



臺灣區域再分析資料之產製與校驗

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中央氣象署科技發展組

2026/09/03

大綱

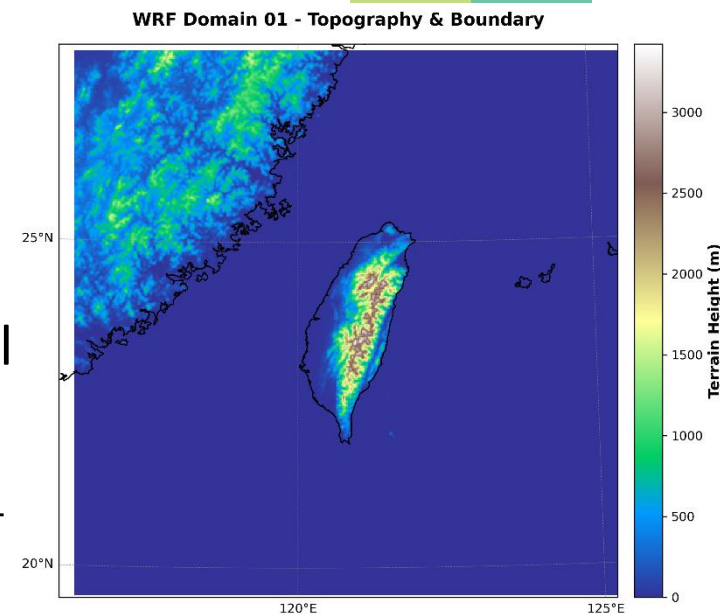
- 再分析資料產製基本設定
- 2025 觀測資料使用概況
- 資料產製流程
- 資料校驗及比較
- 資料產製時間
- 資料產品列表
- 總結



再分析資料產製設定



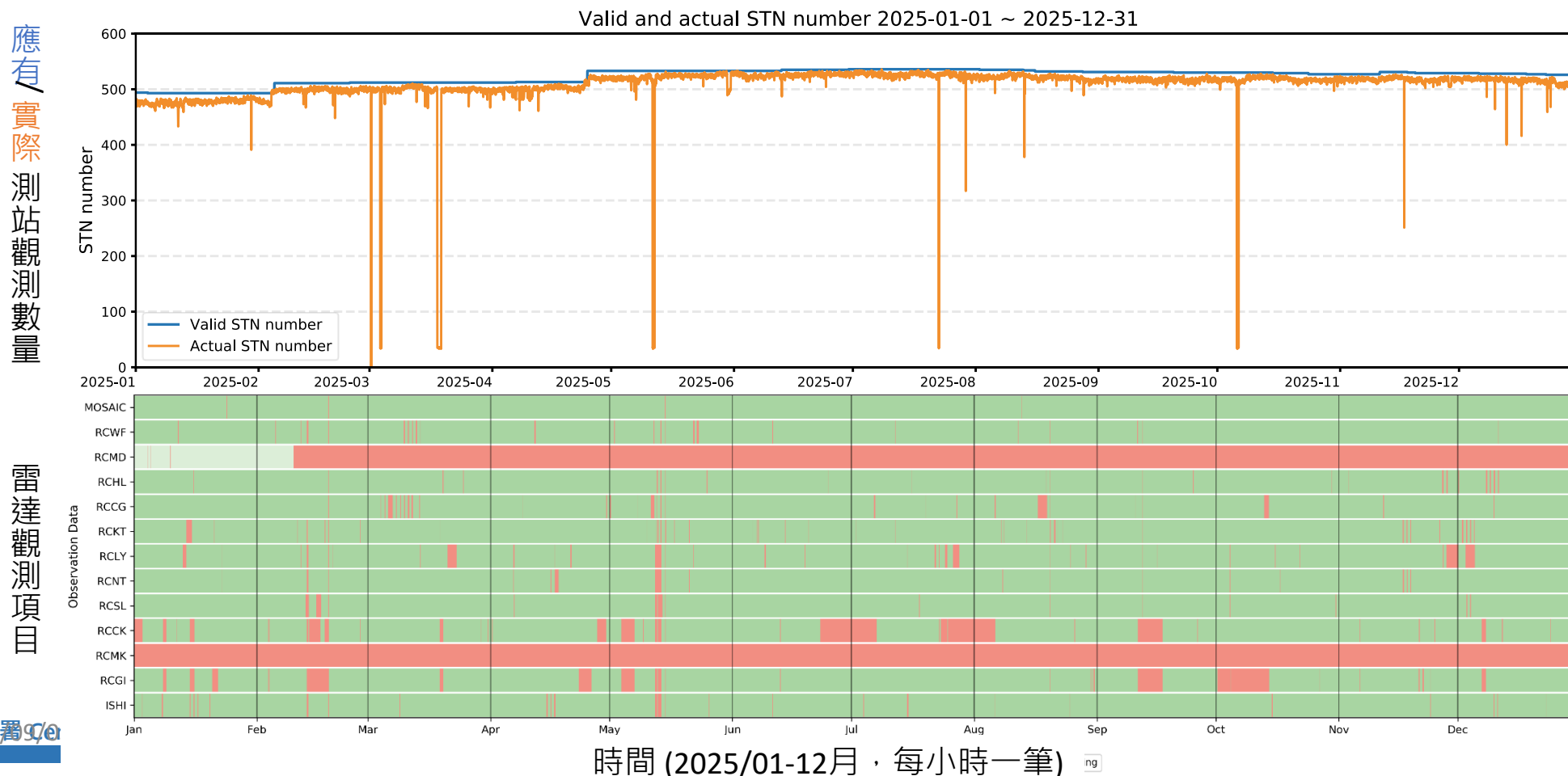
- 臺灣區域再分析資料 (TAIwan Regional ReAnalysis, TARRA)
- 使用 CWA RWRF 系統 (部分設定與作業不同)
- 模式範圍：台灣地區，水平解析度 2 公里，垂直 51 層 ETA level
- 同化設定：使用三維變分法搭配遞增式分析更新 (Incremental Analysis Updating, IAU) 方法，以每小時間隔同化臺灣區域地面測站與雷達觀測資料
- 邊界設定：以 ERA5 全球再分析資料作為邊界條件及大尺度混和 (blending) 之來源資料
- 目前完成 2025 年資料產製



2025 觀測資料使用概況



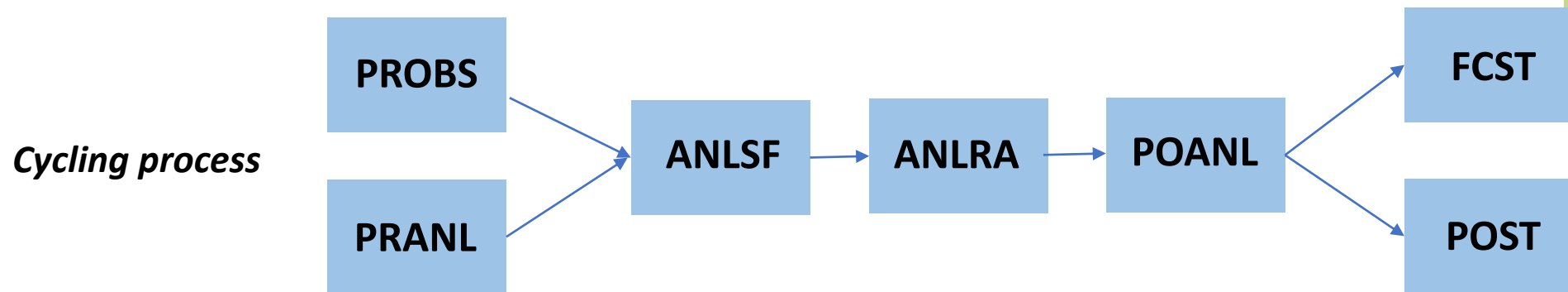
- 地面測站：署屬有人站、自動站
- 雷達資料：整合雷達回波 (MOSAIC)、五分山 RCWF/RCMD、花蓮 RCHL、七股 RCCG、墾丁 RCKT、林園 RCLY、南屯 RCNT、樹林 RCSL、清泉崗 RCCK、馬公 RCMK、綠島 RCGI、石垣 ISHI



地面測站

雷達資料

資料產製流程



Job name	Purpose
PROBS	進行地面及雷達觀測資料 QC 及格式轉換
PRANL	計算大尺度混和分析增量 (IBU)
ANLSF	同化地面測站資料
ANLRA	同化雷達回波及徑向風資料
POANL	1. 計算 IAU 增量 2. 更新側邊界及下邊界
FCST	進行模式預報
POST	1. 後處理輸出 GRIB2 及 NetCDF-4 格式檔案 2. 進行地面測站及雨量 (QPESUMS) 的即時校驗輸出

資料校驗及比較



Experiment name	Descriptions
TARRA	Taiwan Regional Reanalysis
RWRF-OP	Operational RWRF at the time
ERA5	ERA5 data, as a baseline in surface observation verifications
NoDA	Same as TARRA, but with no observations (while maintaining large-scale blending), similar to a downscaling run

→ Only conducted during the heavy rainfall period (July 25–August 4, 2025)

→ Verification was conducted throughout 2025; May and June are shown as examples.

