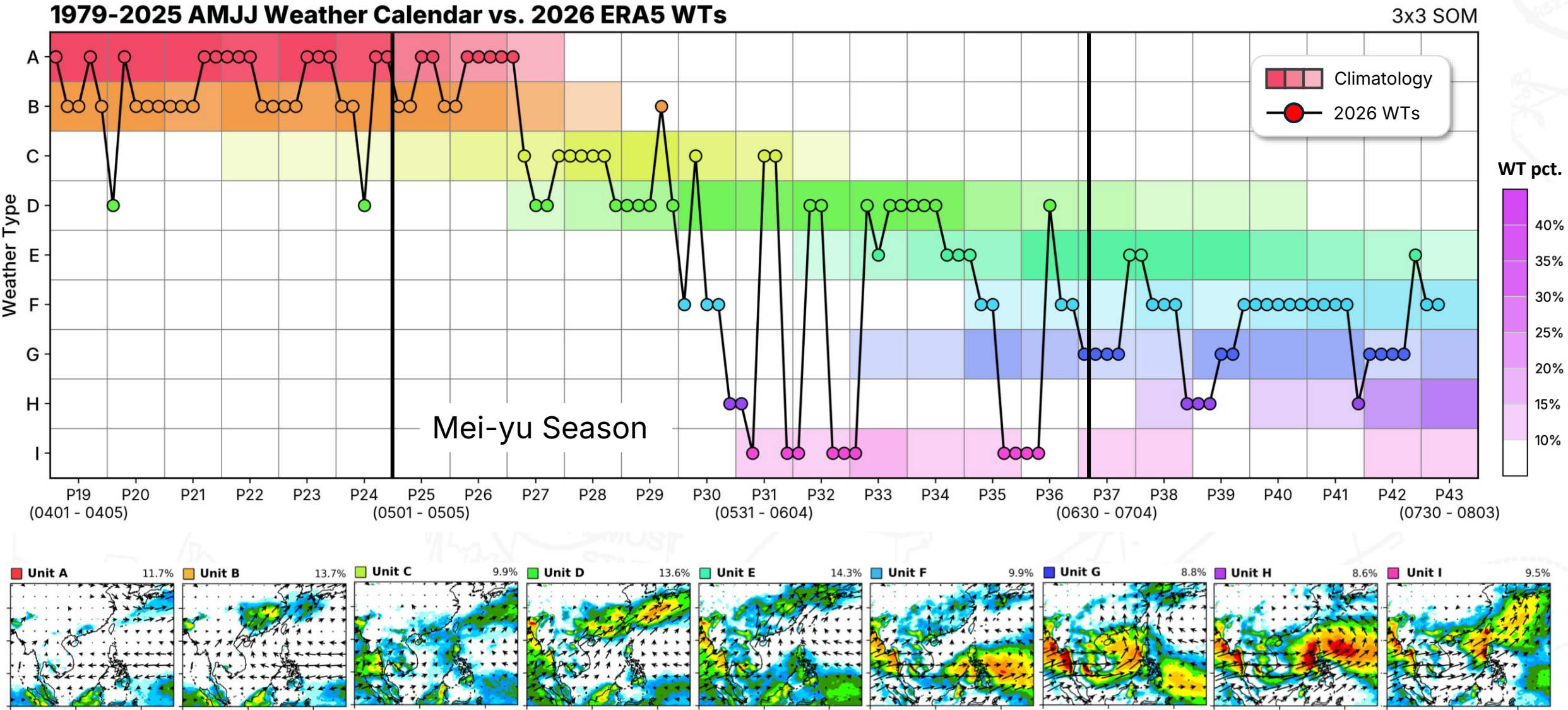
TaiSA Precip.





