

台灣週累積降雨分型機率預報

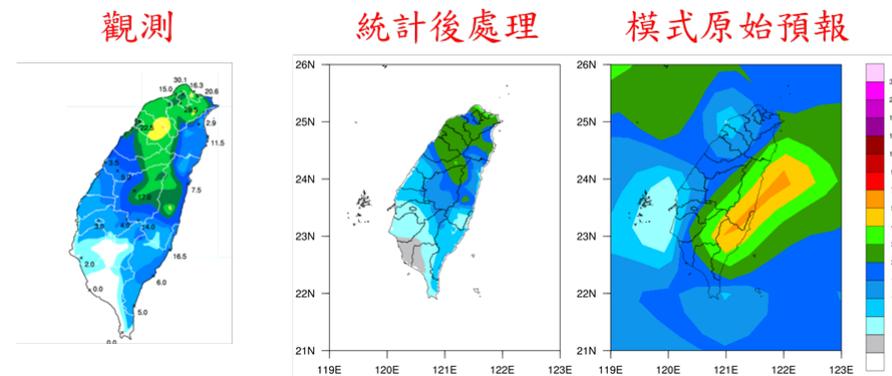
陳昫靖¹ 陳孟詩² 張惠玲³ 羅存文¹ 周柿均¹ 朱心宇¹

科技中心¹ 第三組² 資訊中心³

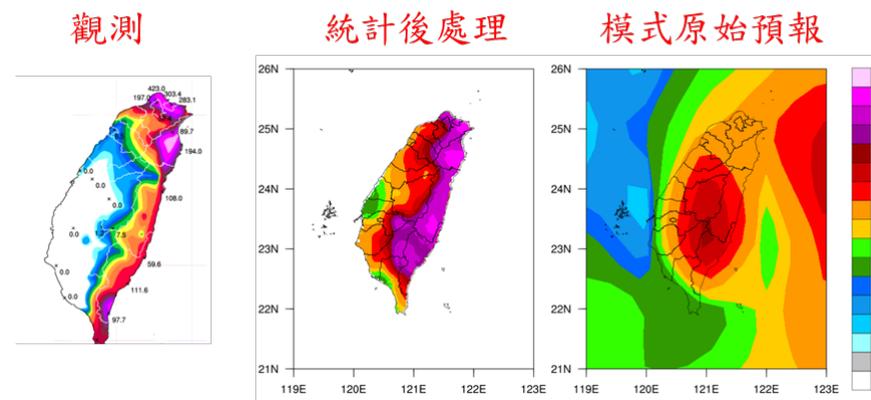
前言

1. 由於模式解析度不足，無法正確模擬出地形影響造成的降雨分佈。
2. 不論台灣被什麼天氣系統影響，模式降雨總集中在台灣東南方。
3. 透過統計後處理連結模式預報資訊及測站觀測資料，得到更貼近觀測的降雨分佈。

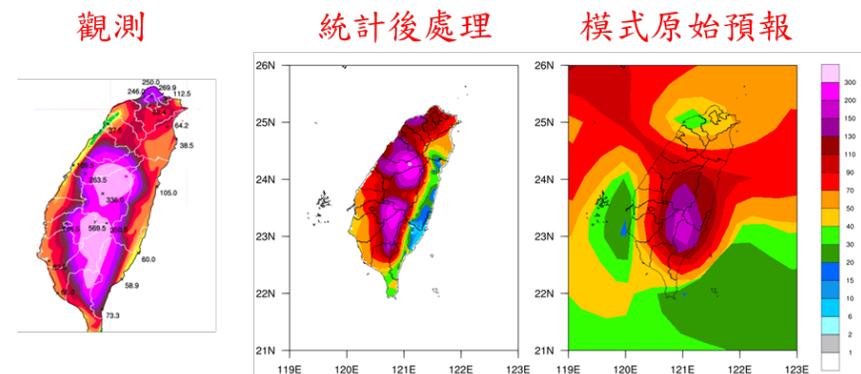
兩週前預報 20200411-20200417



兩週前預報 20190921-20190927



兩週前預報 20190518-20190524



使用資料 & 方法

1. 建模期

模式資料：EMC-GEFS (SubX)

預報時段：1~3 週

歷史預報：1999-2016年 2-4月

預報成員：11

解析度：1°*1°

測站資料：318站

2. 校驗期

即時預報：2017-2020年2-4月

預報成員：21

3. 預報方法

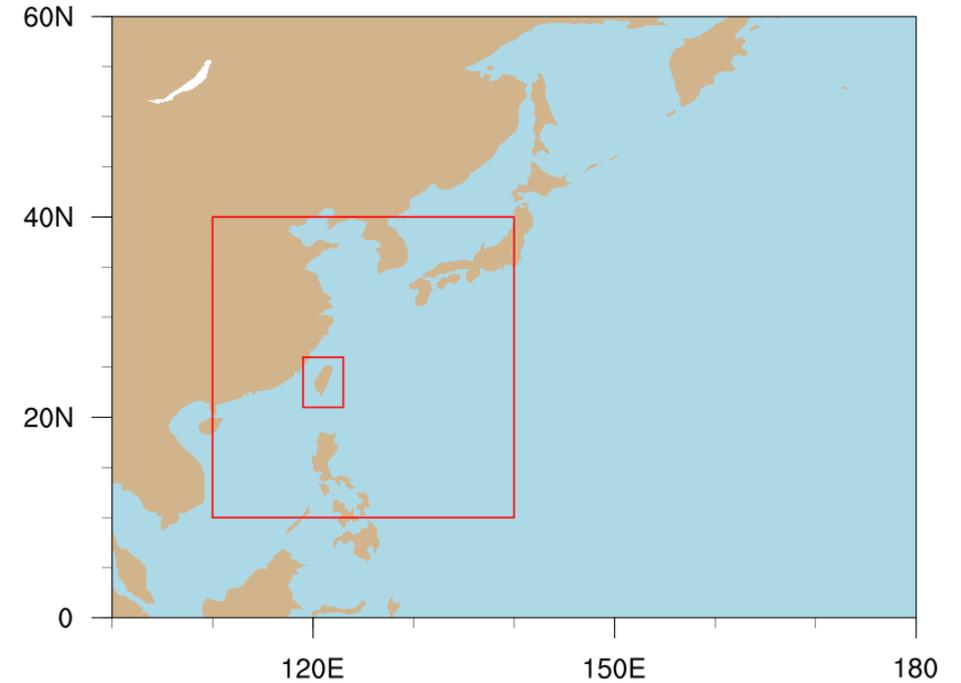
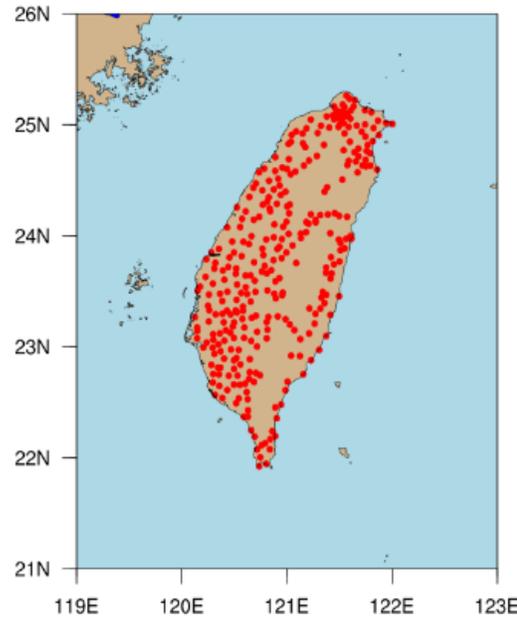
Extended Logistic Regression

