氣象局第二代二步法短期氣候預報系統之全球大氣環流模式氣候模擬能力

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前言

- 中央氣象局在《災害性天氣監測與預報作業系統建置計畫》支持下將CWB全球氣候模式從原來的T42(~約300公里)提升為T119(~約150公里)，垂直層數從18增加為40層，模式物理也更新為與天氣預報的NWP模式類似。預計2016年正式上線執行作業性之季與月預報。

- 在新一代高解析度模式開始建置之前，需要針對此全球氣候模式之氣候場加以分析，所以將分析此高解析度全球模式之氣候模擬能力與誤差範圍。

Method:

- Climatology- Annual Mean, Seasonal Mean
- Pattern correlation & RMSE
- Monsoon Index & Precipitation Index
- Conclusion

OBS and AMIP Data:

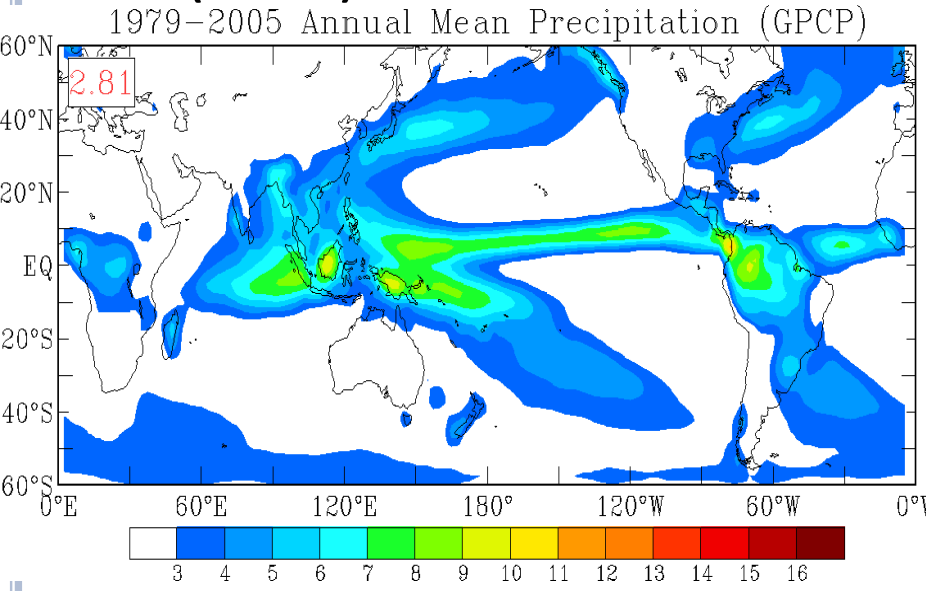
- Observation: NCEP Reanalysis Ⅰ ， NCEP Reanalysis Ⅱ
  GPCP，CMAP，ERSST-V3

- AMIP: T119: 1949-2006, 360 x 180 (1°x 1°)
  T42 : 1950-2005, 128 x 64 (2.8° x 2.8°)
  ECHAM5: 1956-2005, 128 x 64 (2.8° x 2.8°)

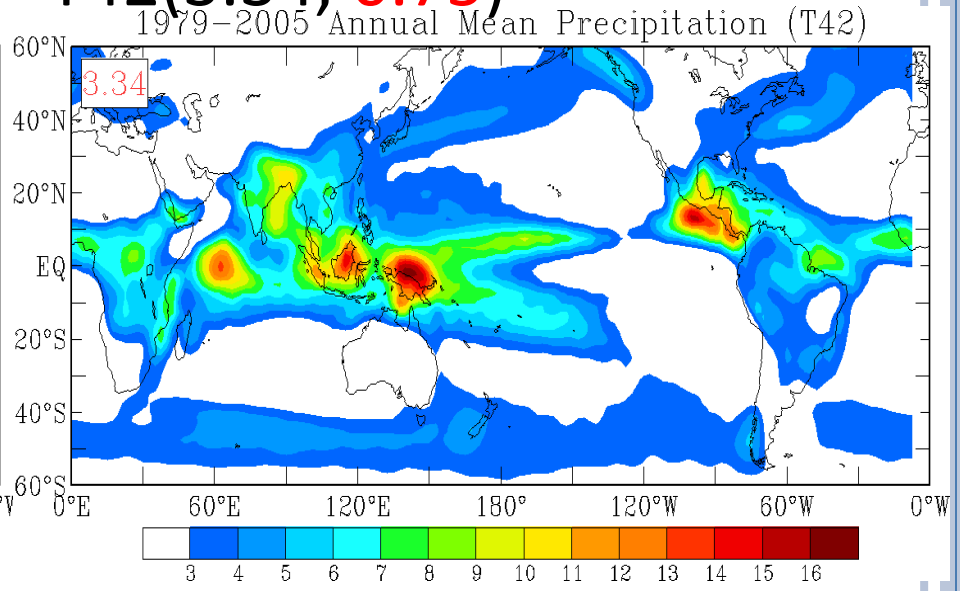
- AMIP格式乃是指下邊界條件使用觀測分析場資料或給定的氣候資料，不隨模式積分改變的全球大氣環流模式的氣候模擬方式(Gates, 1992)。
- 本研究使用1956-2005年(49年)三個模式的模擬結果進行分析，並將模式資料均內插成經緯網格2.5°的格點資料

Annual Mean Precipitation - Climatology

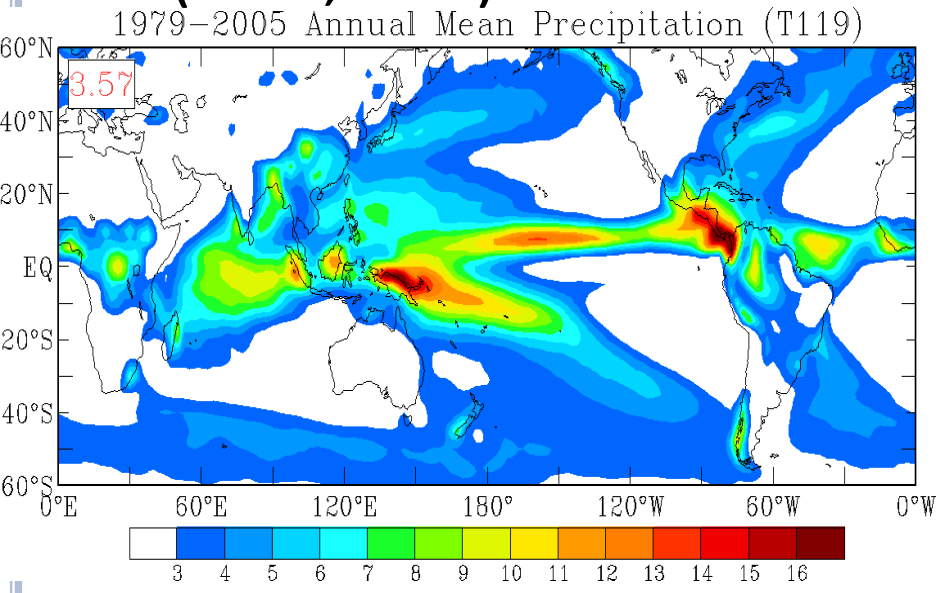
GPCP(2.81)