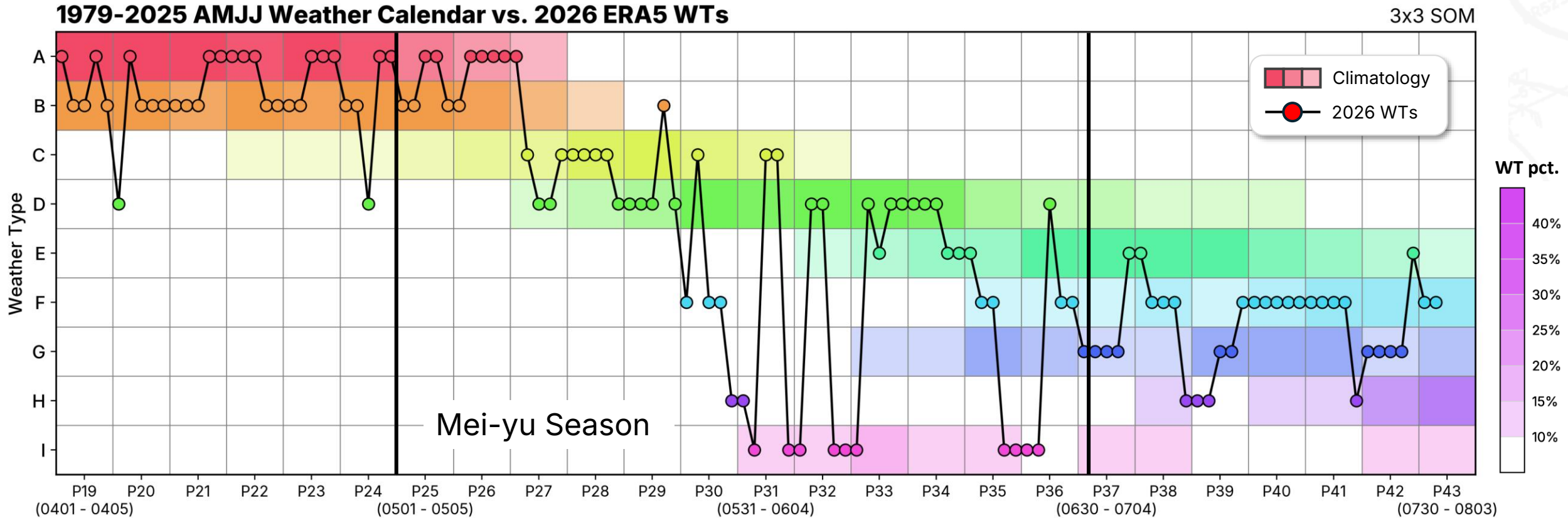
Results

1979-2025 AMJJ Weather Calendar vs. 2026 AMJJ WTs

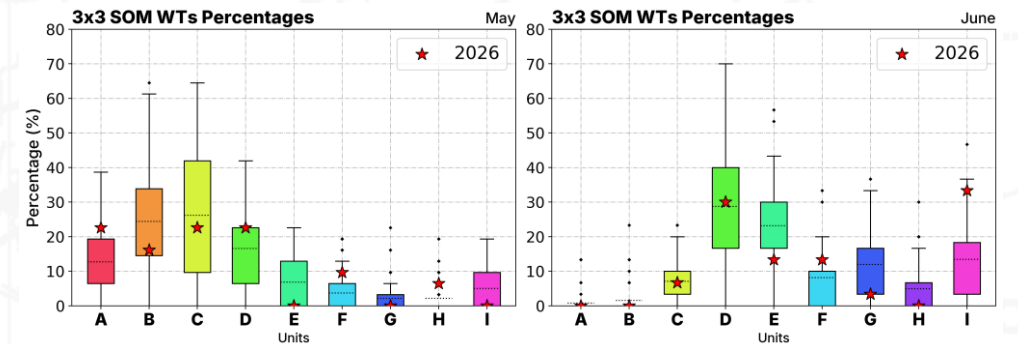


Results

1979-2025 AMJJ Weather Calendar vs. 2026 AMJJ WT



- The occurrence of WTs in 2026 was similar to the 1979–2025 climatology.
- Unit I** occurred more frequently in June 2026, which show low-level circulation patterns of southwesterlies flow.