The “global standard”

~ A carefully designed downscaling system utilizing ERA5 large-scale information

地面測站校驗：2025-05-01 00Z - 2025-05-31 23Z



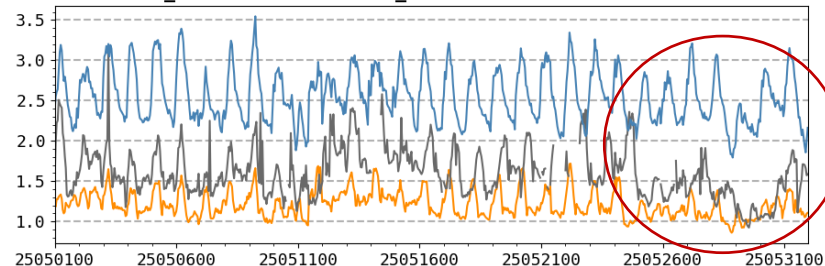
TARRA RWRP-OP ERA5

RMSE

----- 2-m Temperature (K) -----

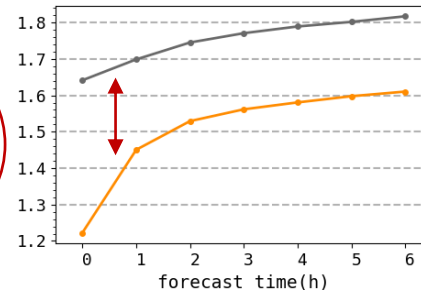
BIAS

RMSE of T2m(K) Analysis
2025-05-01_00:00Z to 2025-05-31_23:00Z

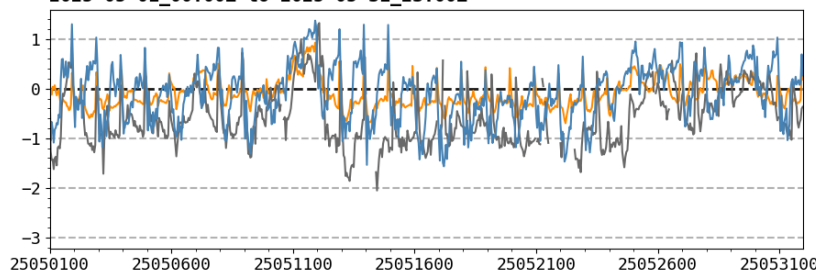


Time series of analysis

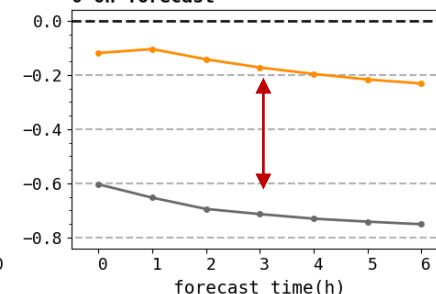
RMSE of T2m(K)
0-6h forecast



Bias of T2m(K) Analysis
2025-05-01_00:00Z to 2025-05-31_23:00Z

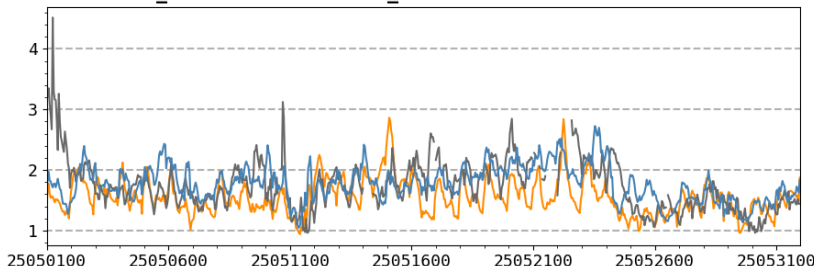


Bias of T2m(K)
0-6h forecast

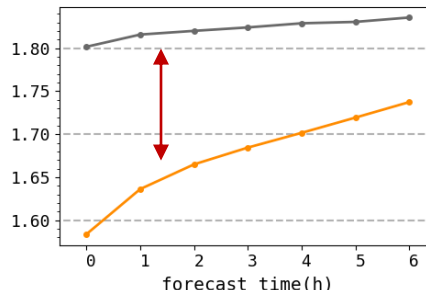


0-6h fcst (avg.)

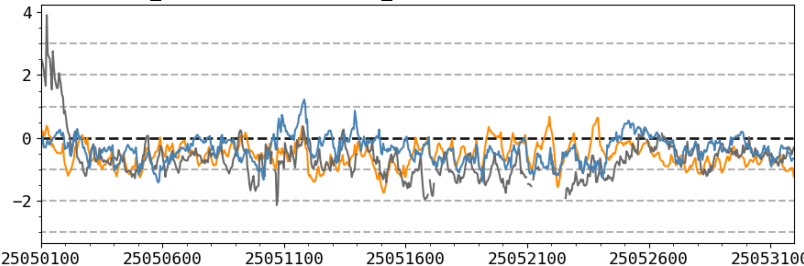
RMSE of Q2m(g/kg) Analysis
2025-05-01_00:00Z to 2025-05-31_23:00Z



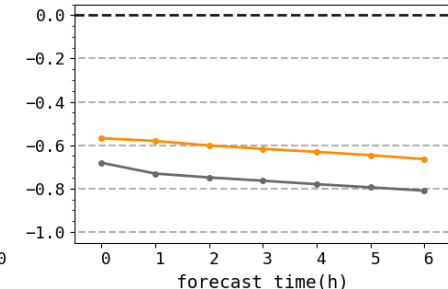
RMSE of Q2m(g/kg)
0-6h forecast



Bias of Q2m(g/kg) Analysis
2025-05-01_00:00Z to 2025-05-31_23:00Z

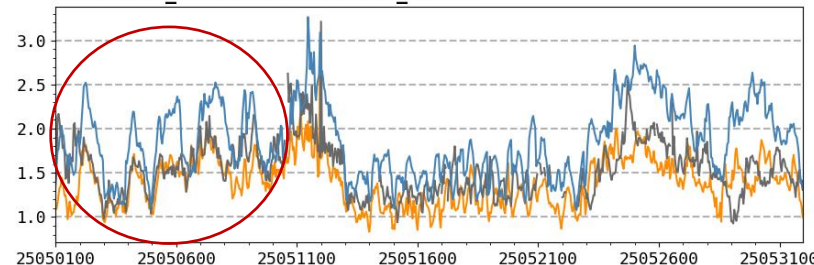


Bias of Q2m(g/kg)
0-6h forecast

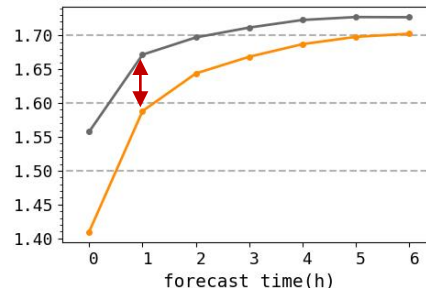


----- 10-m Wind Speed (m/s) -----

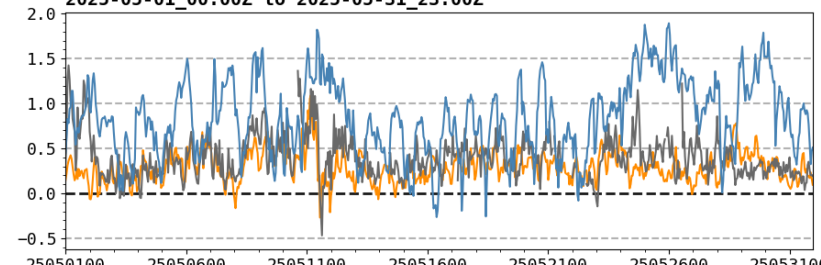
RMSE of Wind_speed(m/s) Analysis
2025-05-01_00:00Z to 2025-05-31_23:00Z



