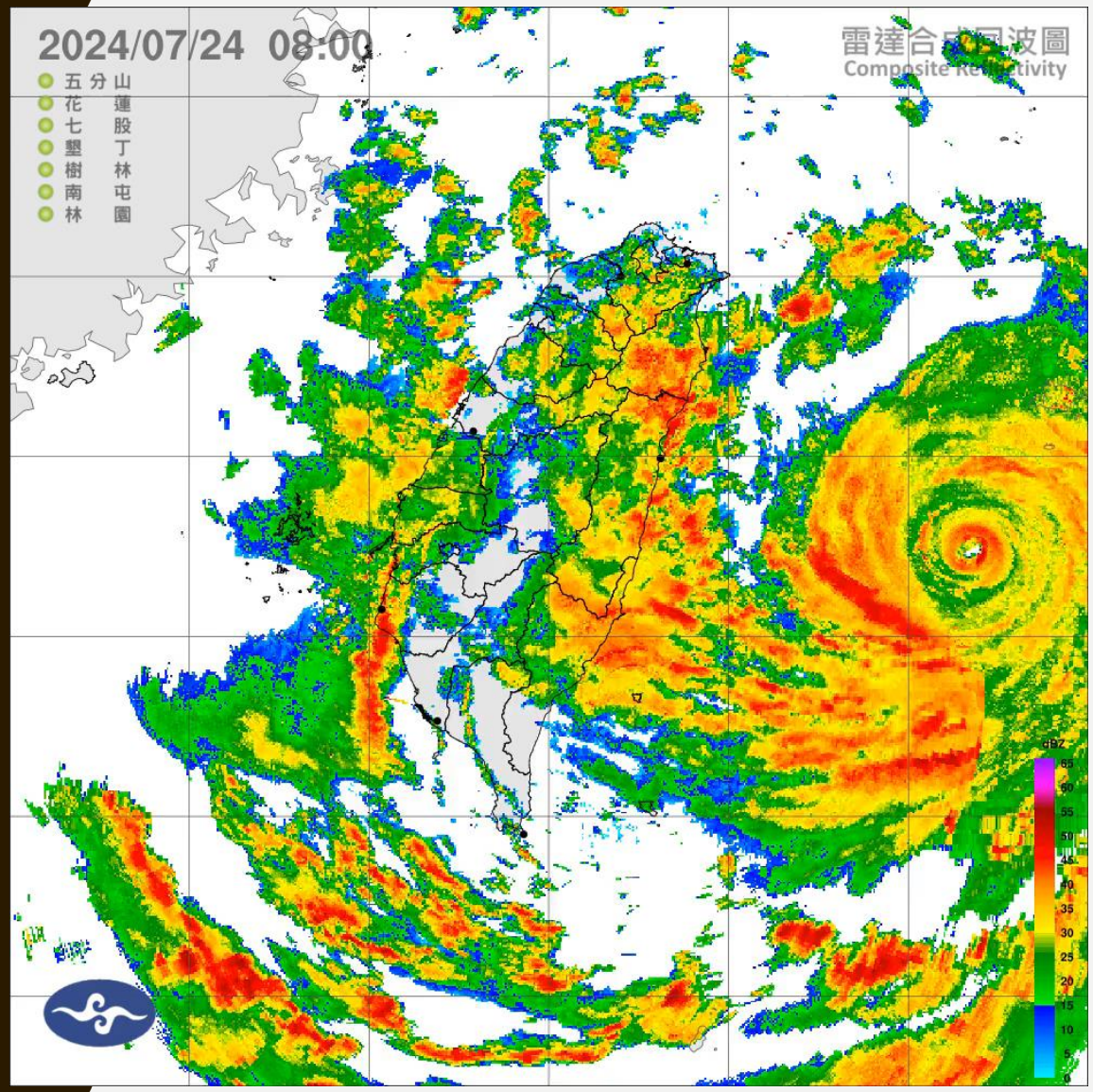
數值模式對凱米颱風預報結果分析

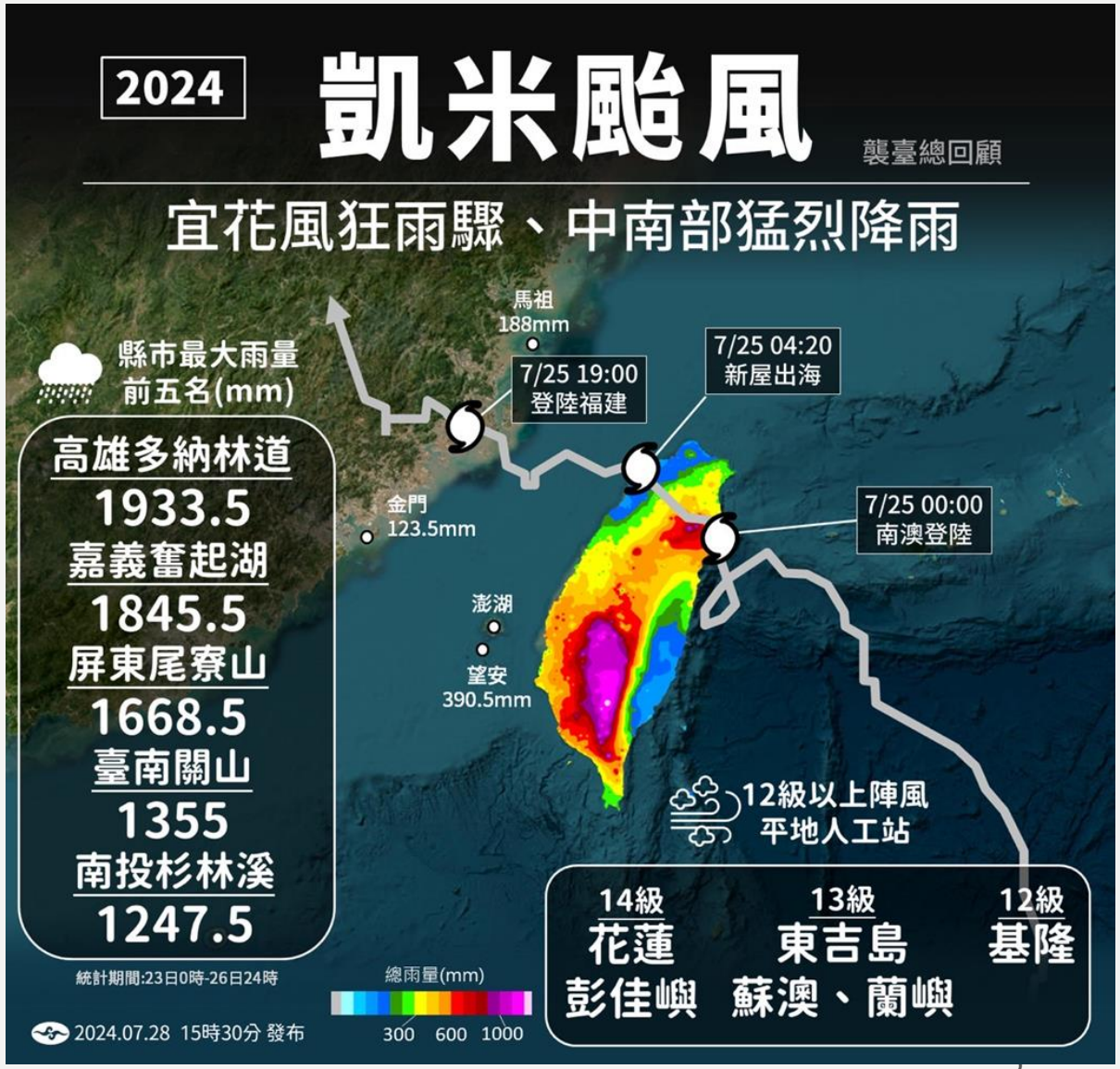
陳得松、NWP團隊

中央氣象署

113年第三十八屆天氣分析與預報研討會
2024/09/03

凱米颱風路徑繞圈、極端降雨





NWP模式TWRF/TGFS/NCEP/EC

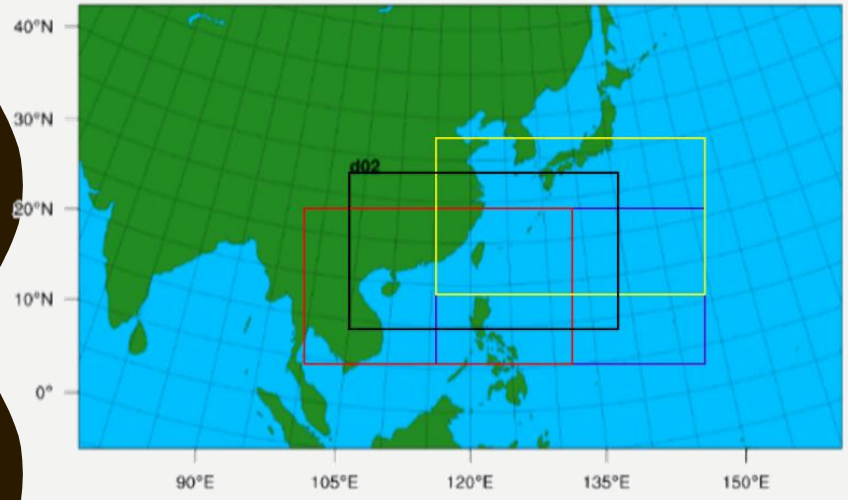
EC: ~9km

NCEP: ~13km

TWRF: 15/3km nest

TGFS: 25/4.8km nest

TWRF_OP



Resolution	Grid points	Vertical level	Model top
15 km	662 X 386	52	20 hPa
3 km	1161 X 676	52	20 hPa

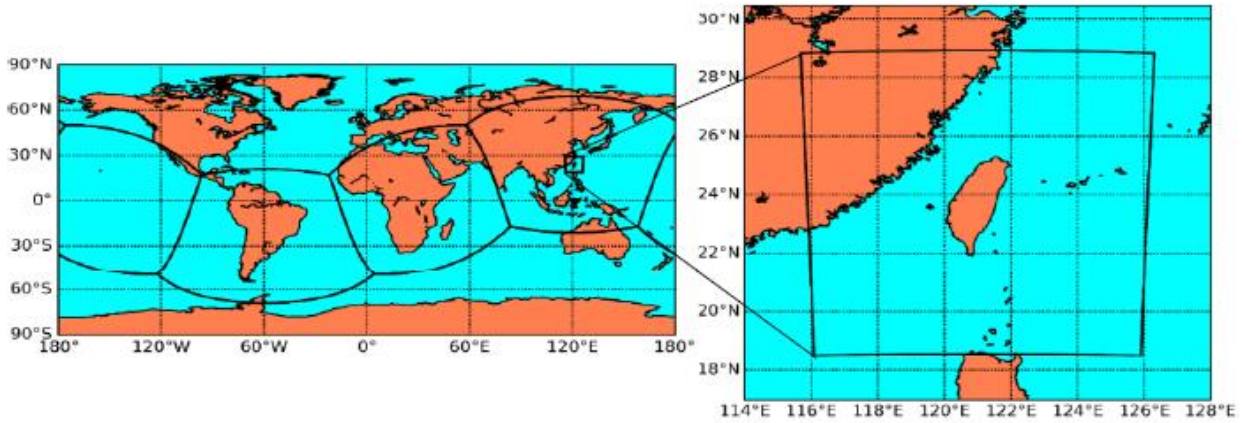
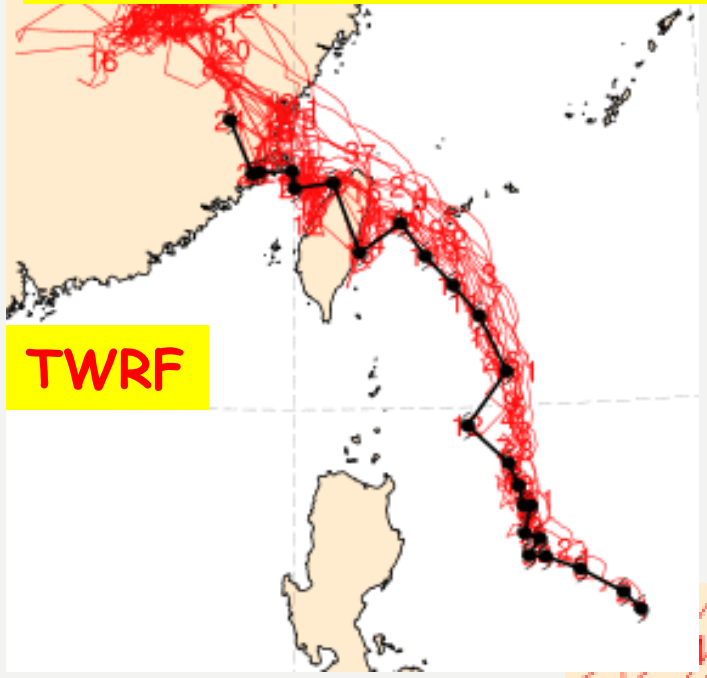
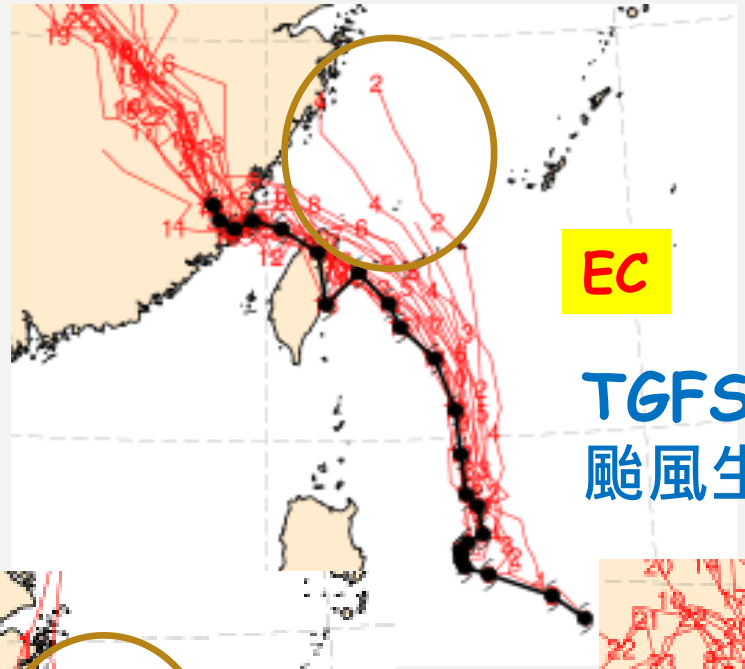


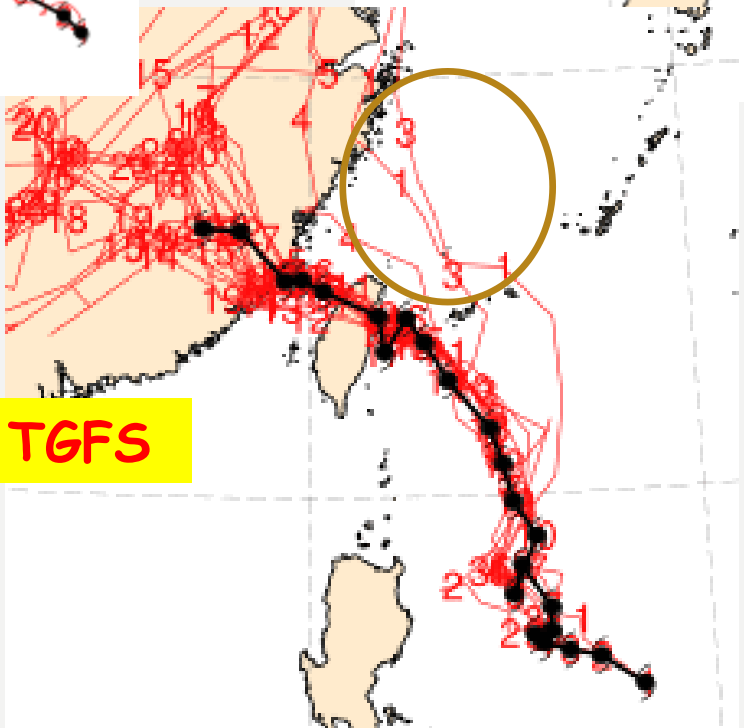
圖 1. 中央氣象局 FV3GFS 全球及巢狀網格配置。全球區域由六個面組成（左圖：解析度約 25 公里；C384T），巢狀網格（右圖：解析度約 4.8 公里）同時針對臺灣周圍進行預報工作。