Results

Daily Accumulated Precipitation During May-June 2026

May 2026

June 2026

1~5

6~10

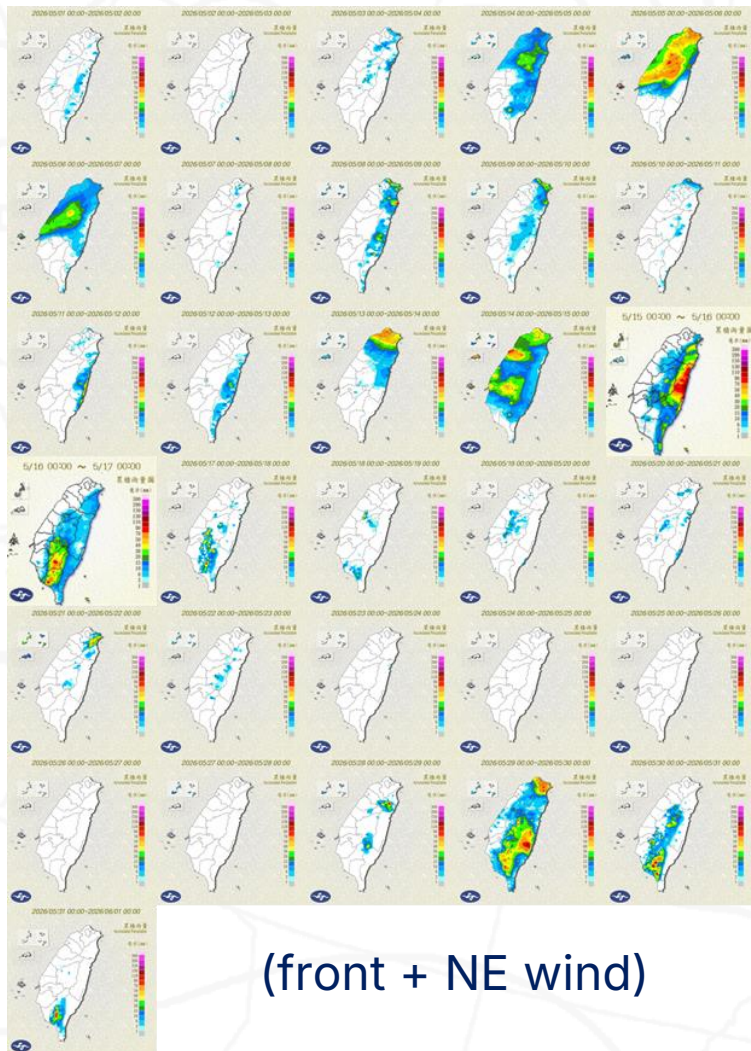
11~15

16~20

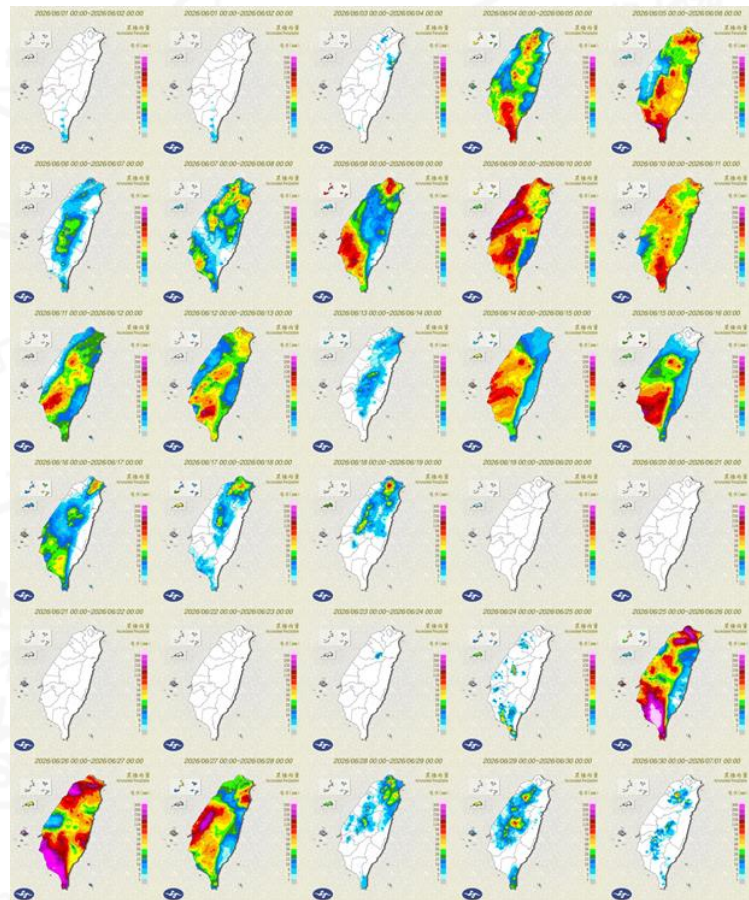
21~25

26~30

31



(front + NE wind)

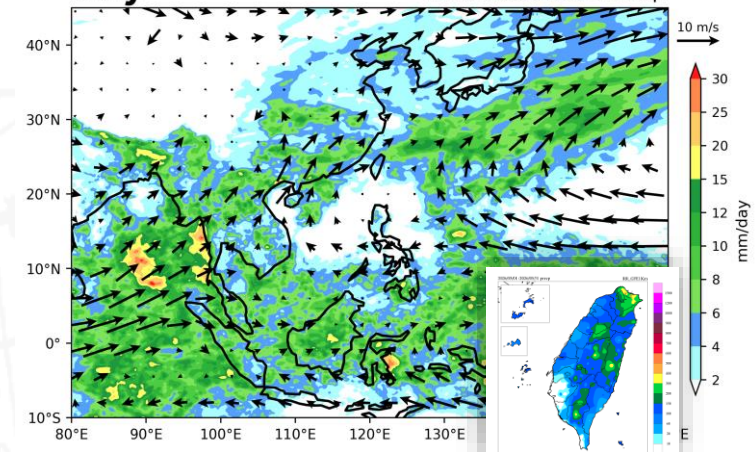


(stationary front / TCs / SW flow)

ERA5 UV850 & CMORPH Rainfall

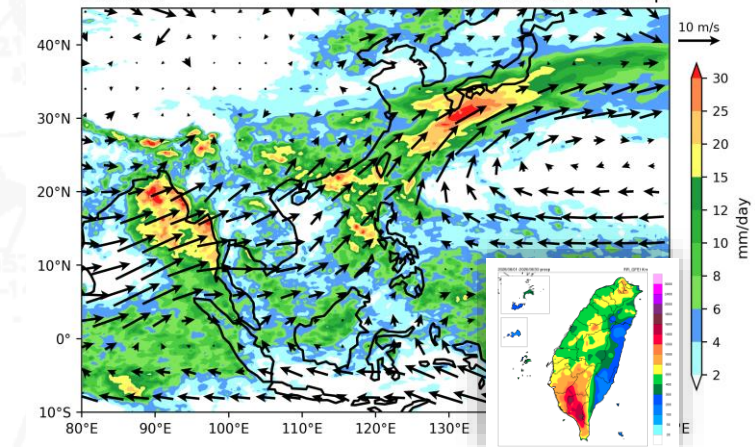
May 2026

ERA5 UV850 & CMORPH Prcp.



June 2026

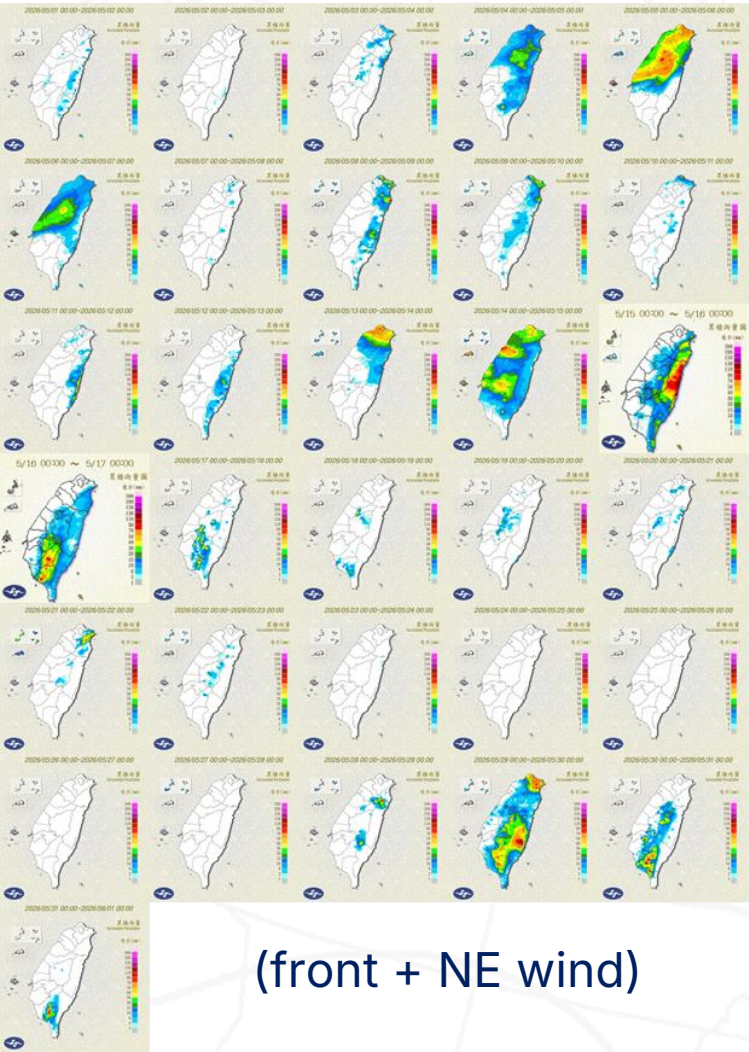
ERA5 UV850 & CMORPH Prcp.