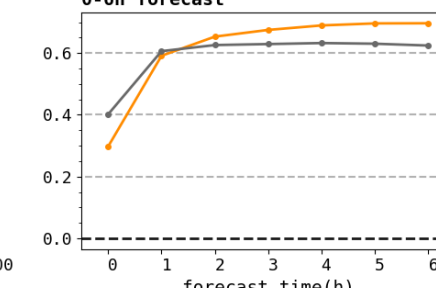
RMSE of Wind_speed(m/s)
0-6h forecast



Bias of Wind_speed(m/s) Analysis
2025-05-01_00:00Z to 2025-05-31_23:00Z



Bias of Wind_speed(m/s)
0-6h forecast



地面測站校驗：2025-06-01 00Z - 2025-06-30 23Z



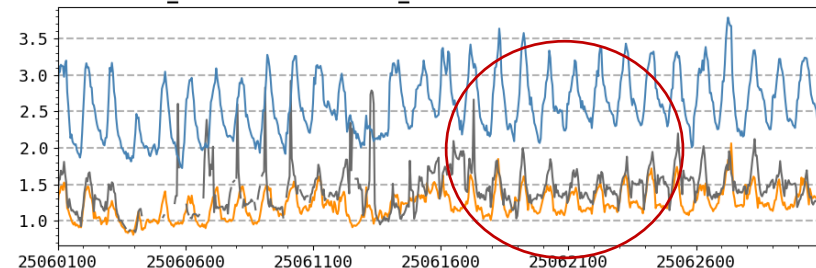
TARRA RWRP-OP ERA5

RMSE

----- 2-m Temperature (K) -----

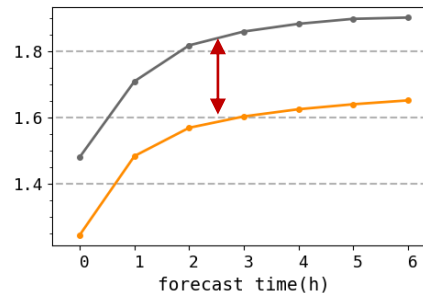
BIAS

RMSE of T2m(K) Analysis
2025-06-01_00:00Z to 2025-06-30_23:00Z

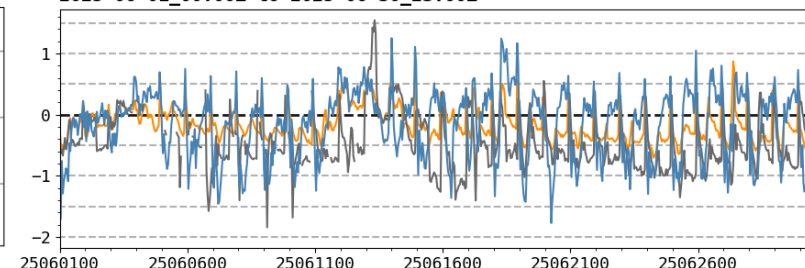


Time series of analysis

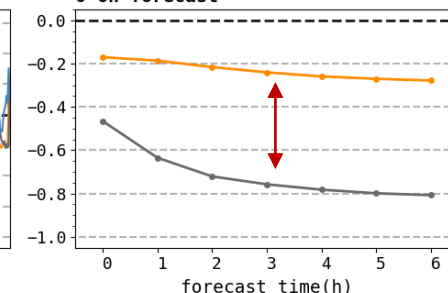
RMSE of T2m(K)
0-6h forecast



Bias of T2m(K) Analysis
2025-06-01_00:00Z to 2025-06-30_23:00Z

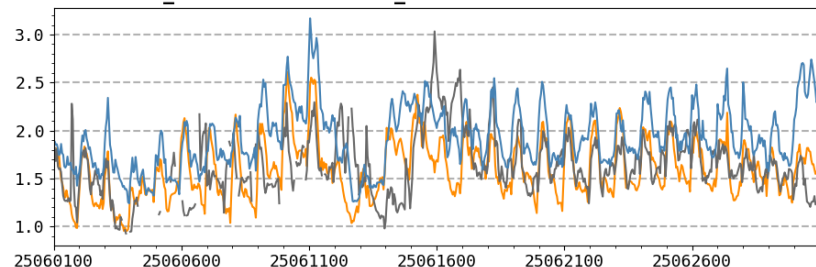


Bias of T2m(K)
0-6h forecast

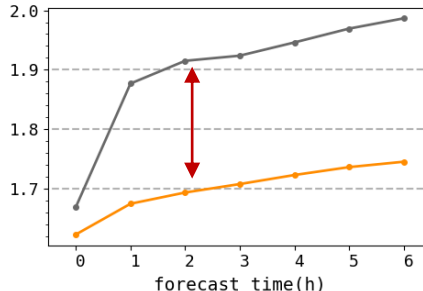


0-6h fcst (avg.)

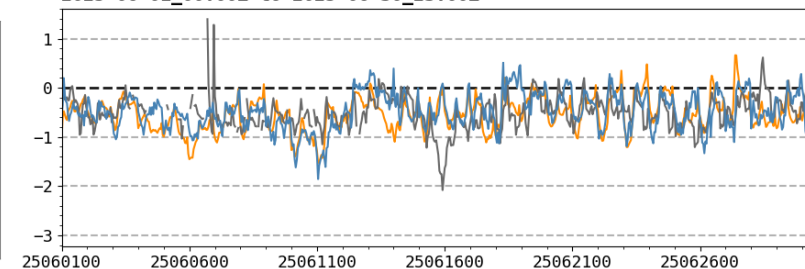
RMSE of Q2m(g/kg) Analysis
2025-06-01_00:00Z to 2025-06-30_23:00Z



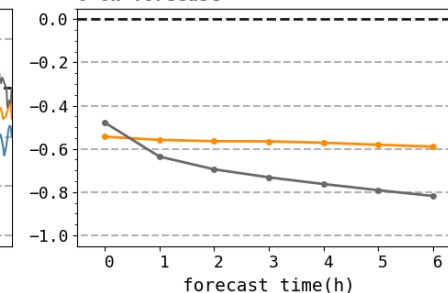
RMSE of Q2m(g/kg)
0-6h forecast



Bias of Q2m(g/kg) Analysis
2025-06-01_00:00Z to 2025-06-30_23:00Z

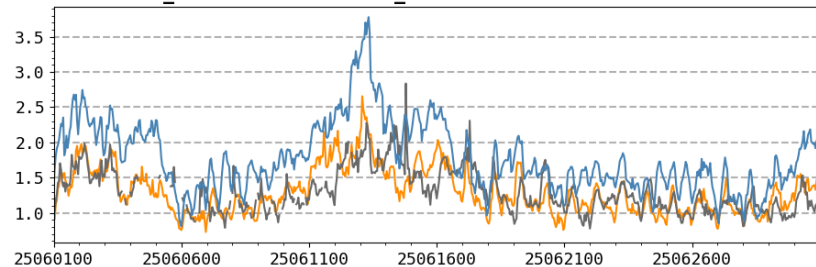


Bias of Q2m(g/kg)
0-6h forecast

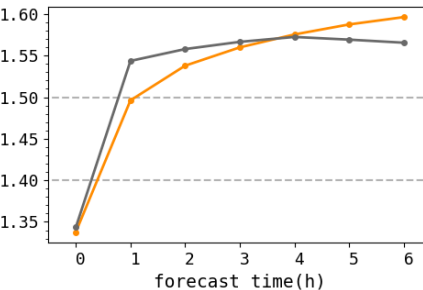


----- 10-m Wind Speed (m/s) -----

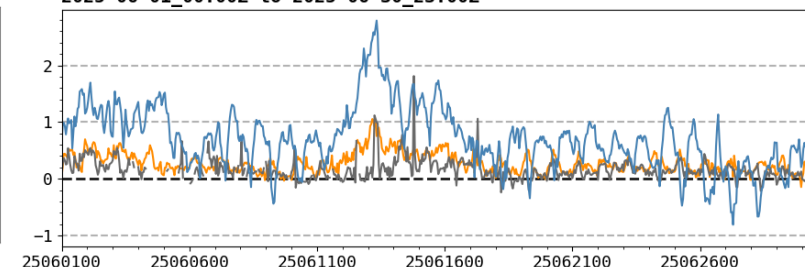
RMSE of Wind_speed(m/s) Analysis
2025-06-01_00:00Z to 2025-06-30_23:00Z