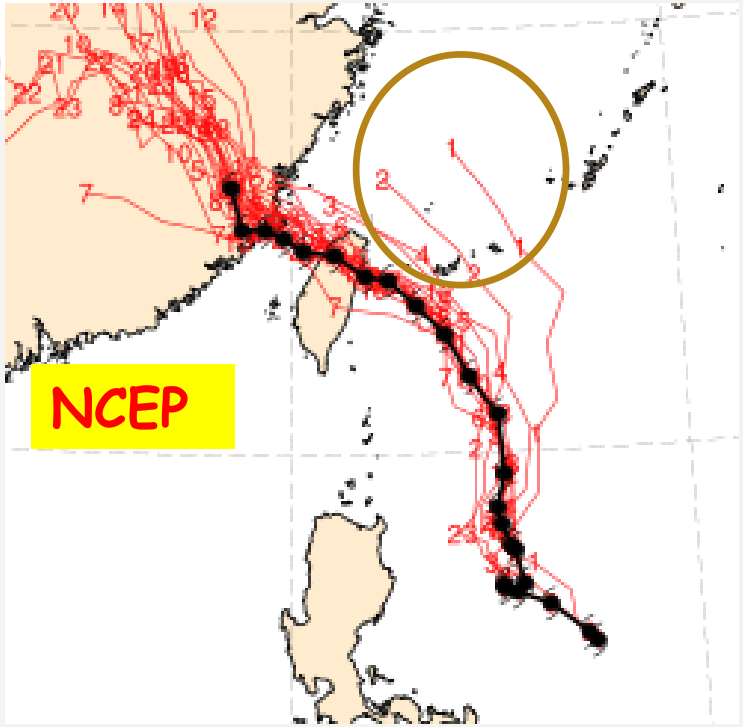
NWP模式TWRF/TGFS/NCEP/EC對凱米颱風之預報



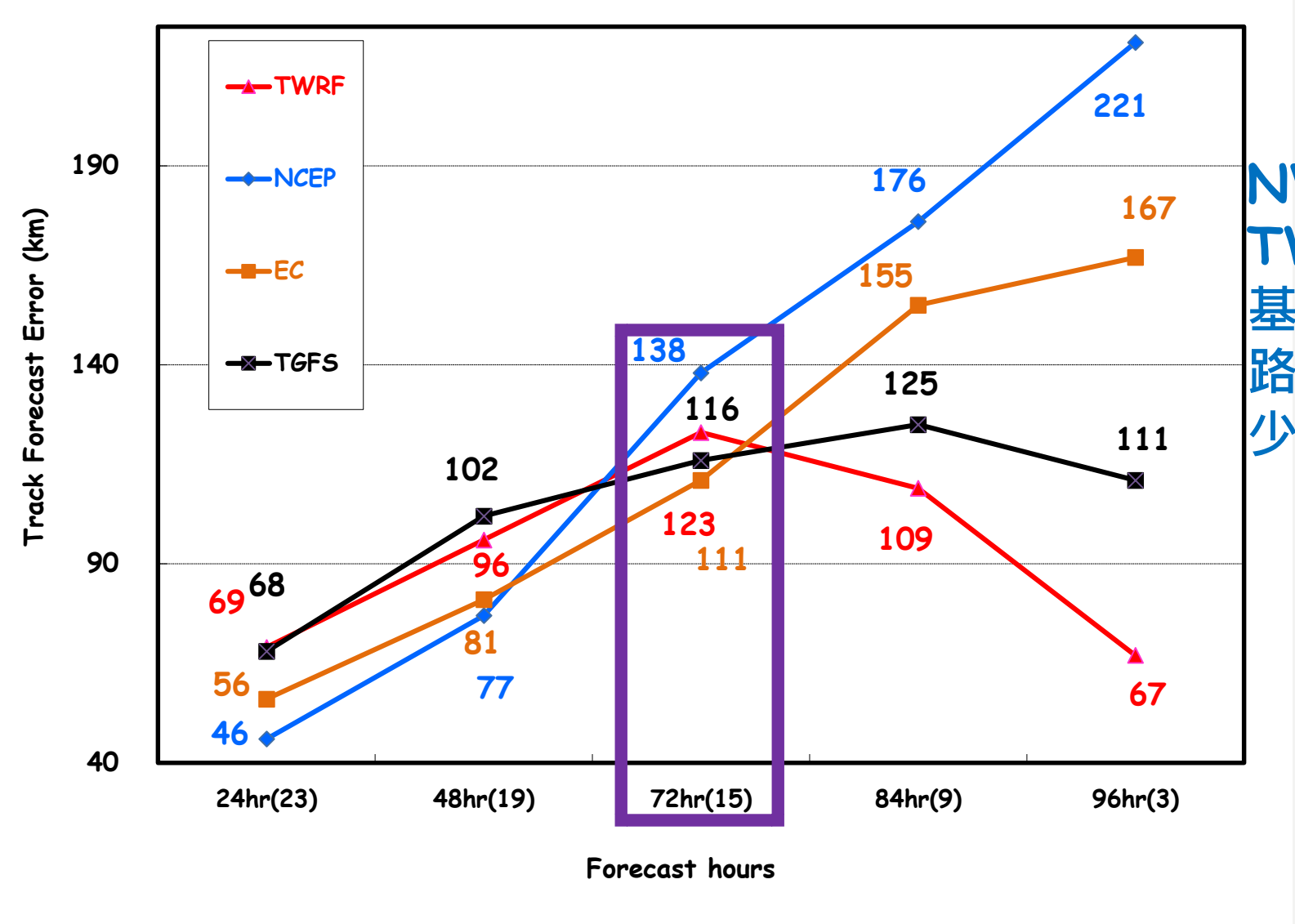


TGFS/NCEP/EC在凱米
颱風生成初期有偏北誤差

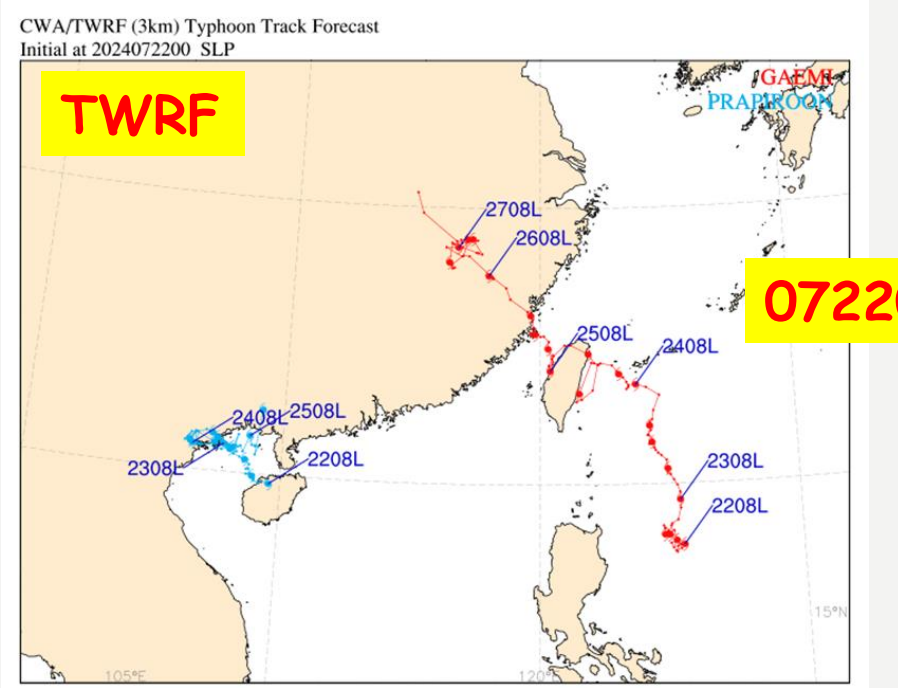




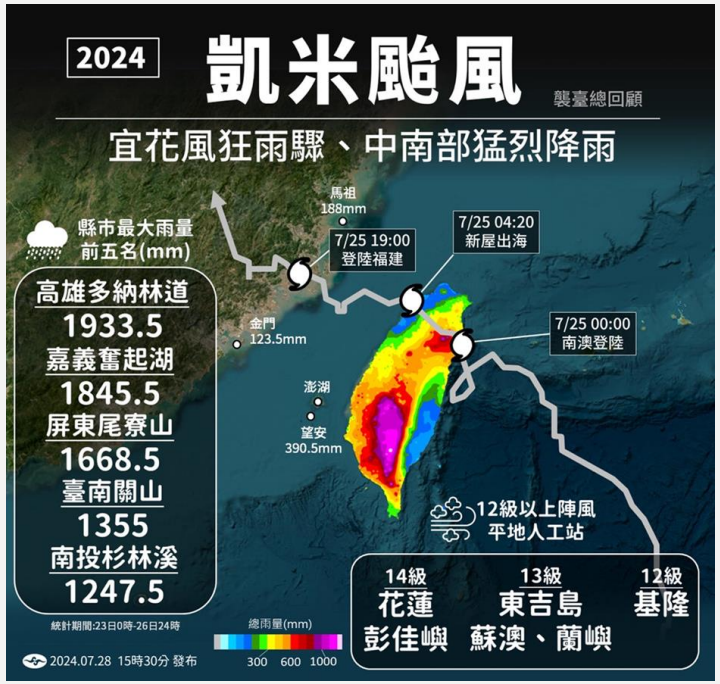
TWRF/TGFS/NCEP/EC對凱米颱風之路徑預報誤差 (homogeneous)

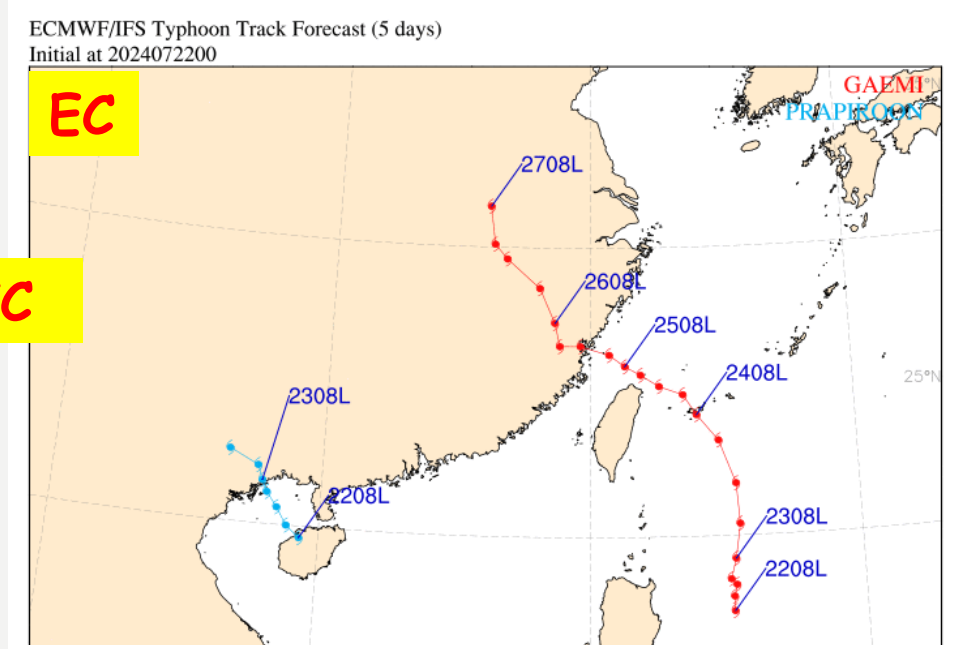


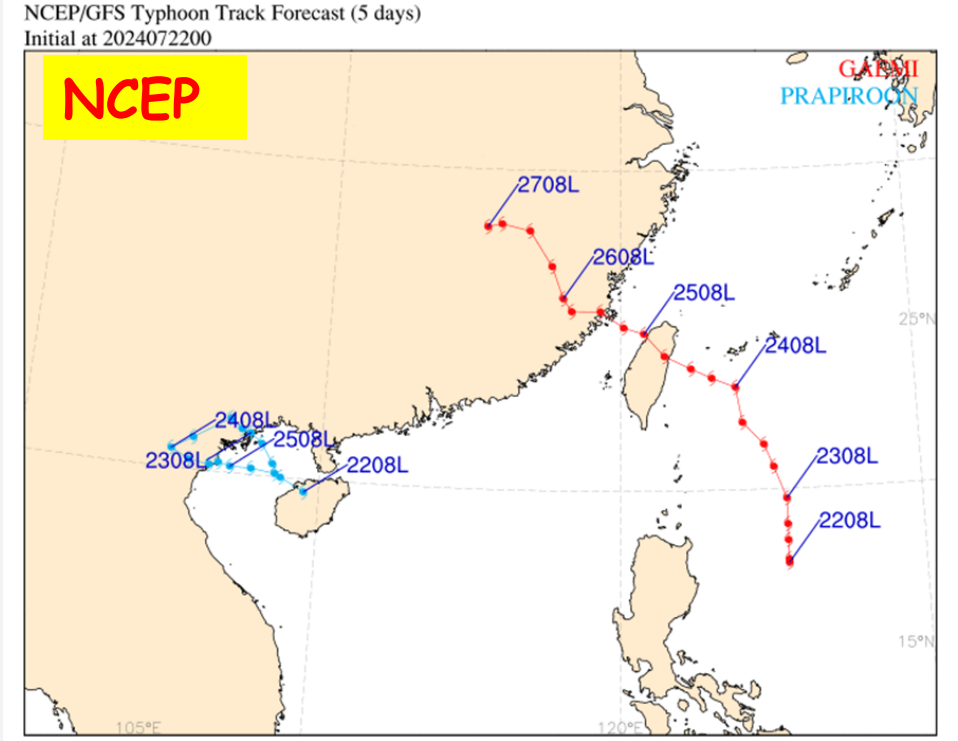
NWP模式TWRF/TGFS/NCEP/EC基本可掌握凱米颱風移動路徑，72小時預報誤差皆少於140公里


CWA/TWRF (3km) Typhoon Track Forecast
Initial at 2024072200 SLP
TWRF
GAEMI
PRAPIROON
2708L
2608L
2508L
2408L
2308L
2208L
2408L
2508L
2308L
2208L
15°N
105°E
120°E

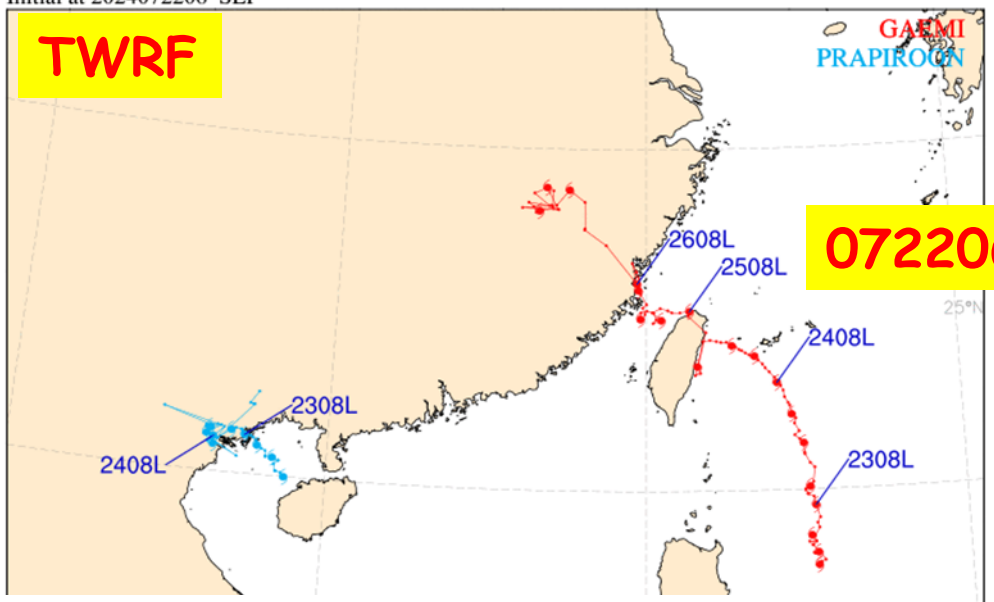
072200 UTC


2024
凱米颱風
襲臺總回顧
宜花風狂雨驟、中南部猛烈降雨
縣市最大雨量
前五名(mm)
高雄多納林道
1933.5
嘉義奮起湖
1845.5
屏東尾寮山
1668.5
臺南關山
1355
南投杉林溪
1247.5
統計期間:23日0時-26日24時
馬祖
188mm
7/25 19:00
登陸福建
7/25 04:20
新屋出海
7/25 00:00
南澳登陸
金門
123.5mm
澎湖
望安
390.5mm
12級以上陣風
平地人工站
14級
花蓮
彭佳嶼
13級
東吉島
蘇澳、蘭嶼
12級
基隆
總雨量(mm)
300 600 1000
2024.07.28 15時30分 發布

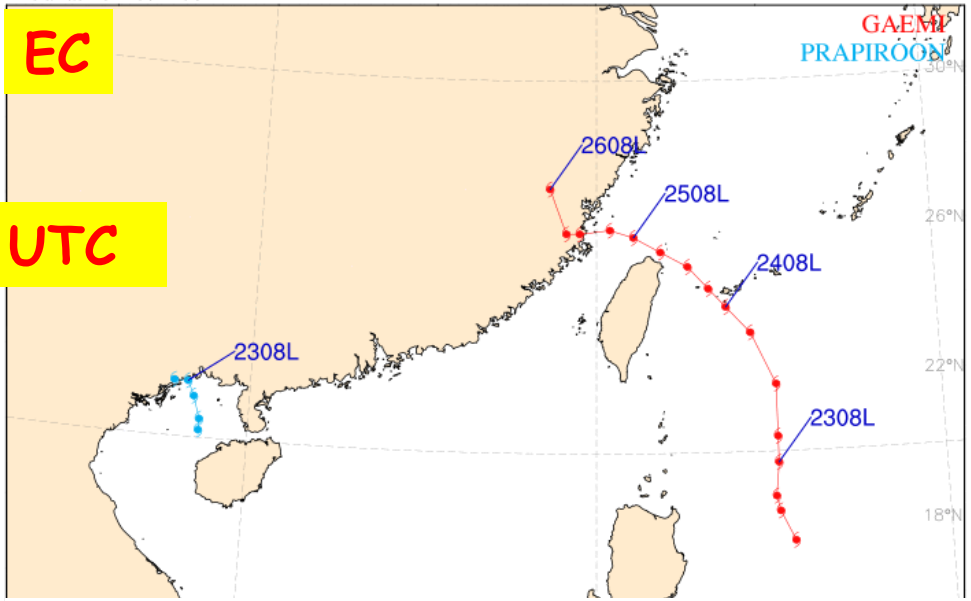

ECMWF/IFS Typhoon Track Forecast (5 days)
Initial at 2024072200
EC
GAEMI
PRAPIROON
2708L
2608L
2508L
2408L
2308L
2208L
2308L
2208L
25°N


NCEP/GFS Typhoon Track Forecast (5 days)
Initial at 2024072200
NCEP
GAEMI
PRAPIROON
2708L
2608L
2508L
2408L
2308L
2208L
2408L
2508L
2308L
2208L
25°N
15°N
105°E
120°E

