

2026天氣分析研討會

# 以臺灣氣象署潮位站未校驗資料 估算海平面變化趨勢之風險

維運任務與科學趨勢分析的視角切換

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廖乃慧 中央氣象署海象氣候組



# 什麼是「校驗」

這不是在說軟體端的資料品管/檢核，不是單純剔除明顯異常的不連續/不合理數值，而是對「儀器回傳數值」本身準確度的檢驗。

校驗可以初步分成兩層：一是基準穩定度\*，二是儀器誤差。

具體怎麼做：簡易的方式是到現場用雷射測距儀獨立量測水位，比對儀器回傳數值。

\*水位是相對於什麼量的「那個零點」。



Figures 1 [b], [c]. The same frame and gauges with a metal target (stirrup) suspended beneath them.

# 為什麼這件事重要

- 現行運作中的潮位站數量有約30個、涵蓋全台與離島、普遍用於即時災防預警與對外供應。
- 署內一直都有對這些水位資料作分析應用，還出版了海象氣候圖集。
- 對氣象署潮位站資料預設信任程度的評估：「這些水位資料是否可以直接拿來做海平面趨勢分析」？

## 維運任務

即時、可讀  
讓民眾看得懂潮汐與暴潮

**VS**

## 趨勢分析任務

逐年、逐毫米  
可追溯的長期基準穩定度

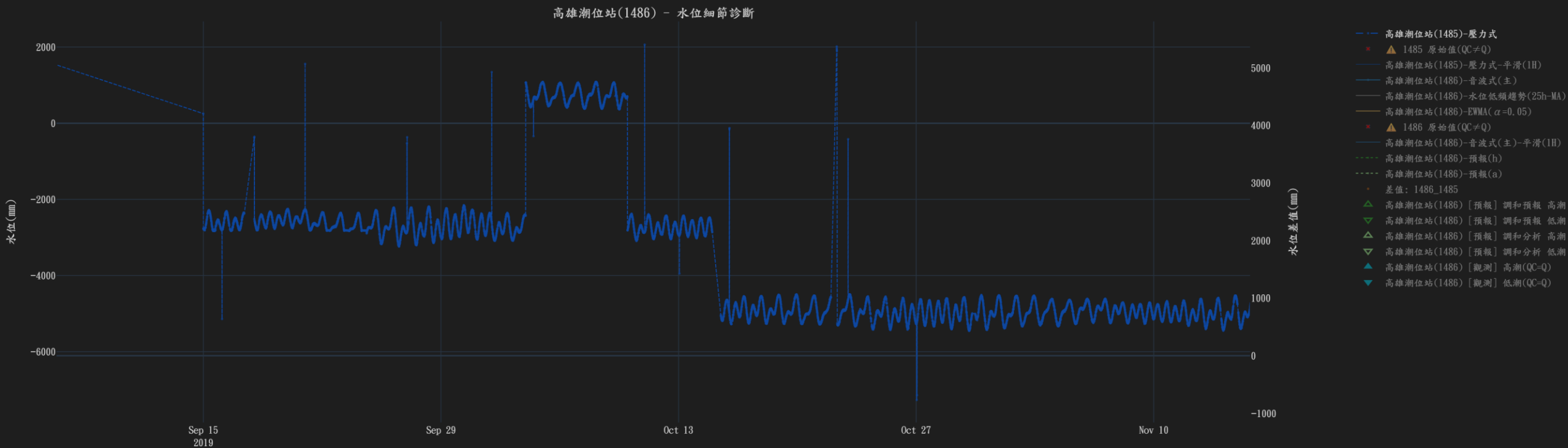
「氣象署潮位站的硬體維運目標，是提供即時、可讀的水位觀測。」

「海平面趨勢分析，要求的是逐毫米、可追溯的長期基準穩定度。」

兩者同樣重要，但要求完全不同。

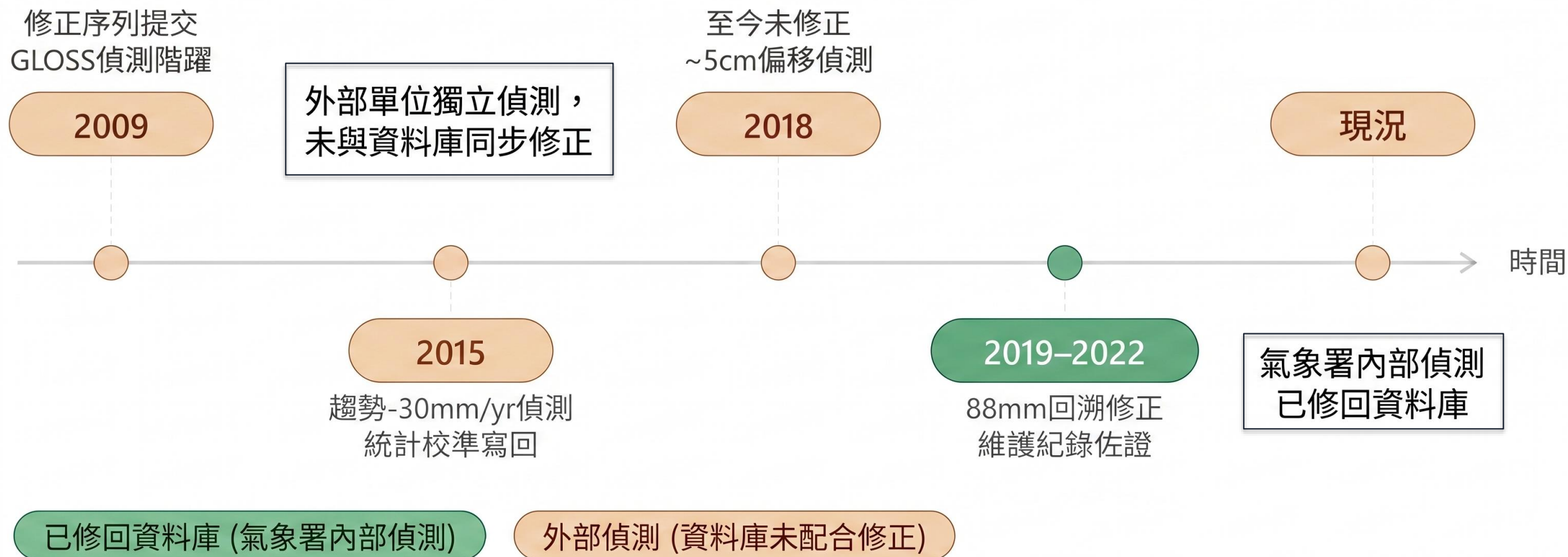
這不是要說誰做得不好，而是：當為了第一個任務設計的資料，被直接拿去做第二個任務的分析時，會發生什麼事。

# 潮位站資料



| STID | STID_NEW | TYPE | DATETIME            | YEAR | MONTH | DAY | HOUR | MIN0  | MIN1  | MIN2  | MIN3  | MIN4  | MIN5  | MIN6  | MIN7  | MIN8  | MIN9  | qc |
|------|----------|------|---------------------|------|-------|-----|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|