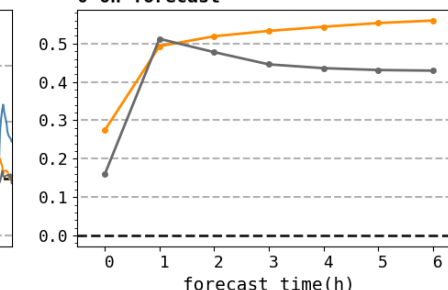
RMSE of Wind_speed(m/s)
0-6h forecast



Bias of Wind_speed(m/s) Analysis
2025-06-01_00:00Z to 2025-06-30_23:00Z



Bias of Wind_speed(m/s)
0-6h forecast



雨量校驗：2025-05-01 00Z – 2025-05-31 23Z

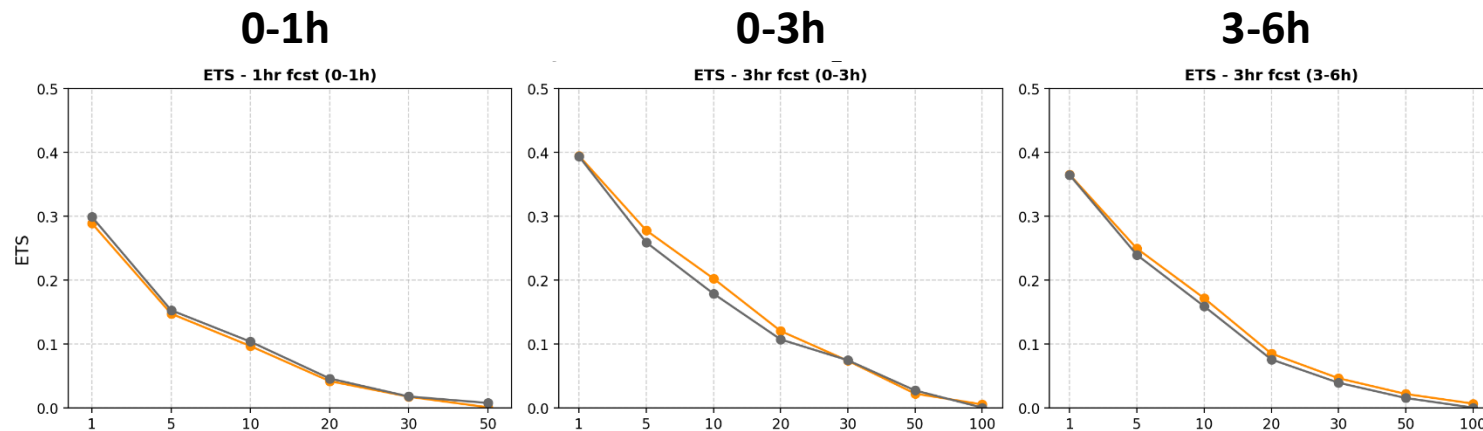
TARRA
RWRF-OP



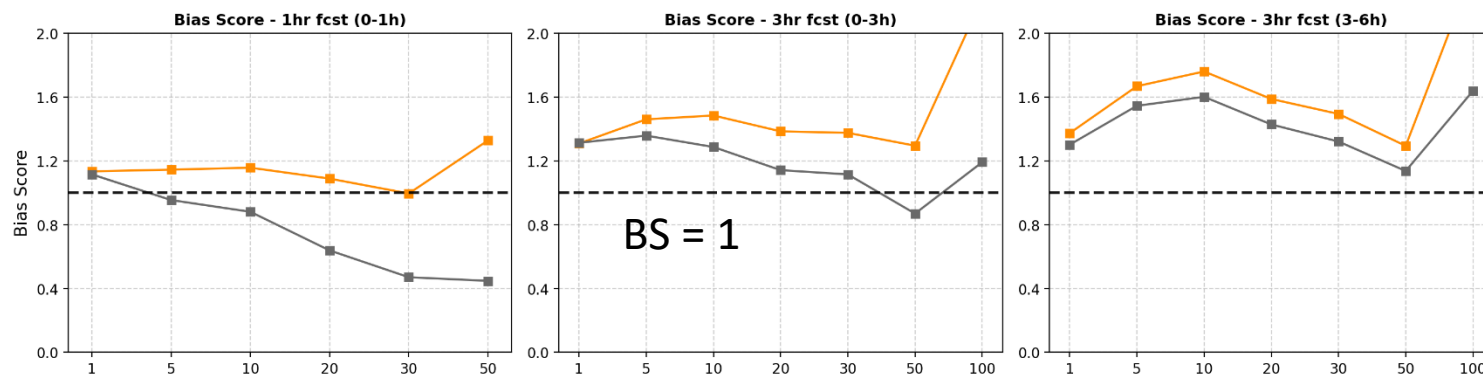
FSS Temporal Evolution (8km)

3-h accumulated

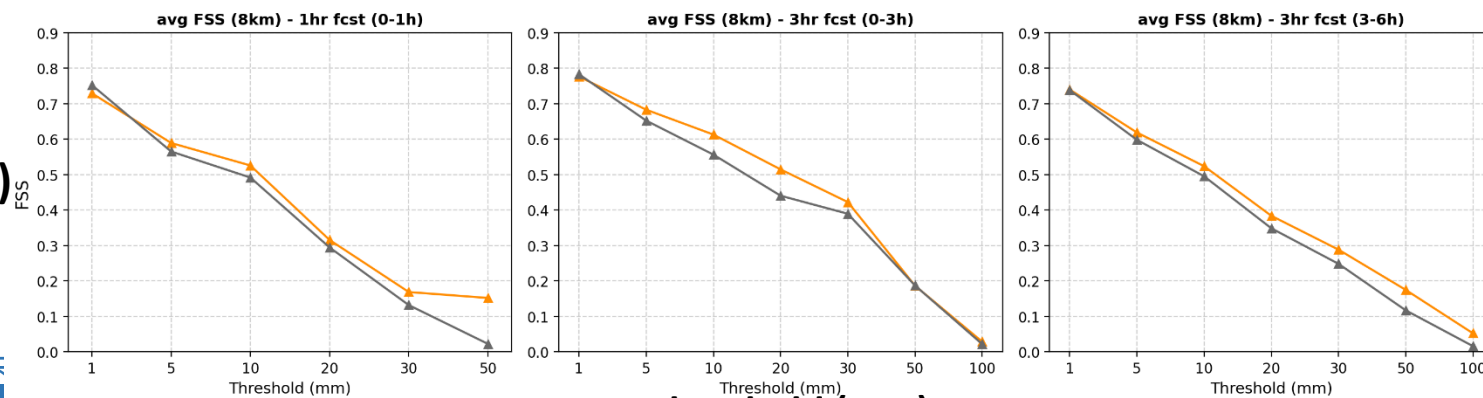
ETS



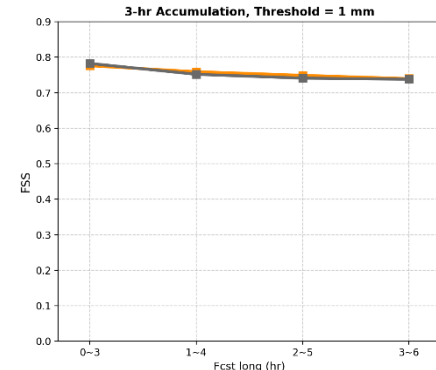
BS



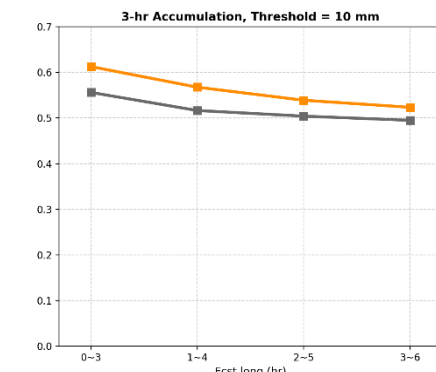
FSS (8km)



