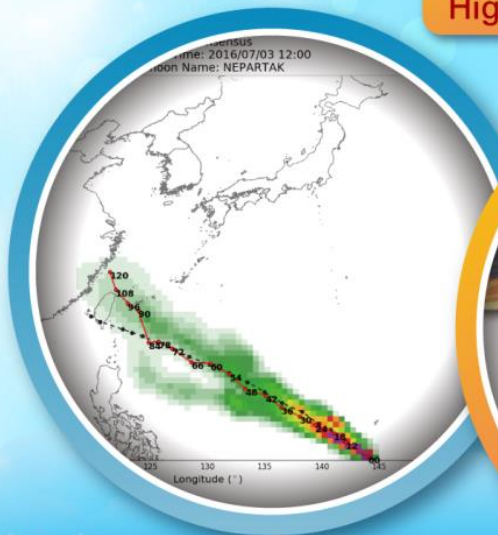


台電日射量基準站觀測與向日葵衛星推估日射量 資料差異分析與整合技術評估

許水德(Shiu S.-D.)¹ 馮智勇(Feng C.-Y.)¹ 張志榮(Chang C.-J.)² 林哲宇(Lin J.-Y.)²
曹灝翰(Tsao H.-H.)² 周儷芬(Chou L.-F.)²
多采科技公司¹ 台灣電力公司²

ManySplendid

高效能科學計算模式研發
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都市積淹水與洪泛測預報
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Hydraulic and water resources engineering planning

氣候服務跨域諮詢與整合
Climate services for interdisciplinary integration

大綱

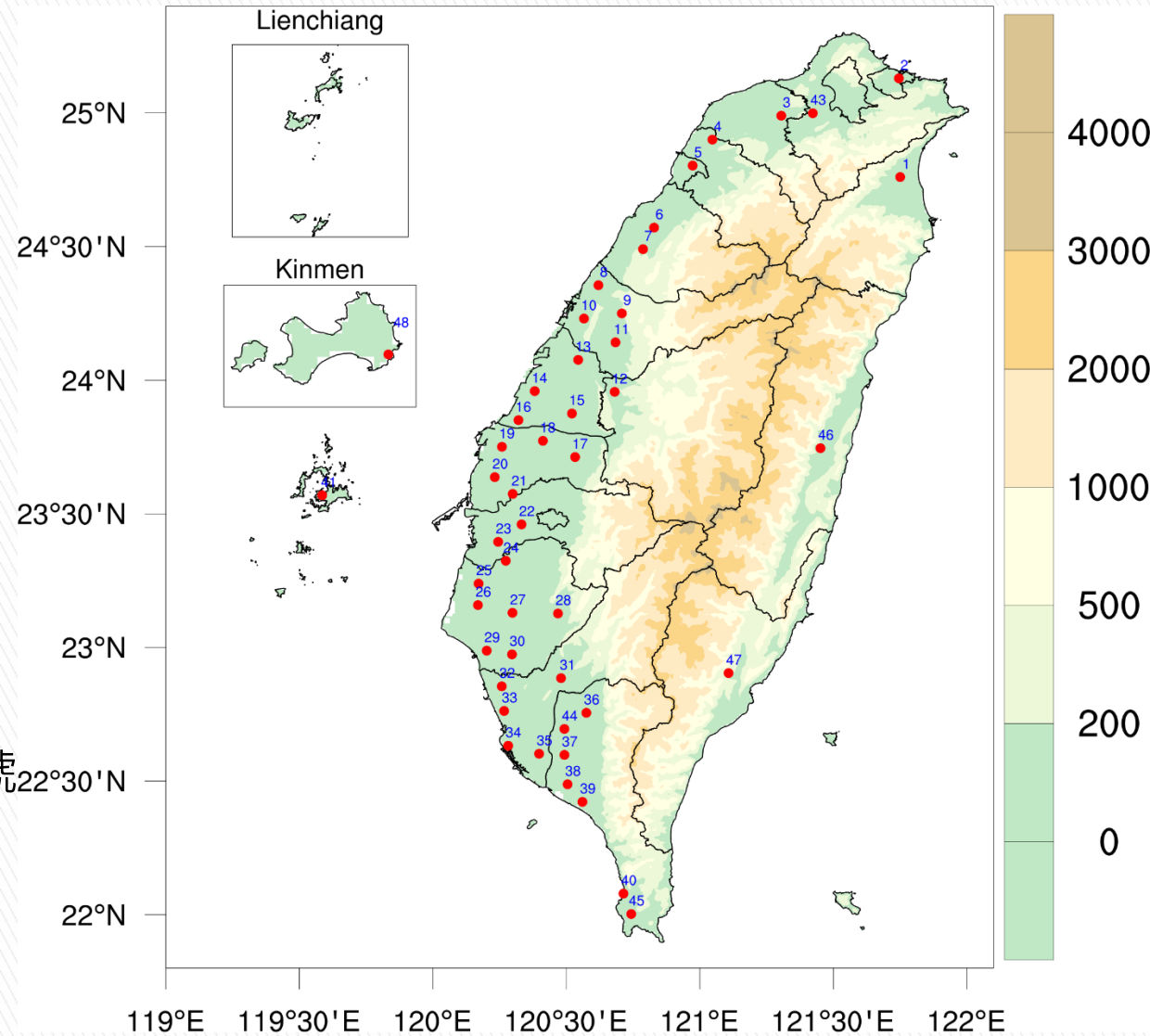
1. 前言與目的
2. 資料說明與檢核
3. 基準站與衛星差異特性
4. 整合方式

前言與目的

- ▶ 本研究蒐集2023年1月至12月的台電日射量觀測基準站點觀測資料與中央氣象署向日葵衛星推估日射量網格資料(以下稱HS)，針對測站點之空間位置、季節與逐時差異進行分析。
- ▶ 嘗試發展整合基準站觀測值與衛星推估日射量網格資料的客觀分析技術

基準站資料說明與檢核

- ▶ 日射量資料時間 2023.01-2023.12
 - 逐10分鐘頻率
 - 台電公司基準站觀測
 - 配合向日葵資料10分鐘資料頻率(W/m^2)，處理成10分鐘一筆
 - 基準站點的空間分布圖
 - 架設位置多為服務所樓頂
 - CWA向日葵衛星推估日射量網格資料(HS)內插至基準站
 - 2022/12/月中之後向日葵八號改為向日葵九號



基準站資料說明與檢核

- ▶ 檢核處理-剔除不合理觀測條件
 - 基準站不合理之負值($>=0$)
 - 日出前與日落後之非零正值
 - 使用CWA各地日出、日落時刻估算資訊
 - 日出~日落間的零值
 - 僅傳輸斷訊才可能為零值

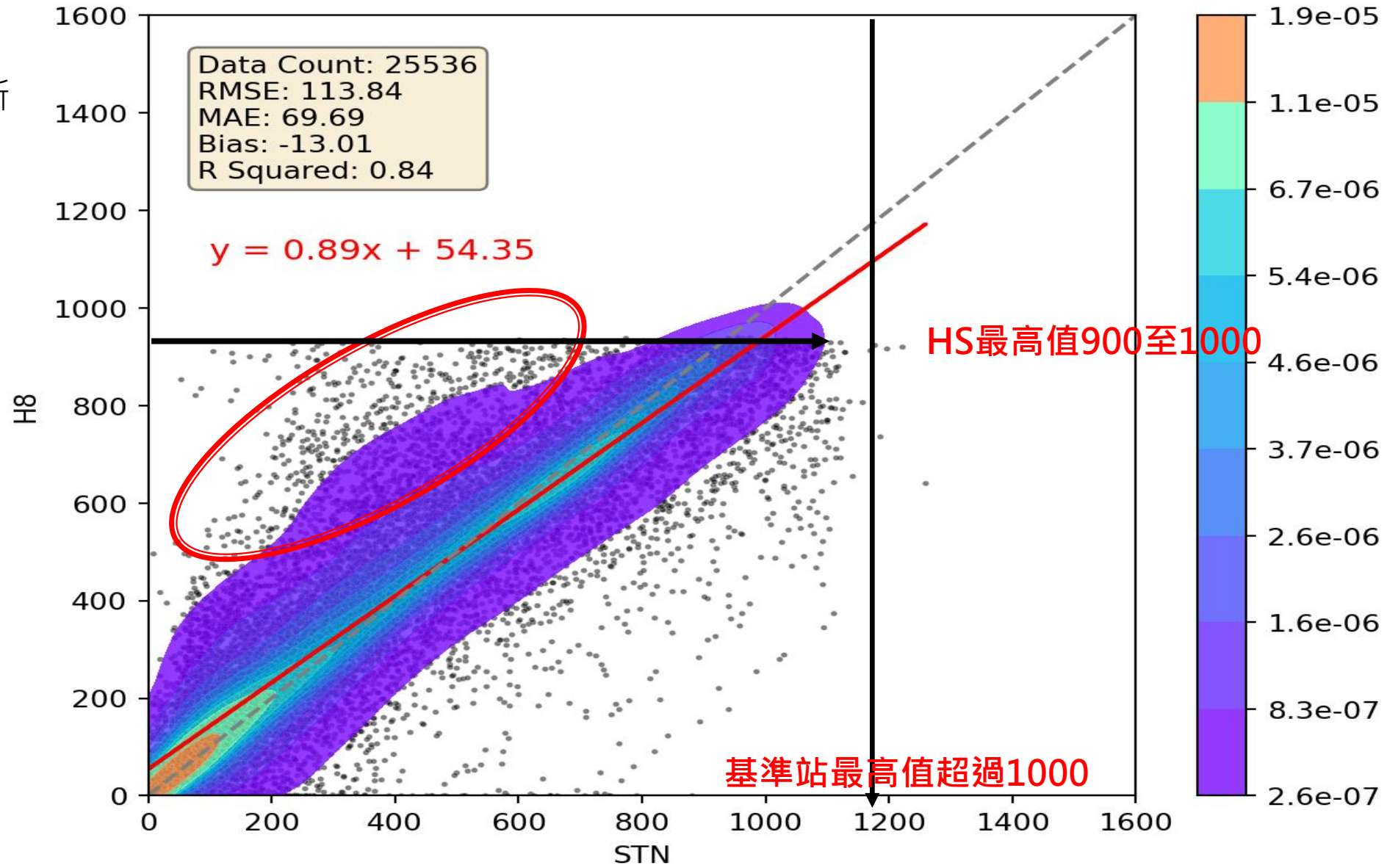
202310160410	-0.1	No. 1
202310160420	-0.1	
202310160430	-0.1	
202310160440	-0.1	
202310160450	-0.1	
202310160500	-0.1	
202310160510	-0.1	
202310160520	-0.1	
202310160530	-0.1	
202310160540	-0.1	
202310160550	-0.1	
202310160600	-0.1	
202310160610	-0.1	
202310160620	-0.1	