CWA/TWRF (3km) Typhoon Track Forecast
Initial at 2024072206 SLP

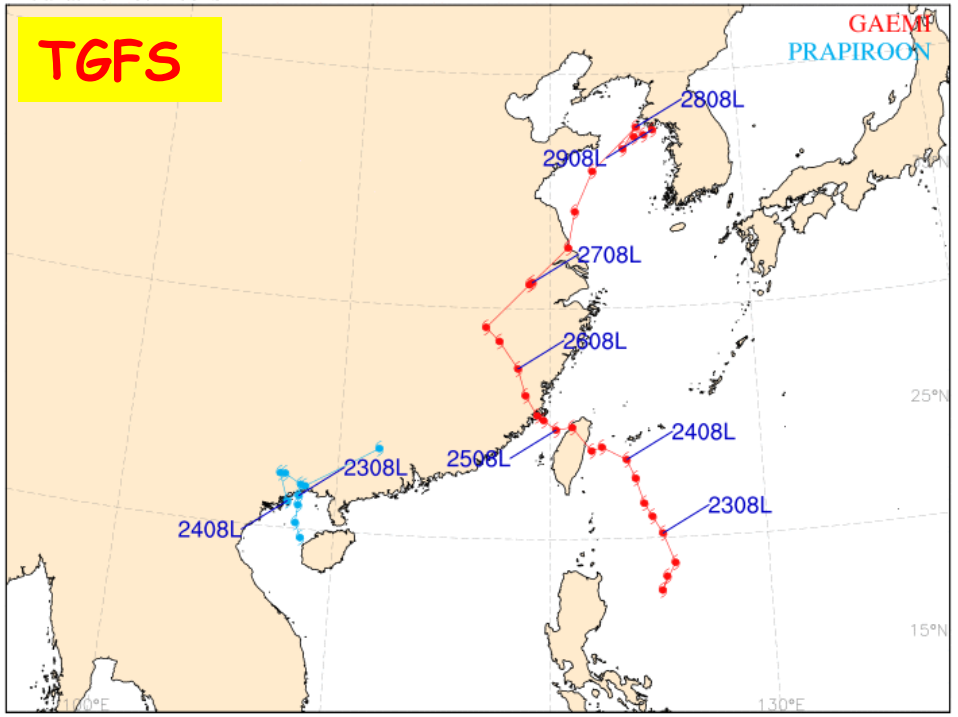


ECMWF/IFS Typhoon Track Forecast (5 days)
Initial at 2024072206

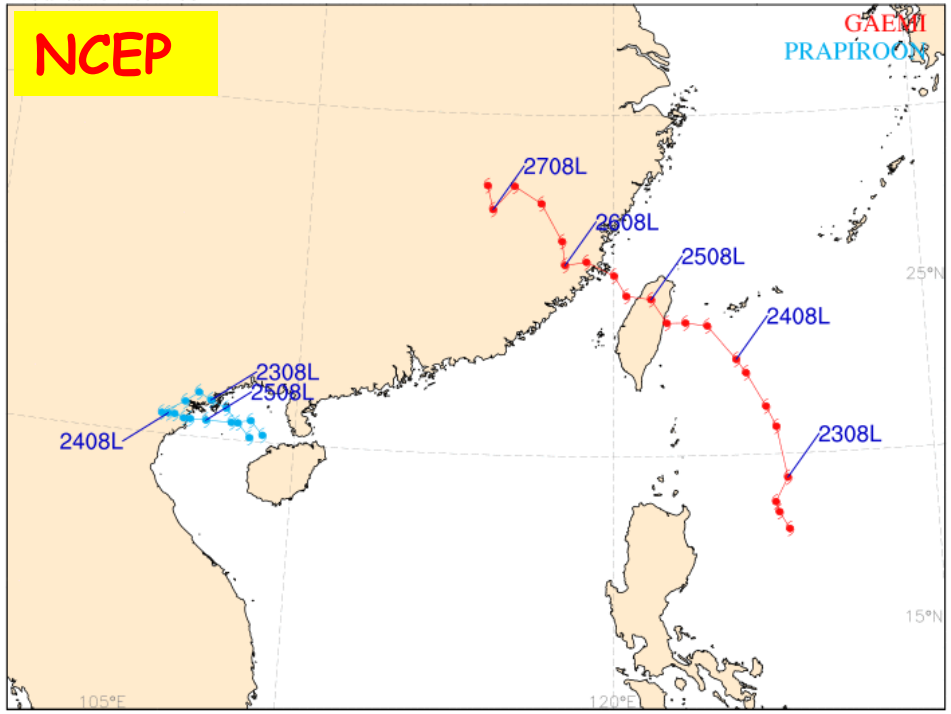


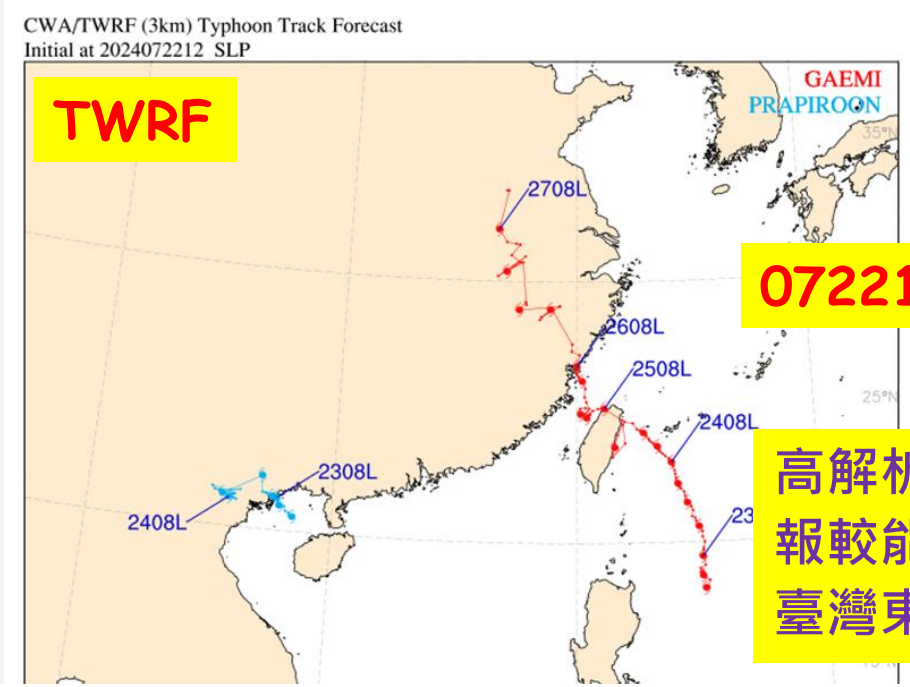
072206 UTC

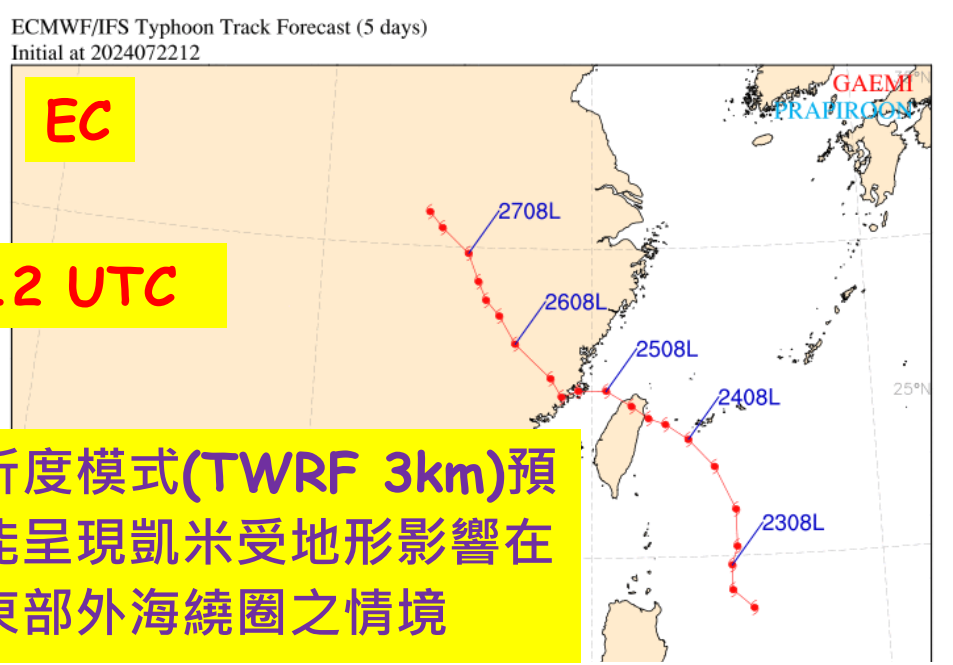
CWA/TGFS Typhoon Track Forecast
Initial at 2024072206 SLP