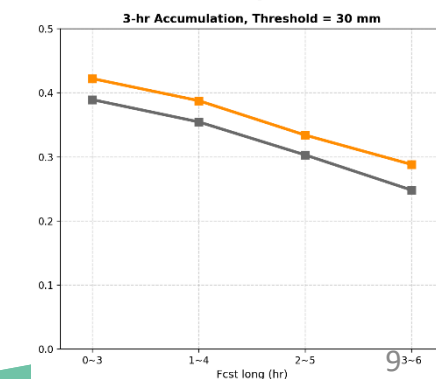
1-mm



10-mm



30-mm



雨量校驗：2025-06-01 00Z - 2025-06-30 23Z

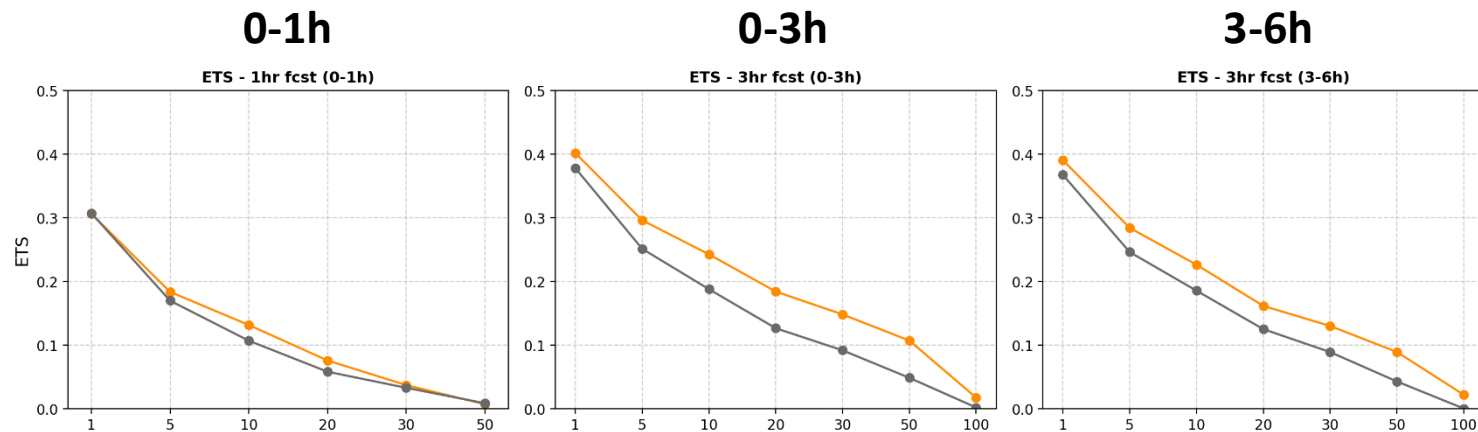
TARRA
RWRF-OP



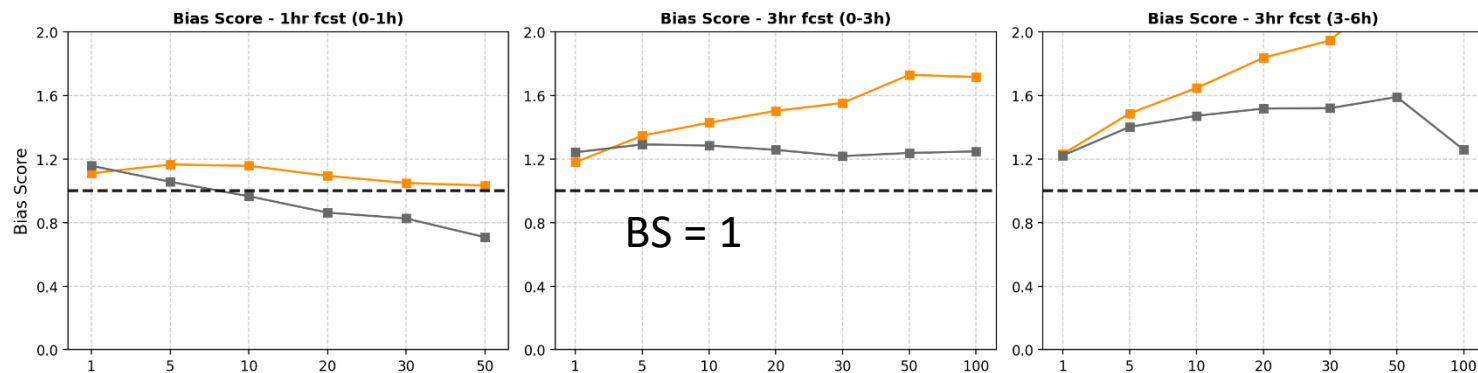
FSS Temporal Evolution (8km)

3-h accumulated

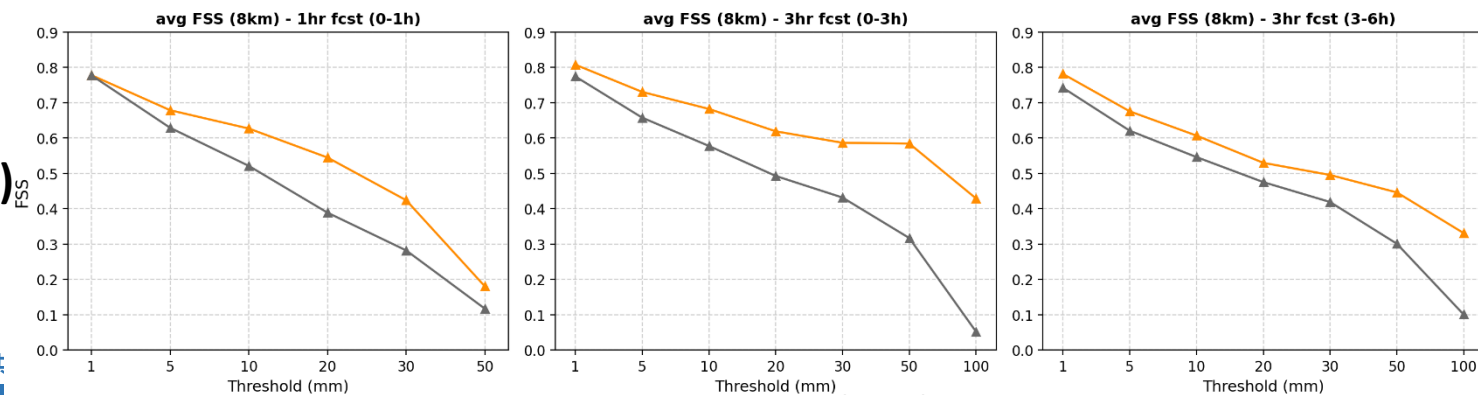
ETS



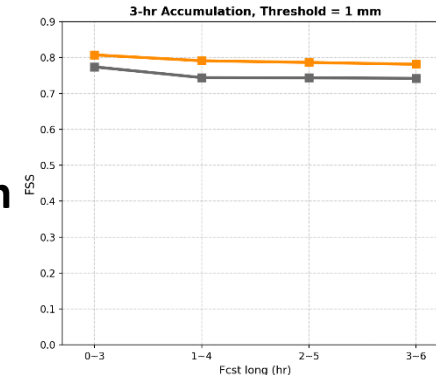
BS



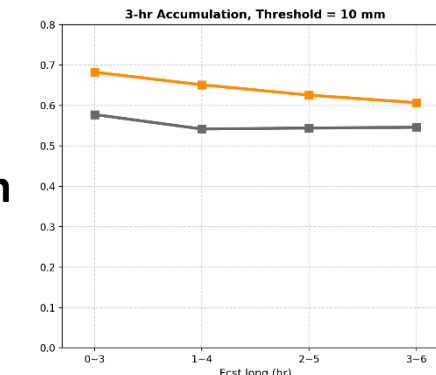
FSS (8km)



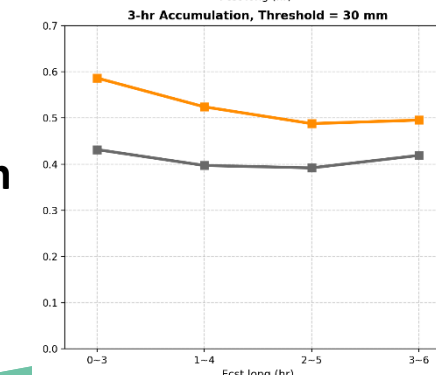
1-mm



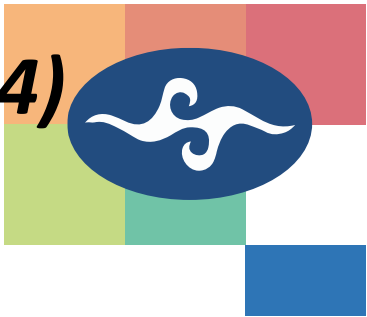
10-mm



30-mm



地面測站校驗：A heavy rainfall period in 2025 (07/25-08/04)