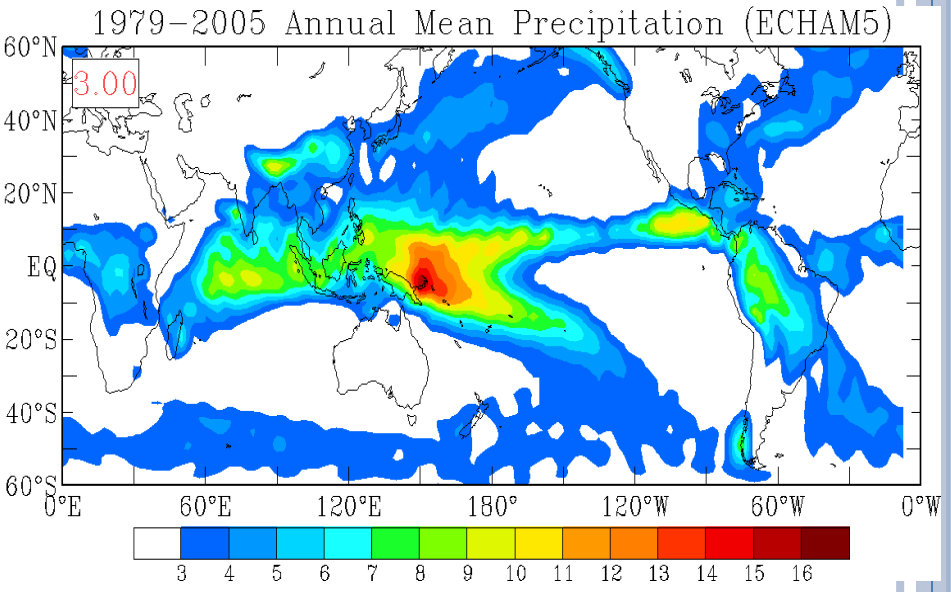
T42(3.34, 0.75)



T119(3.57,0.86)



ECHAM5(3.0, 0.86)