預報因子(週累積, 系集平均): 1. 鄰近格點降雨內插

2. 經度119-123 緯度21-26範圍內模式降雨取EOF前三個mode(PC1-PC3)

3. 經度110-140 緯度10-40範圍內模式降雨取EOF前三個mode(PC1-PC3)

找出與台灣測站Correlation最高的預報因子建模



Extended Logistic Regression(XLR)

Logistic Regression

$$P(Y=1 | X) = (\exp(a+bx)) / (1+\exp(a+bx))$$

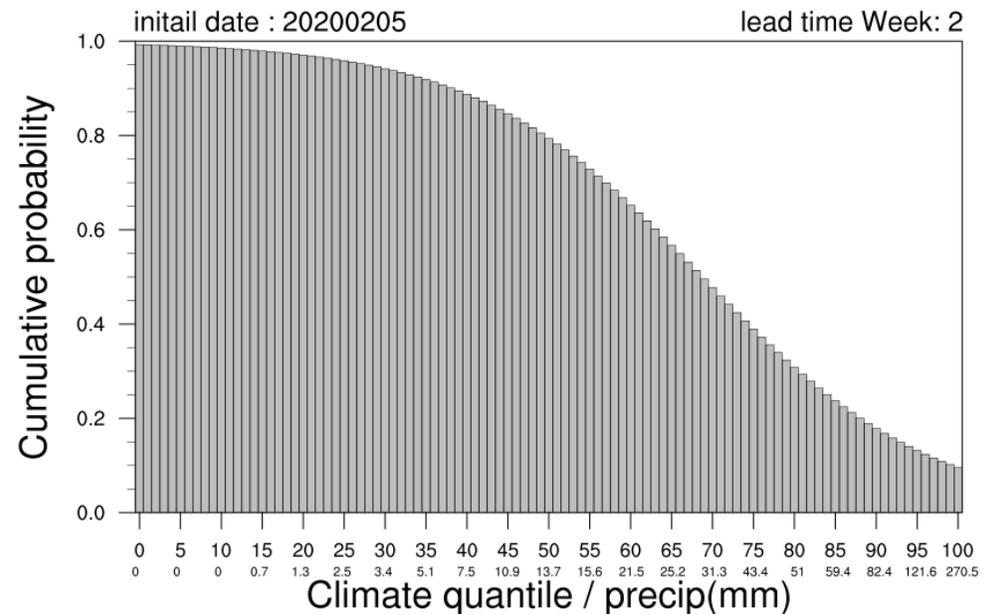
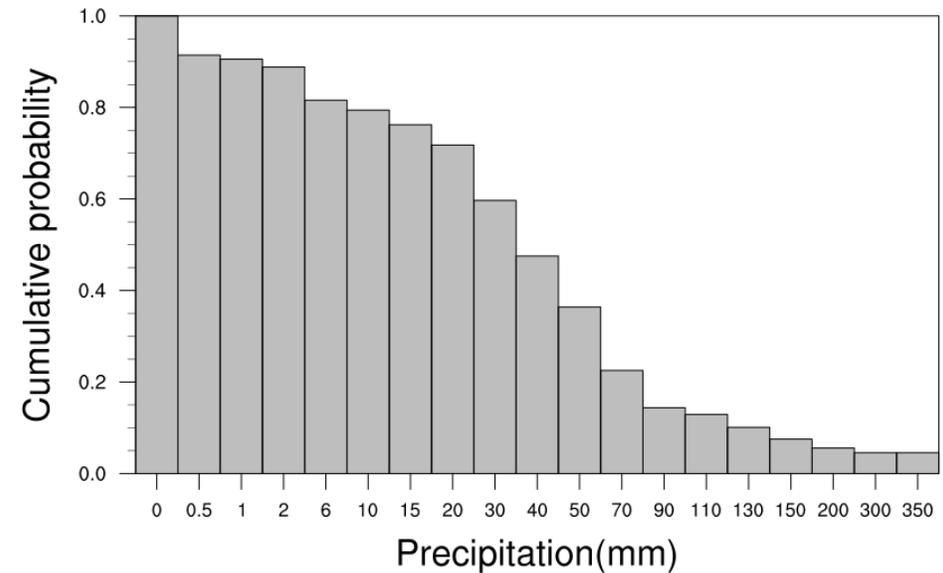
透過最大概似法 求出係數a, b

$$\text{Lost function : } P(y_i=1 | X) \quad , y_i = 1 \\ 1 - P(y_i=1 | X) \quad , y_i = 0$$