NCEP/GFS Typhoon Track Forecast (5 days)
Initial at 2024072206

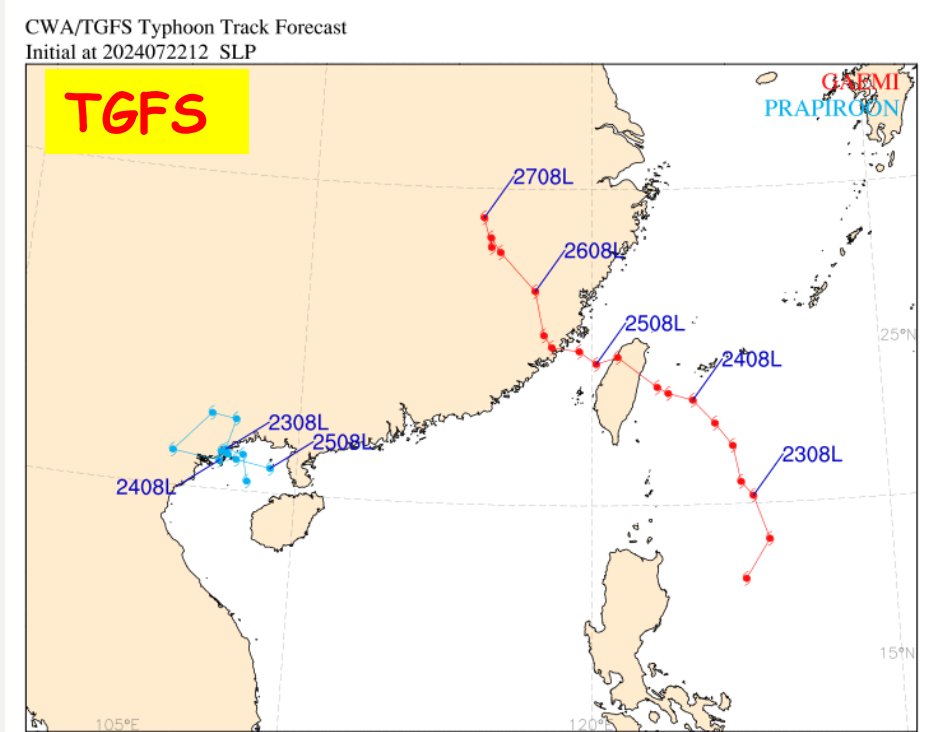


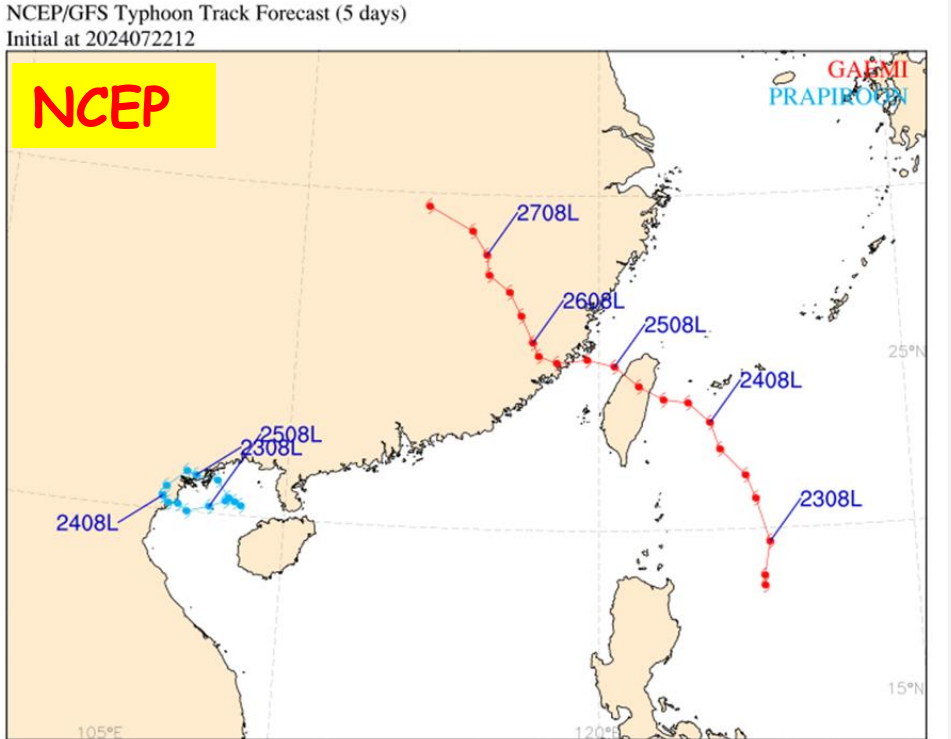


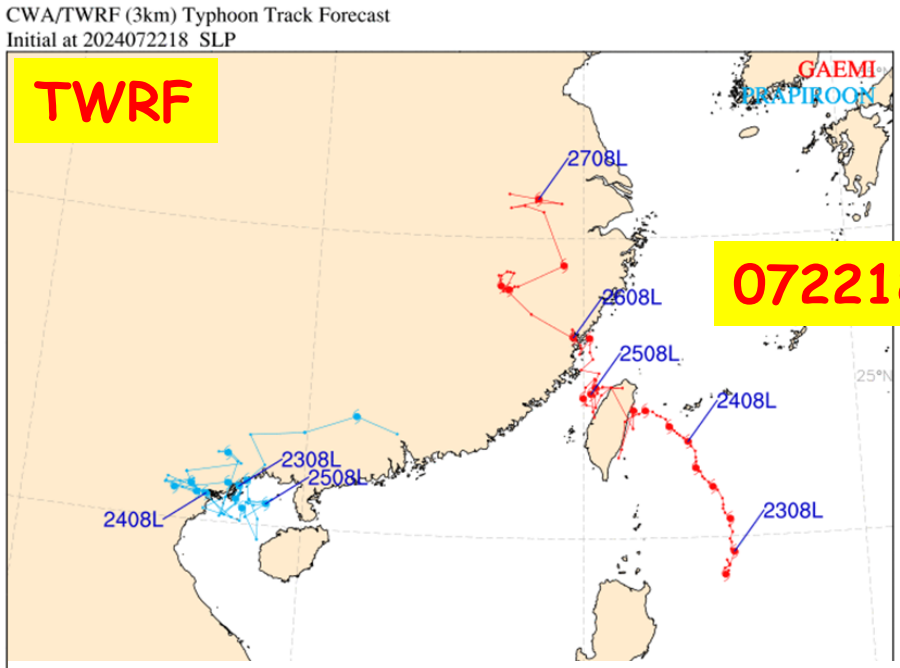


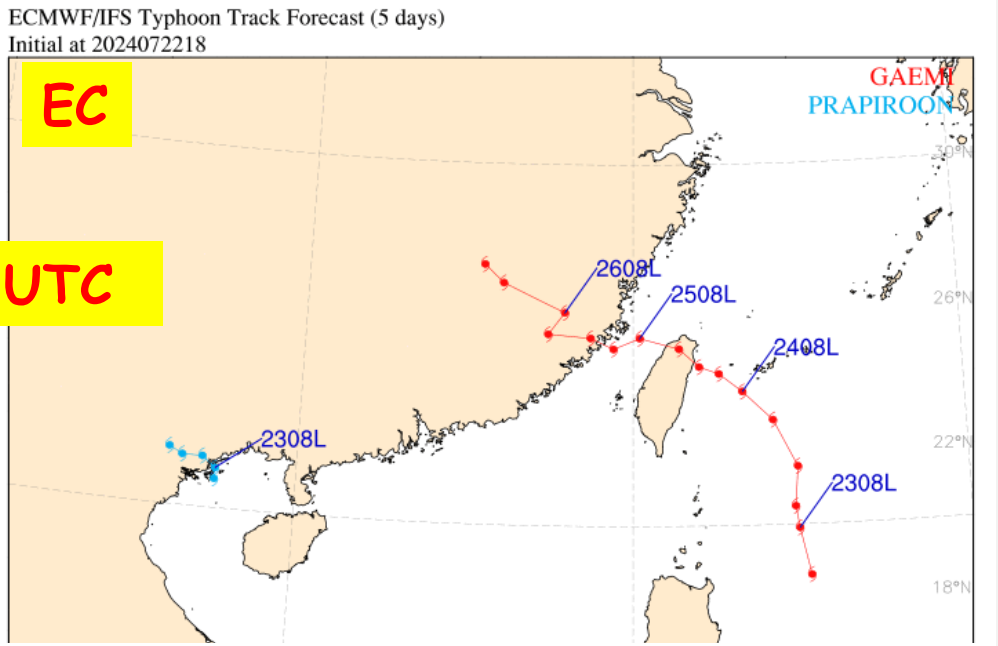
072212 UTC

高解析度模式(TWRF 3km)預報較能呈現凱米受地形影響在臺灣東部外海繞圈之情境

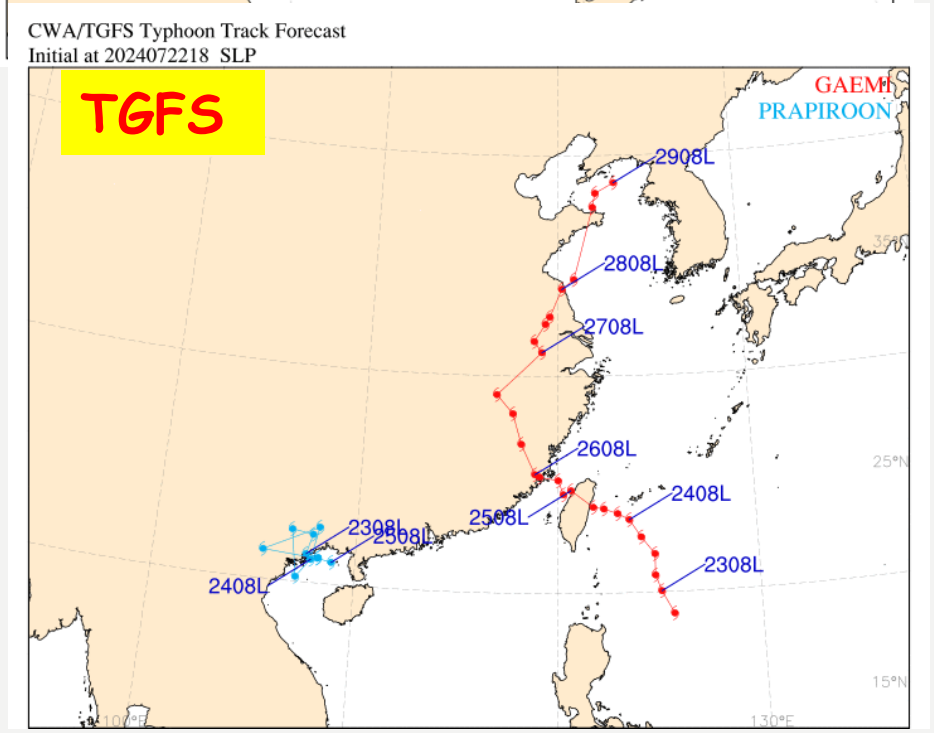


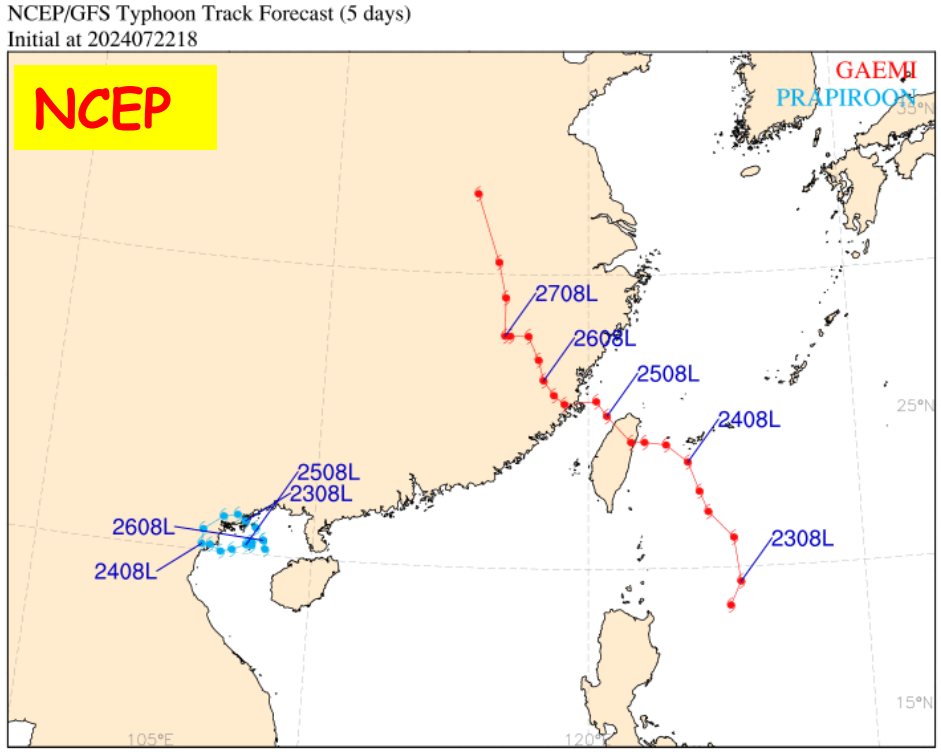


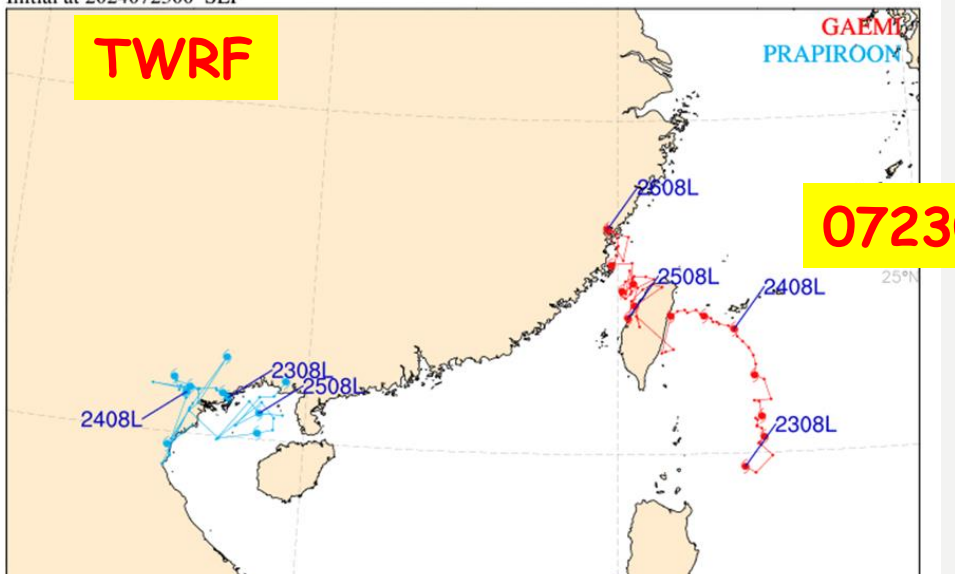

CWA/TWRF (3km) Typhoon Track Forecast
Initial at 2024072218 SLP
TWRF
GAEMI
PRAPIROON
2708L
2608L
2508L
2408L
2308L
2308L
2508L
2408L
2308L


ECMWF/IFS Typhoon Track Forecast (5 days)
Initial at 2024072218
EC
GAEMI
PRAPIROON
2608L
2508L
2408L
2308L
2308L
30°N
26°N
22°N
18°N

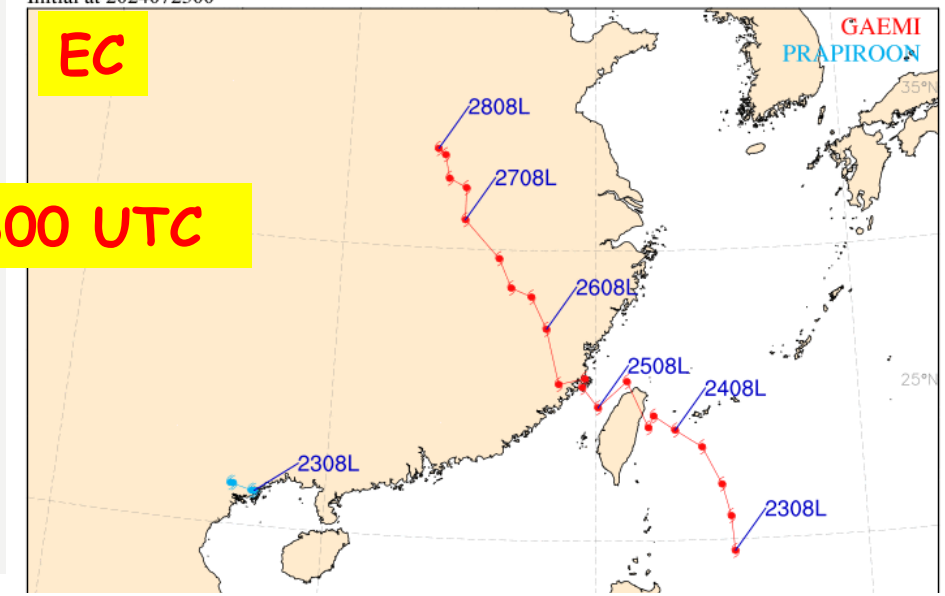
072218 UTC

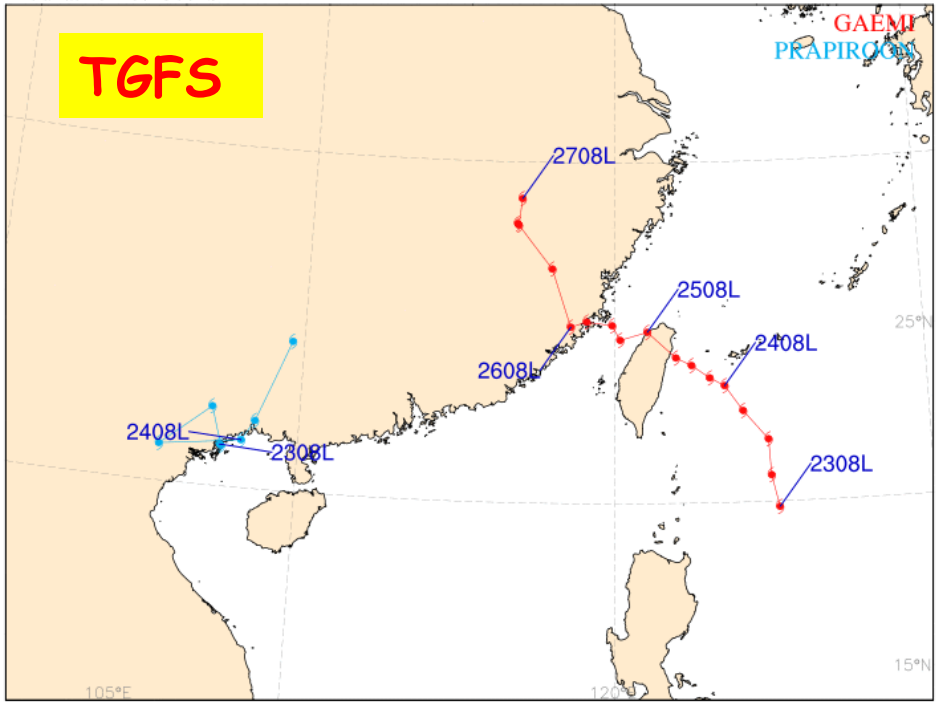

CWA/TGFS Typhoon Track Forecast
Initial at 2024072218 SLP
TGFS
GAEMI
PRAPIROON
2908L
2808L
2708L
2608L
2408L
2308L
2308L
2508L
2508L
2408L
25°N
15°N
100°E
130°E

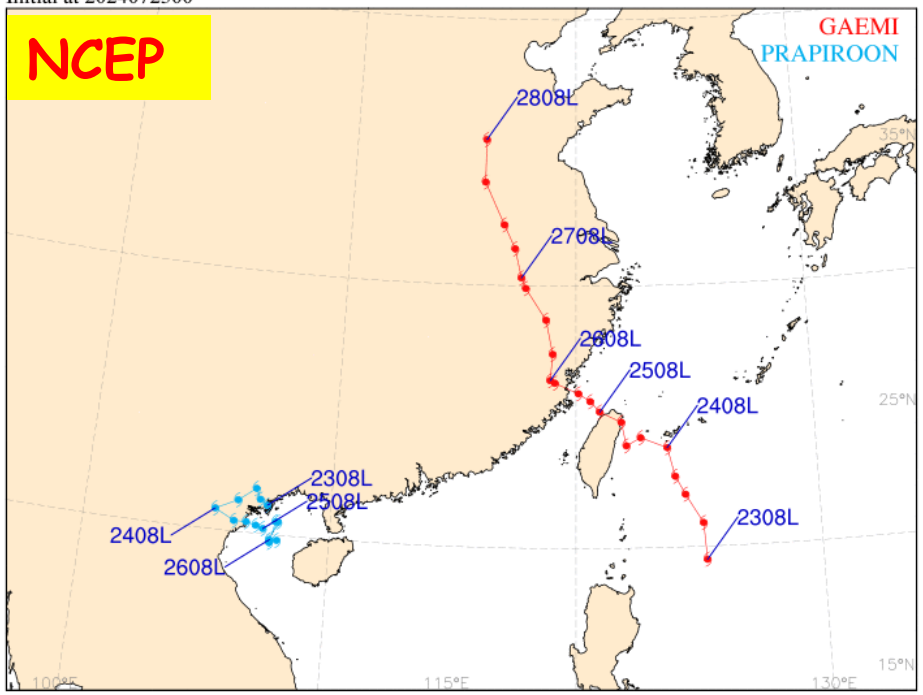

NCEP/GFS Typhoon Track Forecast (5 days)
Initial at 2024072218
NCEP
GAEMI
PRAPIROON
2708L
2608L
2508L
2408L
2308L
2508L
2308L
2608L
2408L
25°N
15°N
105°E
120°E


CWA/TWRF (3km) Typhoon Track Forecast
Initial at 2024072300 SLP
TWRF
GAEMI
PRAPIROON
2508L
2508L
2408L
2308L
2508L
2408L
2308L
25°N

072300 UTC


ECMWF/IFS Typhoon Track Forecast (5 days)
Initial at 2024072300
EC
GAEMI
PRAPIROON
2808L
2708L
2608L
2508L
2408L
2308L
2308L
35°N
25°N


CWA/TGFS Typhoon Track Forecast
Initial at 2024072300 SLP
TGFS
GAEMI
PRAPIROON
2708L
2508L
2408L
2608L
2408L
2308L
2308L
25°N
15°N
105°E
120°E


NCEP/GFS Typhoon Track Forecast (5 days)
Initial at 2024072300
NCEP
GAEMI
PRAPIROON
2808L
2708L
2608L
2508L
2408L
2308L
2308L
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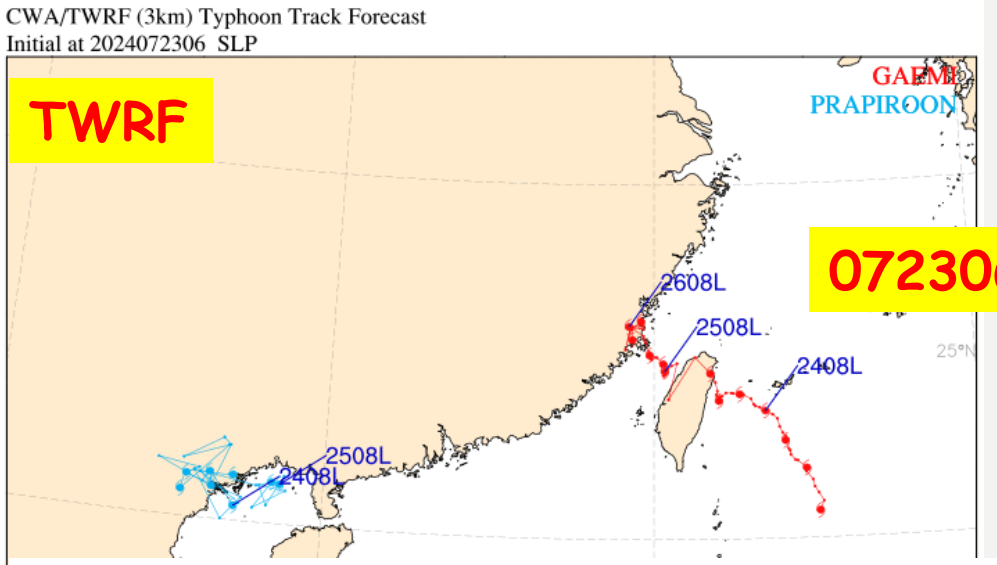
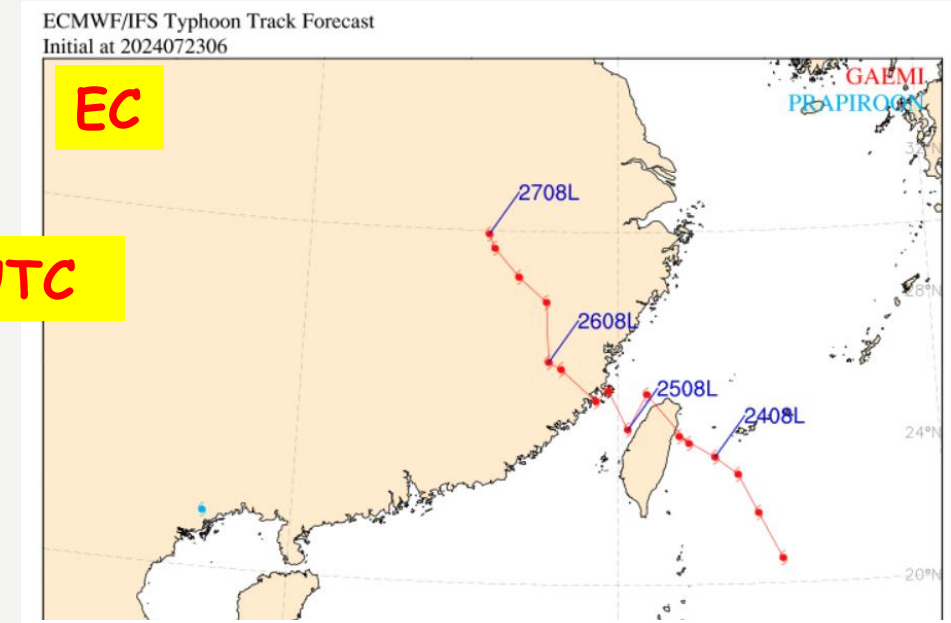
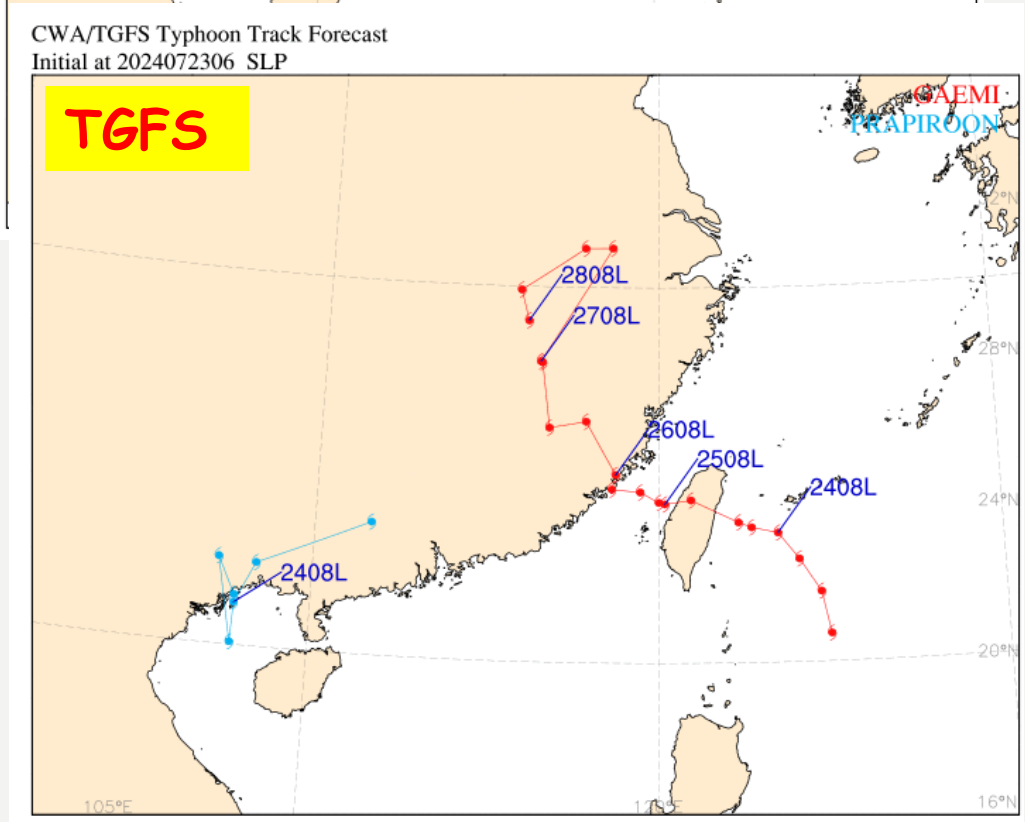
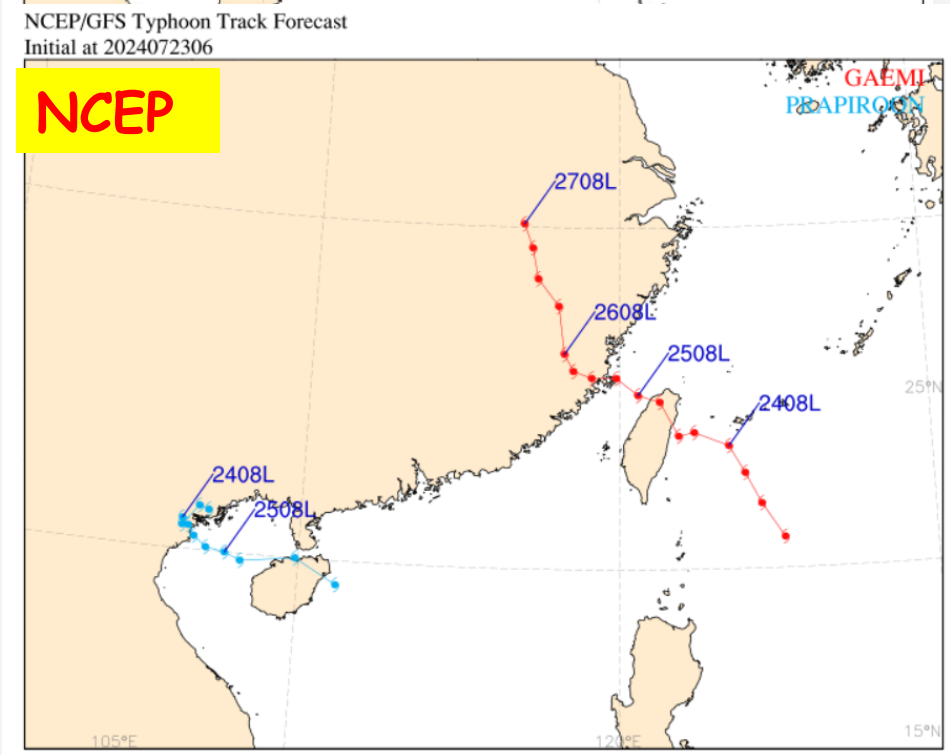
2408L
2608L
35°N
25°N
15°N
115°E
130°E