Seasonal Mean Precipitation - Climatology

JJA

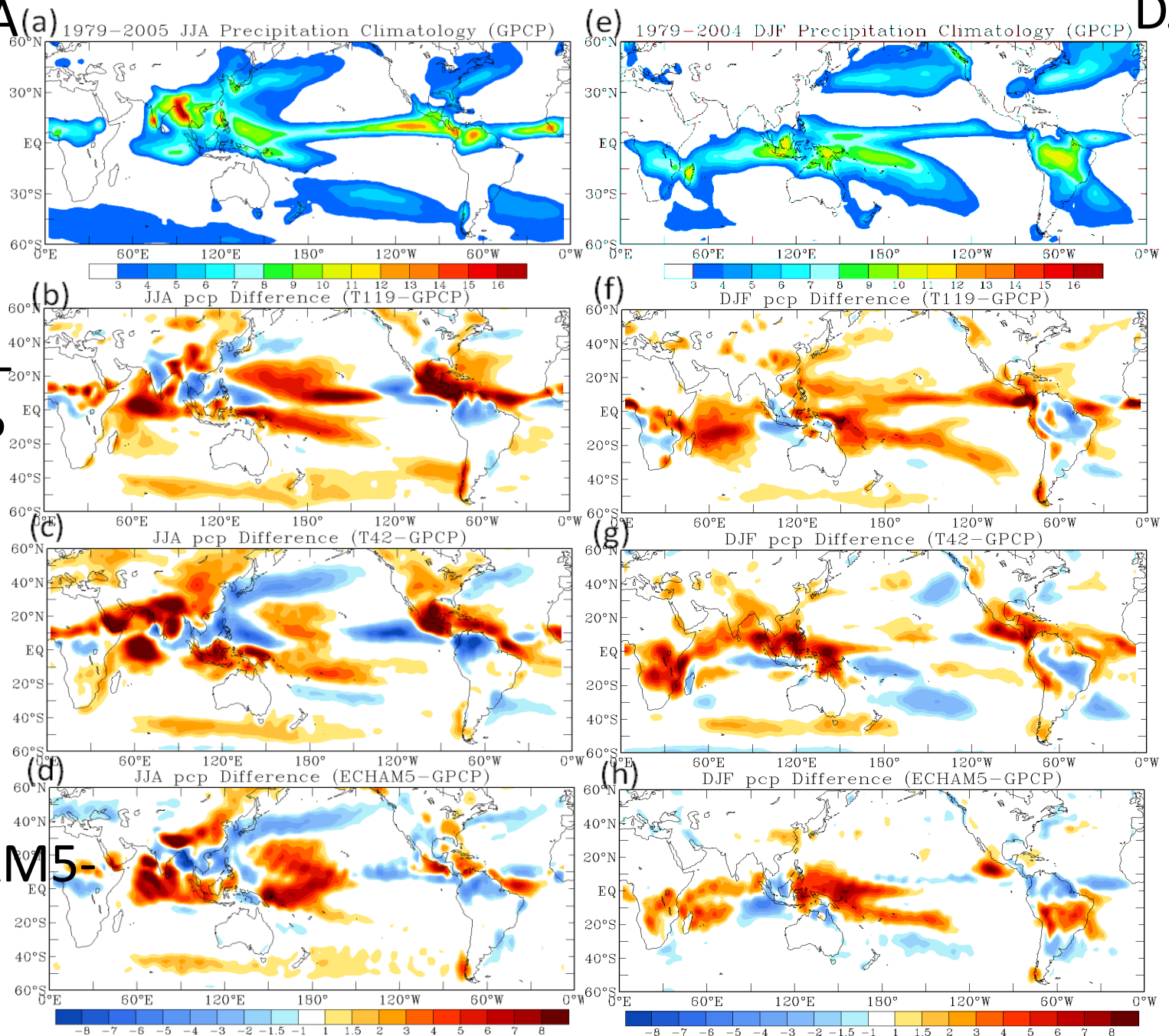
DJF

GPCP

T119-GPCP

T42-GPCP

ECHAM5-GPCP

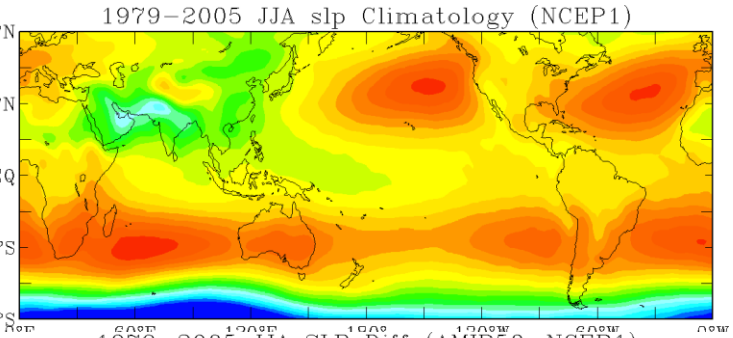


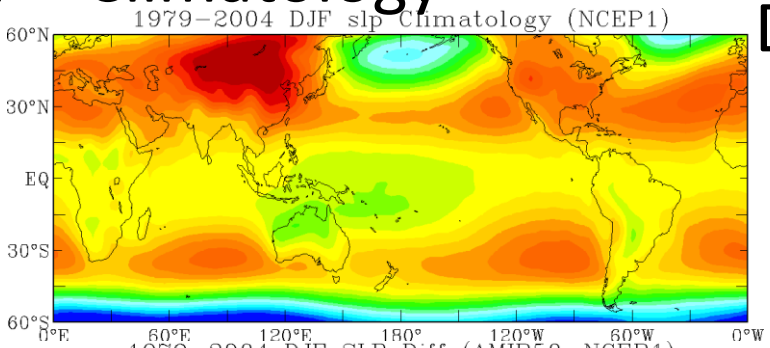
Seasonal Mean SLP - Climatology

JJA

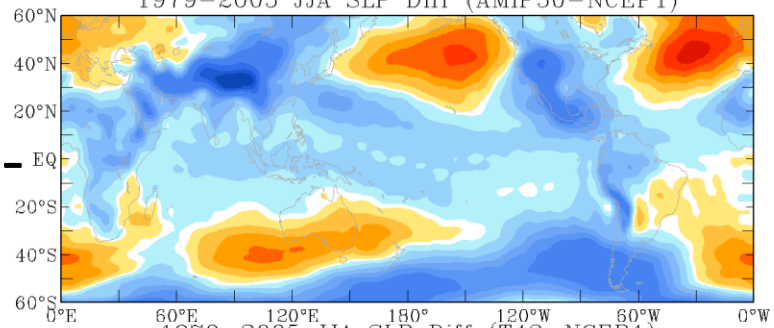
DJF

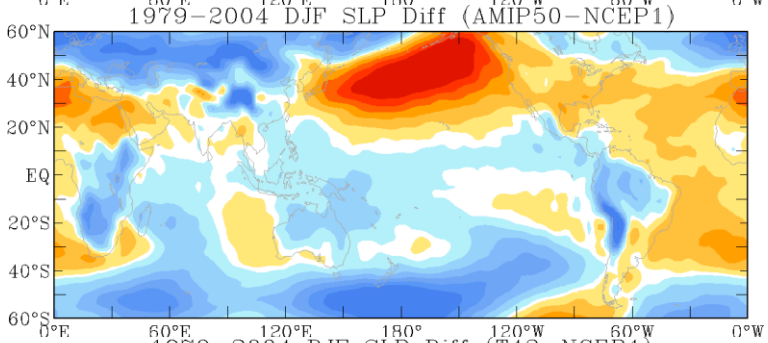
R1



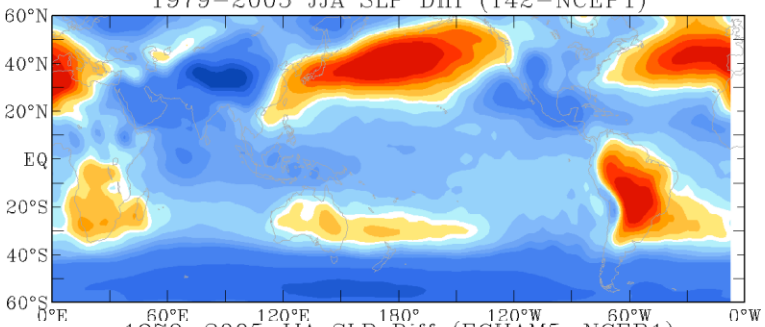