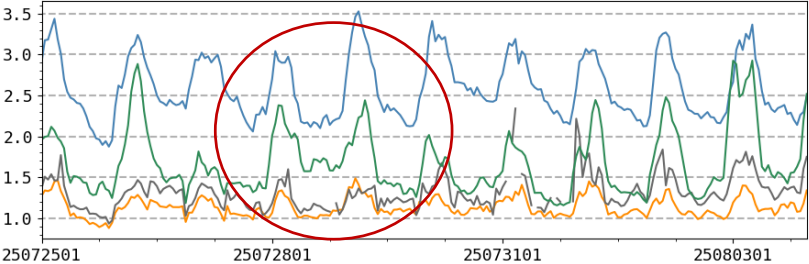


RMSE

----- 2-m Temperature (K) -----

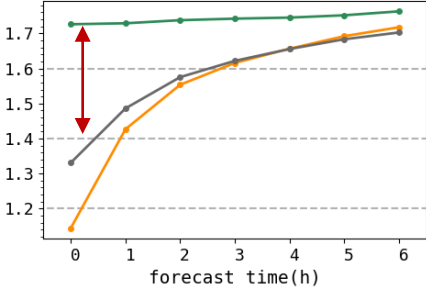
BIAS

RMSE of T2m(K) Analysis
2025-07-25_01:00Z to 2025-08-04_00:00Z

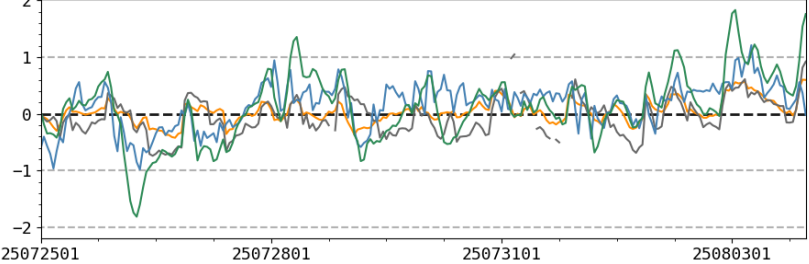


Time series of analysis

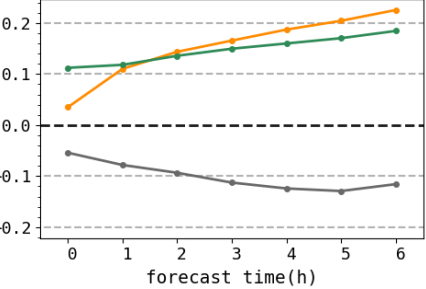
RMSE of T2m(K)
0-6h forecast



Bias of T2m(K) Analysis
2025-07-25_01:00Z to 2025-08-04_00:00Z

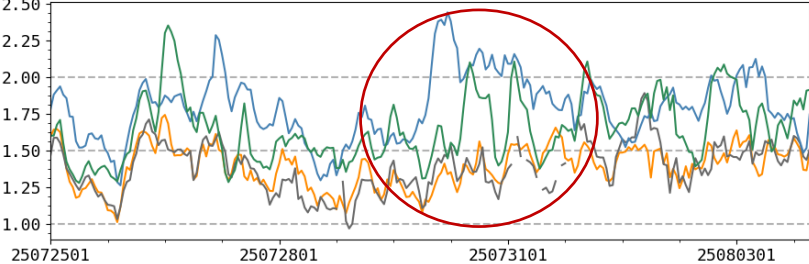


Bias of T2m(K)
0-6h forecast

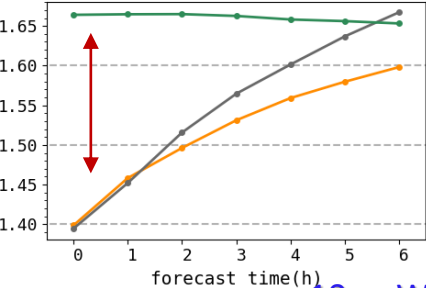


0-6h fcst (avg.)

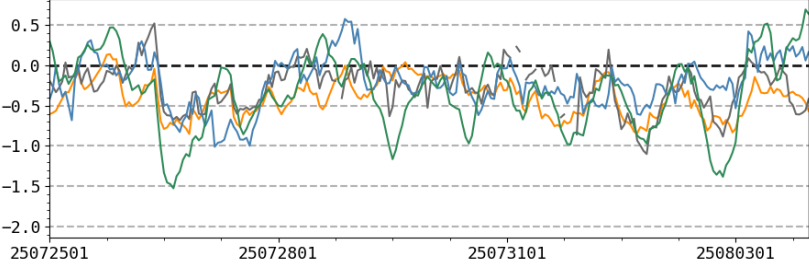
RMSE of Q2m(g/kg) Analysis
2025-07-25_01:00Z to 2025-08-04_00:00Z



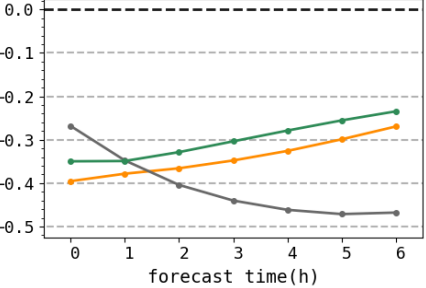
RMSE of Q2m(g/kg)
0-6h forecast



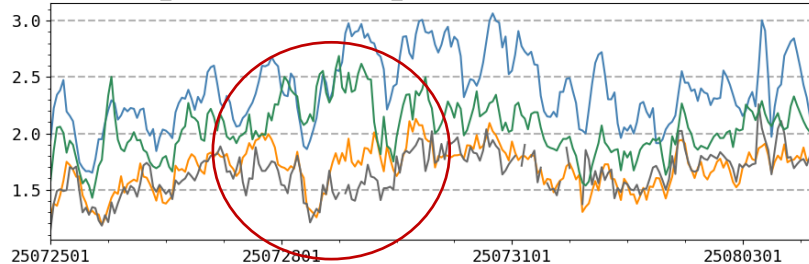
Bias of Q2m(g/kg) Analysis
2025-07-25_01:00Z to 2025-08-04_00:00Z



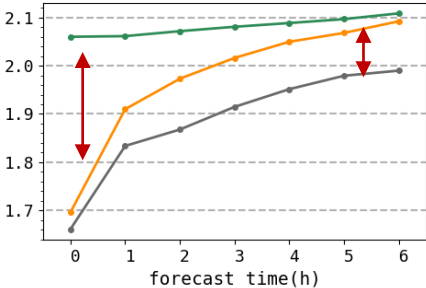
Bias of Q2m(g/kg)
0-6h forecast



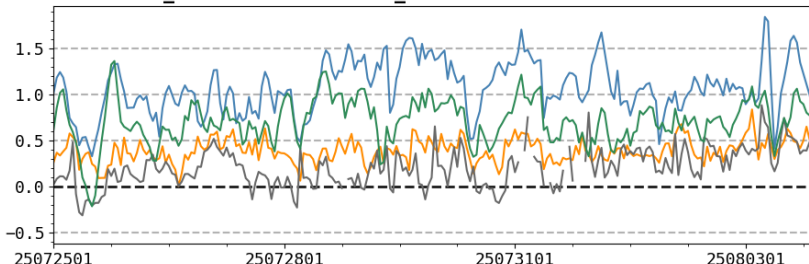
RMSE of Wind_speed(m/s) Analysis
2025-07-25_01:00Z to 2025-08-04_00:00Z



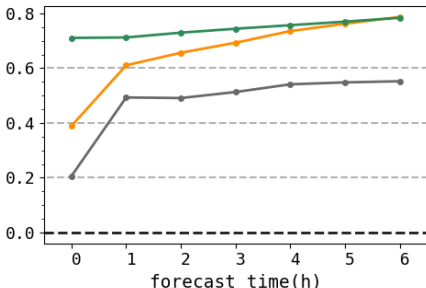
RMSE of Wind_speed(m/s)
0-6h forecast



Bias of Wind_speed(m/s) Analysis
2025-07-25_01:00Z to 2025-08-04_00:00Z



Bias of Wind_speed(m/s)
0-6h forecast



----- 10-m Wind Speed (m/s) -----

雨量校驗：A heavy rainfall period in 2025 (07/25-08/04)