202310152230	0.0	No. 1
202310152240	0.6	
202310152250	0.6	
202310152300	0.5	
202310152310	0.5	
202310152320	0.4	
202310152330	0.4	
202310152340	0.4	
202310152350	0.3	
202310160000	0.3	
202310160010	0.2	
202310160020	0.2	
202310160030	0.2	
202310160040	0.1	
202310160050	0.1	
202310160100	0.0	

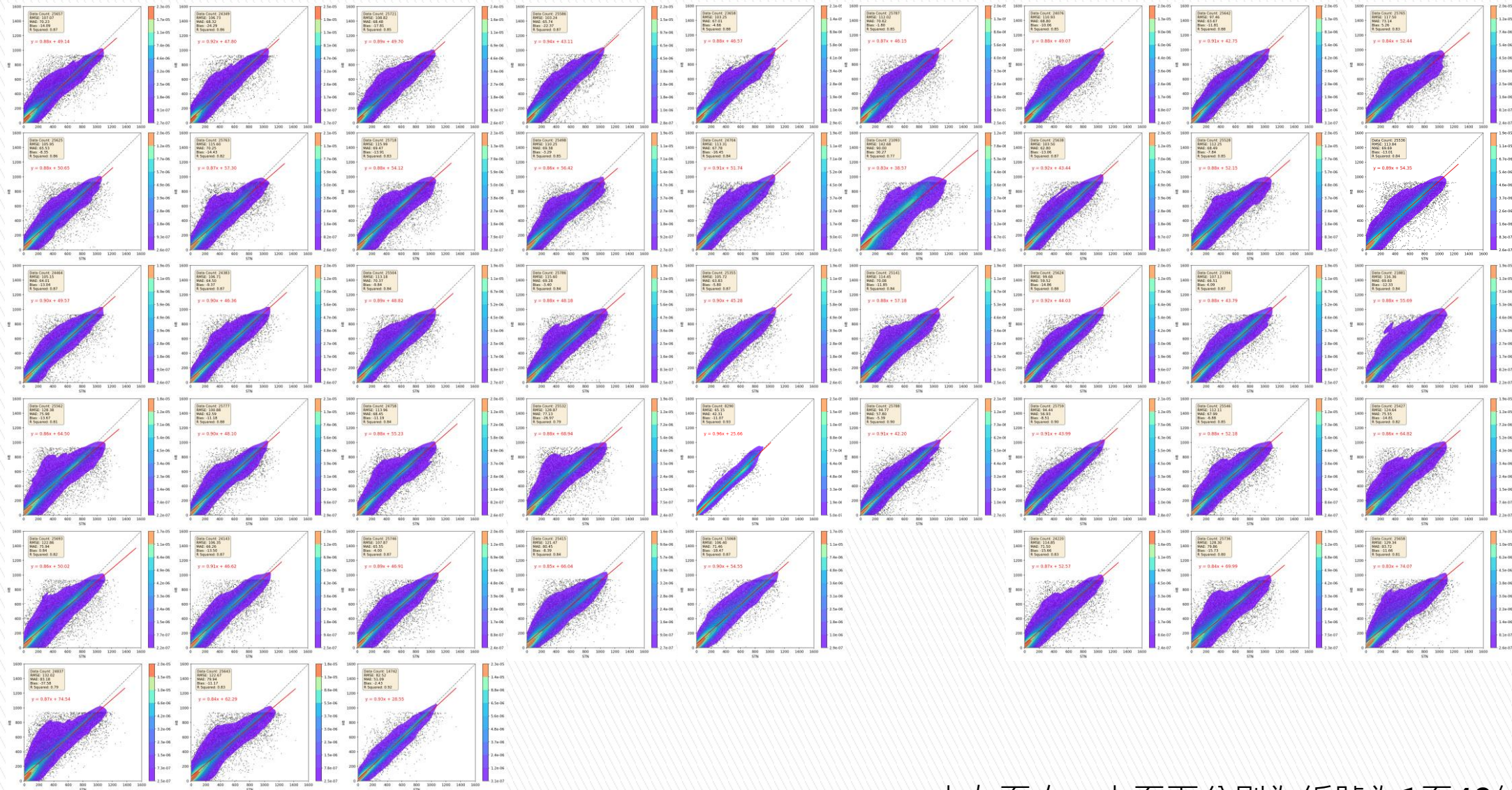
202301121350	125.3	No. 48
202301121400	197.9	
202301121410	208.0	
202301121420	244.2	
202301121430	293.7	
202301121440	242.2	
202301121450	0.0	
202301121500	0.0	
202301121510	304.9	
202301121520	228.7	
202301121530	220.6	
202301121540	146.6	
202301121550	141.9	
202301121600	119.6	
202301121610	113.4	