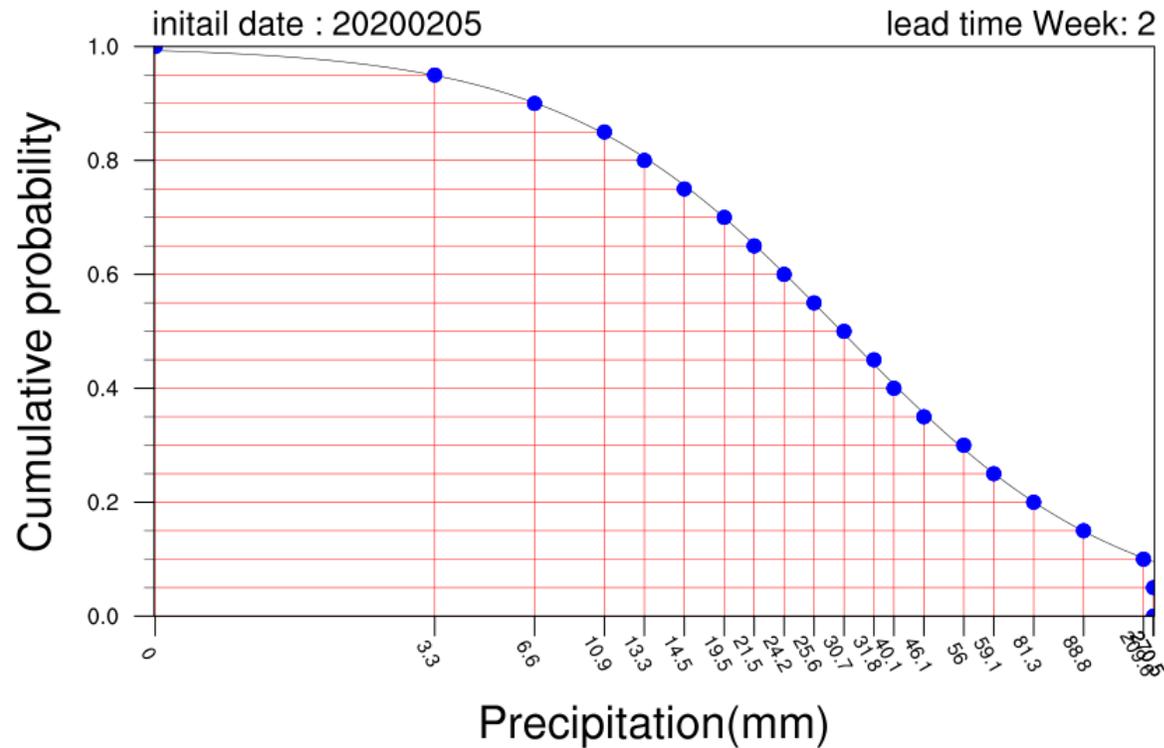
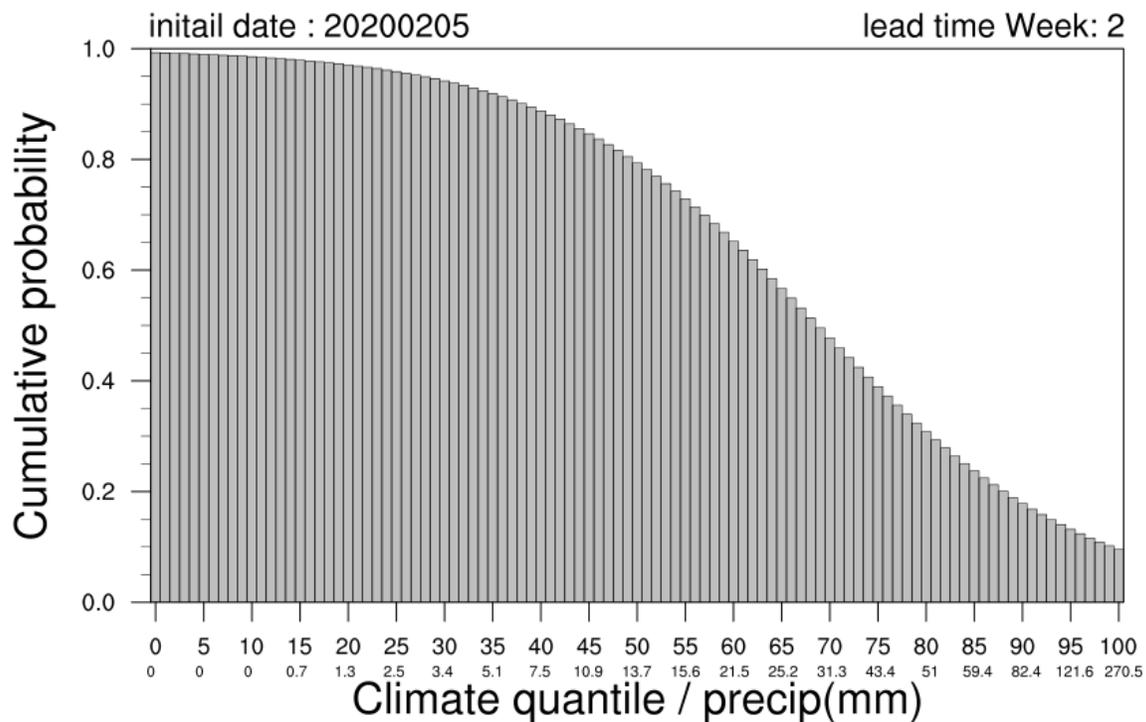
$$\prod_i^n p_i^{y_i} (1 - p_i)^{1-y_i}$$

Extended Logistic Regression(XLR)