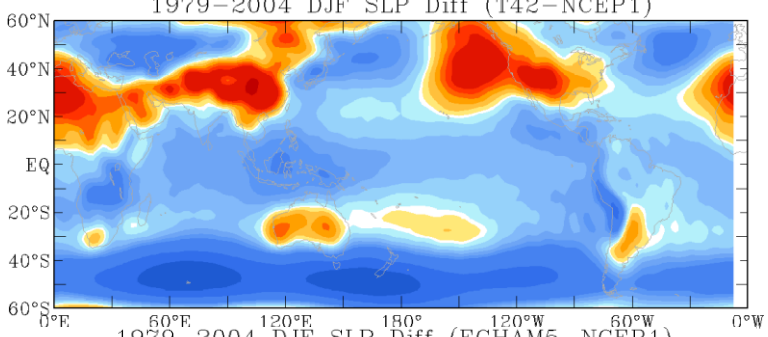
T119-R1



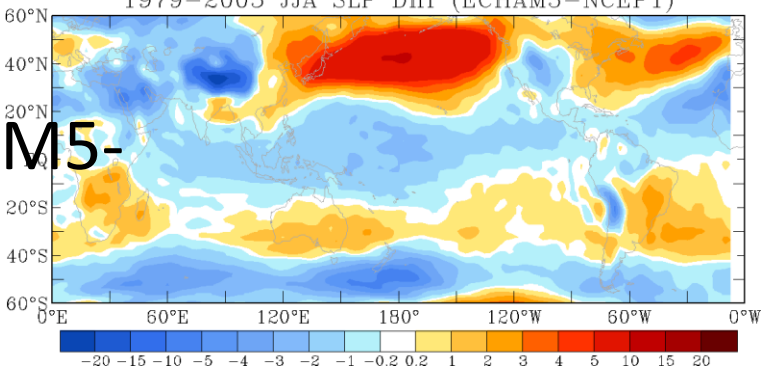


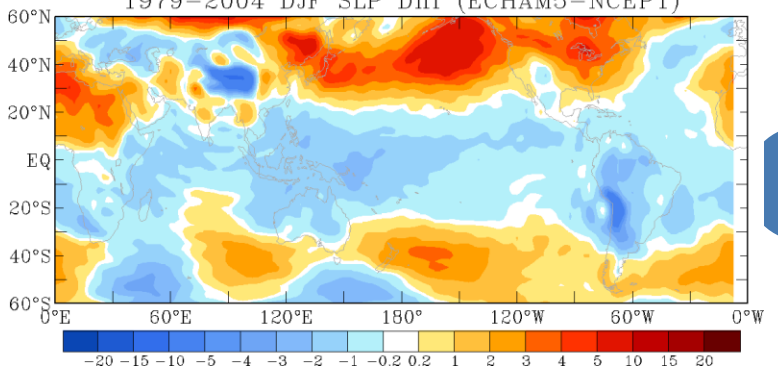
T42-R1



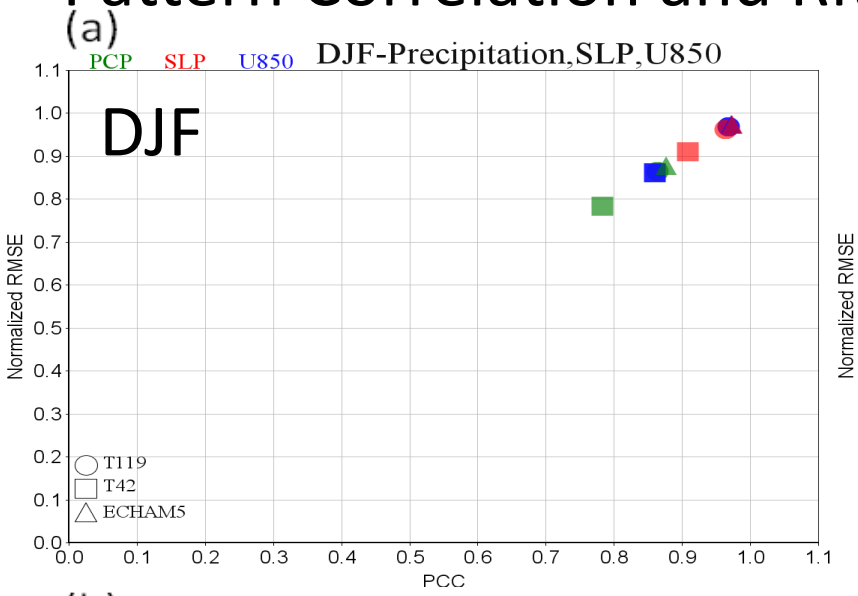


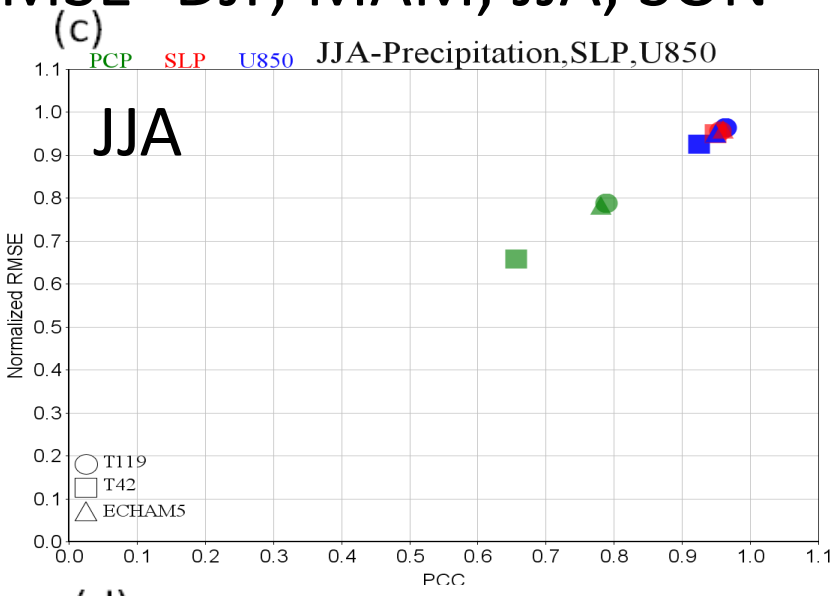
ECHAM5-R1

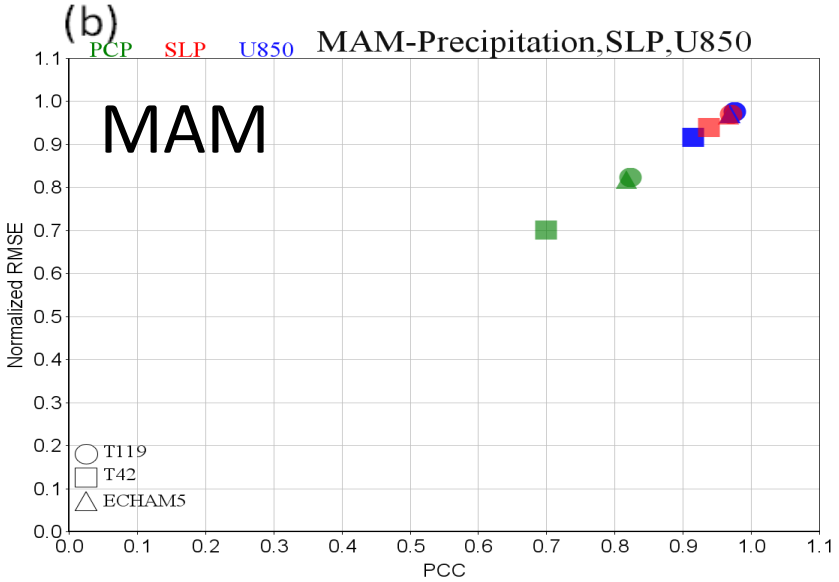


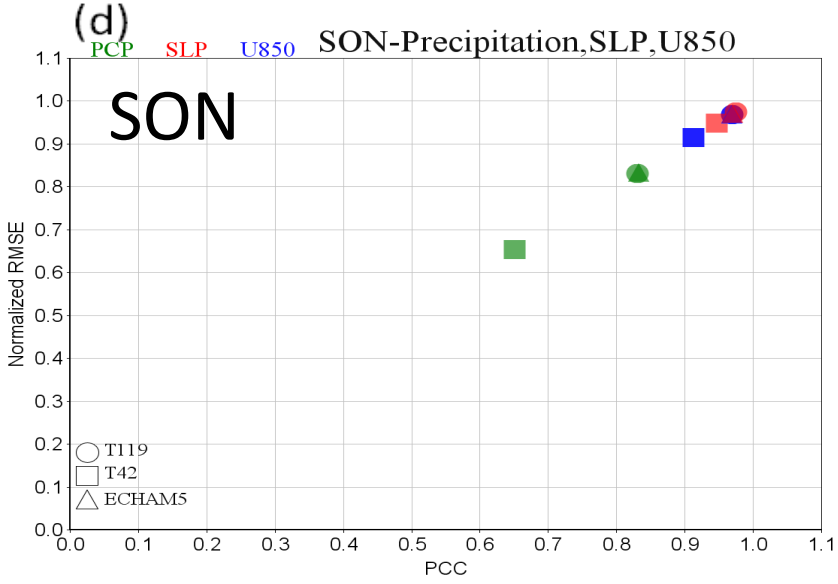


Pattern Correlation and RMSE- DJF, MAM, JJA, SON