基準站之衛星推估(縱軸)vs 觀測(橫軸)散布圖

No.18
二崙服務所

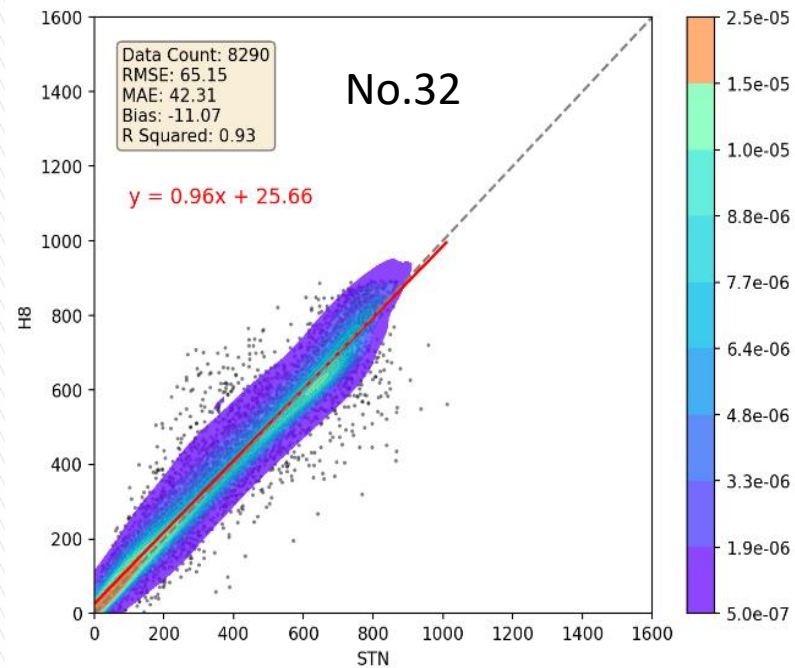


各基準站的散布圖樣態

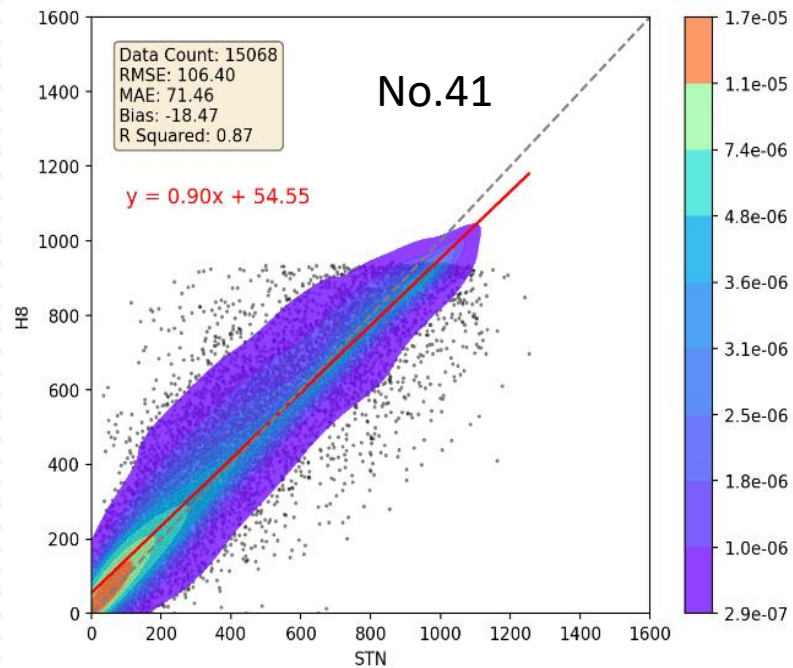


由左至右、上至下分別為編號為1至48的基準站

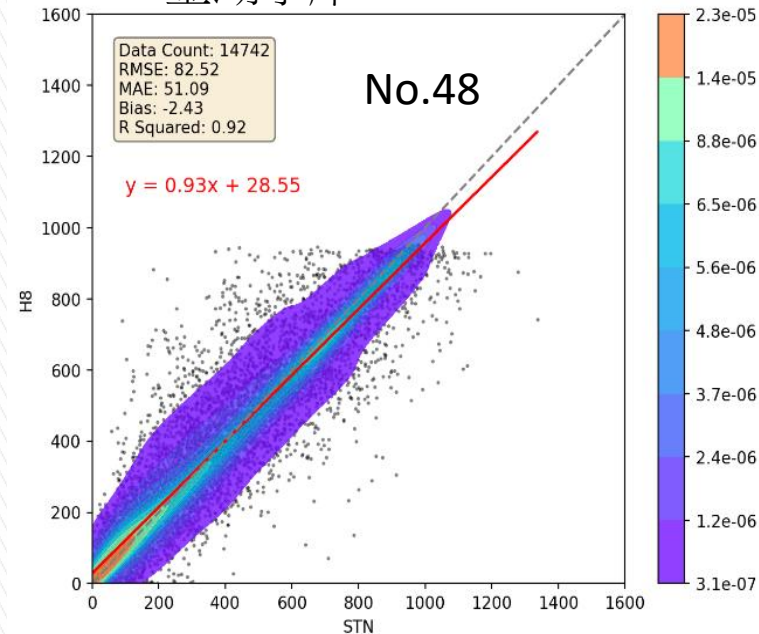
路竹服務所



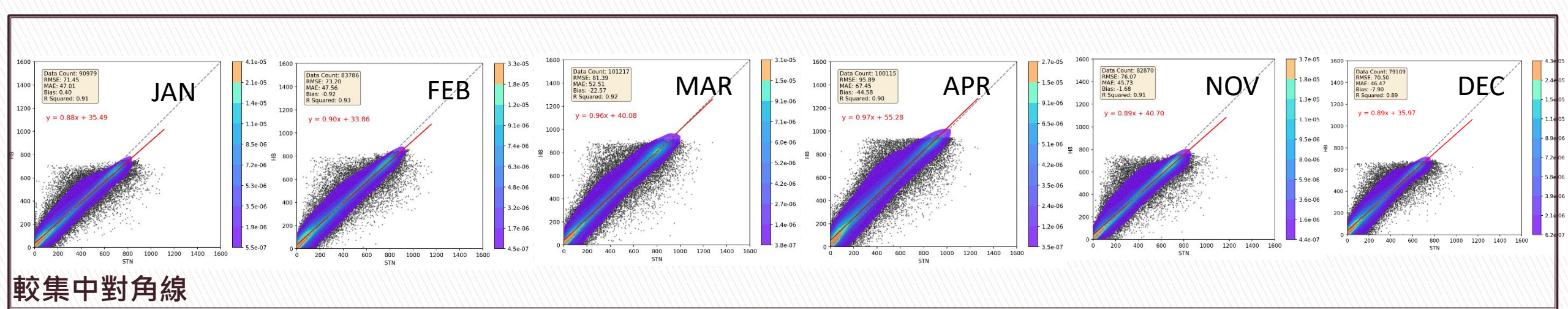
澎湖區處營業大樓



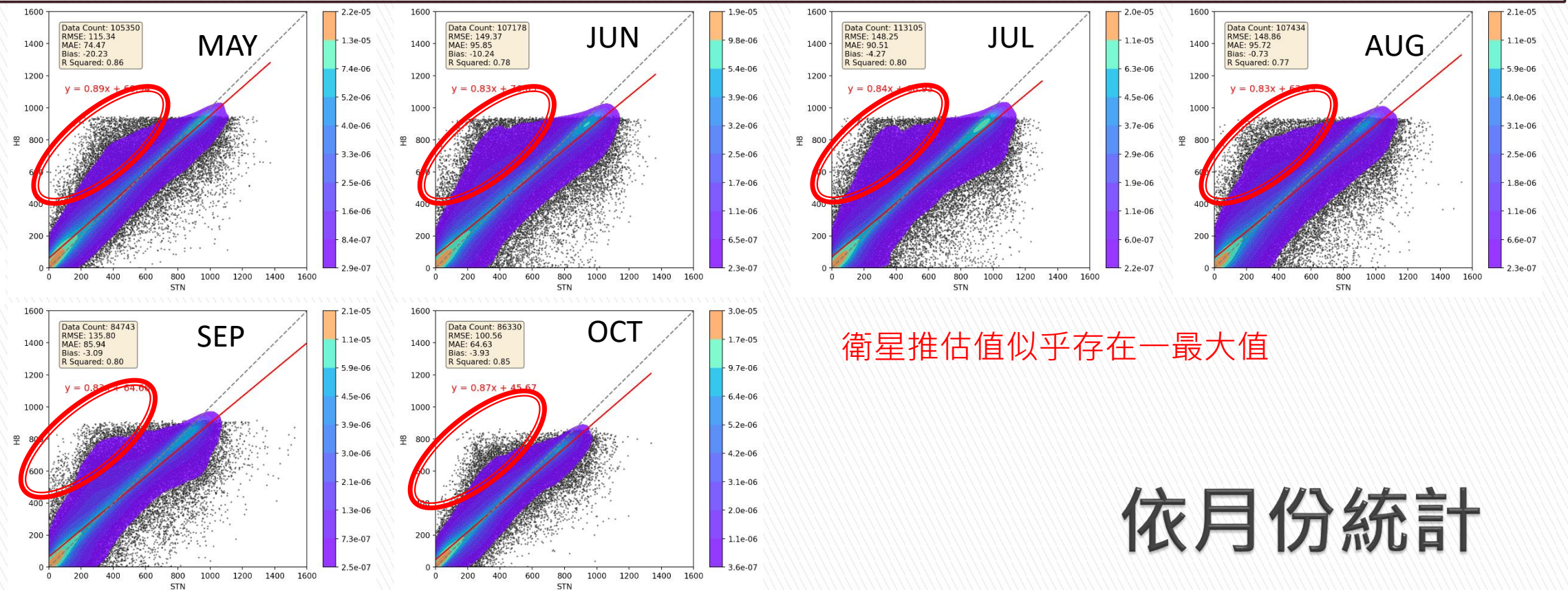