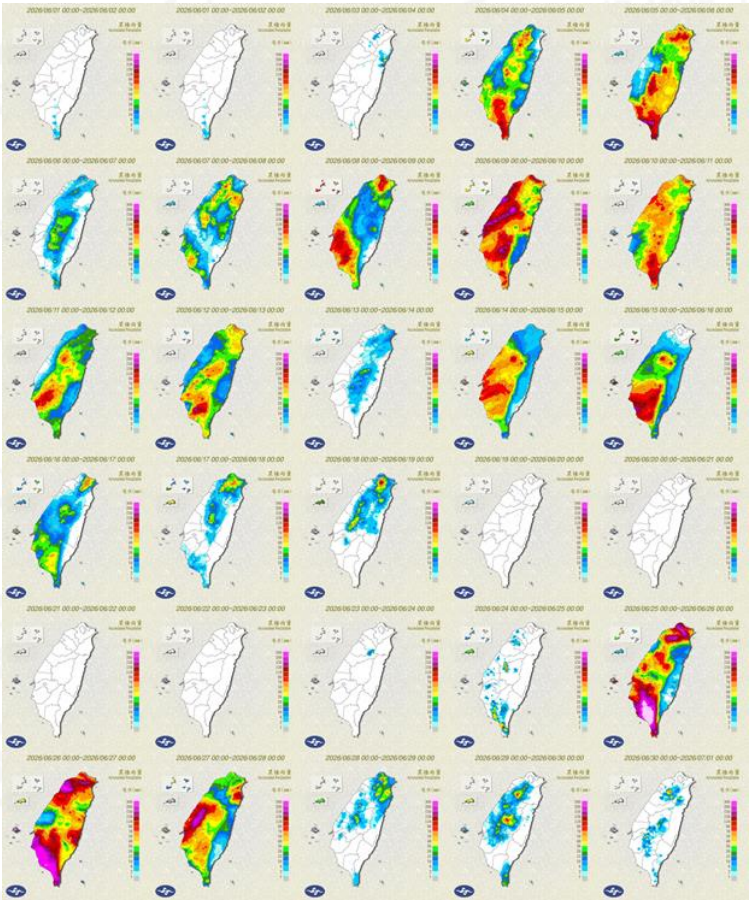
May 2026

June 2026

- 1~5
- 6~10
- 11~15
- 16~20
- 21~25
- 26~30
- 31

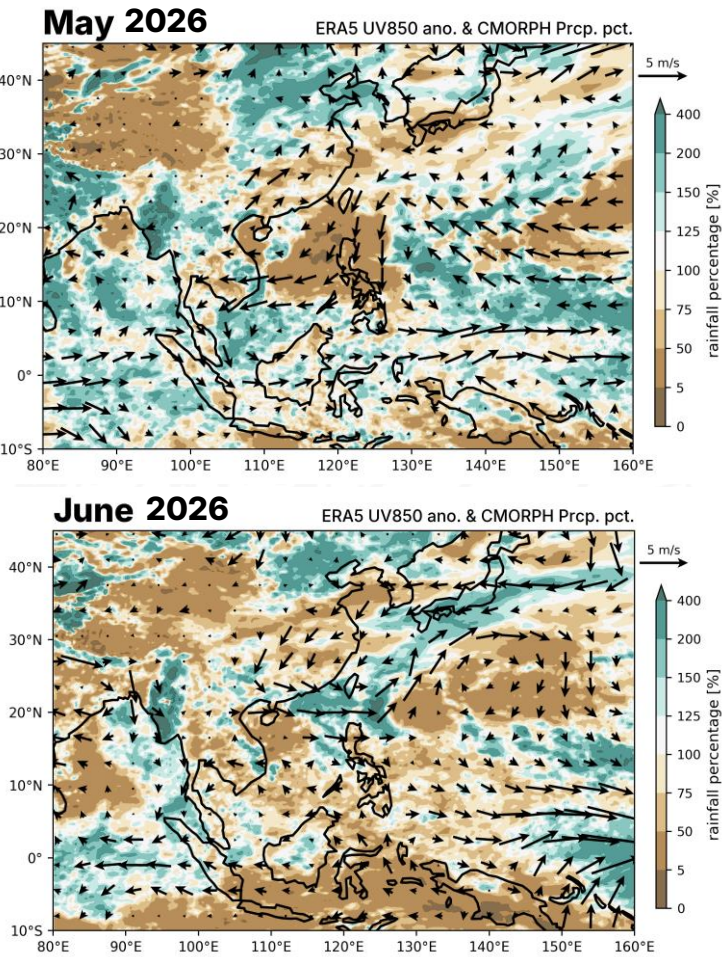


(front + NE wind)