$$P(Y=1 | X) = (\exp(a+bx+cQ)) / (1+\exp(a+bx+cQ))$$



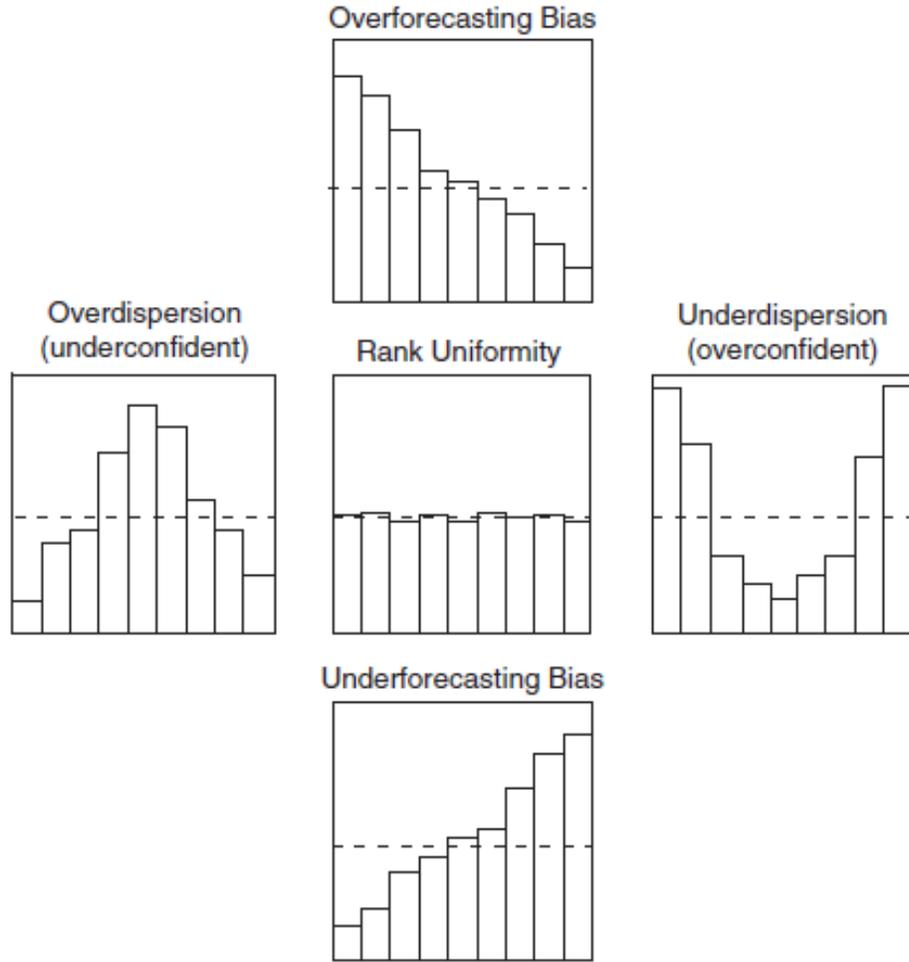
CDF → 預報降雨量



統計組員保有預報CDF提供的離散度

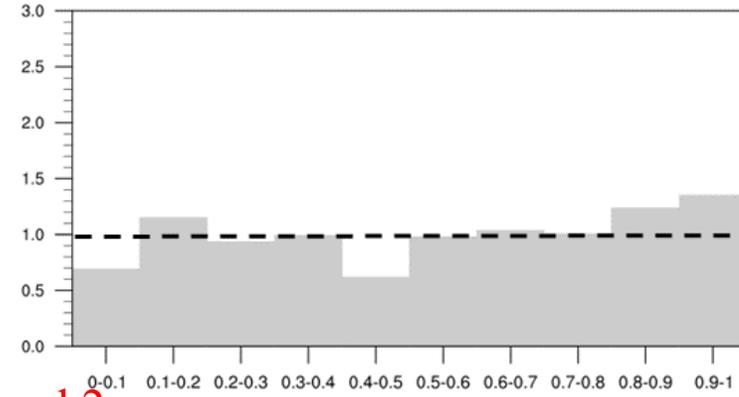
預報離散度校驗

PIT

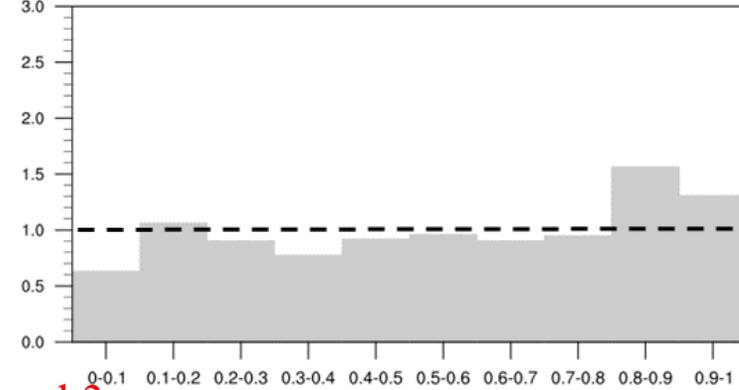


Wilks.d.s. ,2006

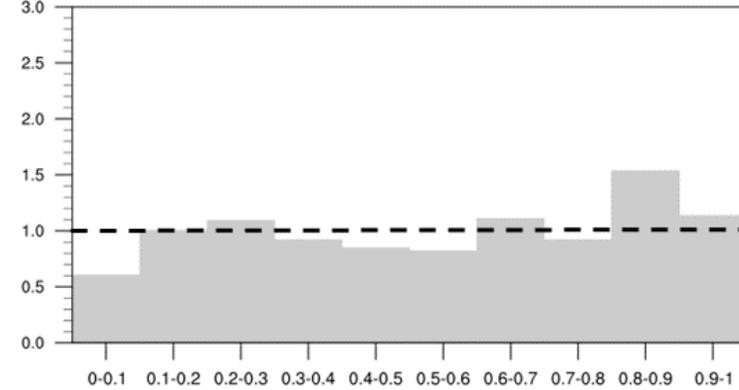
week1



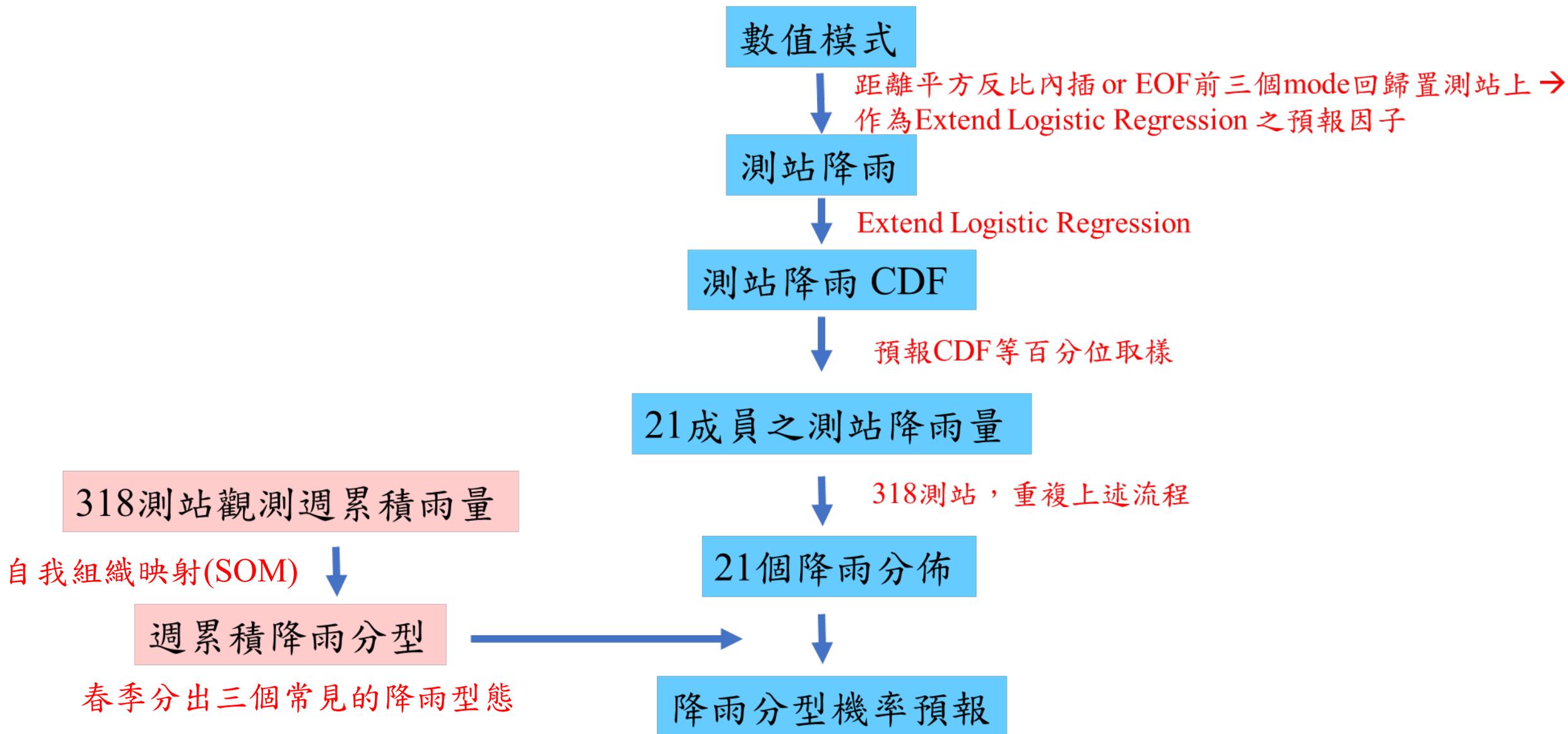
week2