| 1485 | NULL     | NULL | 2019-10-01 00:00:00 | 2019 | 10    | 1   | 0    | -2668 | -2687 | -2687 | -2720 | -2736 | -2751 | NULL  | NULL  | NULL  | -2835 | Q  |
| 1485 | NULL     | NULL | 2019-10-01 01:00:00 | 2019 | 10    | 1   | 1    | -2849 | NULL  | -2858 | -2898 | -2915 | -2912 | NULL  | -2949 | -2968 | -2976 | Q  |
| 1485 | NULL     | NULL | 2019-10-01 02:00:00 | 2019 | 10    | 1   | 2    | -2984 | -3002 | -3002 | -3008 | -3011 | -3013 | -3031 | -3034 | -3047 | -3034 | Q  |
| 1485 | NULL     | NULL | 2019-10-01 03:00:00 | 2019 | 10    | 1   | 3    | -3043 | -3044 | -3044 | -3054 | -3055 | -3048 | -3050 | -3050 | -3051 | -3043 | Q  |
| 1485 | NULL     | NULL | 2019-10-01 04:00:00 | 2019 | 10    | 1   | 4    | -3017 | -3022 | -3022 | -3007 | -2985 | -2987 | -2980 | -2969 | -2939 | -2910 | Q  |
| 1485 | NULL     | NULL | 2019-10-01 05:00:00 | 2019 | 10    | 1   | 5    | -2901 | -2896 | -2896 | -2862 | -2842 | -2837 | -2826 | -2811 | -2785 | -2759 | Q  |
| 1485 | NULL     | NULL | 2019-10-01 06:00:00 | 2019 | 10    | 1   | 6    | -2736 | -2719 | -2719 | -2709 | -2692 | -2668 | -2639 | -2630 | -2622 | -2609 | Q  |