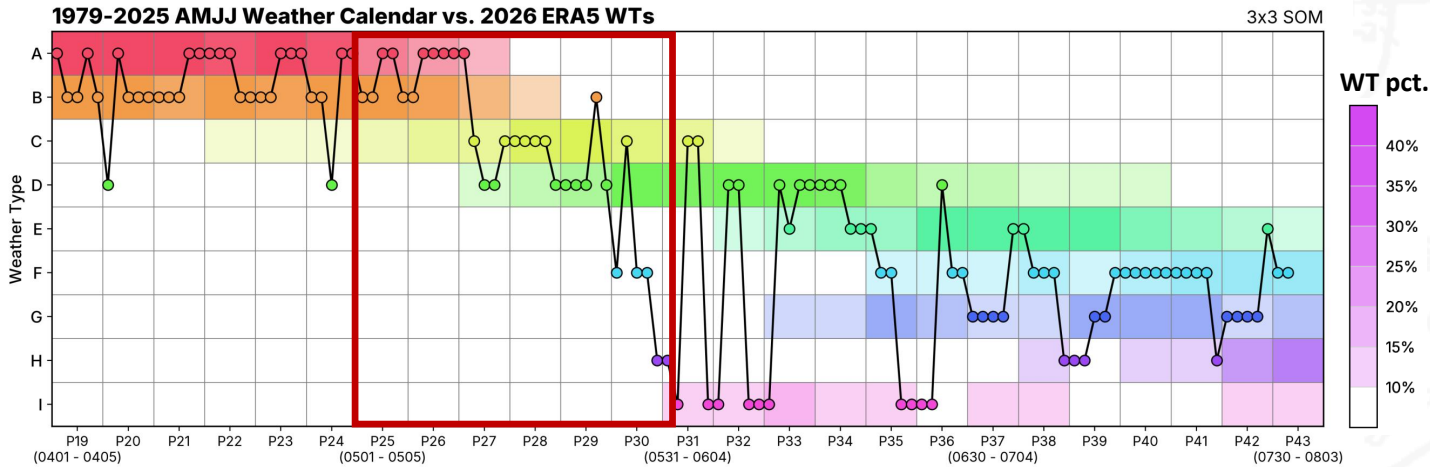
(stationary front / TCs / SW flow)

ERA5 UV850 ano. & CMORPH Rainfall pct.