week3



預報流程



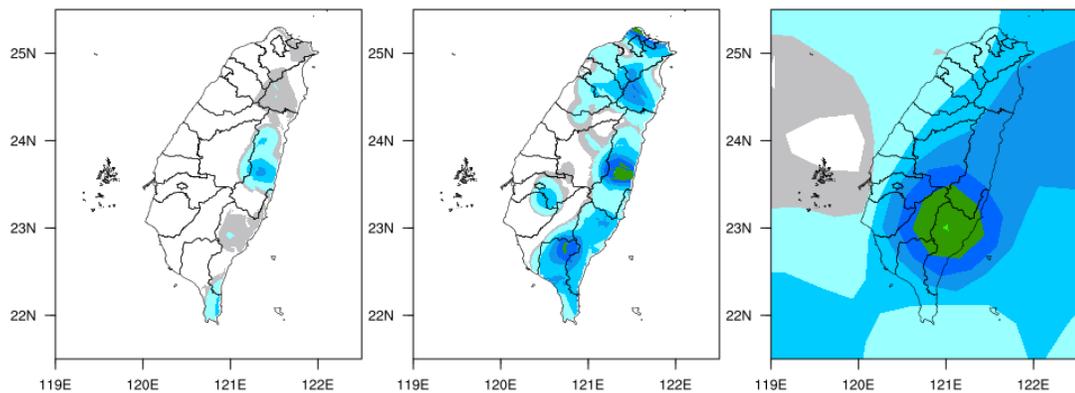
降雨分佈改善

20180331 - 20180406

Ensemble Mean

OBS

Model Raw Output

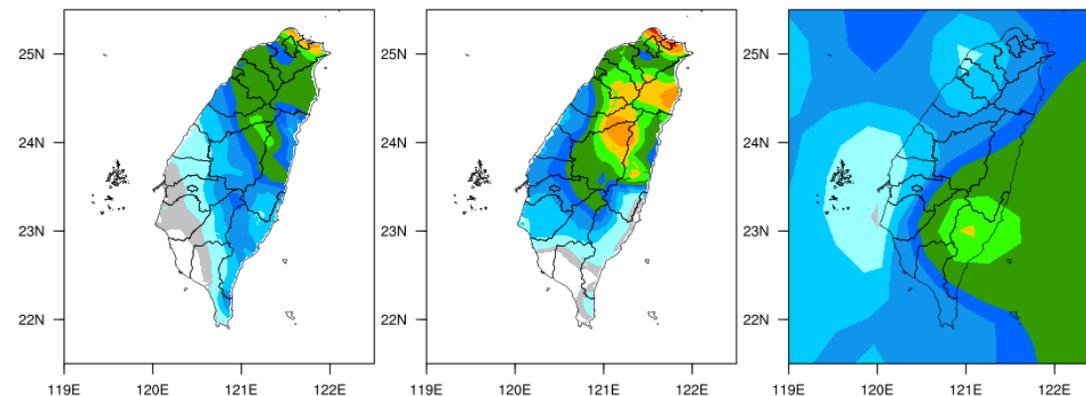


20180217 - 20180223

Ensemble Mean

OBS

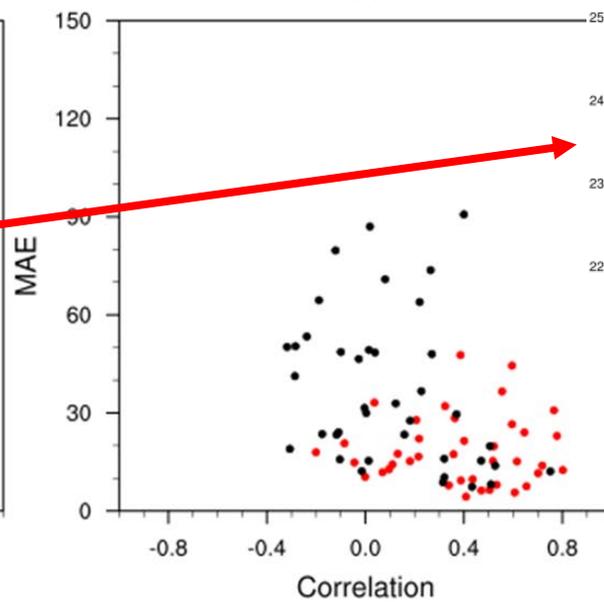
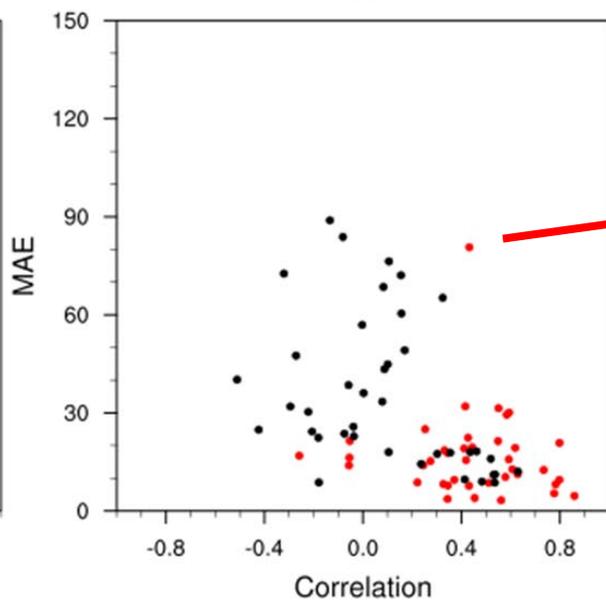
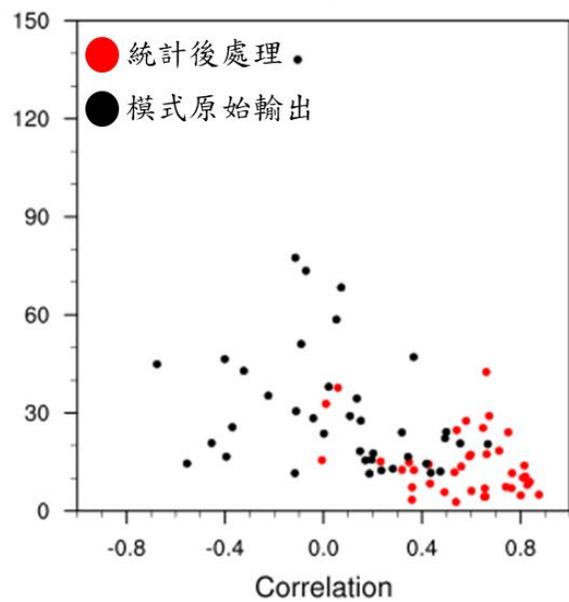
Model Raw Output