金湖水庫



3個測站與多數樣態不同，原因為資料量少



較集中對角線



HS較高估

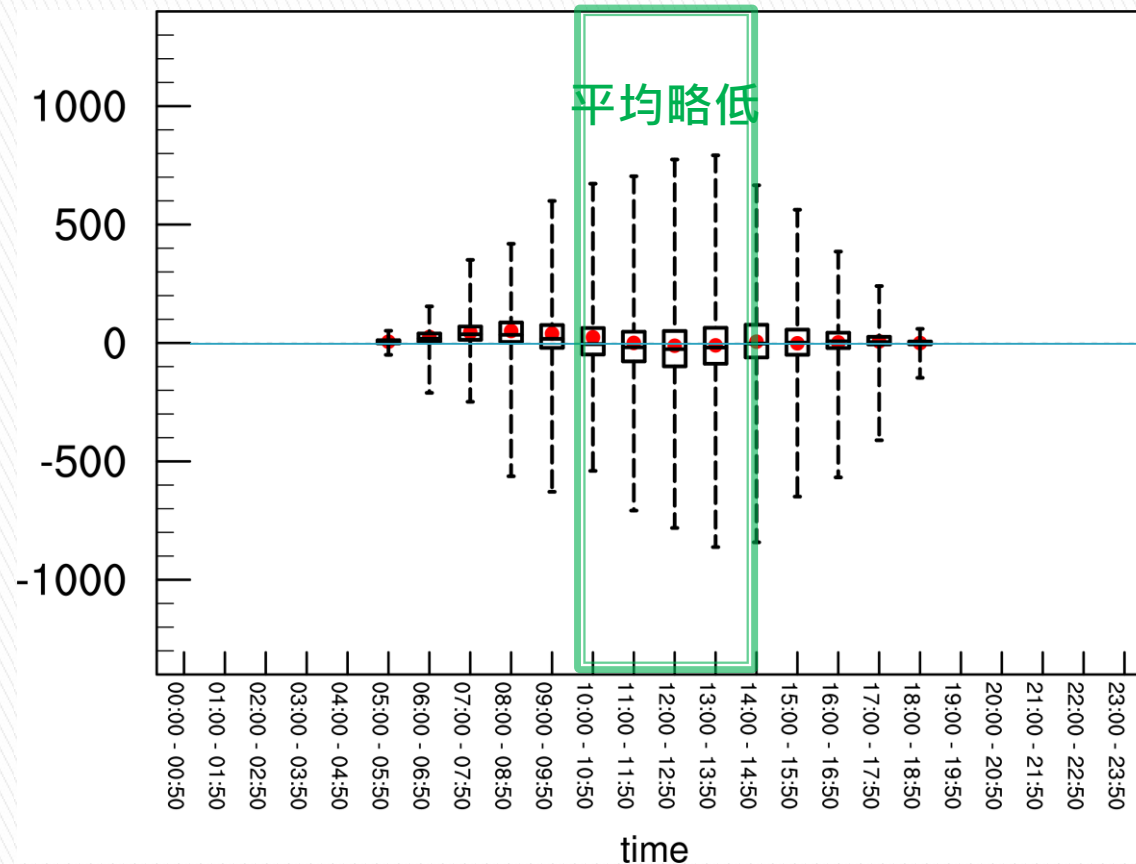
衛星推估值似乎存在一最大值

依月份統計

衛星推估減去基準站觀測之差值分析 – 逐站

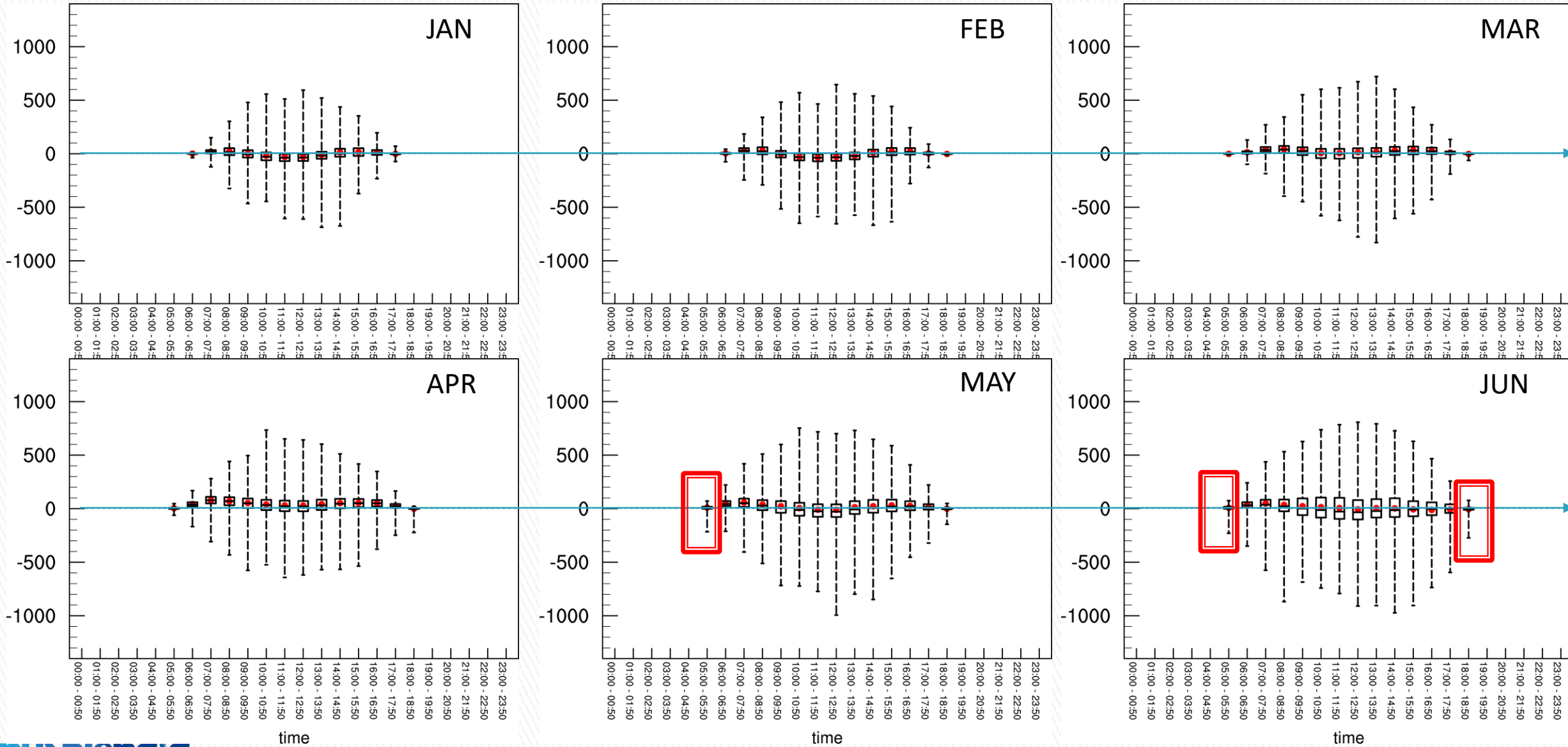
- ▶ 多數基準站盒鬚圖為這樣形態，近中午時段IQR較早晚時間高

編號28
玉井服務所



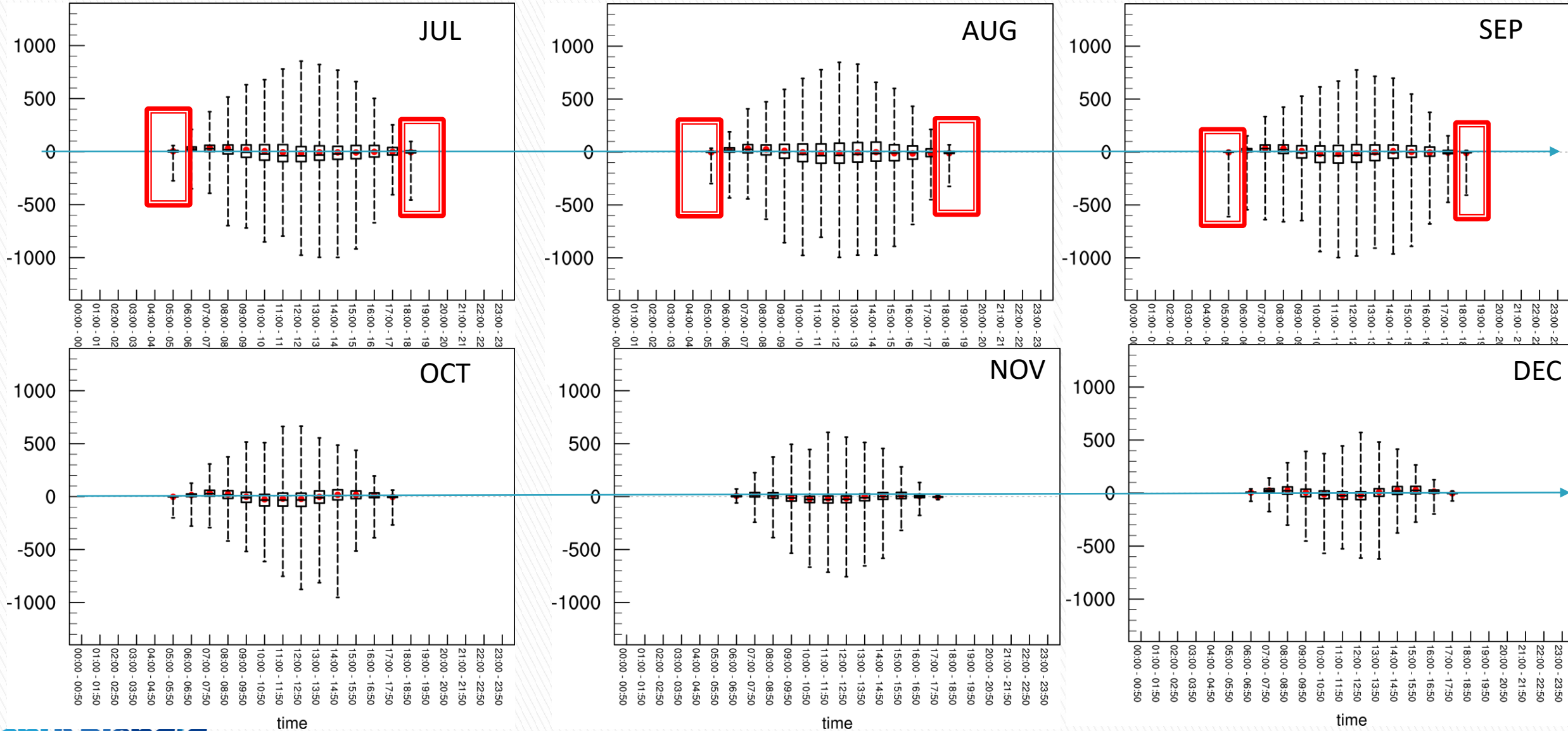
衛星推估減去基準站觀測之差值分析 – 逐月(1/2)