# 高雄站十年修正史



# 高雄站十年修正史

| 時間        | 事件                                   | Metadata 佐證 | 資料庫現況          |
|-----------|--------------------------------------|-------------|----------------|
| 2009      | 國際單位通知資料存在 Step Function             | 無           | 未知是否寫回         |
| 2012-2014 | 海平面檢校系統統計修正<br>( Tseng et al. 2012 ) | 無           | 已寫回            |
| 2015      | 統計方式分段對齊修正<br>( Lan et al. 2017 )    | 無           | 修正資訊僅供氣象局參考    |
| 2018/01   | 偵測到約 5 cm 新偏移                        | 無           | 無其他佐證資訊可供修正    |
| 2019–2022 | 找到 metadata 佐證，回溯修正 88 mm 偏移         | 有           | 已寫回，2022 後保持連續 |

# 我們連自己改過什麼都沒有完整追溯能力

「光是高雄一站，十年之間，我們自己就處理過好幾次基準偏移——有些有紀錄佐證、有些沒有。這還只是『未校驗』的第一層意思。」

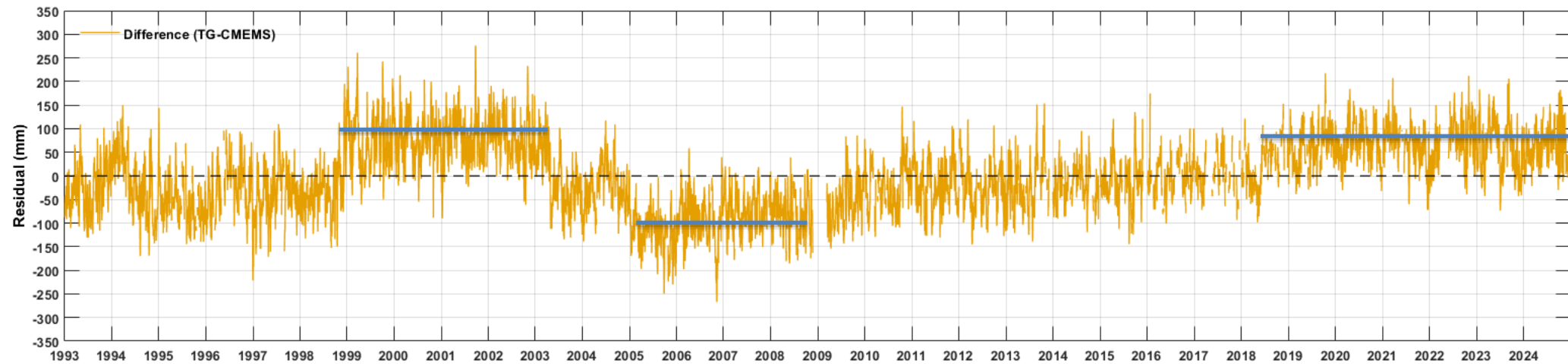
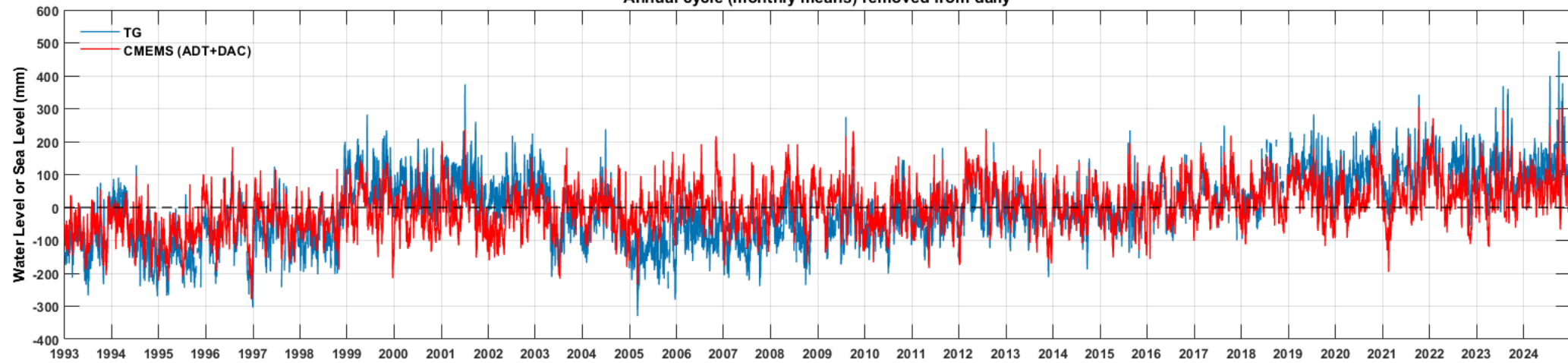
[ 高雄潮位站 1486/C4P01 ; 1356/340A ]