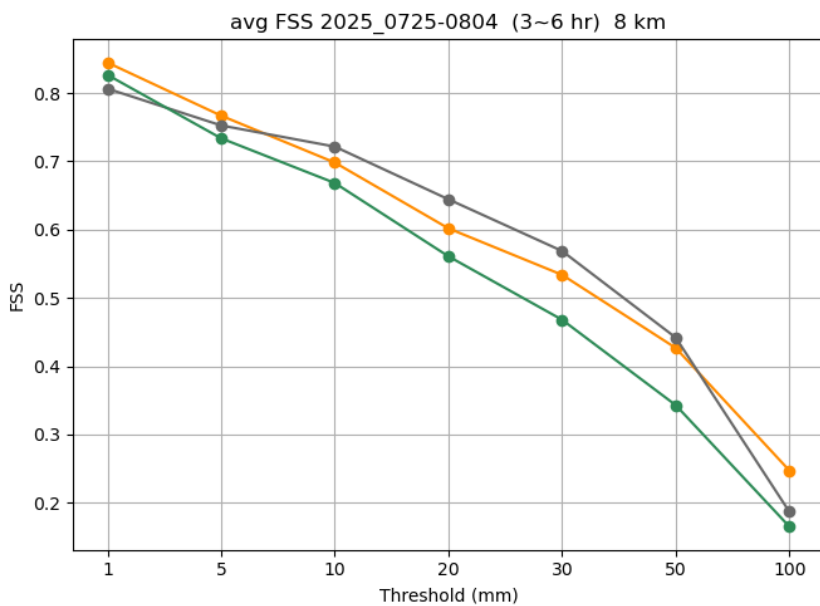
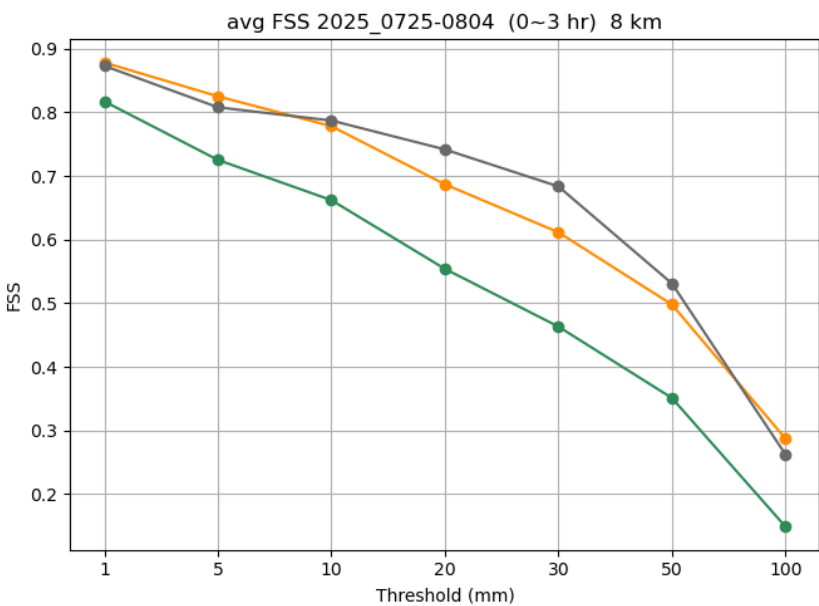
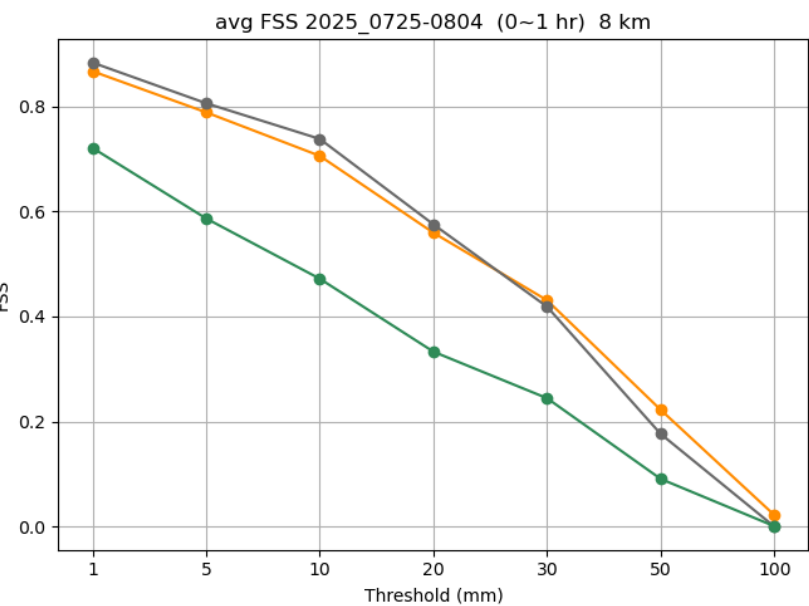


0-1 h accumulated precipitation

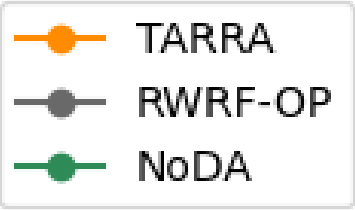
0-3 h accumulated precipitation

3-6 h accumulated precipitation

(FSS aggregated over 240 forecasts, 8-km radius)



Threshold (mm)



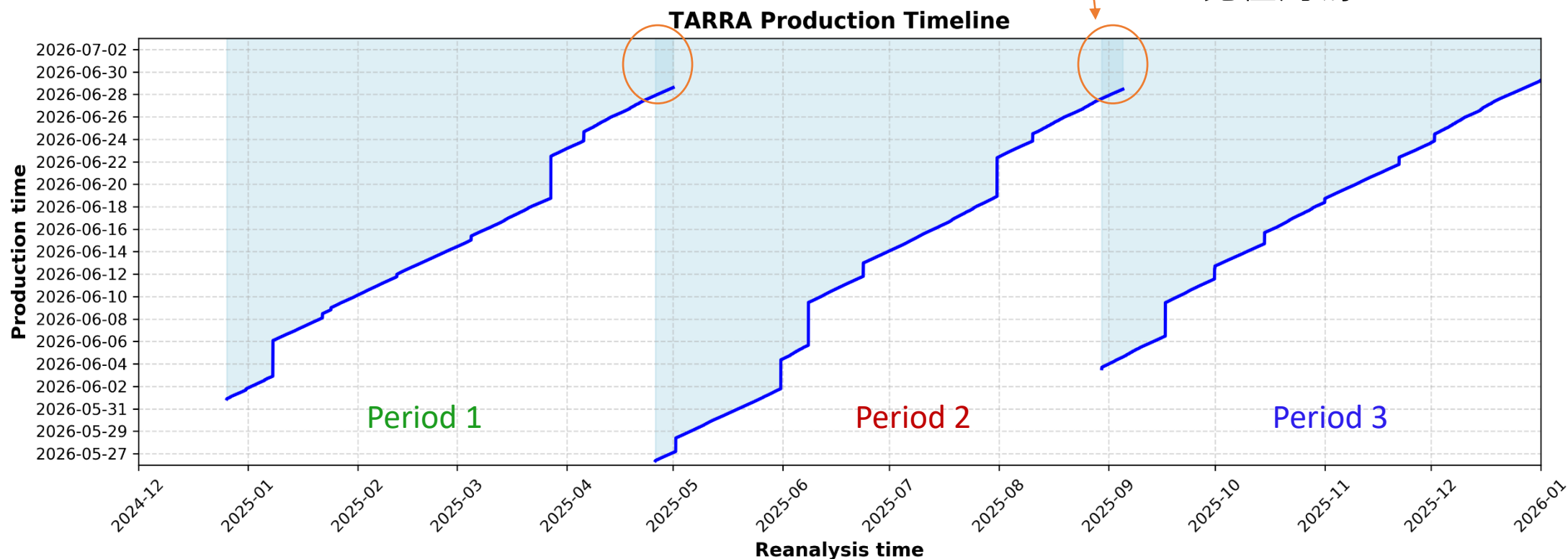
資料產製時間



- **Period 1** [2025-1-RC3] 2024-12-26 00Z – 2025-04-30 23Z
- **Period 2** [2025-2-RC3] 2025-04-26 00Z – 2025-09-03 23Z
- **Period 3** [2025-3-RC3] 2025-08-30 00Z – 2026-01-04 23Z

資料產製重疊期間

運算時間與資料時間
比值約為 1 : 6



資料產製重疊期間地面測站校驗

T2m, Q2m, Wind Speed RMSE



Period 1 & Period 2

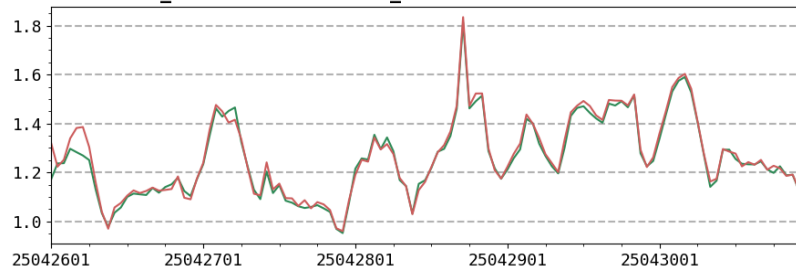
2025-04-26 00Z – 2025-04-30 23Z

Period 2 & Period 3

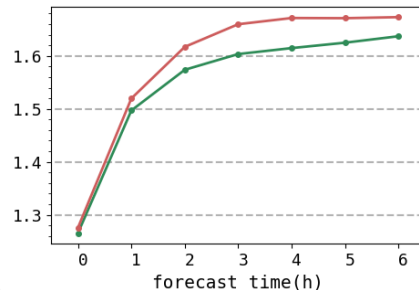
2025-08-30 00Z – 2025-09-04 23Z

2-m Temperature (K)