CWA/TWRF (3km) Typhoon Track Forecast
Initial at 2024072306 SLP
TWRF
GAEMI
PRAPIROON
2608L
2508L
2408L
2508L
2408L
25°N

072306 UTC


ECMWF/IFS Typhoon Track Forecast
Initial at 2024072306
EC
GAEMI
PRAPIROON
2708L
2608L
2508L
2408L
24°N
20°N


CWA/TGFS Typhoon Track Forecast
Initial at 2024072306 SLP
TGFS
GAEMI
PRAPIROON
2808L
2708L
2608L
2508L
2408L
2408L
28°N
24°N
20°N
16°N
105°E

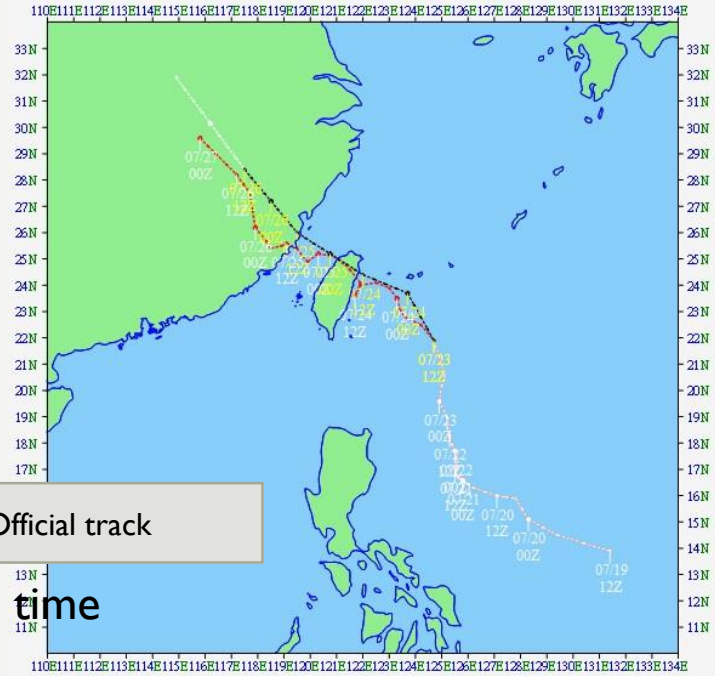

NCEP/GFS Typhoon Track Forecast
Initial at 2024072306
NCEP
GAEMI
PRAPIROON
2708L
2608L
2508L
2408L
2408L
2508L
25°N
15°N
105°E

系集模式颱風定量降水預報系統（ETQPF）

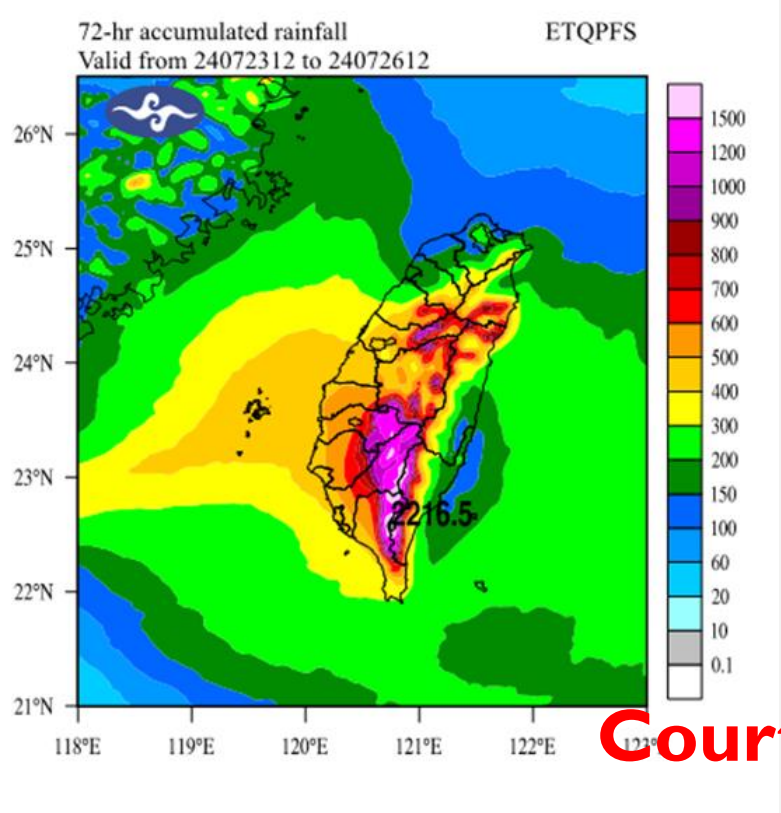
颱風在臺灣所造成的**降水量與颱風中心和臺灣**兩者之間的相對位置有著密切關係，稱為**地形鎖定效應**。涵蓋地形效應以及系集預報不確定性之系集颱風定量降水預報系統（Ensemble Typhoon Quantitative Precipitation Forecast ,ETQPF）整合中央氣象署之**颱風路徑預報與系集預報之定量降水預報資料**，當颱風進入資料輸入範圍中即會觸發系統開始進行**系集預報的颱風路徑篩選**，最後合成出**降雨預報資料**。

Jing-Shan Hong, Chin-Tzu Fong, Ling-Feng Hsiao, 2015
蘇奕叡、洪景山、李志昕 2020

颱風路徑 **(INITIAL AT 24072312)**

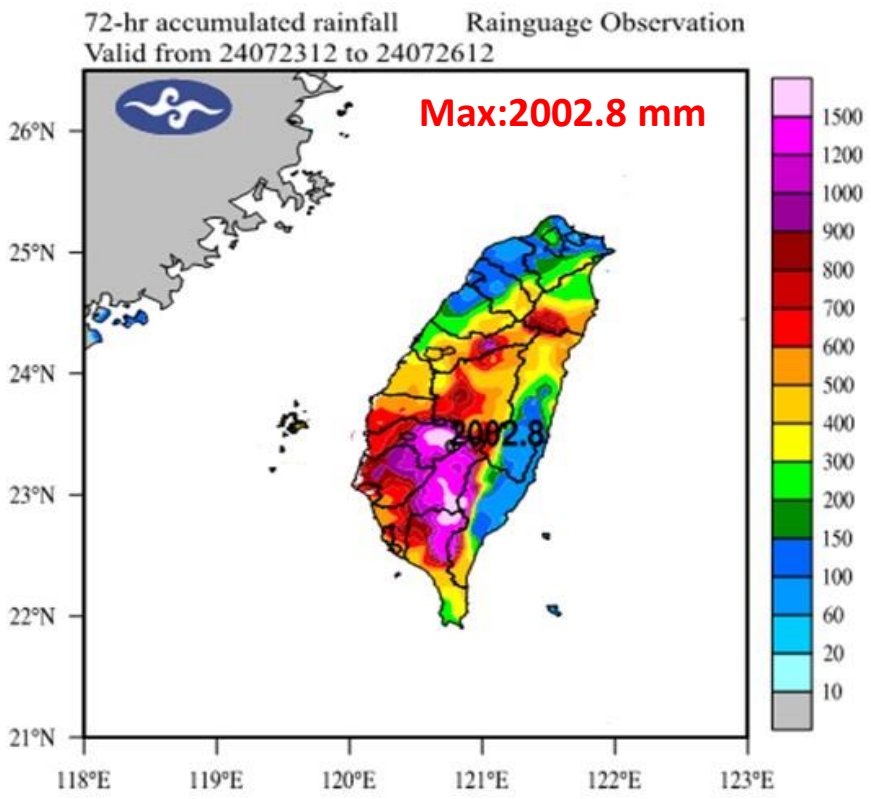


Real time



Courtesy 蘇奕叡

OBS



TWRF	TGFS-nest	ETQPF

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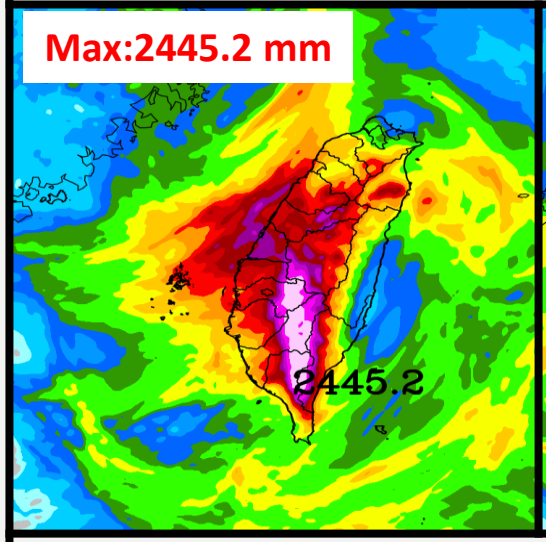

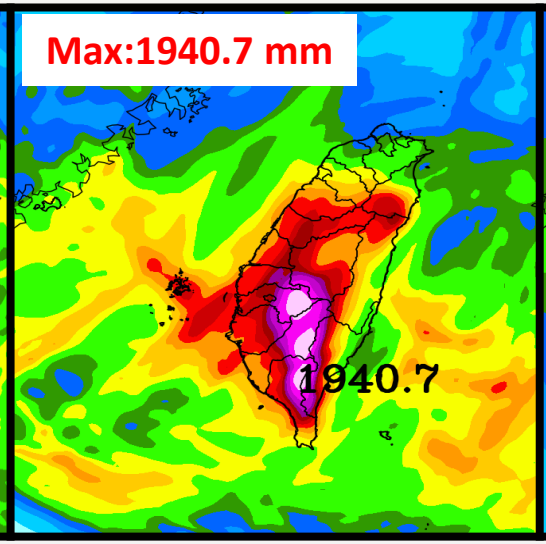

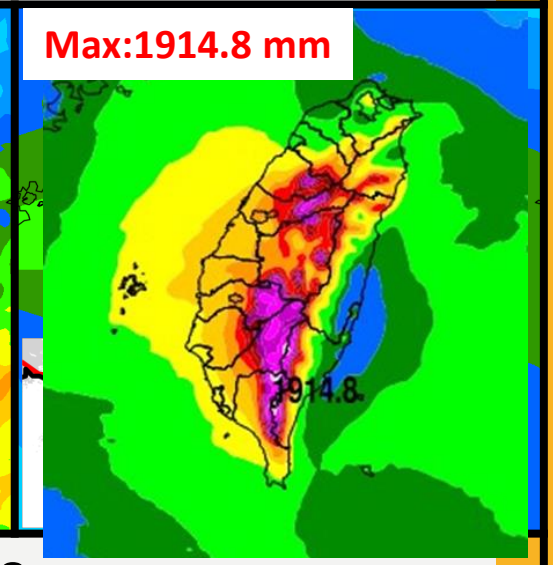

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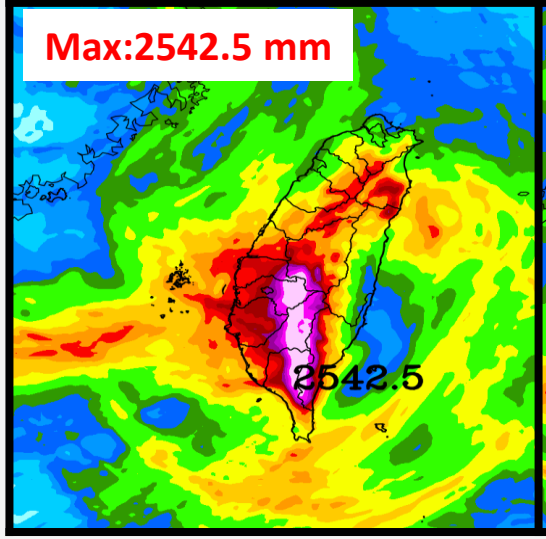

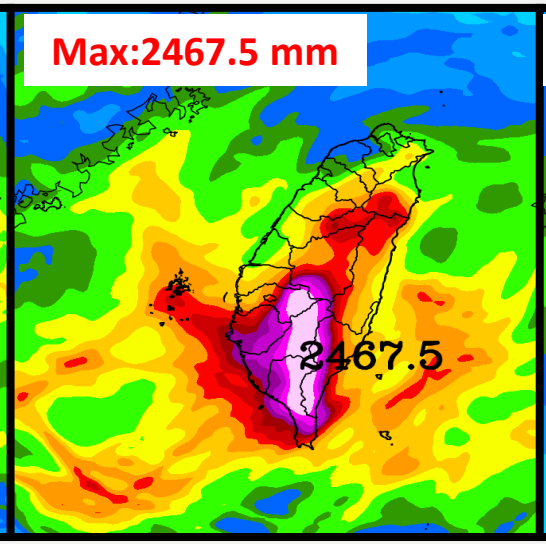

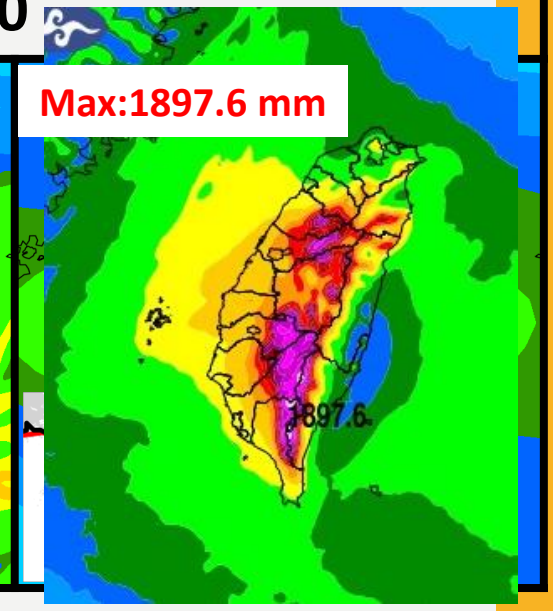

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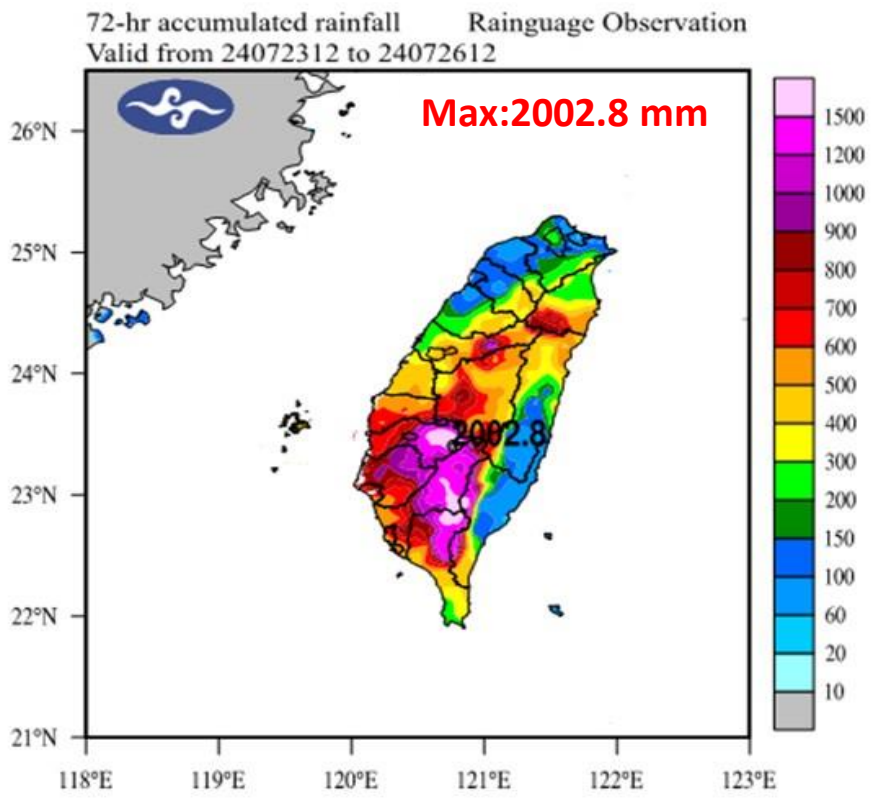