Week1

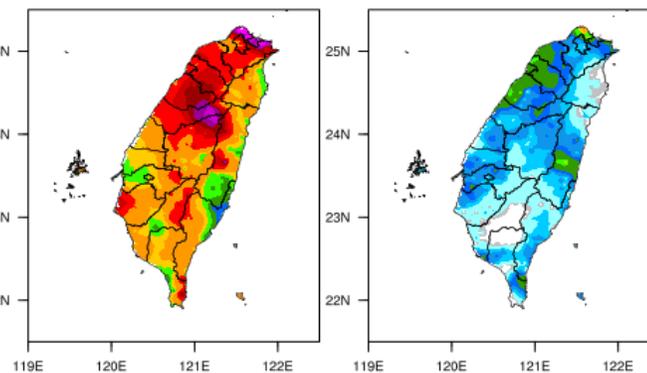
Week2

Week3



Ensemble Mean

OBS



降雨分型 春季

850hPa 風場+降雨

決定分類：歐式距離

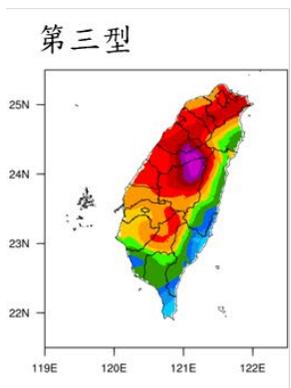
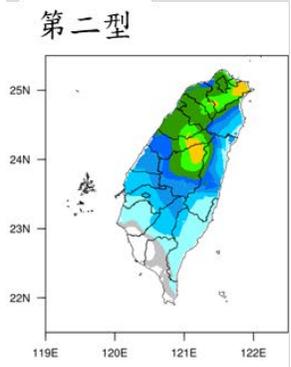
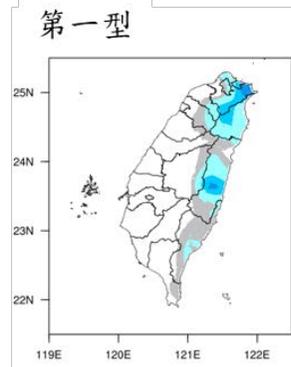
$$d(x, y) := \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \dots + (x_n - y_n)^2}$$