▶ 中午期間，除4月份衛星呈現微高估外，其餘月份皆略低估

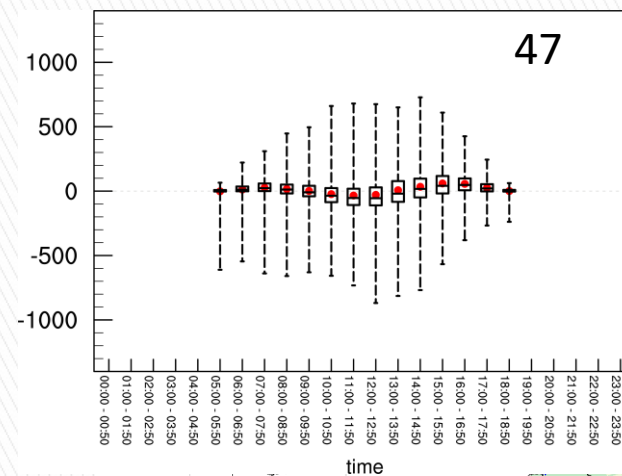
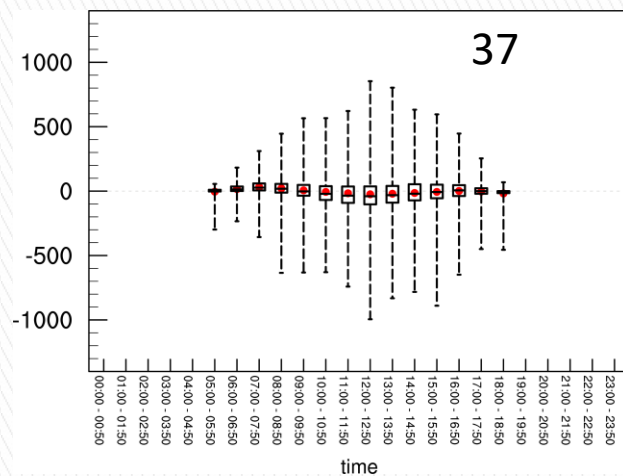
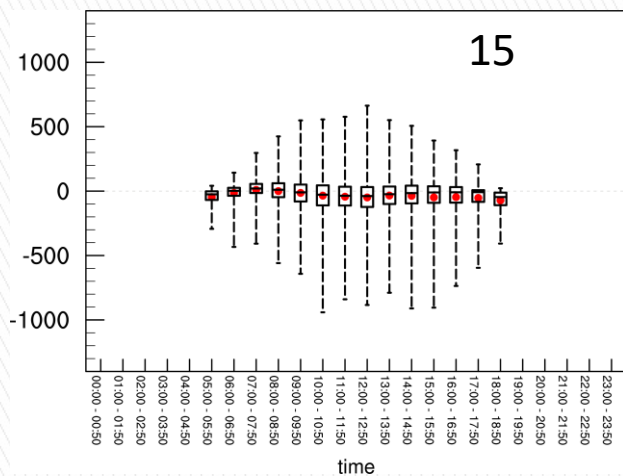


衛星推估減去基準站觀測之差值分析 - 逐月(2/2)

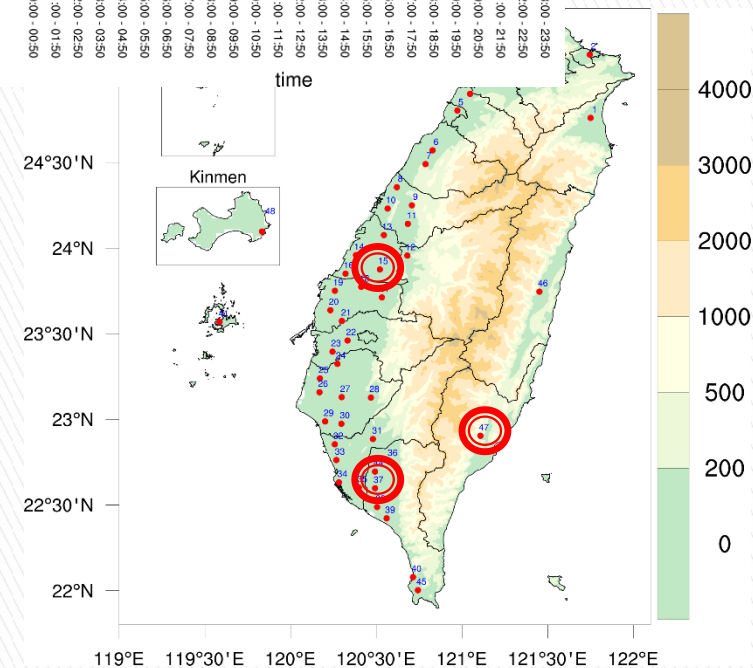
▶ 6~10月份的盒鬚圖相較其他月份為寬 可能與局部小範圍系統有關



5-9月接近日出日落 有H8低於觀測的原因為?



這三站在5-9月間日出前及日落後有較高的觀測值(不合理)
，懷疑受到光害影響。



如何利用克利金整合?

- ▶ 已知基準站與HS量值有差異
- ▶ 日射量在經度或緯度有空間趨勢的可能

克利金法簡述

▶ 最佳線性不偏估估計法

- 具有確保測站處的空間內插估計值=觀測值的特性

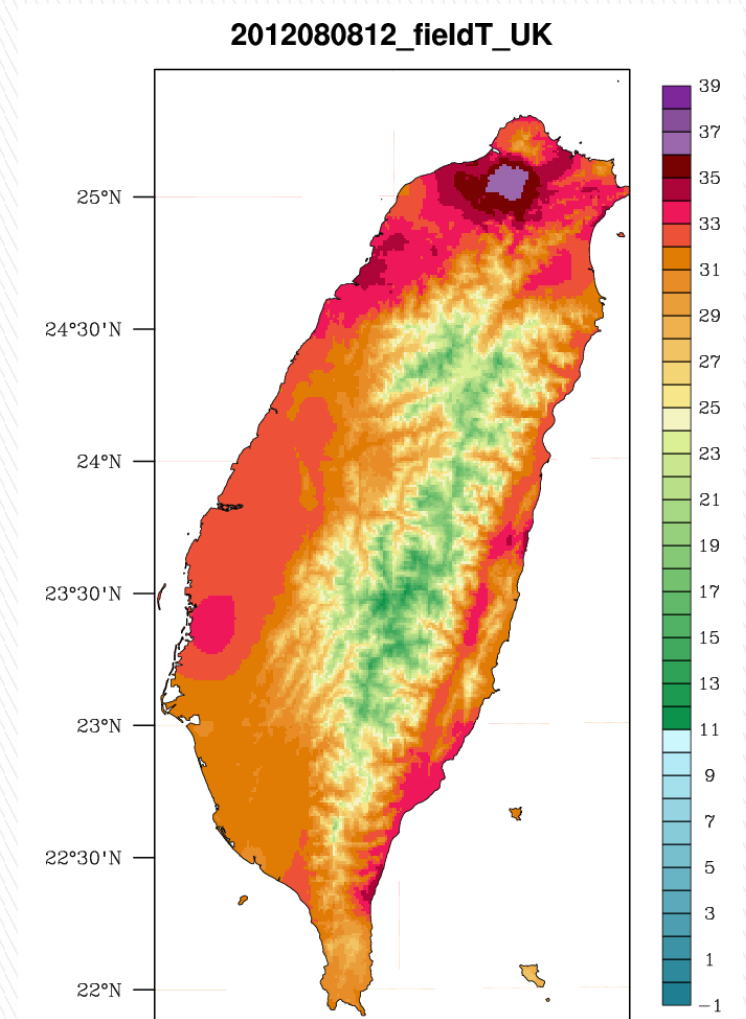
▶ 依據套配資料所得的半變異數圖計算權重係數

- 以半變異數圖代表測站觀測資料間的空間相關性

▶ 權重係數計算原理

- 不偏估：BLUE (Best Linear Unbiased Estimation)
- 最小估計誤差變異數 (Least square error variance)
- 依面化範圍內網格點期望值的假設
 - 已知常數平均值：簡單克利金 (Simple Kriging, SK)
 - 未知常數平均值：普通克利金 (Ordinary Kriging, OK)
 - 趨勢函數：通用克利金 (Universal Kriging, UK)
 - Ex. 溫度隨高度與緯度之線性趨勢 $E[Z(u_0)] = \beta_0 + \beta_h h + \beta_y y$