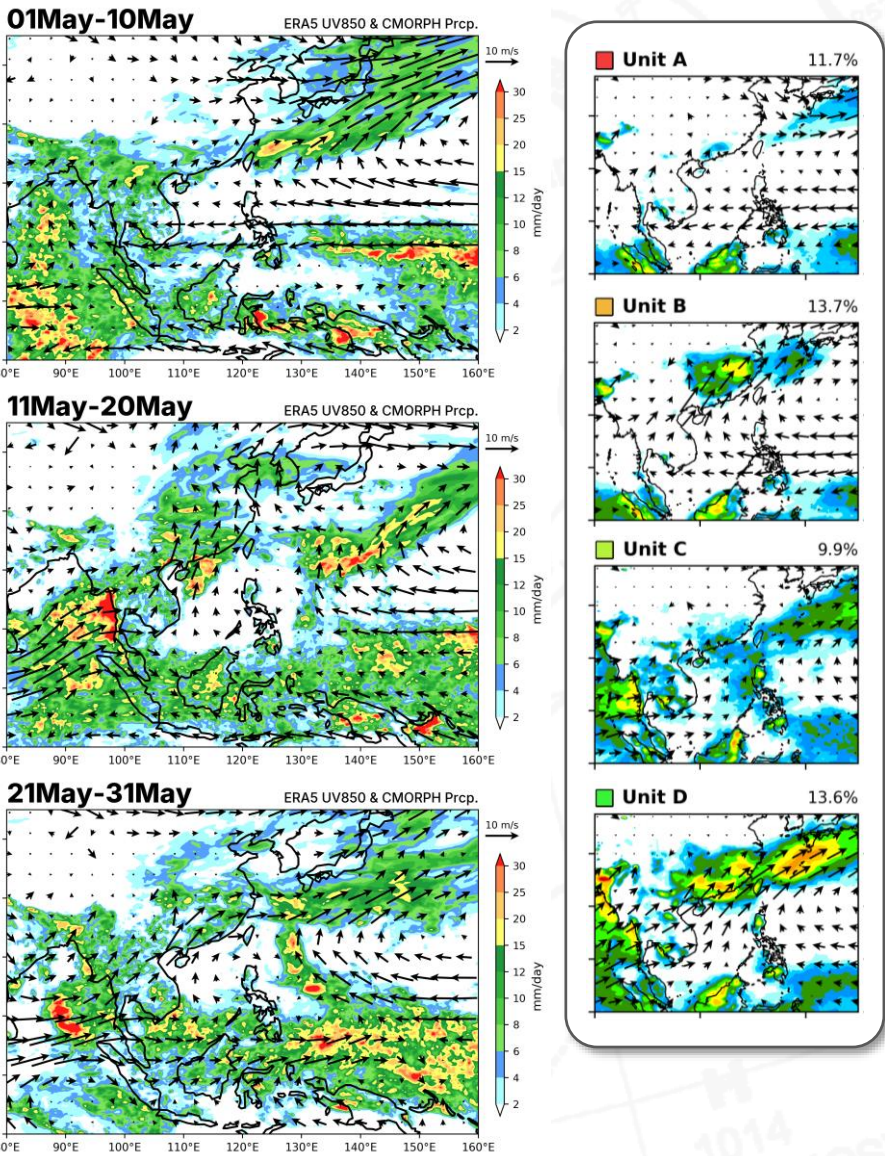
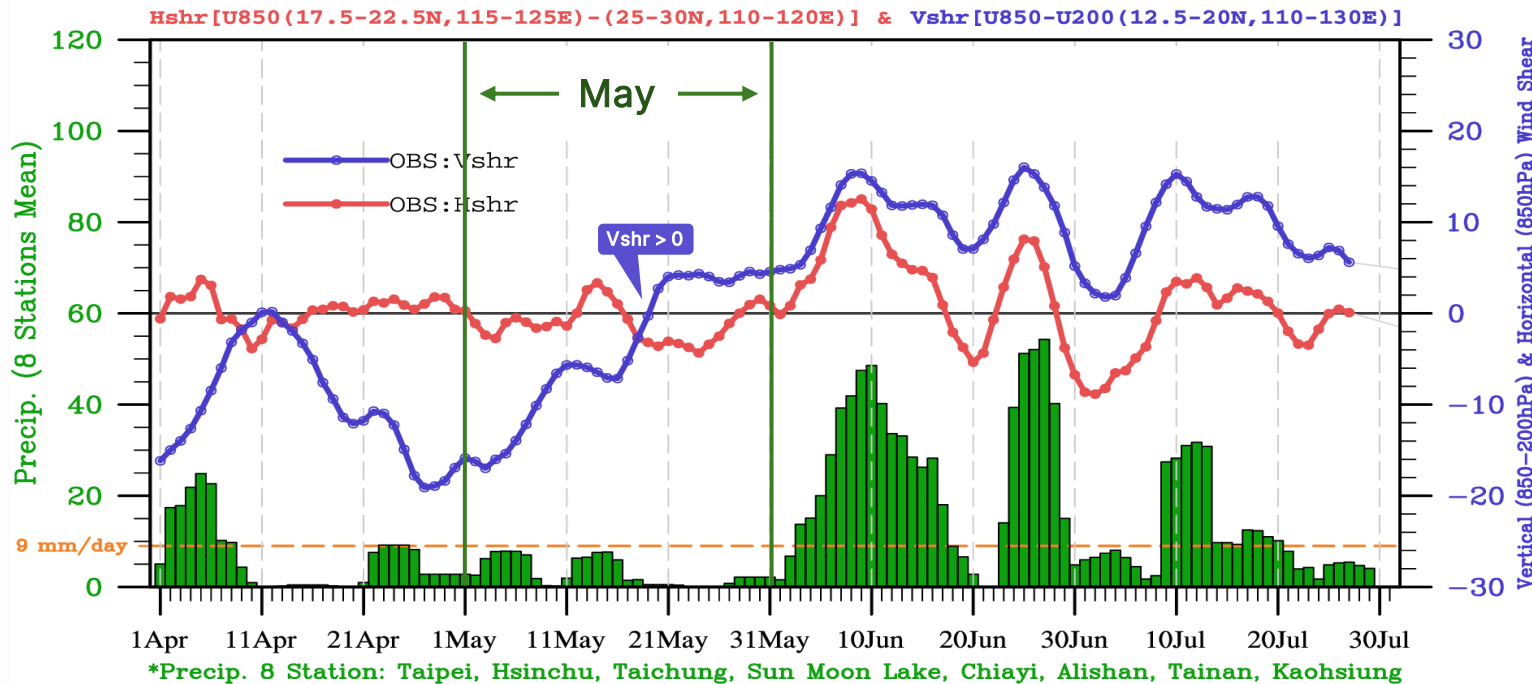