分類資料：

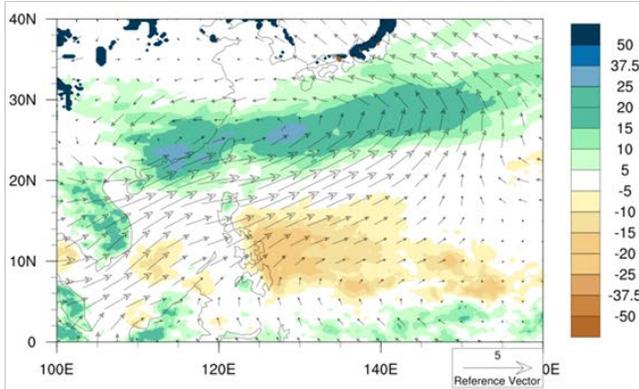
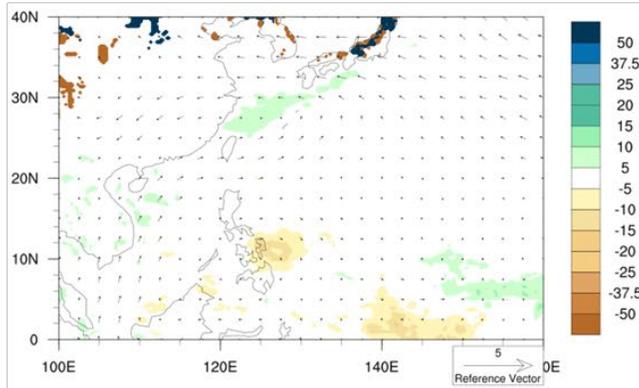
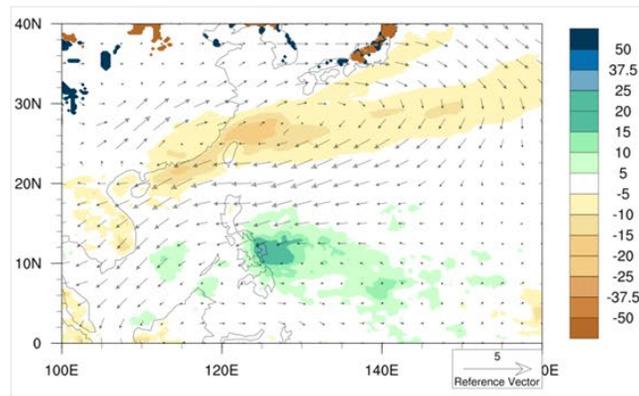
T1 1999-2016 318站

2-4月週累積降雨

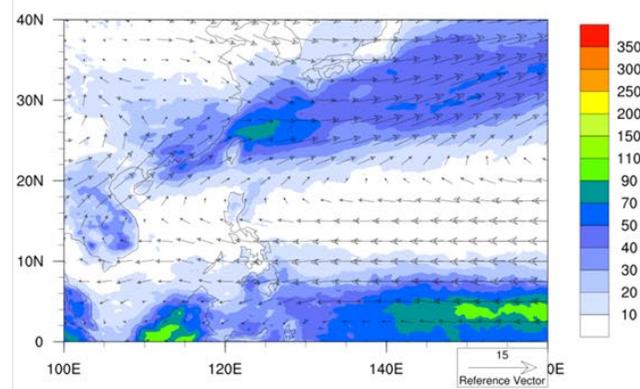
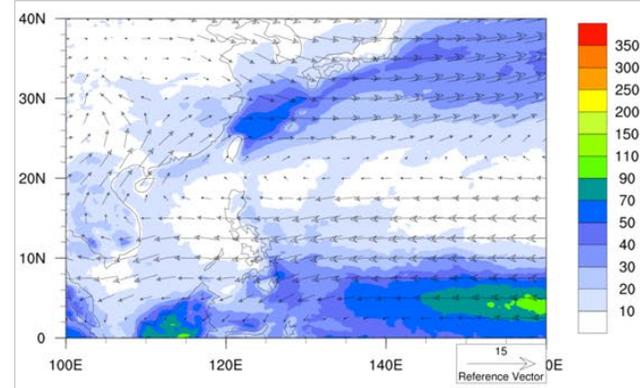
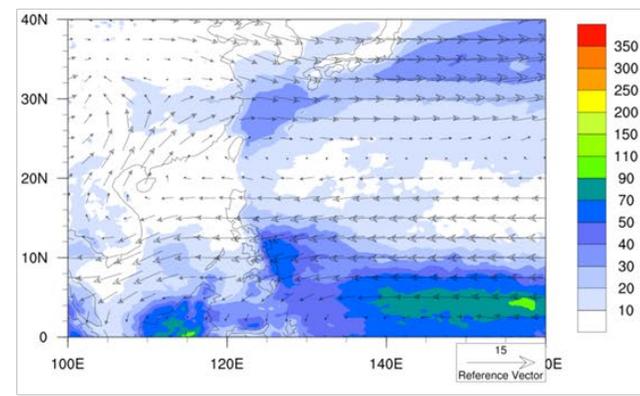
降雨分佈