TWRF	TGFS-nest	ETQPF

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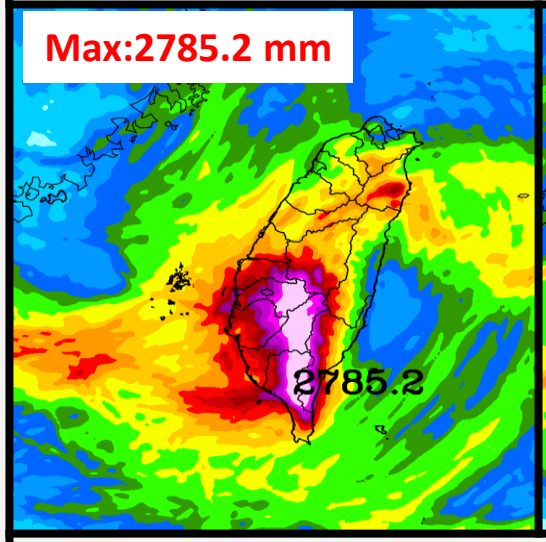

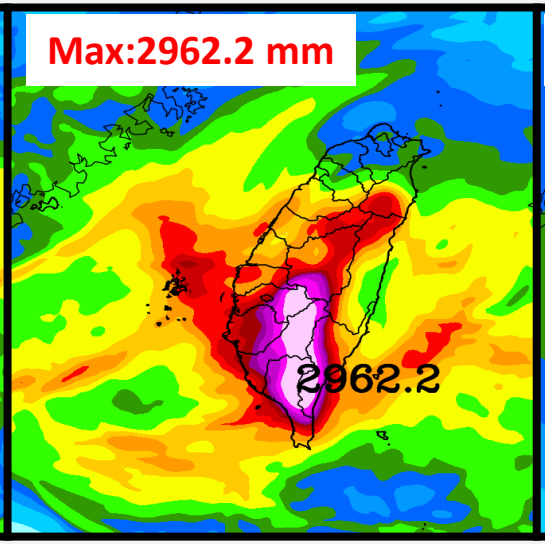

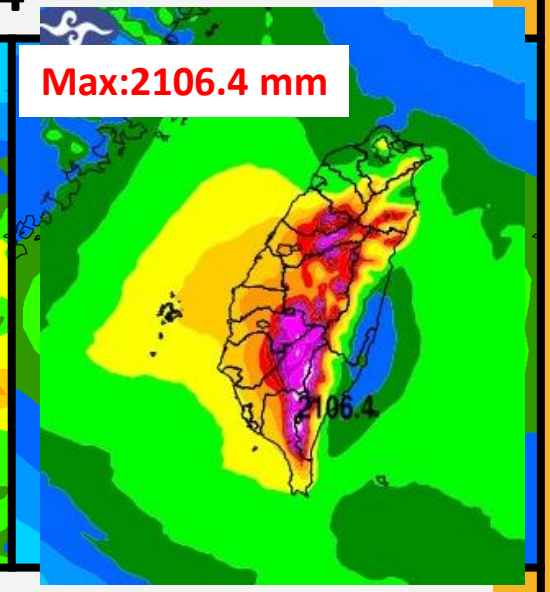

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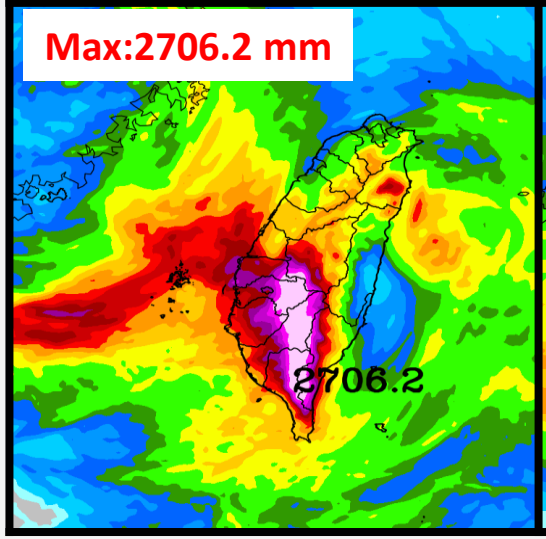

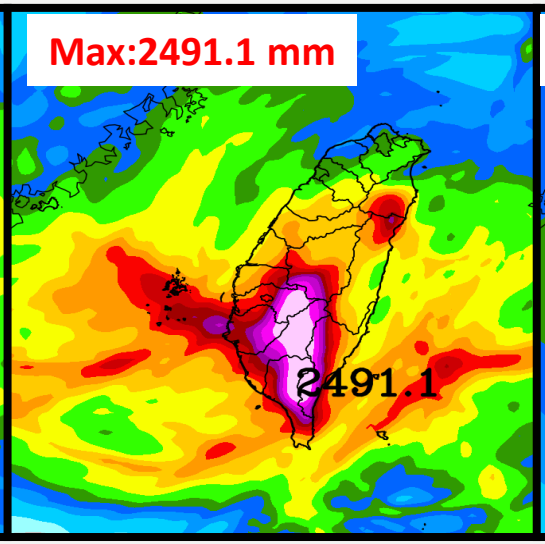

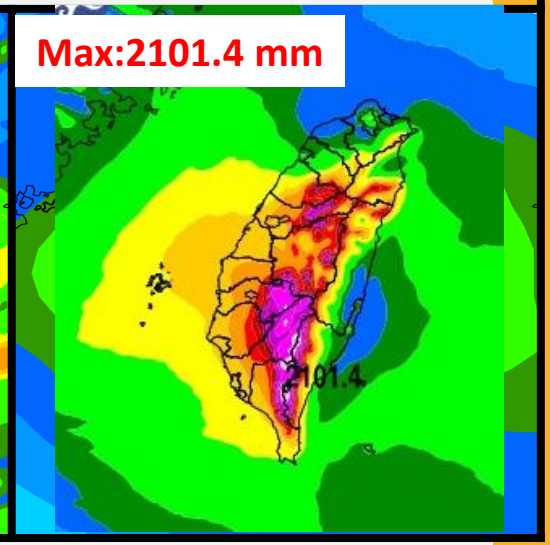

OBS	TWRF	TGFS-nest	ETQPF
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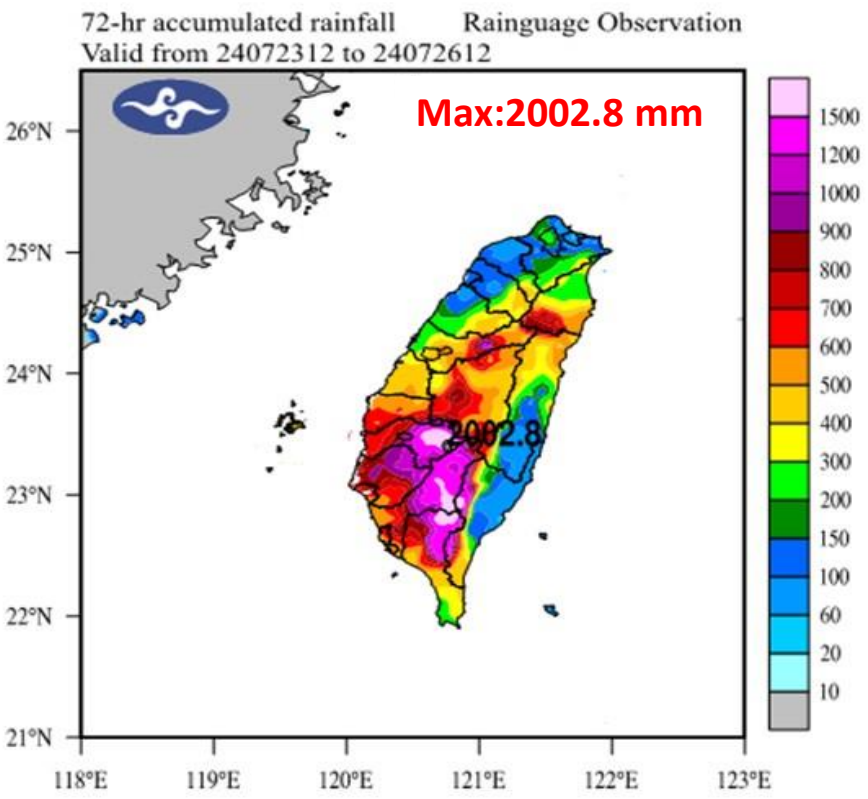
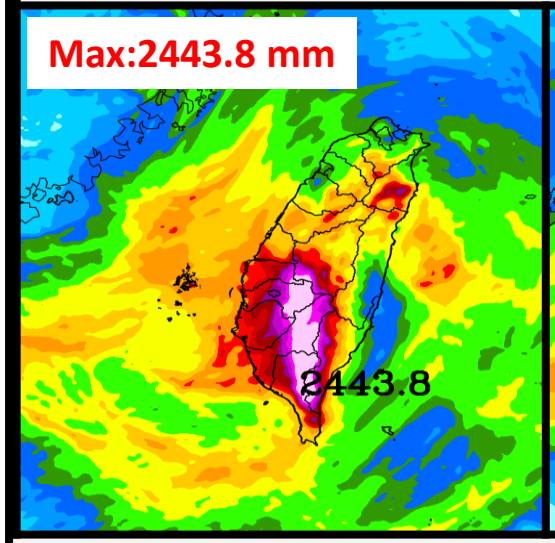
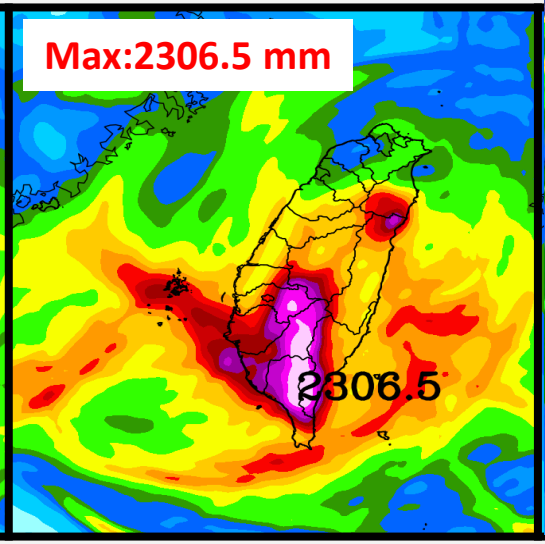
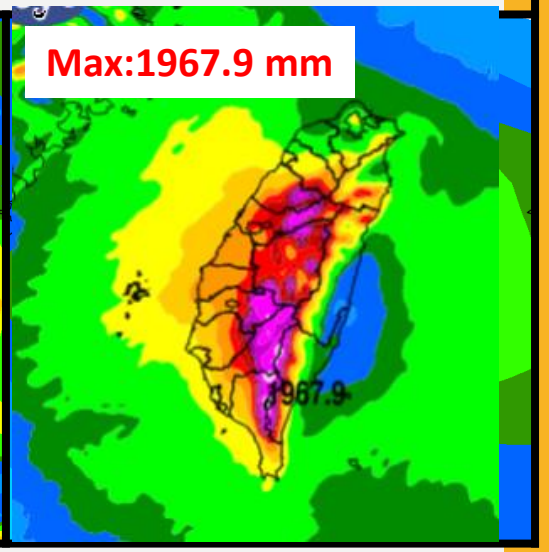








結論：

1. NWP模式TWRF/TGFS/NCEP/EC基本可掌握凱米颱風移動路徑，72小時預報誤差皆少於140公里

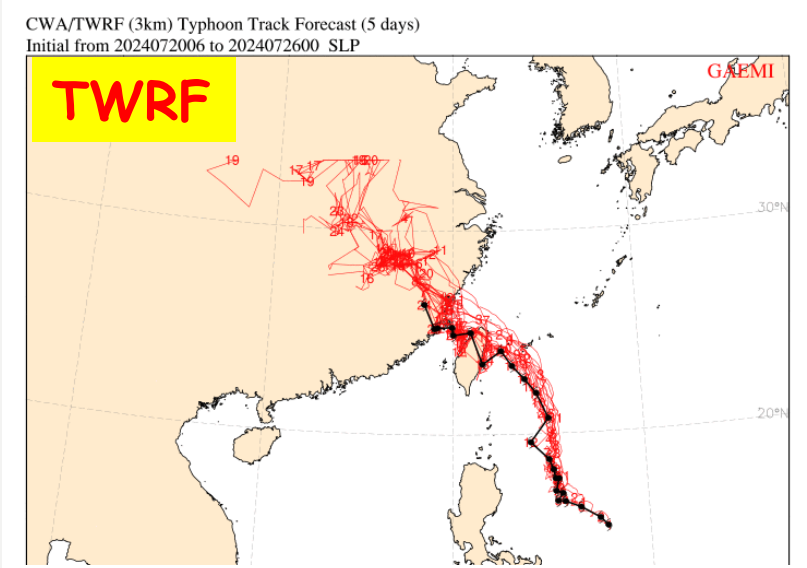
2. 高解析度模式(TWRF 3km)預報較能呈現凱米受地形影響在臺灣東部外海繞圈之情境

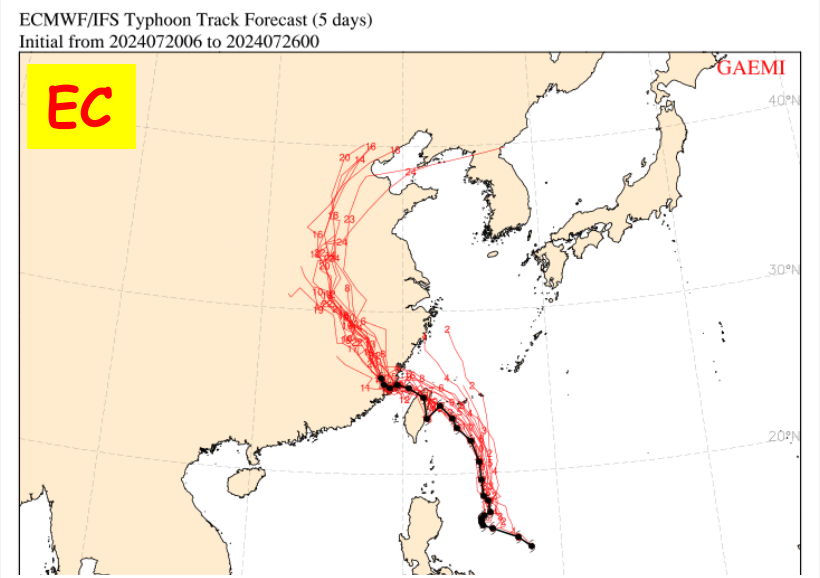
3. 凱米颱風3天最大總雨量約2000mm，TWRF及TGFS預報雨量高估，ETQPF表現不錯

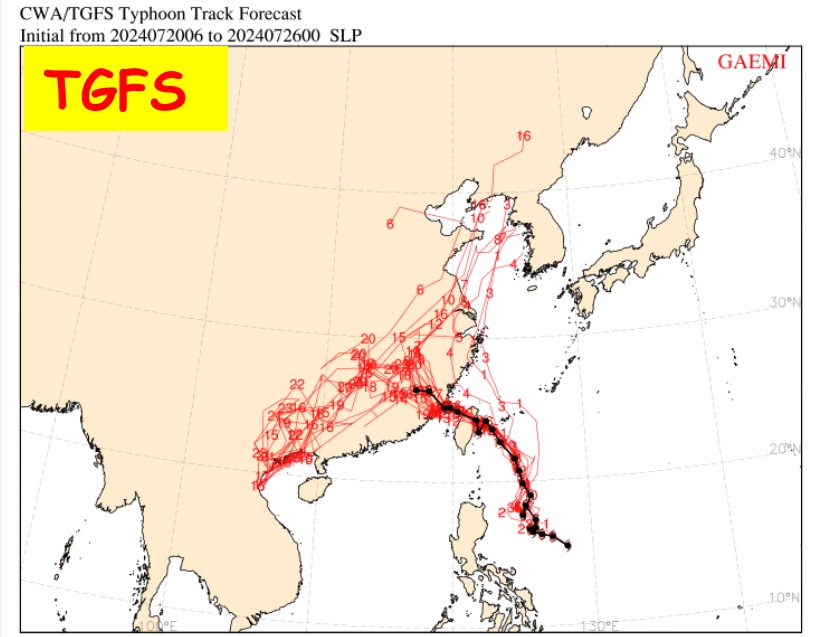
4. 雖然NWP模式對凱米颱風已展現蠻好預報能力，但AI/ML天氣模型蓬勃發展來勢洶洶。
---→ NWP因應之道

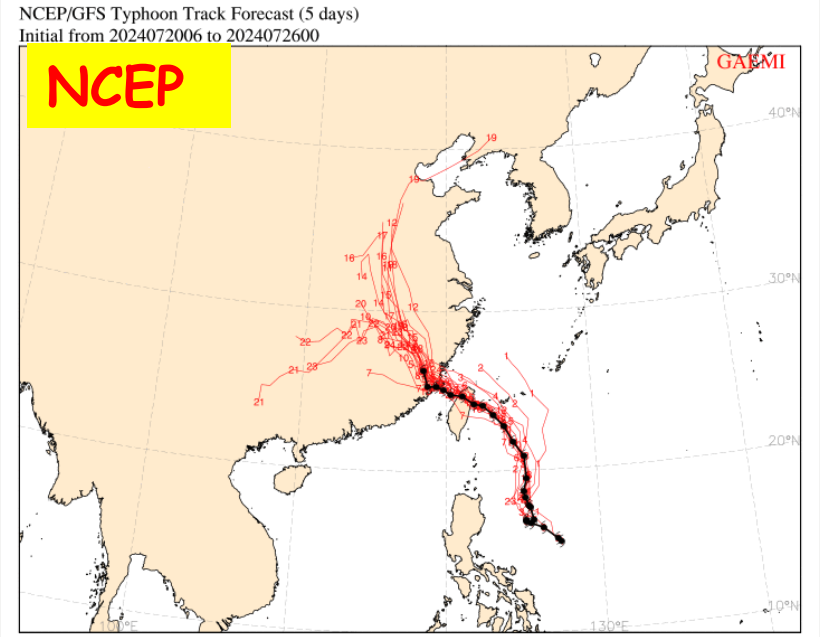
Thank you for your attention and patience!