Green: Precipitation

Red: SLP

Blue: U850

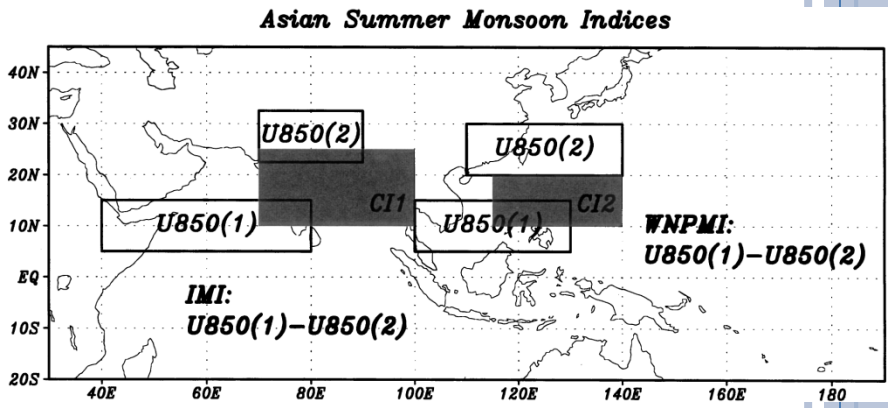
◯: **T119**

□: **T42**

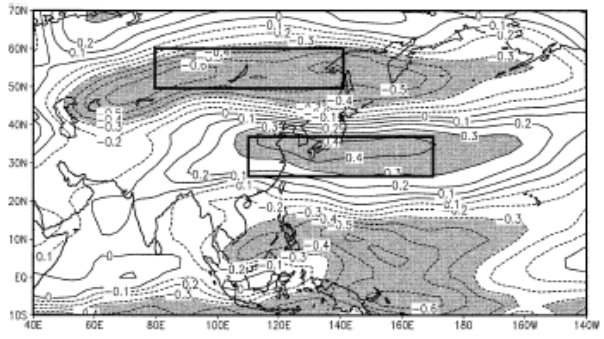
△: **ECHAM5**

Summer and Winter Monsoon Index

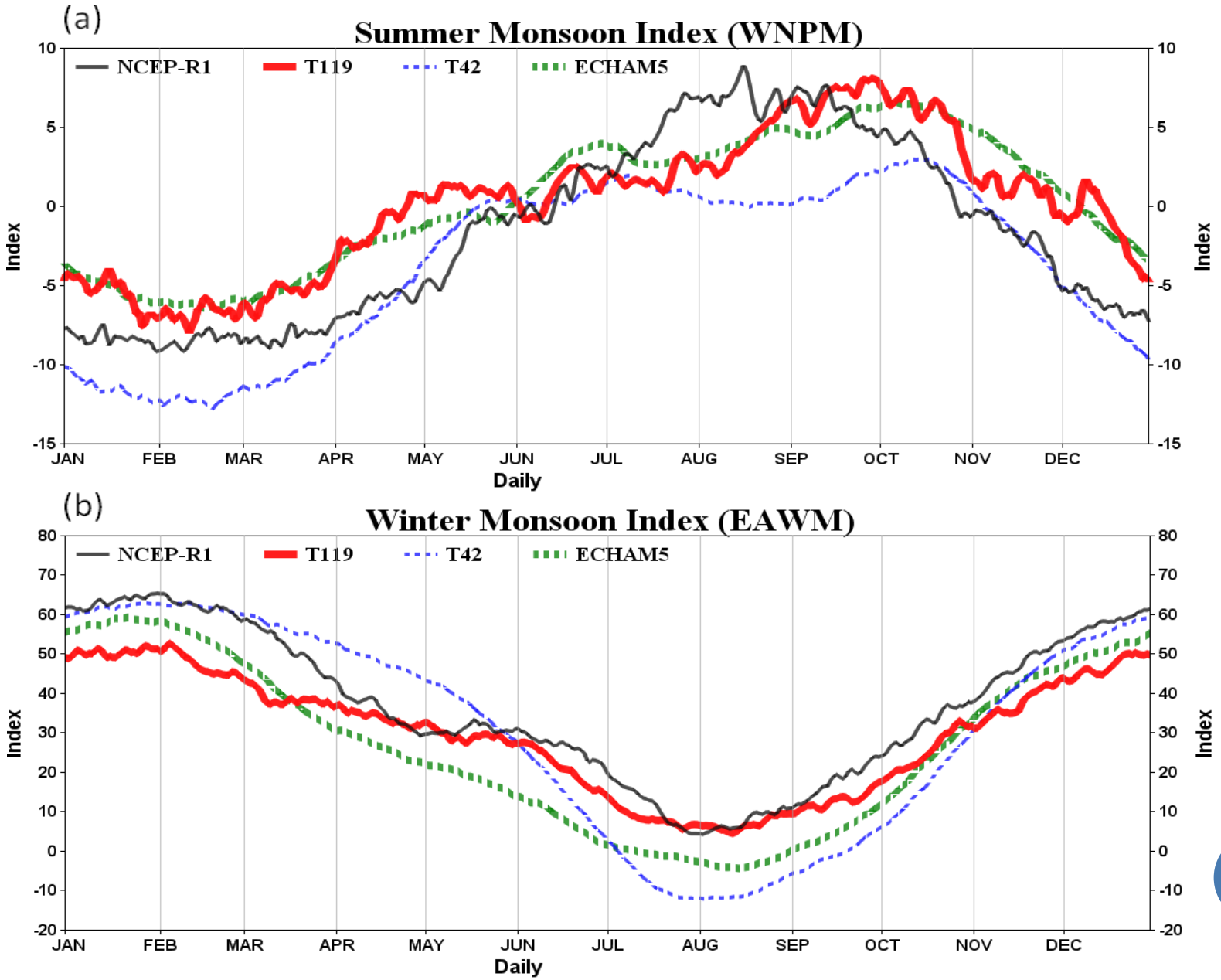
- WNPM-西北太平洋夏季季風指標:定義為U850(5°-15°N,100°-130°E) 與U850(20°-30°N,110°-140°E)的差值，以伴隨東亞夏季季風的低緯度低層風特徵為主要考慮(Wang et al.,2001)