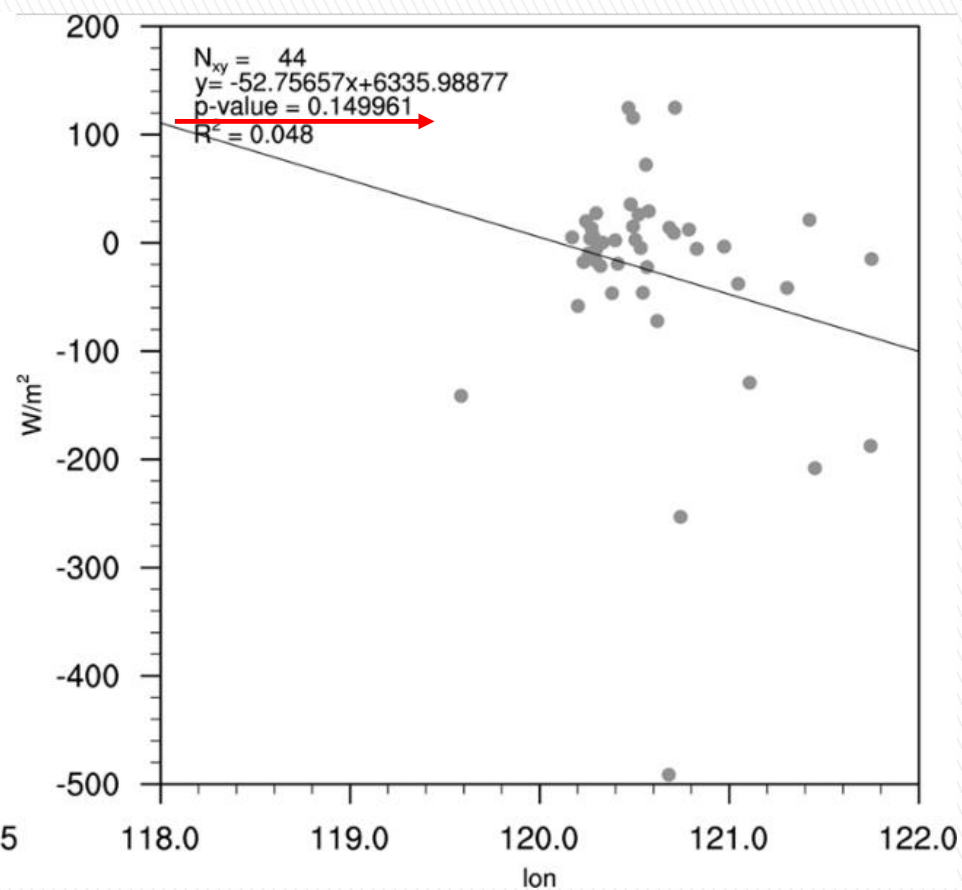
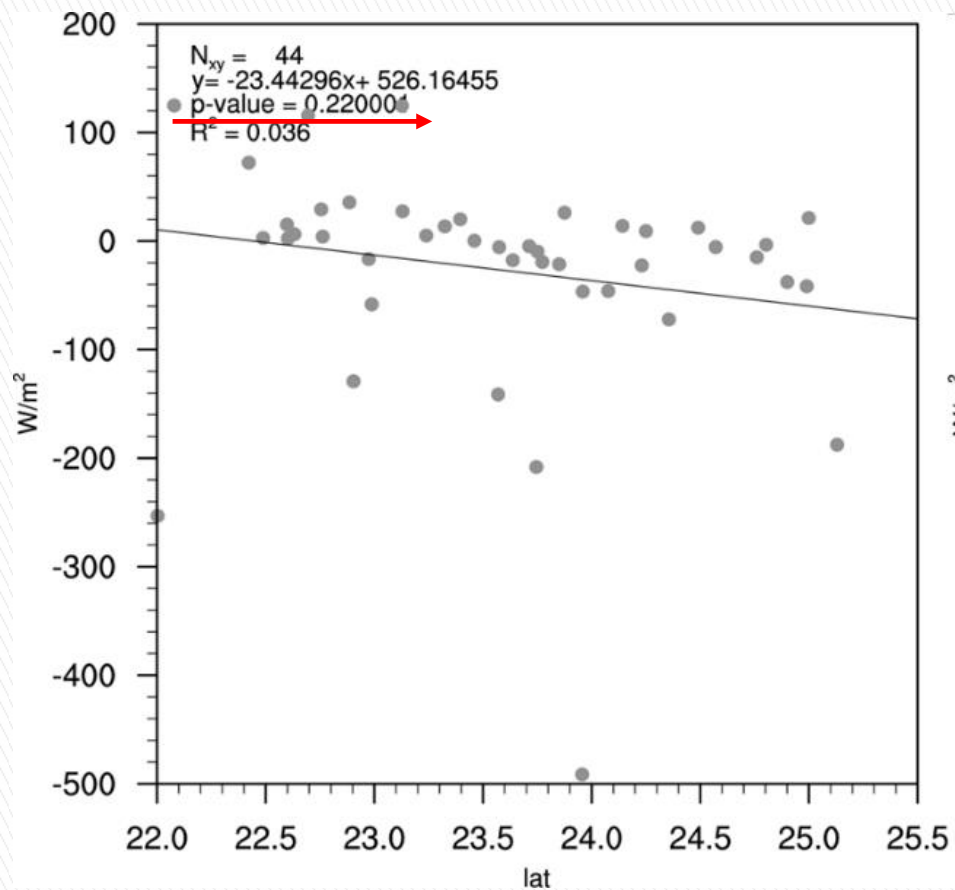
$$\hat{z}(\mathbf{u}_0) = \sum_{i=1}^n \lambda_i z(\mathbf{u}_i)$$