這個問題明顯到，IOC/GLOSS 《Manual on Sea Class Measurement, Vol. V》 p.80-81 都曾將高雄列為國際案例佐證

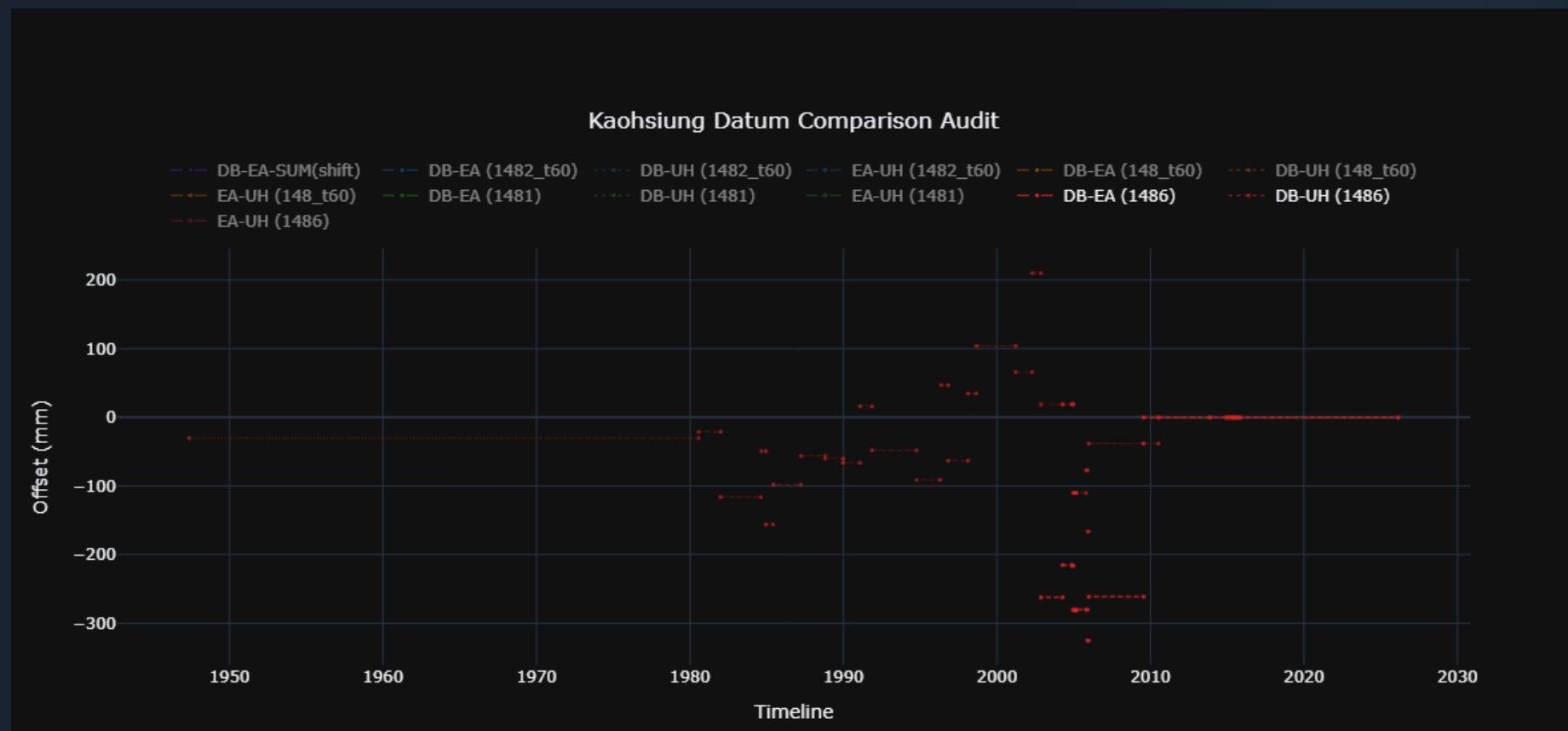
。

Kaohsiung (CMEMS lat:22.625 lon:120.25)  
Annual cycle (monthly means) removed from daily