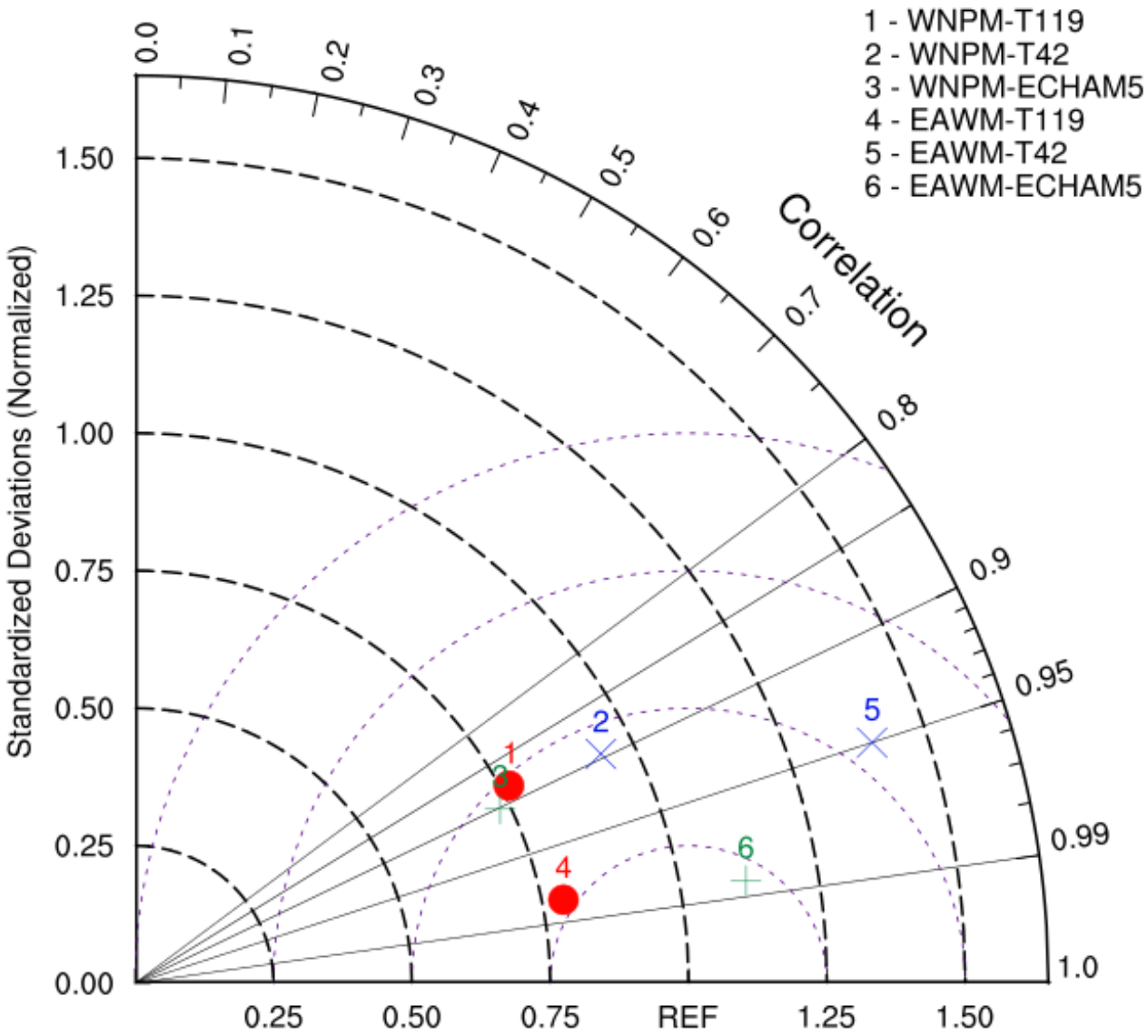
- EAWM-亞洲冬季季風指標:定義為U300(27.5°-37.5°N,110°-170°E) 與U300(50°-60°N,80°-140°E)的差值，EAWM的決定則是以伴隨東亞冬季季風的高緯度高層風特徵為考慮對象(Jhun and Lee,2004)