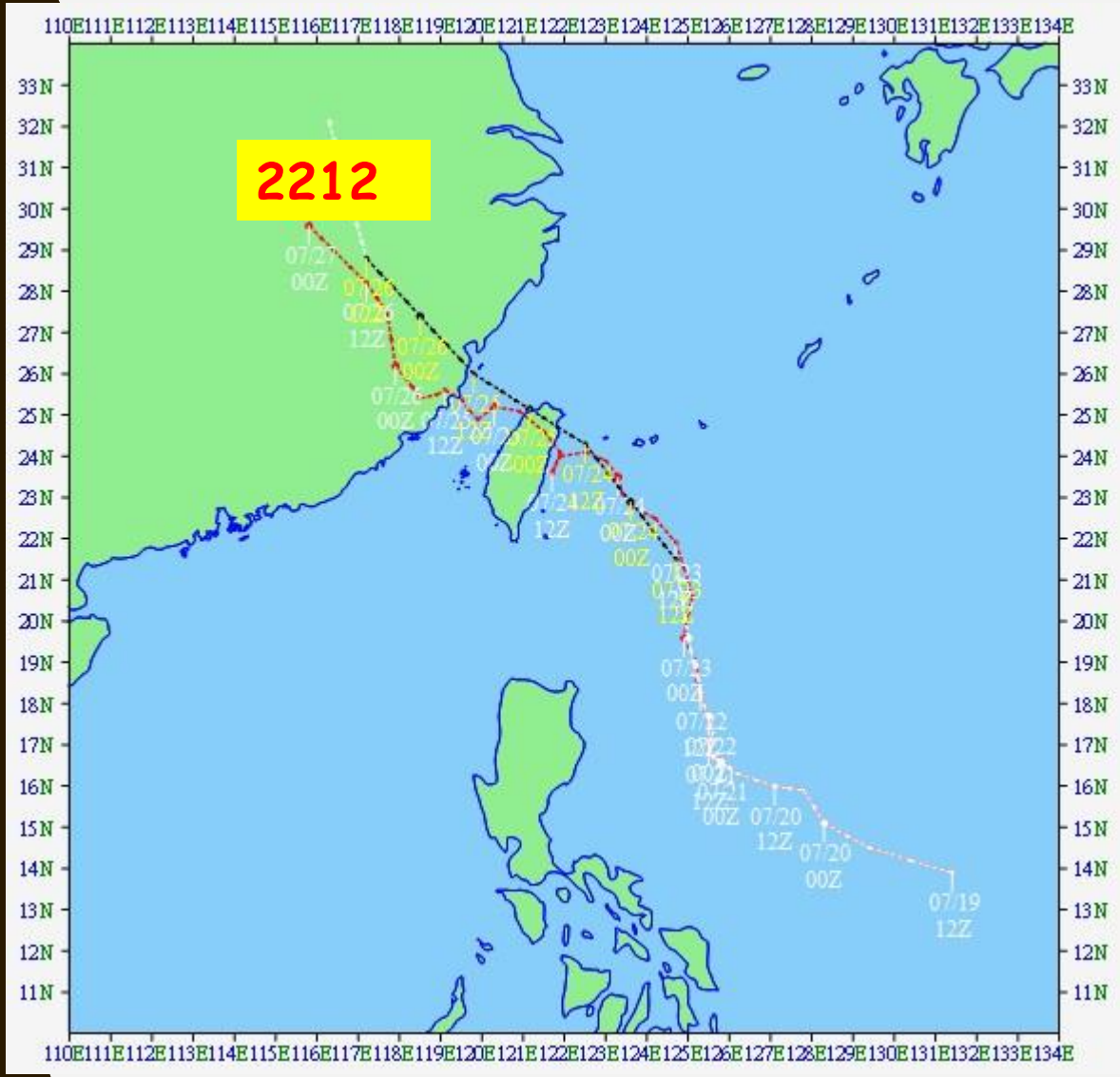
NWP模式TWRF/TGFS/NCEP/EC對凱米颱風之預報







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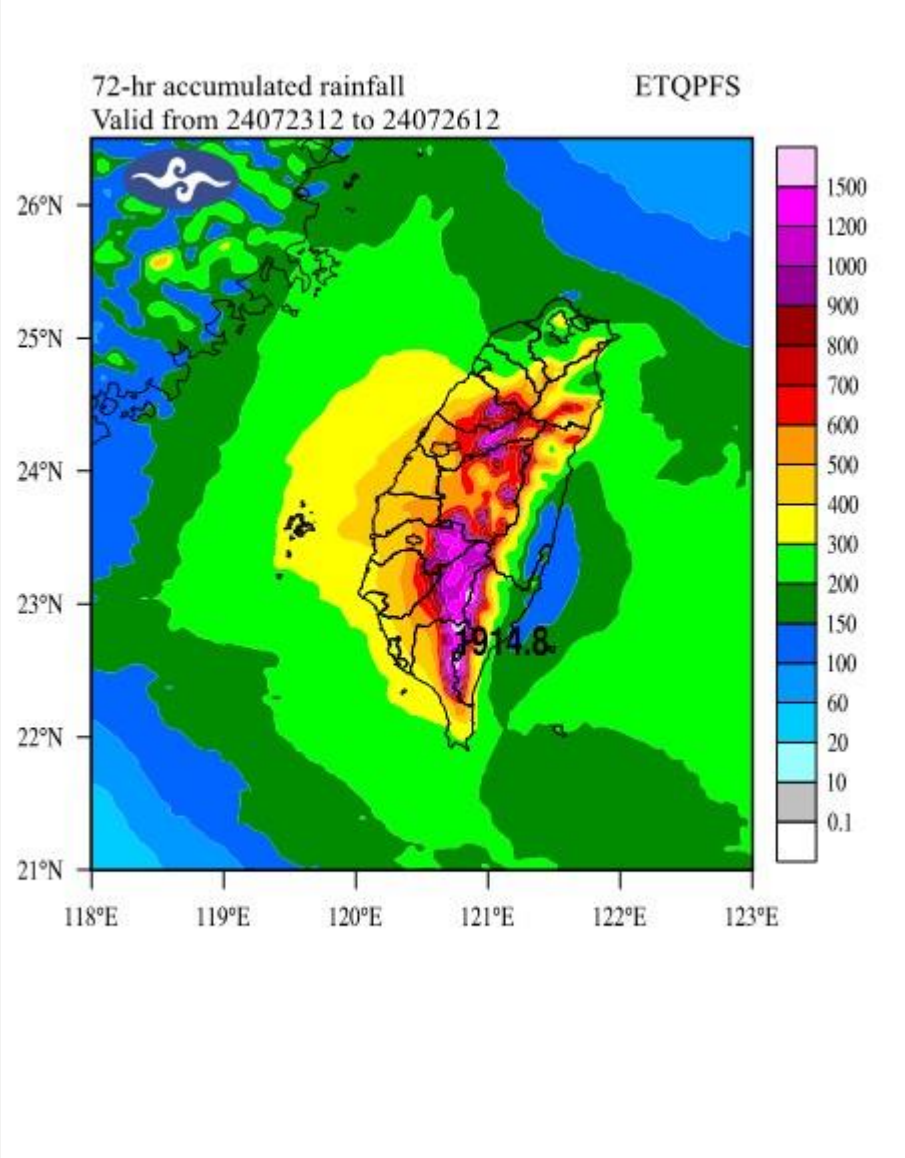
12Z
07/20
00Z
07/20
12Z
07/21
00Z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1500
1200
1000
900
800
700
600
500
400
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200
150
100
60
20
10
0.1
26°N
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119°E
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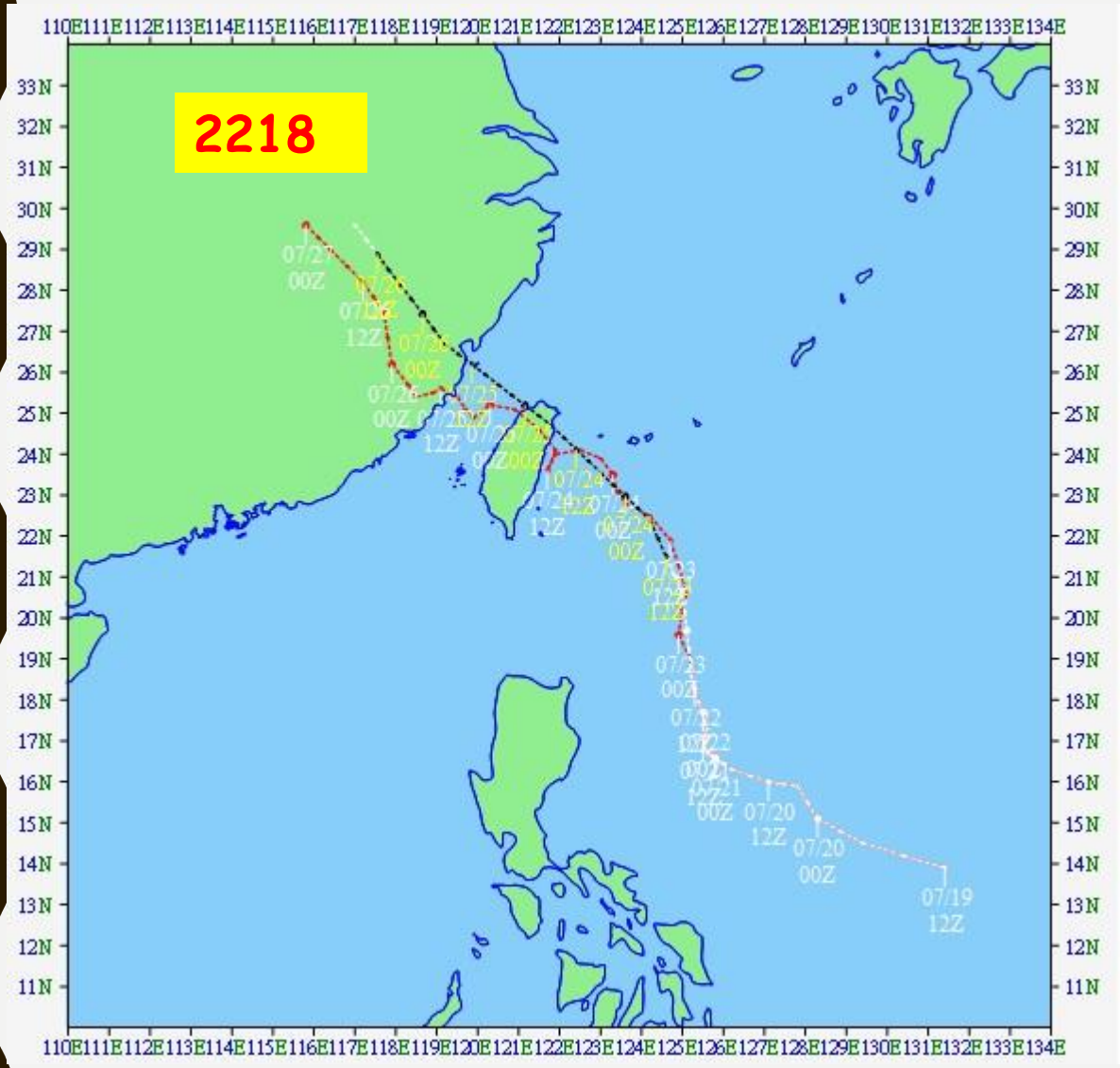
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07/19
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00Z
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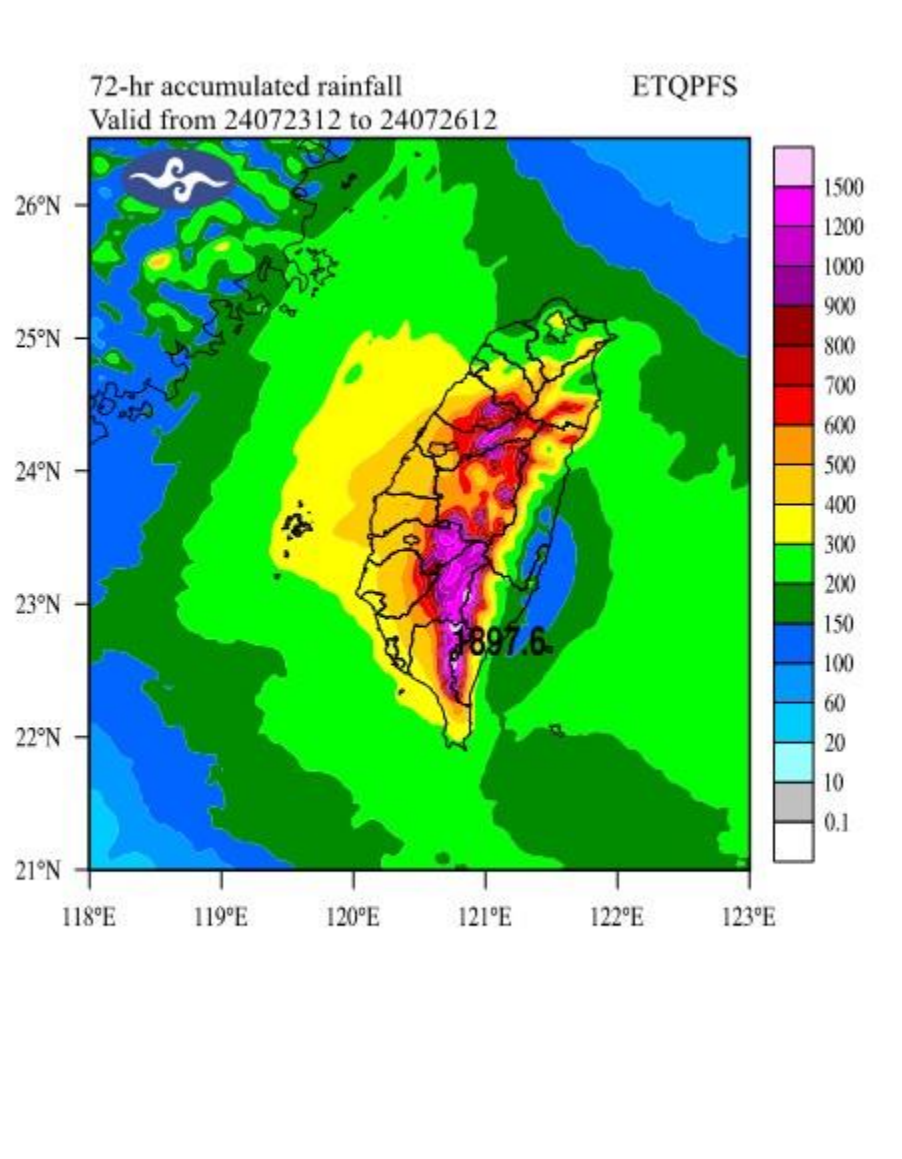
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1000
900
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150
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60
20
10
0.1
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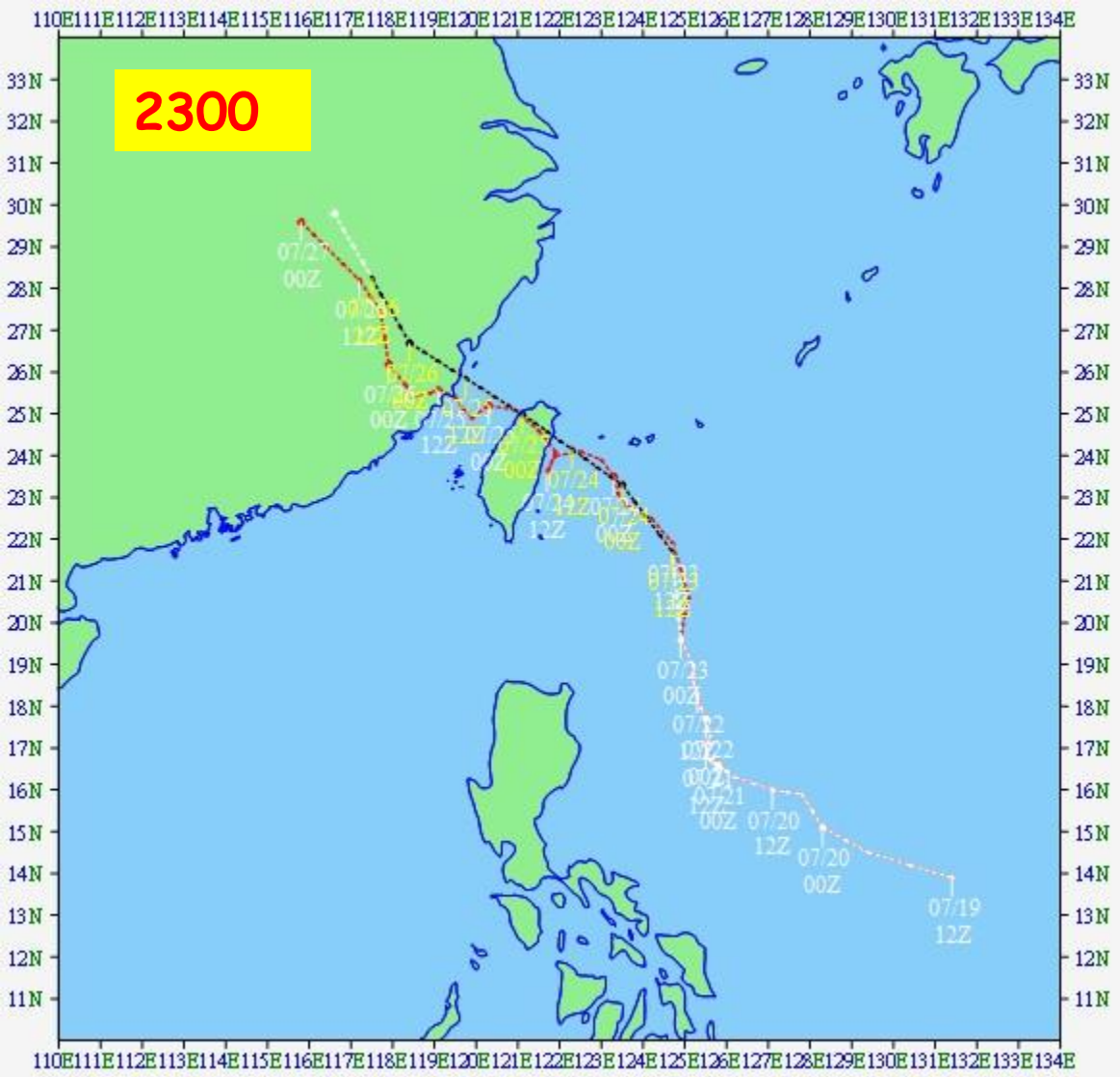
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00Z
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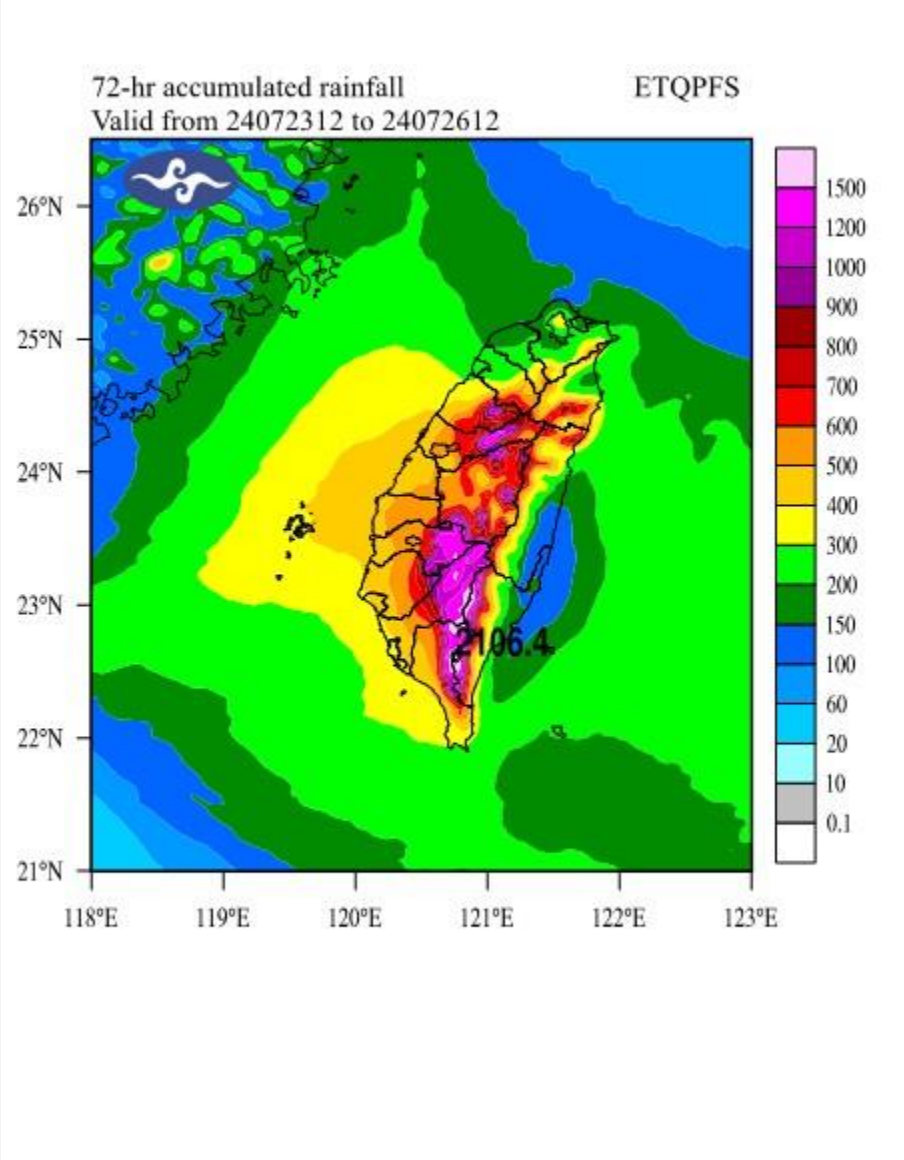
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2106.4
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1200
1000
900
800
700
600
500
400
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150
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60
20
10
0.1
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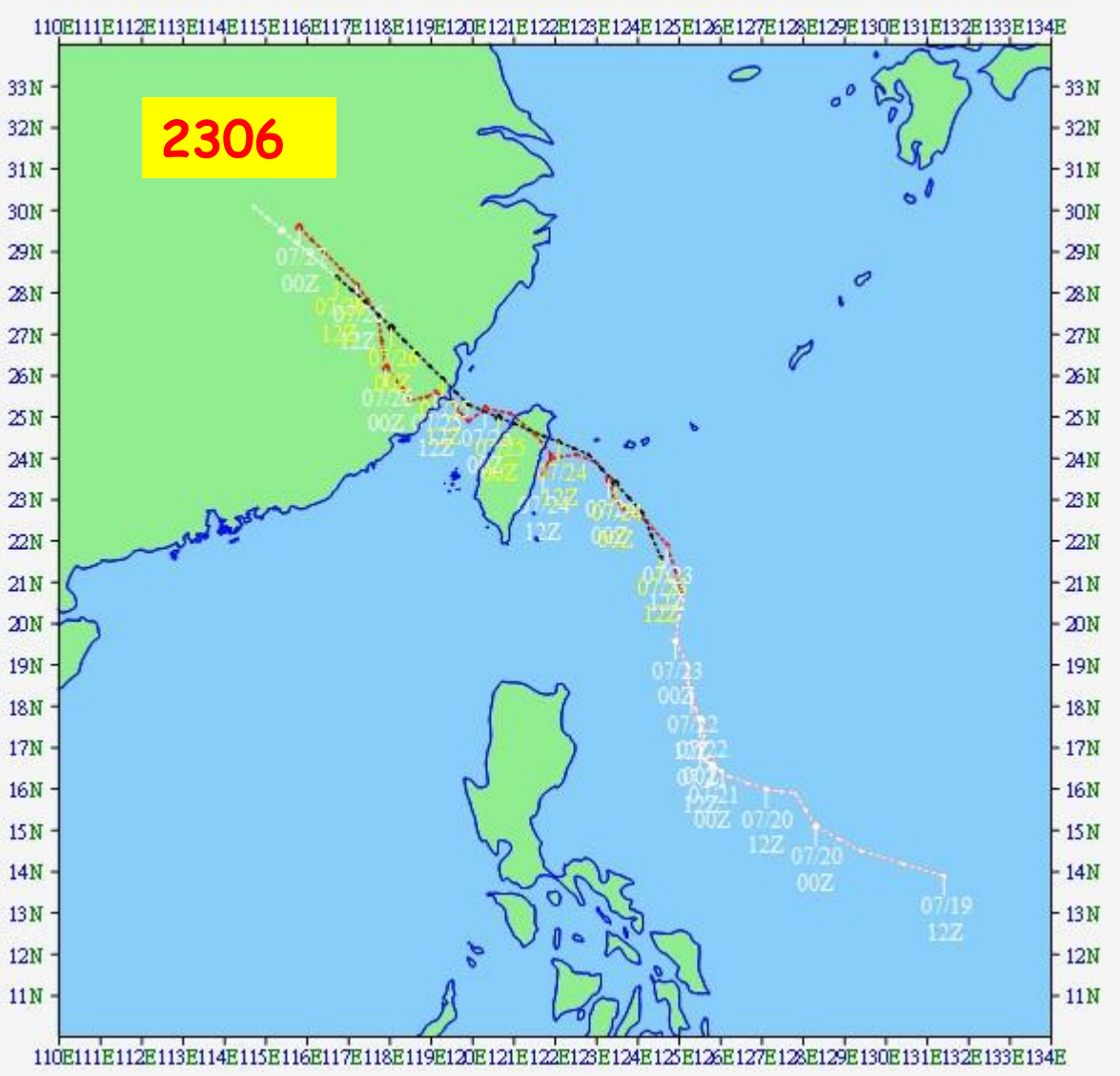
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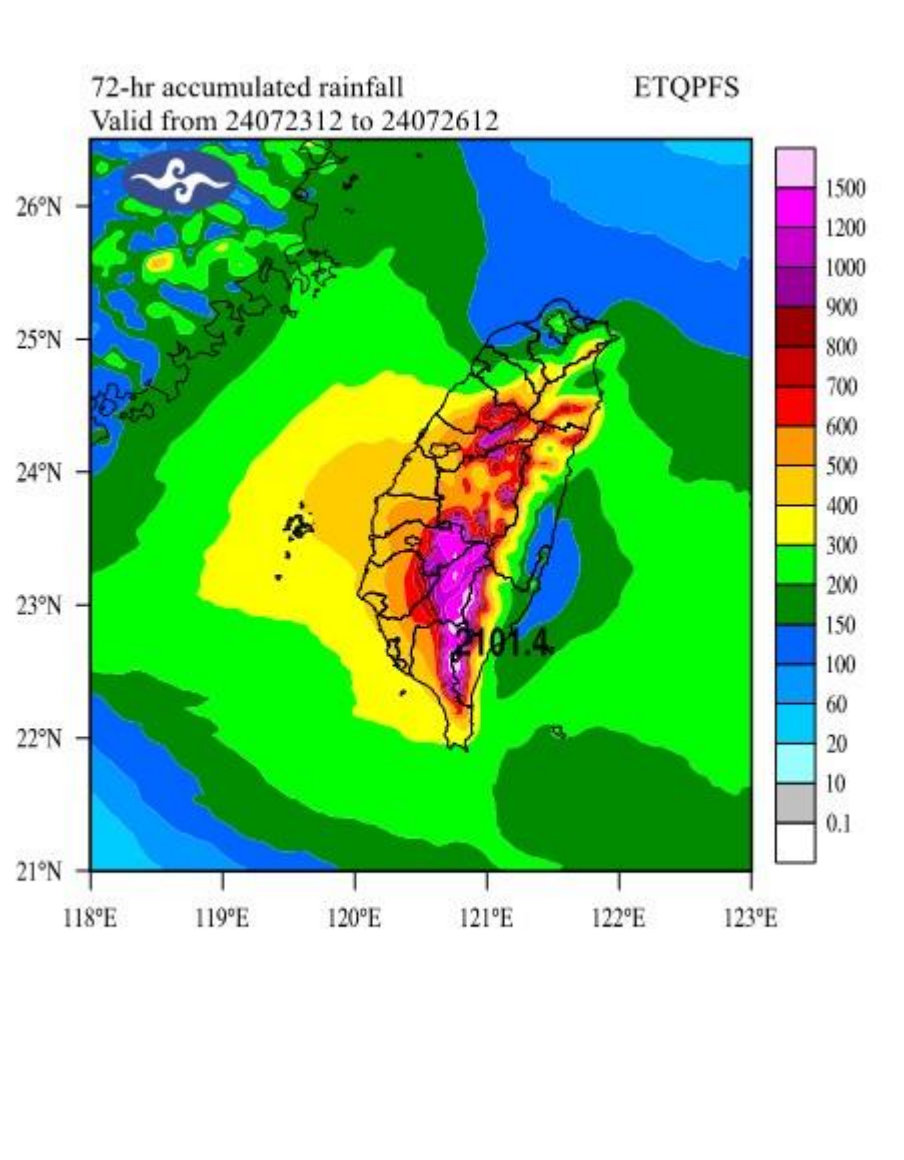
72-hr accumulated rainfall
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1500
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1000
900
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600
500
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150
100
60
20
10
0.1
26°N
25°N
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22°N
21°N
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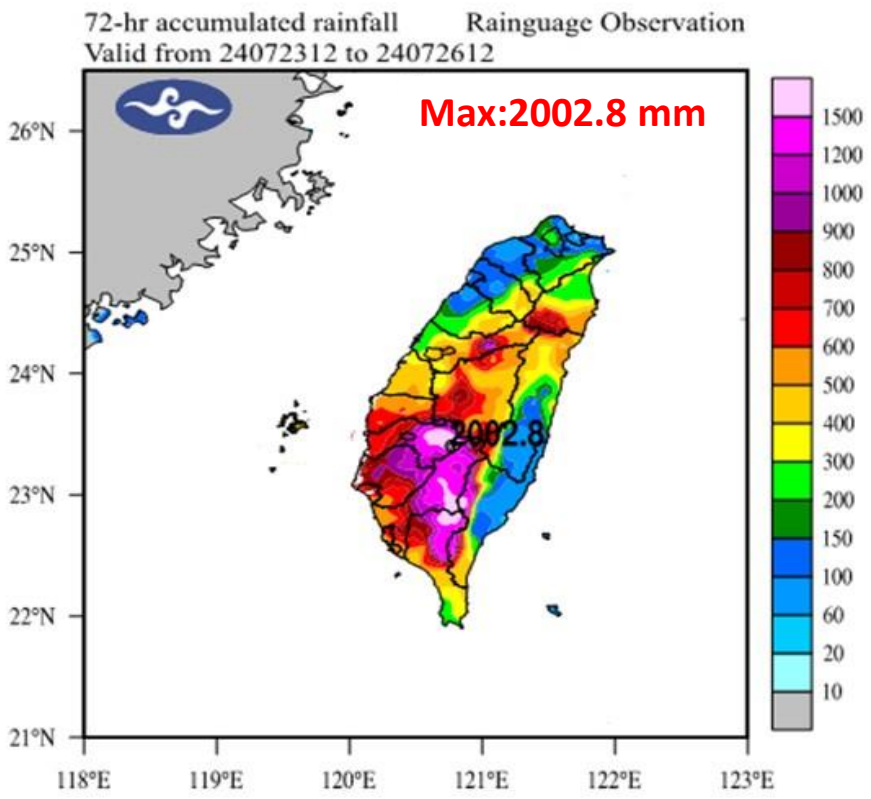
OBS