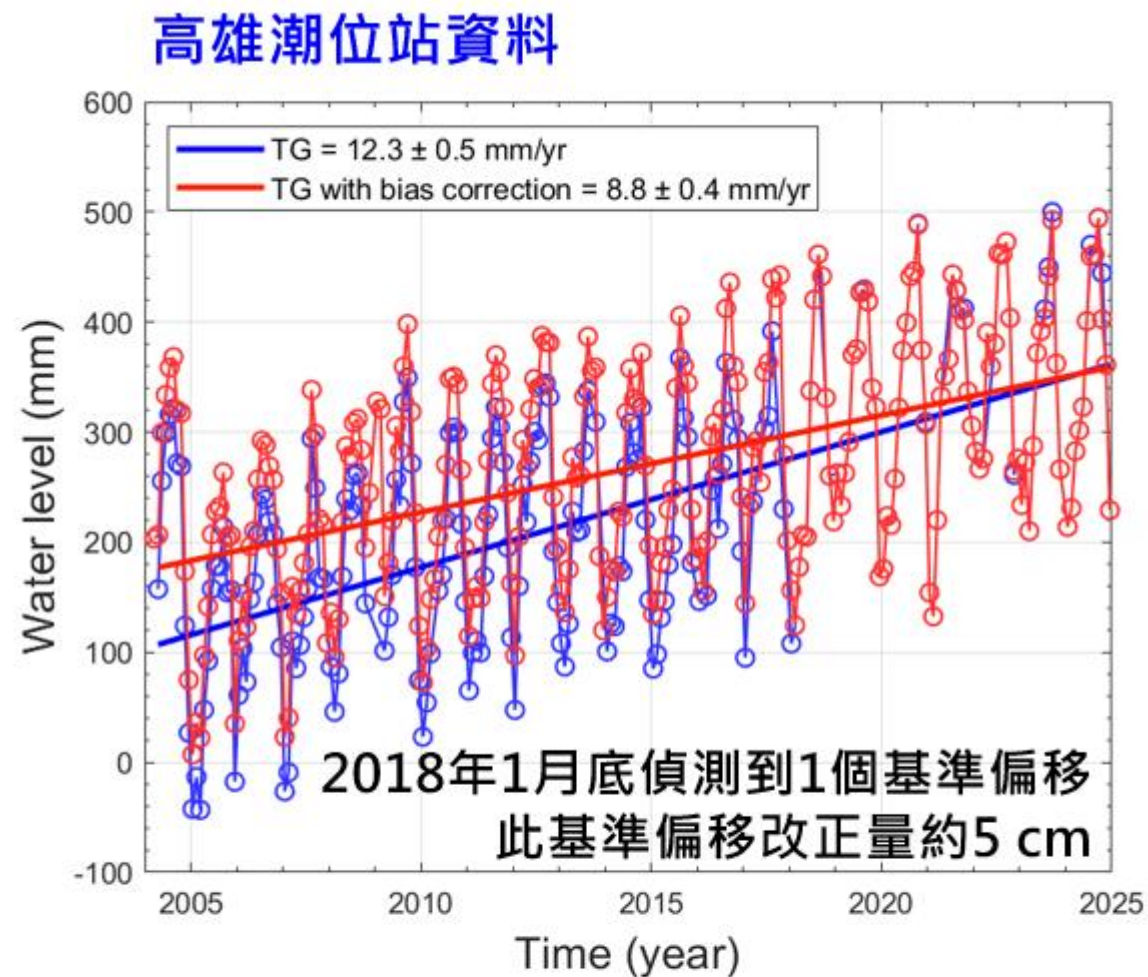
# DB-EA-UH 資料源不一致

- 同測站、同一時間，不同資料源。
- 資料落差高達 200–300 mm。
- 無法用資料庫調整紀錄合理解釋。



## 基準偏移的實際影響

- 只改一個 5 cm 偏移量，趨勢就完全不同。
- 計算結果跟偏移偵測時間點、選取來分析趨勢的時間段有關。
- 這種偏移偵測結果無法被數學推算以外的方式實際驗證。