Monsoon Index- Daily Climatology



Taylor Diagram of Summer and Winter Monsoon Index

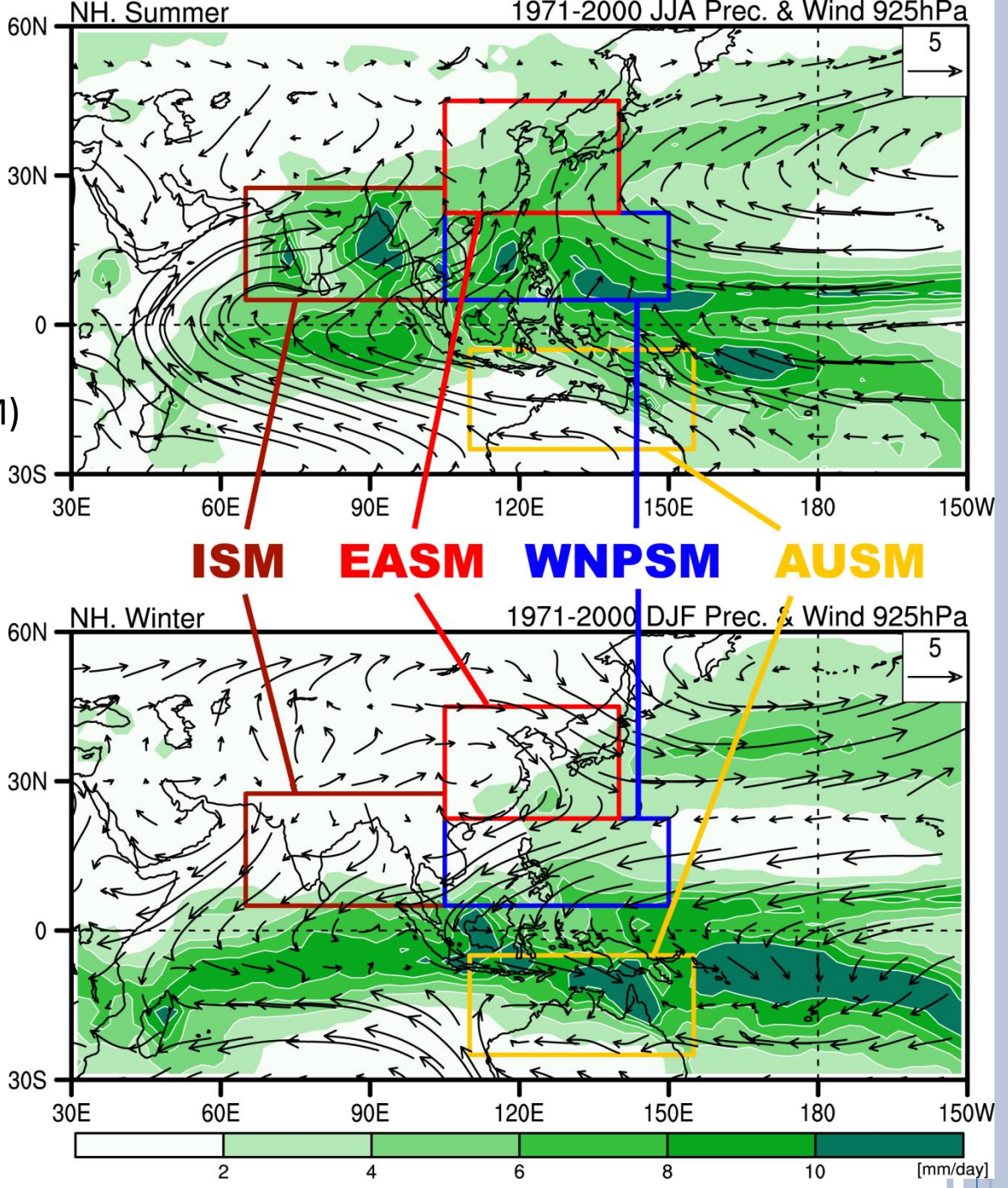


印度夏季季風區(ISM)
65°E-105°E, 5°N-27.5°N

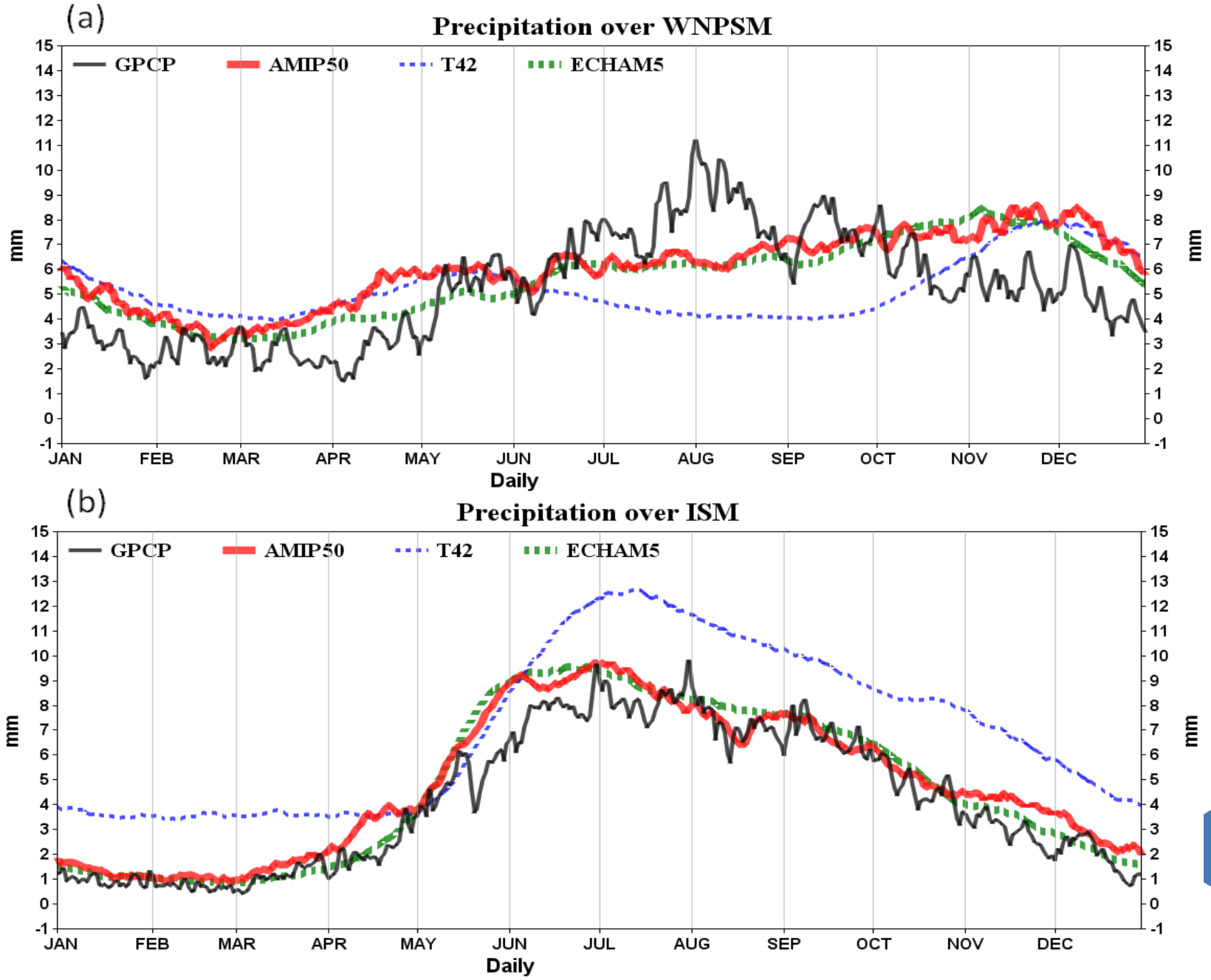
東亞夏季季風區(EASM)
105°E-140°E, 22.5°N-45°N

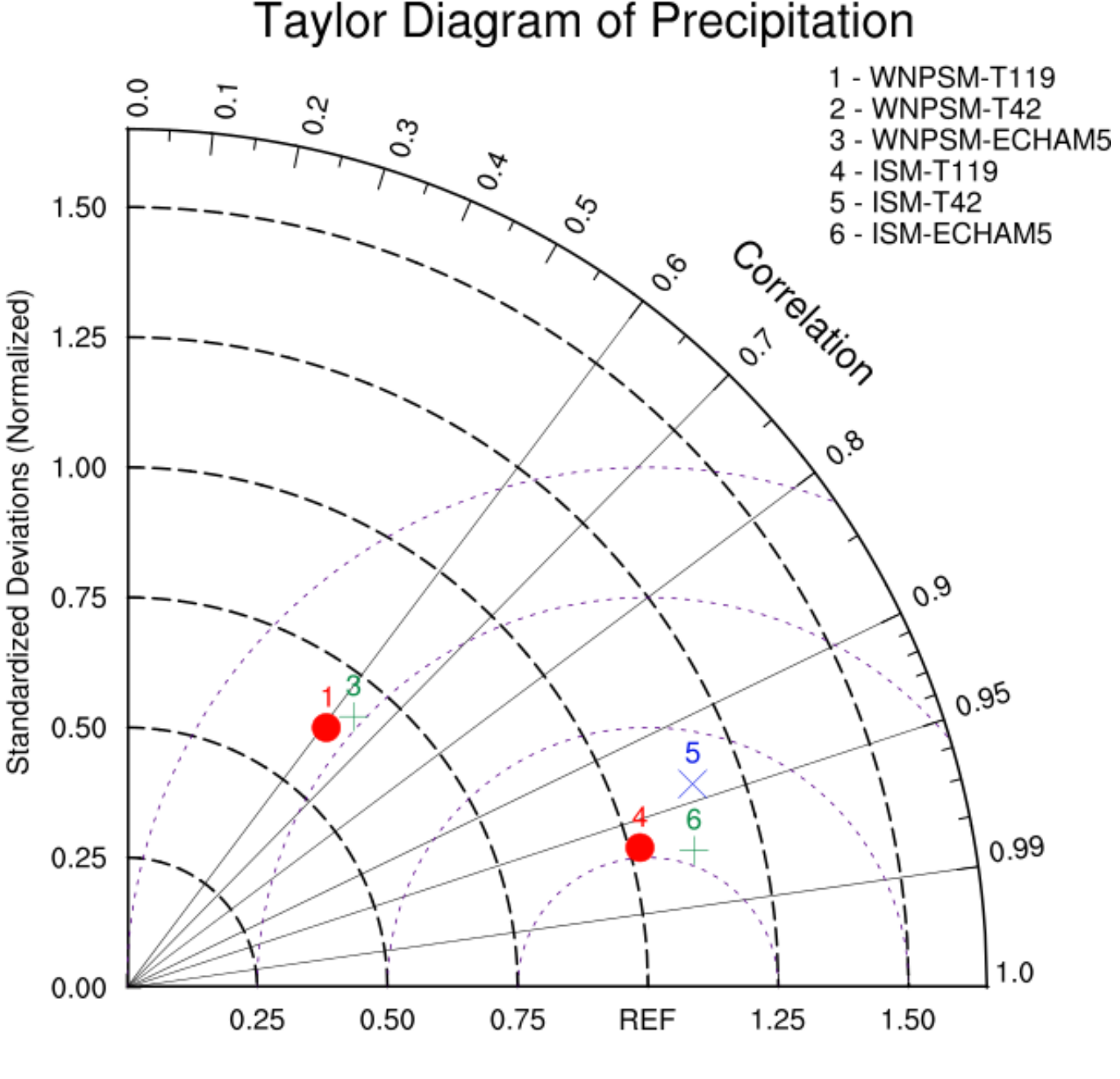
西北太平洋夏季季風區(WNPSM)
105°E-150°E, 5°N-22.5°N

澳洲季風區(AUSM)
110°E-155°E, 5°S-25°S



Precipitation Index over monsoon areas- Daily Climatology




Taylor Diagram of Precipitation
1 - WNPSM-T119
2 - WNPSM-T42
3 - WNPSM-ECHAM5
4 - ISM-T119
5 - ISM-T42
6 - ISM-ECHAM5
Correlation
Standardized Deviations (Normalized)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0.95
0.99
1.0
0.00
0.25
0.50
0.75
1.00
1.25
1.50
0.25
0.50
0.75
REF
1.25
1.50

Conclusion:

- 氣象局的新一代高解析氣候預報模式(T119)與目前的作業模式T42比較得到，不論是在雨量、海平面氣壓或環流的氣候平均場的結果明顯優於T42，表示模式物理參數化的改進與解析度提高改善了模式的氣候模擬能力。

- 分析東亞季風區高低層風場季節變化與西北太平洋夏季季風區和印度夏季季風區的雨量變化，同樣T119明顯優於T42，尤其是改善夏季降水誤差。

Future Work:

- 目前氣象局氣候預報系統發展小組正在建立用T119做1981-2010年事後預報資料庫(hindcast data base)，海溫預報是用OPGSST_v2與NCEP CFSRR的預報資料，大氣初始場是 NCEP CFSv2產出的重分析資料CFSR 。未來將會根據些事後預報資料來分析與評估新一代高解析模式之預報技術。