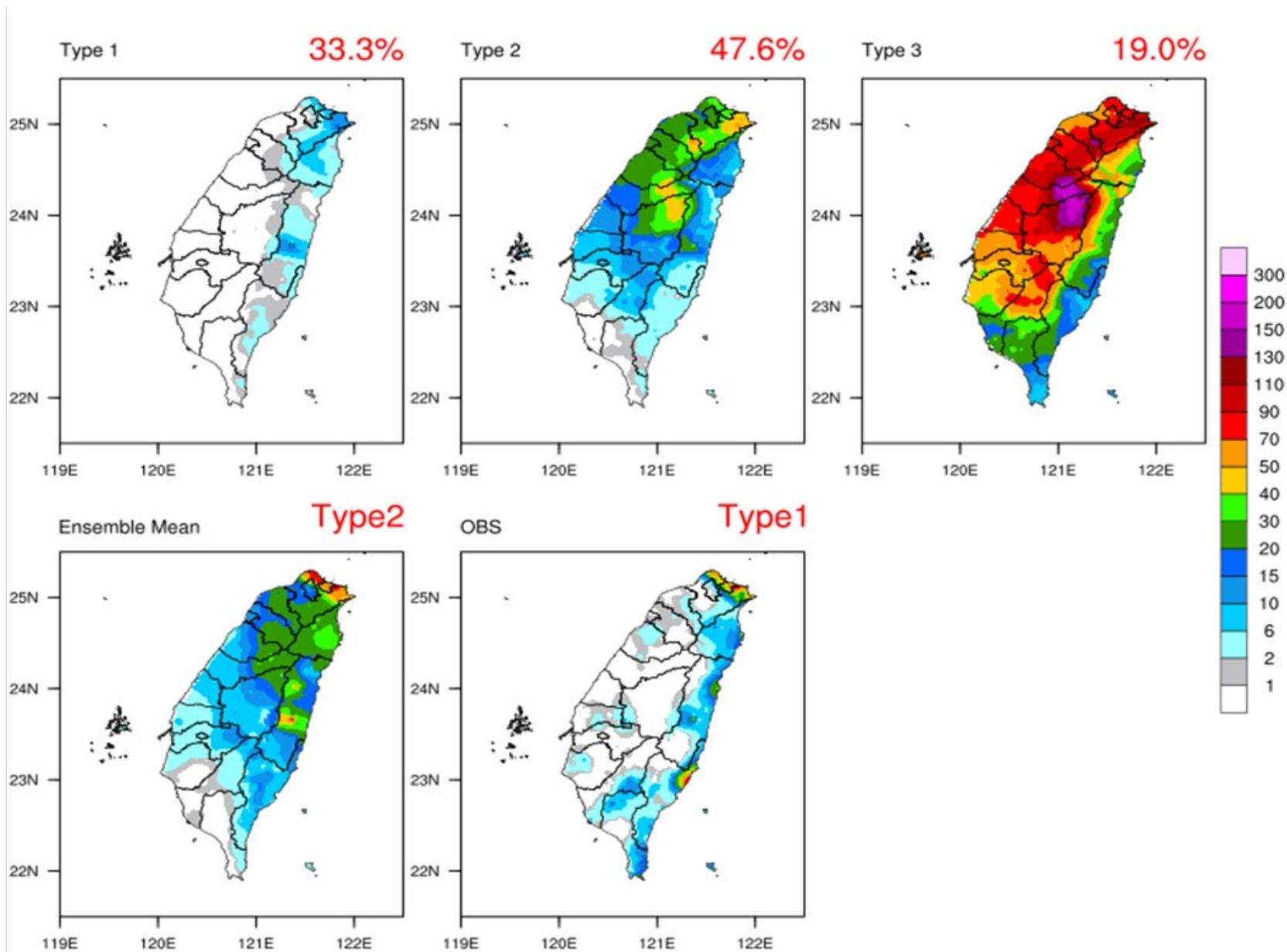
氣候距平合成圖



原始值合成圖

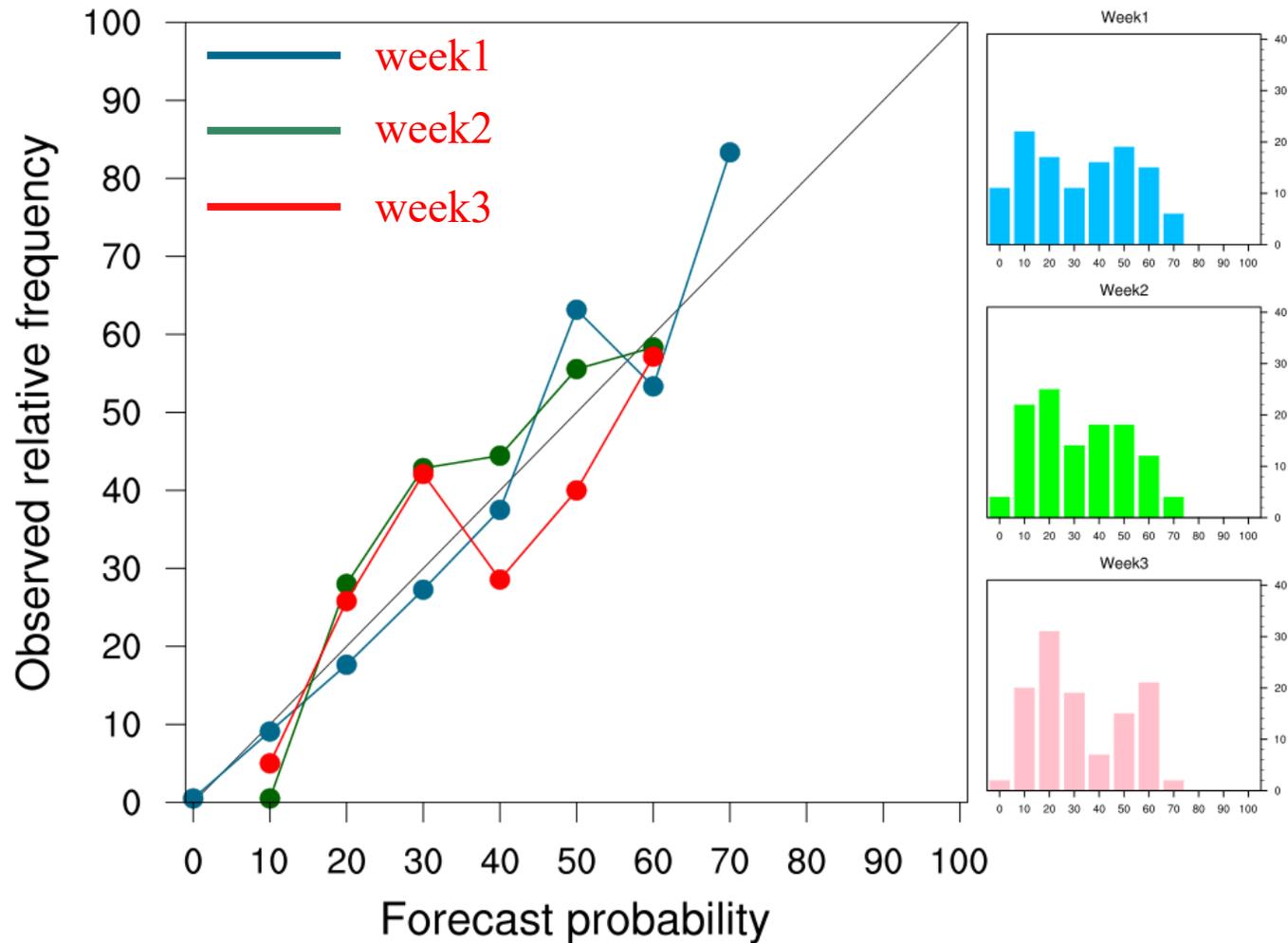


降雨分型機率預報好處 以兩週前預報20180324 - 20180330為例



降雨分型機率預報校驗

降雨分型預報機率 Reliability Diagram



預報各個降雨類別之Brier skill score

Brier skill score	week1	week2	week3
Type1	0.40	0.15	0.12
Type2	0.09	0.01	0.09
Type3	0.15	0.10	0.02

結論

1. 模式預報的大尺度變化趨勢正確時，透過上述的流程，就有機會得到較接近觀測的降雨分佈。
2. 以春季來說，到了第三週仍有些許預報技術，且還能提供可信之機率預報。
3. 透過降雨分型機率預報不僅能呈現出春季常出現的週累積降雨分佈外，也考慮到模式預報之不確定性，提升預報參考價值。