Results

2026 AMJJ Daily WTs vs. Mei-yu Indices vs. UV850 & Precip. in May 2026

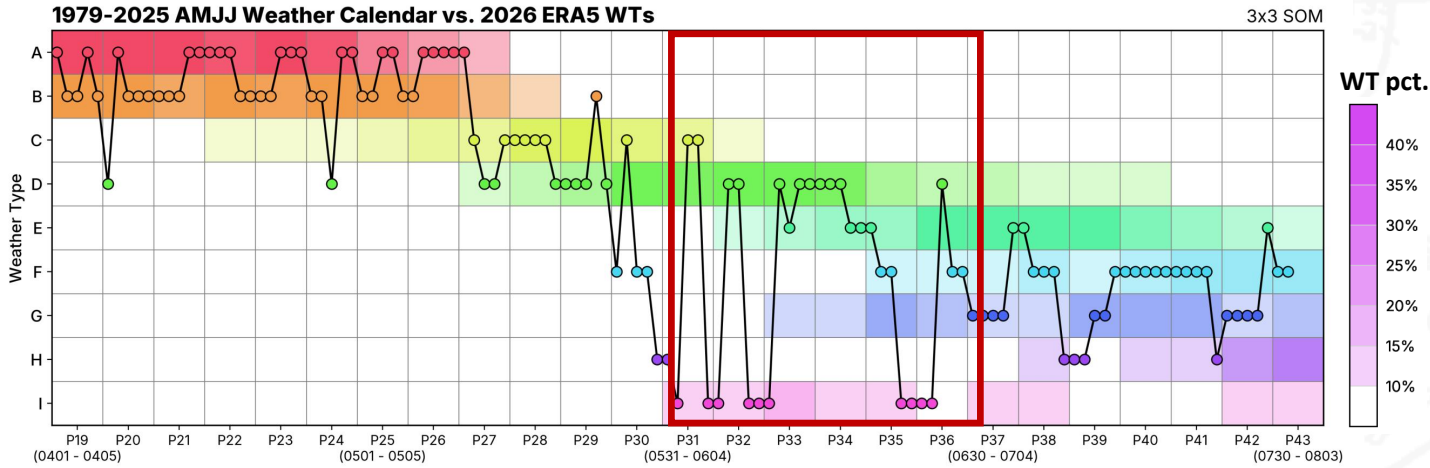


2026 Taiwan Mei-yu Index & TWN-8-Prcp(Green Bar) (5-day running mean)



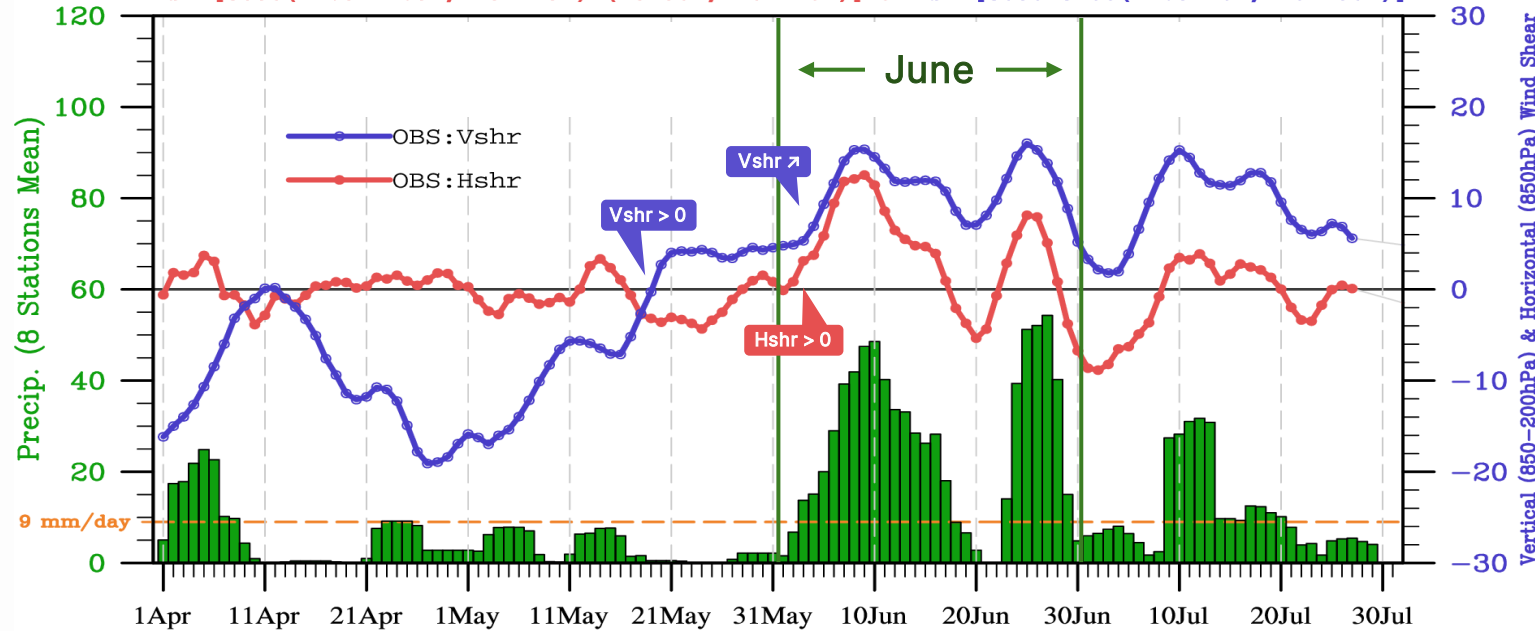
Results

2026 AMJJ Daily WTs vs. Mei-yu Indices vs. UV850 & Precip. in June 2026



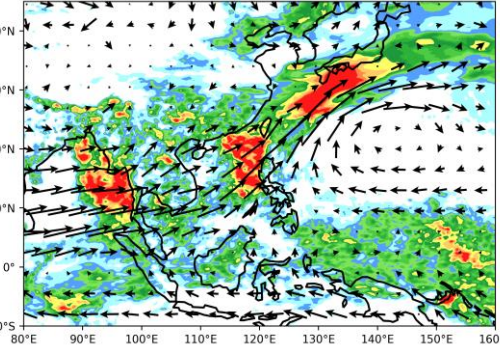
2026 Taiwan Mei-yu Index & TWN-8-Prcp(Green Bar) (5-day running mean)

Hshr [U850 (17.5-22.5N, 115-125E) - (25-30N, 110-120E)] & Vshr [U850-U200 (12.5-20N, 110-130E)]

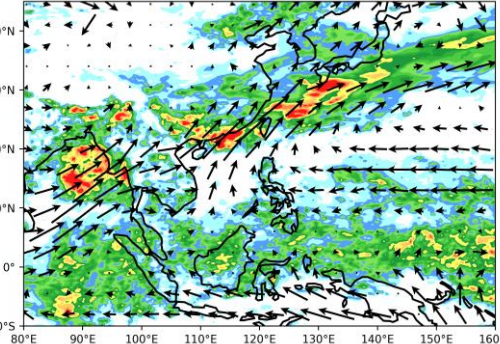


*Precip. 8 Station: Taipei, Hsinchu, Taichung, Sun Moon Lake, Chiayi, Alishan, Tainan, Kaohsiung