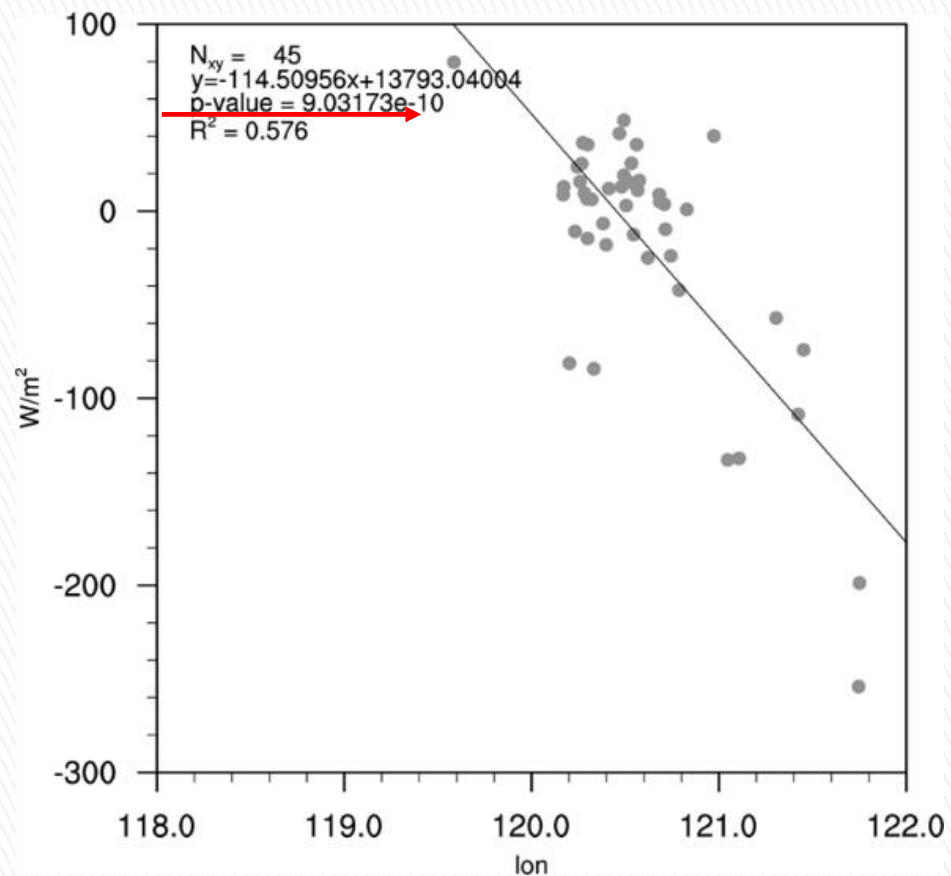
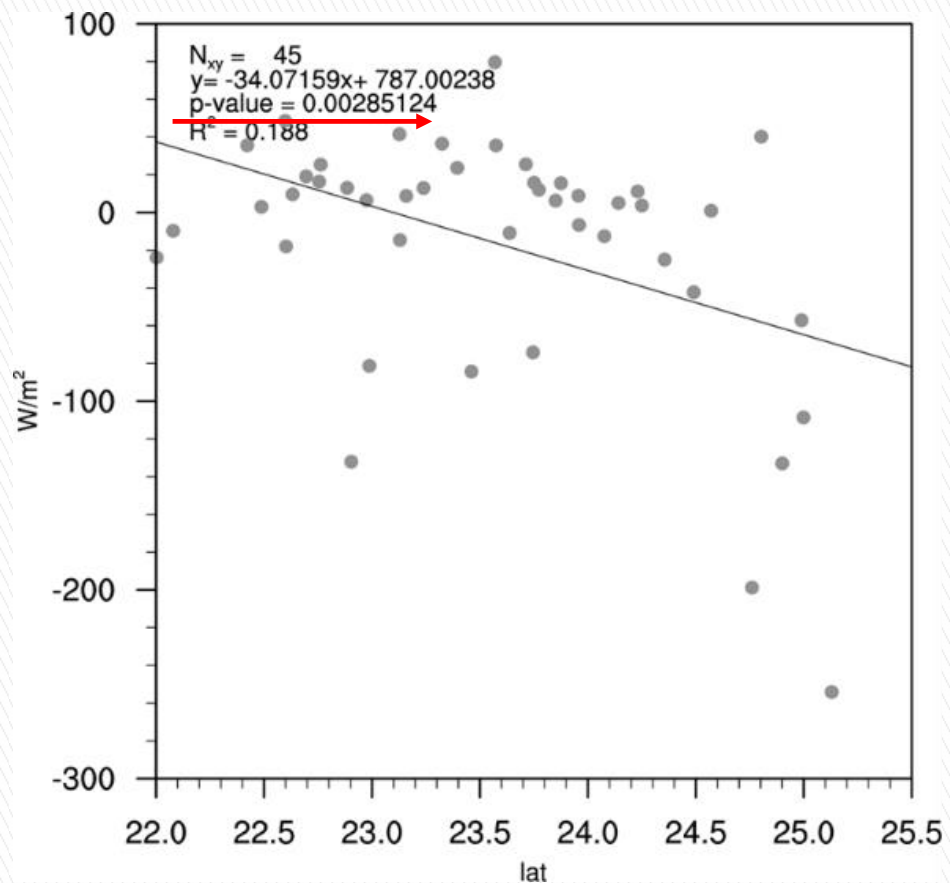
以日射量差值優化輻射量網格資料

- ▶ 分析測站日射量與HS網格資料差值是否具空間趨勢
 - 以當下觀測進行分析
 - 若無空間趨勢，則利用SK或OK網格化差值，再疊加H8日射量網格資料
 - 假設斜率=0,係數的P值<0.05

無空間趨勢(2023/06/02/14:10)

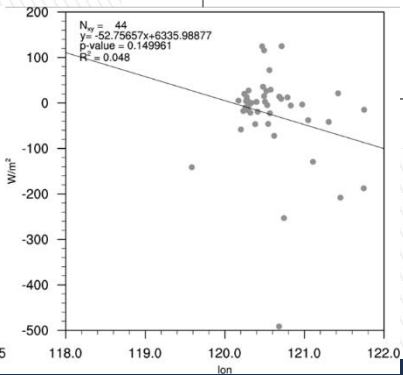
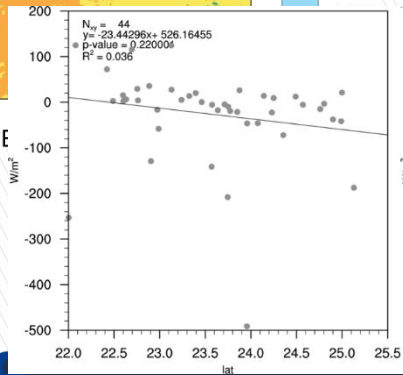
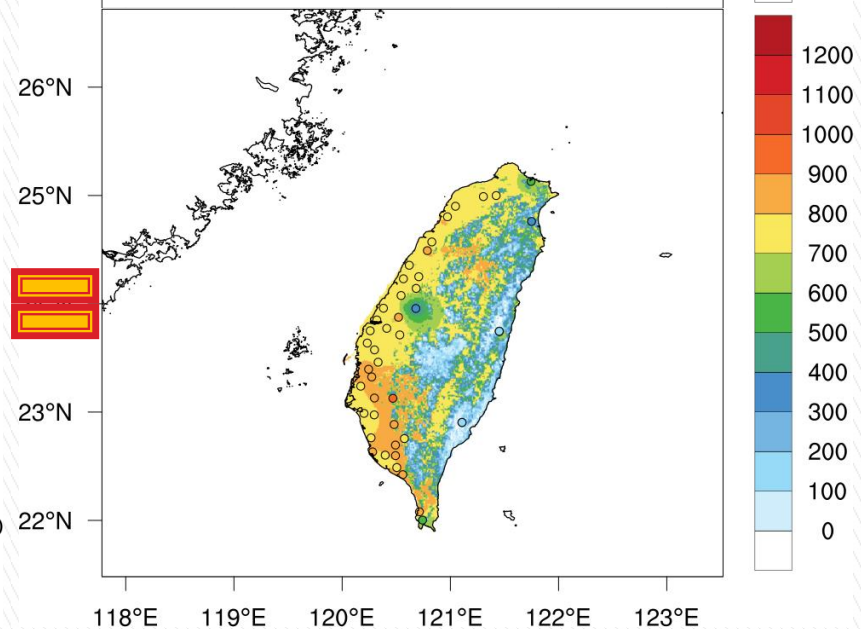
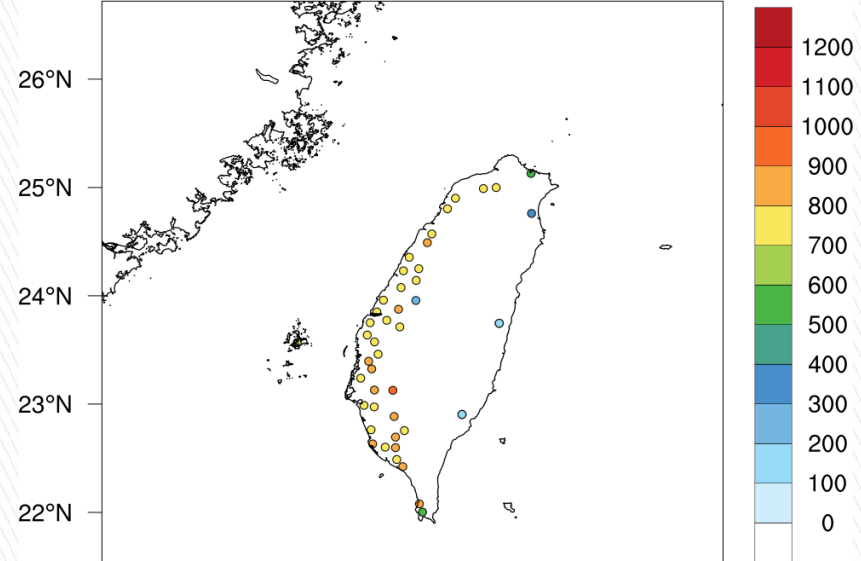
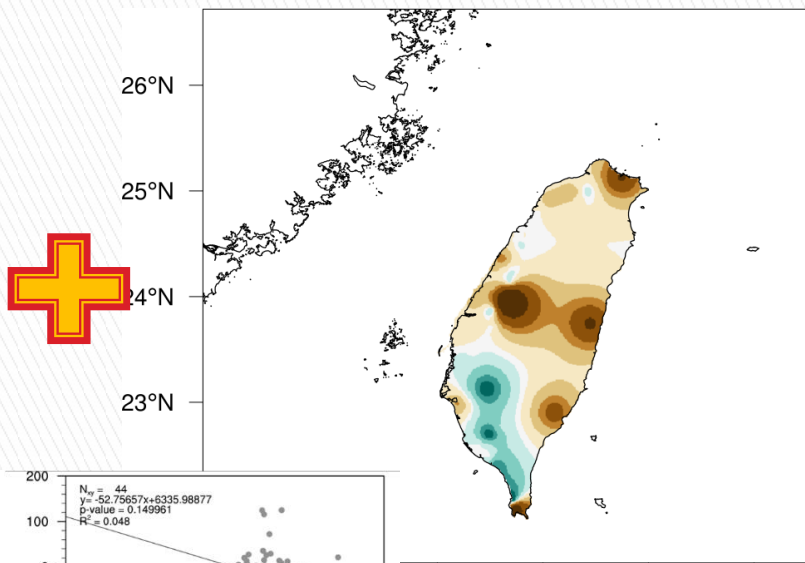
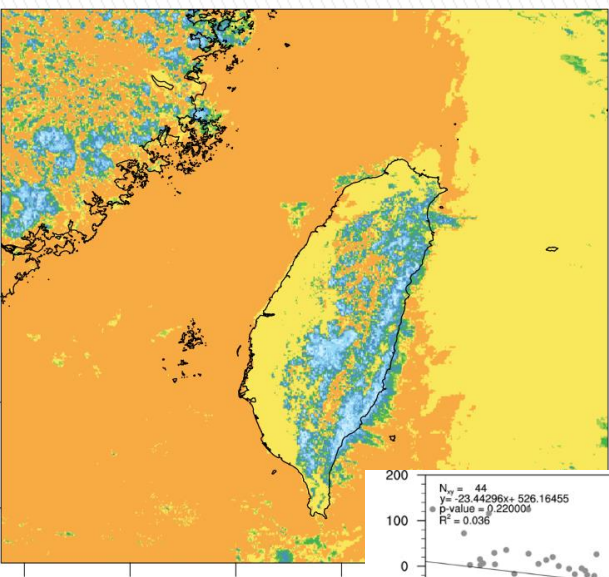