RMSE of T2m(K) Analysis
2025-04-26_01:00Z to 2025-04-30_23:00Z

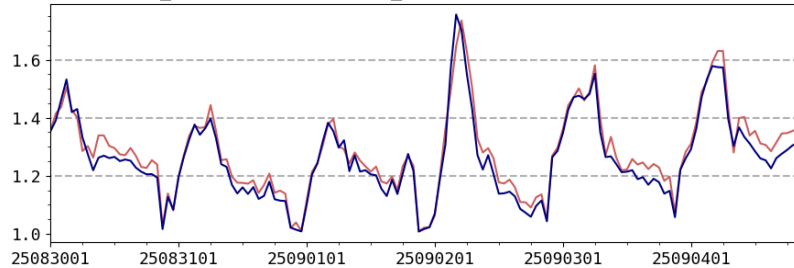


RMSE of T2m(K)
0-6h forecast

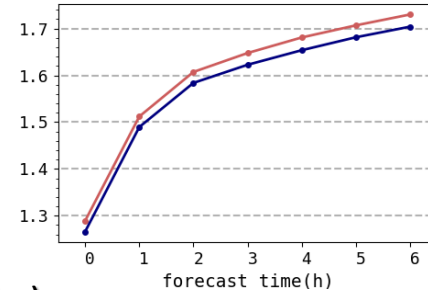


2-m Temperature (K)

RMSE of T2m(K) Analysis
2025-08-30_01:00Z to 2025-09-04_23:00Z

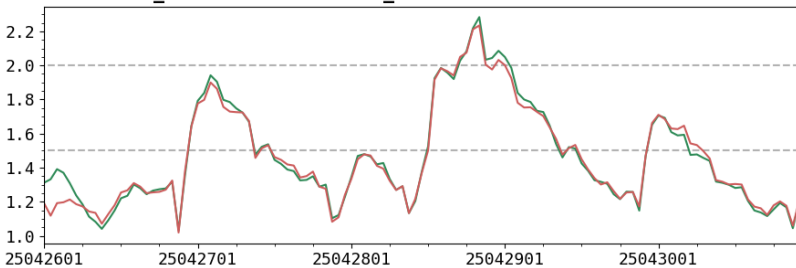


RMSE of T2m(K)
0-6h forecast

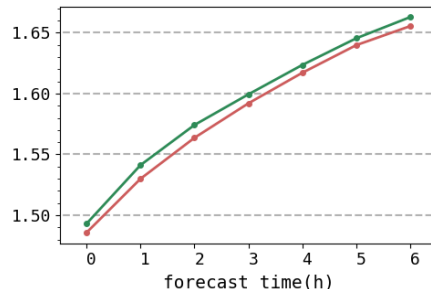


2-m Humidity (g/kg)

RMSE of Q2m(g/kg) Analysis
2025-04-26_01:00Z to 2025-04-30_23:00Z

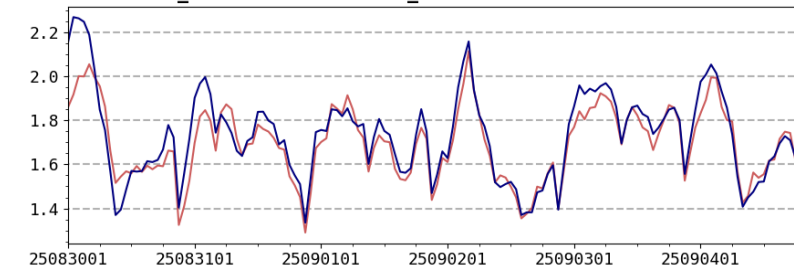


RMSE of Q2m(g/kg)
0-6h forecast

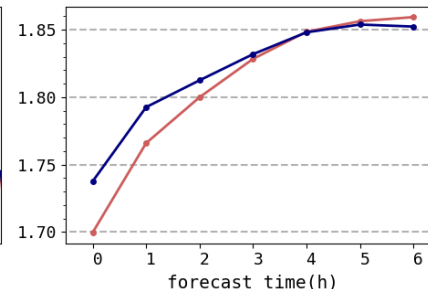


2-m Humidity (g/kg)

RMSE of Q2m(g/kg) Analysis
2025-08-30_01:00Z to 2025-09-04_23:00Z

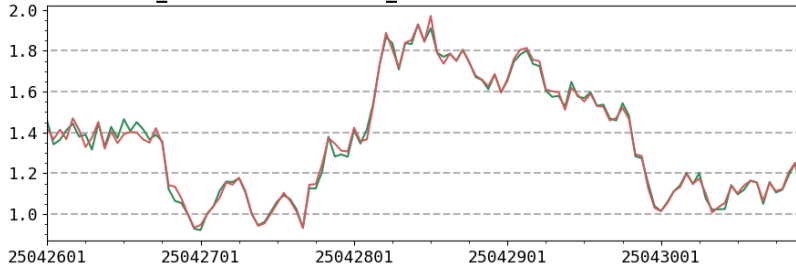


RMSE of Q2m(g/kg)
0-6h forecast

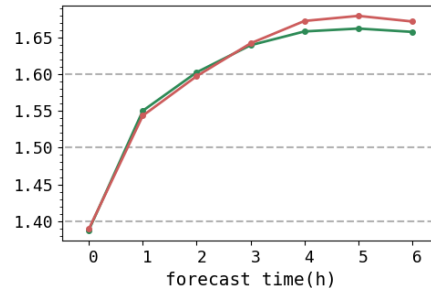


10-m wind speed (m/s)

RMSE of Wind_speed(m/s) Analysis
2025-04-26_01:00Z to 2025-04-30_23:00Z

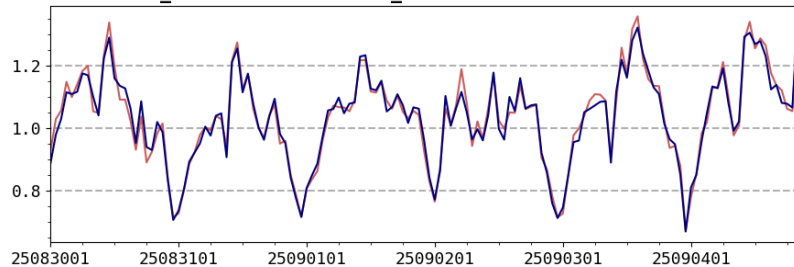


RMSE of Wind_speed(m/s)
0-6h forecast

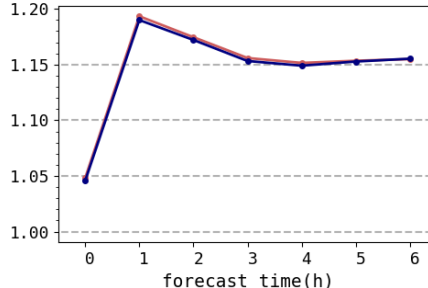


10-m wind speed (m/s)

RMSE of Wind_speed(m/s) Analysis
2025-08-30_01:00Z to 2025-09-04_23:00Z



RMSE of Wind_speed(m/s)
0-6h forecast





TARRA 產品列表

Product type	Output frequency	Forecast length	Data format		
			Original WRF-format model-level data (NetCDF-4)	Pressure-level and single-level data on unstaggered grids, processed by wrf-python (NetCDF-4)	Pressure-level and single-level data, processed by UPP (GRIB2)
Analysis	Hourly		V	V	V
Short forecast	Every 10 minutes	1 hours	Only 1-h forecast	V	V
Extended forecast	Hourly	6 hours			V

總結



- 中央氣象署已於今年分段完成 2025 年全年臺灣區域再分析資料 (TARRA) 的產製，運算時間與資料時間的比值約為1：6。
- 地面測站及雷達觀測資料在 2025 年全年分布情況大多完整，部分時間有零散缺失。與地面測站及雨量觀測的校驗結果顯示：TARRA 資料各變數的分析及短期預報場與氣象署作業之 RWRF 系統資料品質相近，且相較於 ERA5 資料有較小誤差，更能精確地分析臺灣區域中小尺度的天氣狀態。
- TARRA 產出原始 WRF model-level 資料 (NetCDF-4)、以及氣壓層與單層 (NetCDF-4/GRIB2) 資料，以逐時 (部分資料逐10分鐘) 頻率提供使用，另提供 6 小時預報範圍之逐時 GRIB2 資料。