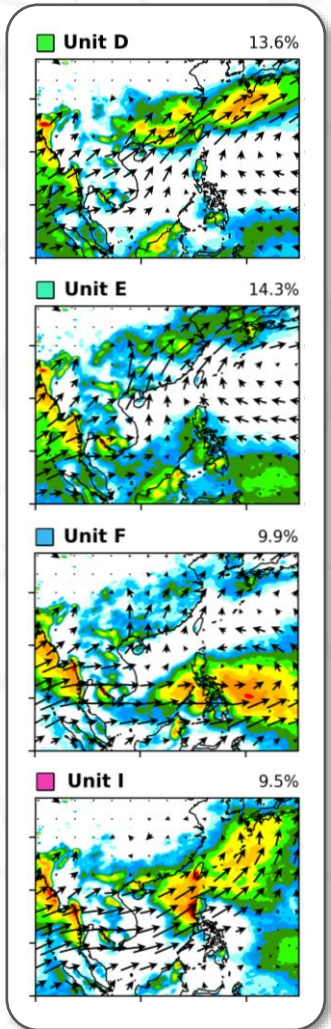
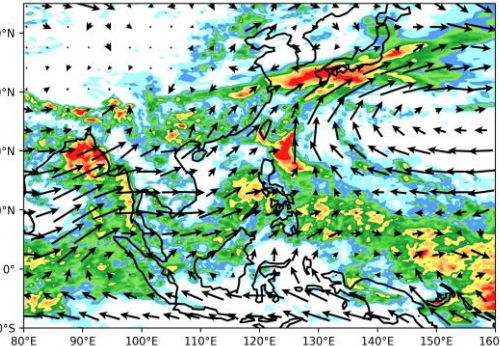
01Jun-10Jun



11Jun-20Jun



21Jun-30Jun



Conclusions

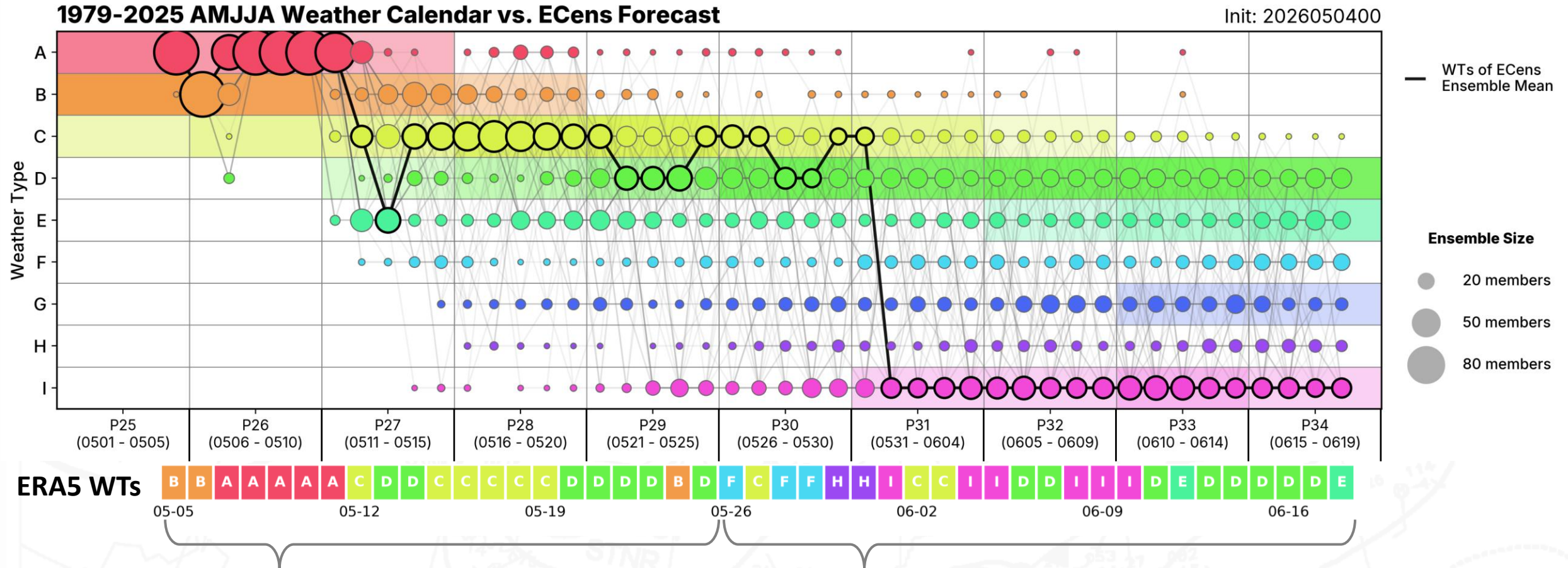
- The 2026 WT evolution was broadly consistent with the climatological pattern, shifting from frontal-system-related WTs in May to both frontal- and southwesterly-flow-related WTs in June.
- In 2026, limited rainfall occurred in May despite frontal influences. In June, widespread rainfall occurred over Taiwan, along with the establishment of the summer monsoon and favorable atmospheric conditions. Similar features were reflected in the WTs.

Future Works

- Add quantitative analysis of WT–rainfall relationships over Taiwan.
- Compare 2026 WT variability with that associated with ENSO, ISO, and other timescales.
- Apply the WT framework to real-time monitoring and S2S forecasting.

Future Works

Apply Weather-Type Analysis to ECens 46-day Forecast (101 members)



WT Forecasts ≤ 3 Weeks

- Closer to observations
- Stronger ensemble consensus

WT Forecasts ≥ 4 Weeks

- Larger observation errors
- Greater ensemble spread
- Poor capture of high-frequency variability

References

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