有空間趨勢(2023/06/01/15:30)



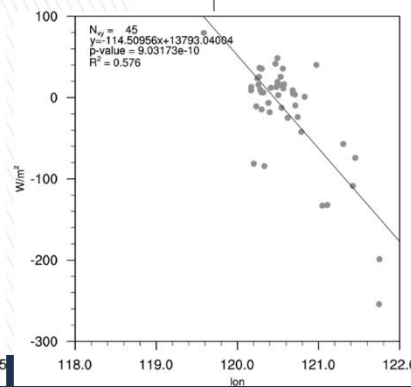
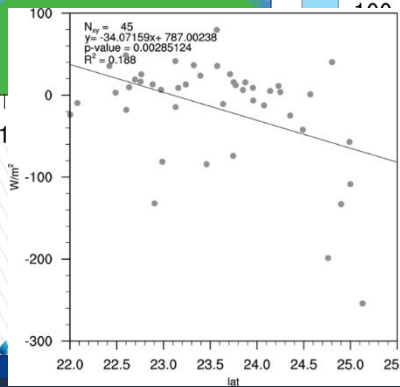
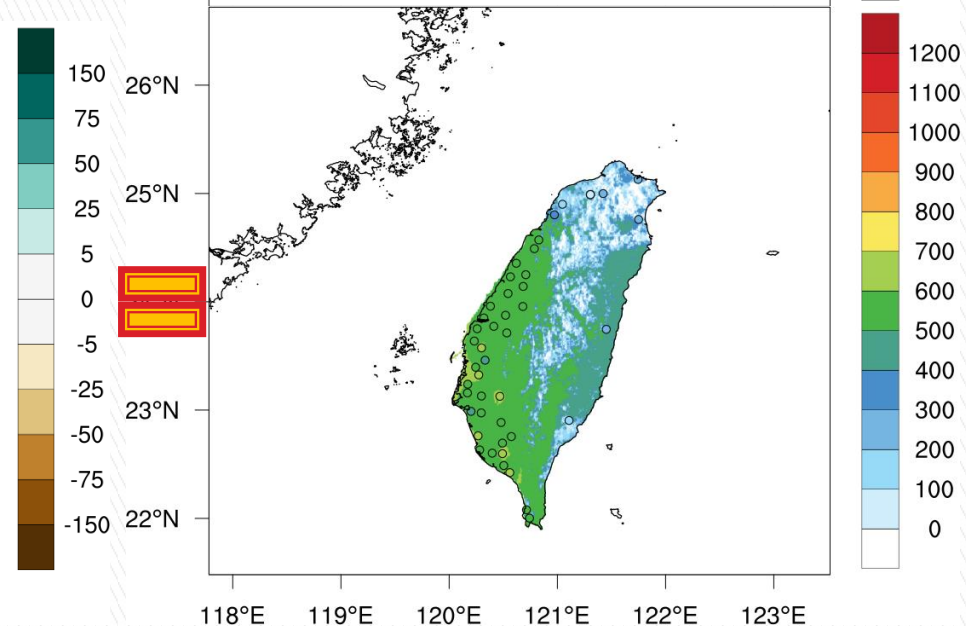
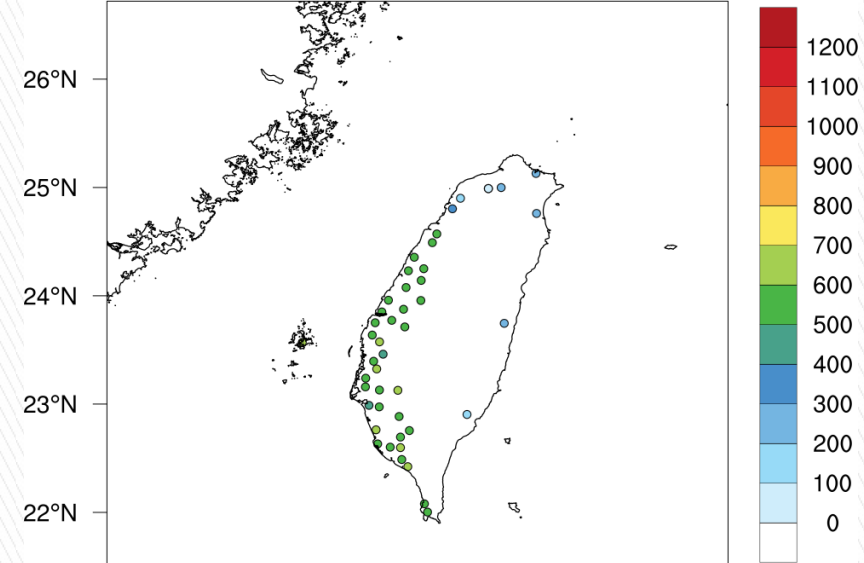
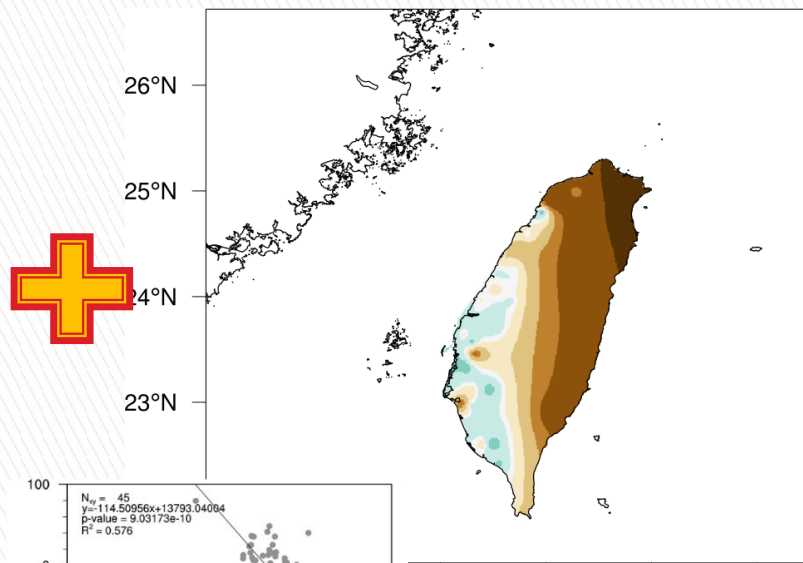
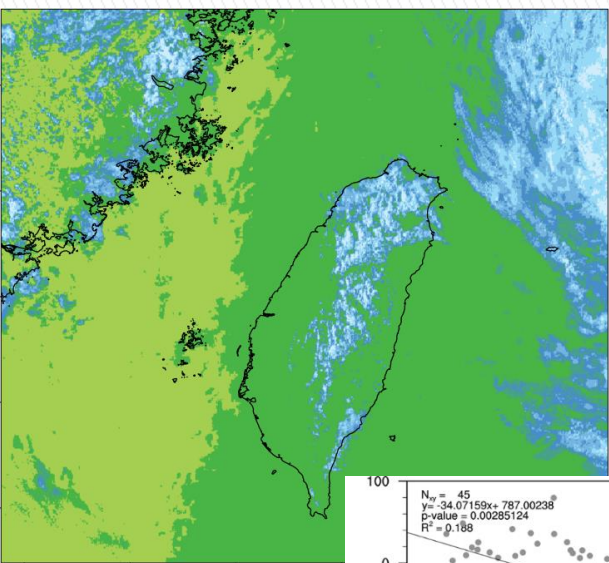
整合HS與基準站

2023/0602/14:10



整合HS與基準站

2023/0601/15:30



Thank you for listening