TWRF	TGFS-nest	GRAPHCAST-EC

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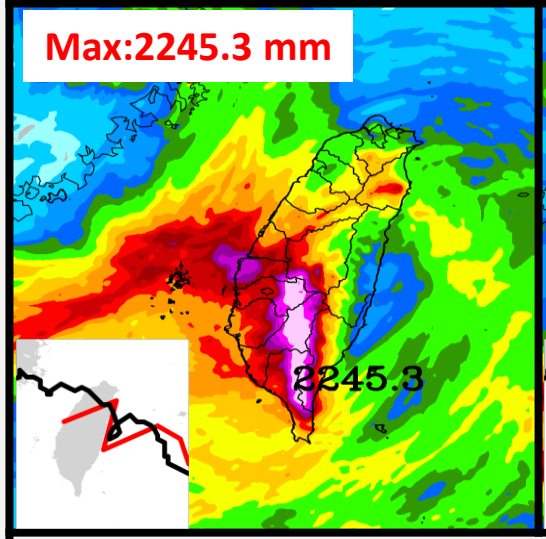

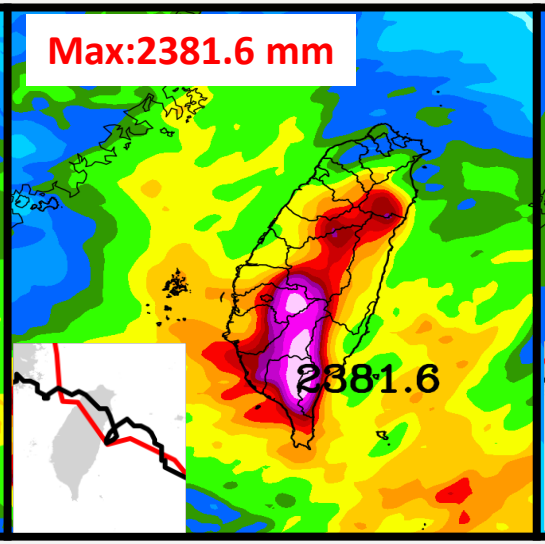

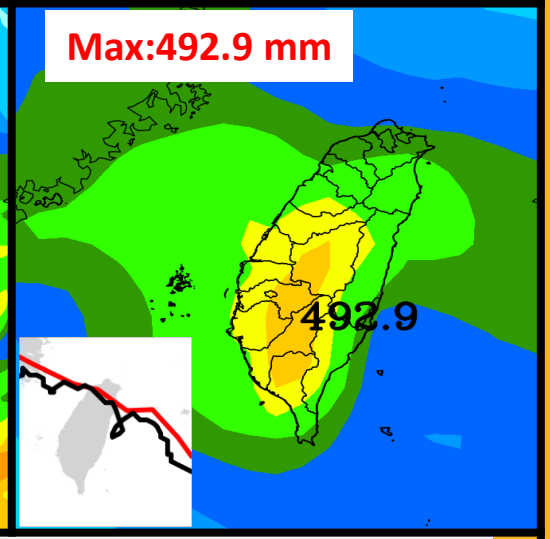
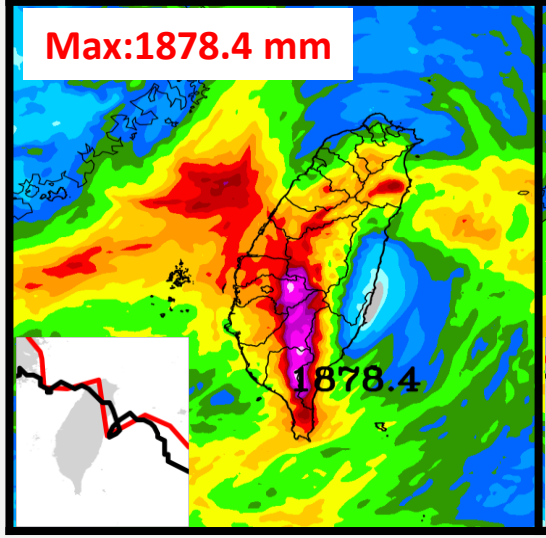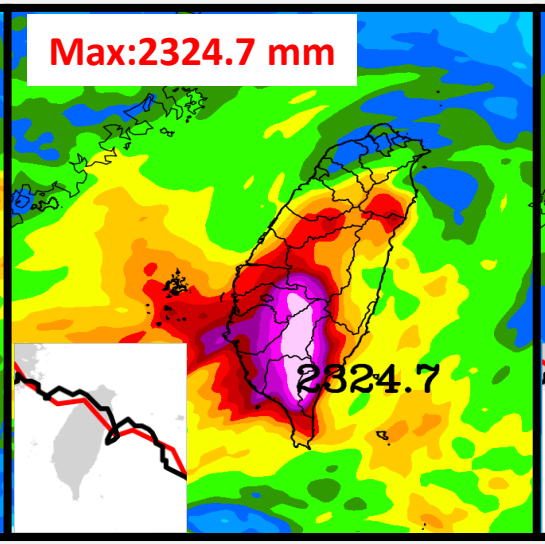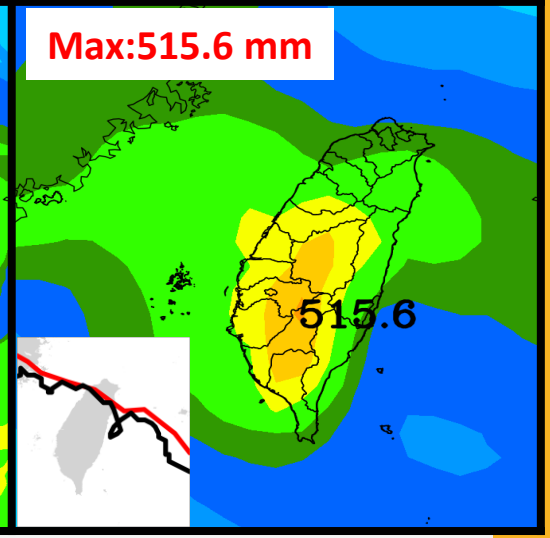
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