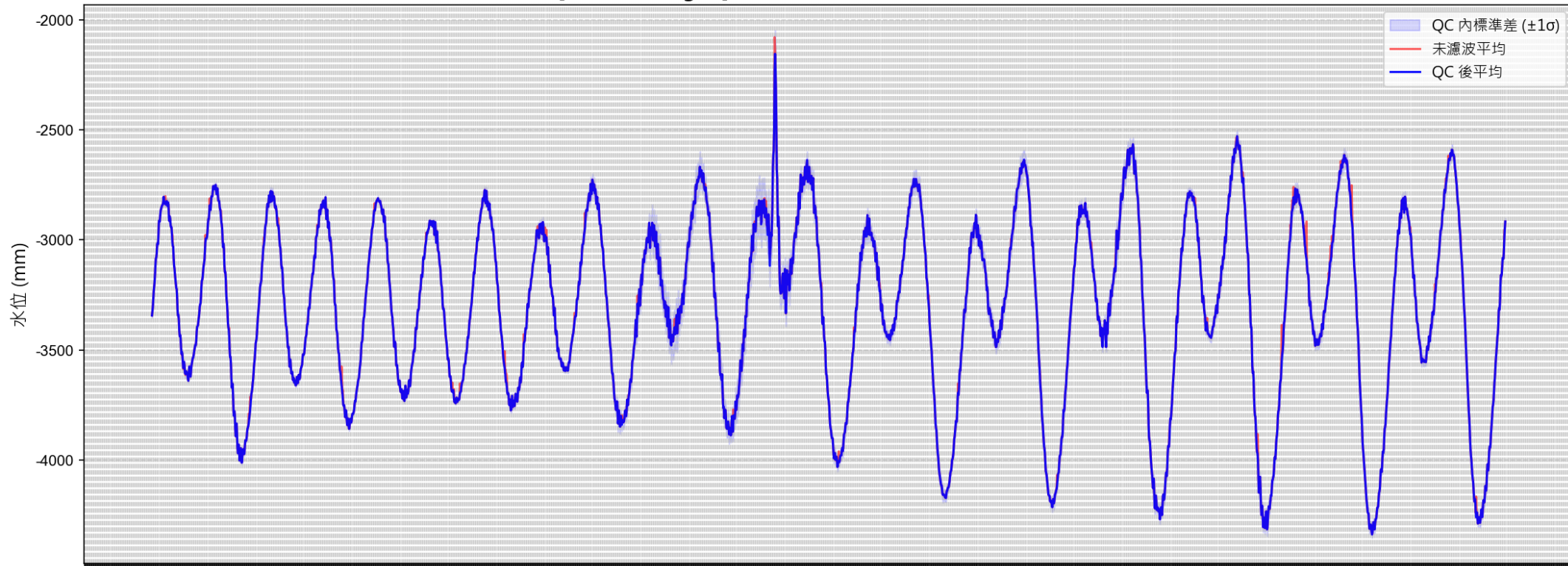
| 測站  | 成大近海水文交付程式<br>資料庫排程執行結果<br>20年趨勢 | 成大近海水文交付程式<br>資料庫排程執行結果<br>長期趨勢 |
|-----|----------------------------------|---------------------------------|
| 新竹  | 4.37 mm/yr                       | 2.63 mm/yr                      |
| 箔子寮 | ----                             | ----                            |
| 東石  | 11.52 mm/yr                      | 8.05 mm/yr                      |
| 將軍  | 8.95 mm/yr                       | 6.89 mm/yr                      |
| 東港  | ----                             | ----                            |
| 後壁湖 | ----                             | ----                            |
| 蘇澳  | 3.62 mm/yr                       | 6.49 mm/yr                      |
| 花蓮  | 8.61 mm/yr                       | 3.22 mm/yr                      |
| 成功  | 5.78 mm/yr                       | 5.38 mm/yr                      |
| 澎湖  | 1.13 mm/yr                       | 2.27 mm/yr                      |
| 塭港  | 13.09 mm/yr                      | 4.72 mm/yr                      |
| 台中港 | 13.97 mm/yr                      | 8.48 mm/yr                      |
| 高雄  | 12.88 mm/yr                      | 2.60 mm/yr                      |
| 基隆  | 3.87 mm/yr                       | 2.64 mm/yr                      |

| 測站  | 運技中心委外<br>2017多參數<br>10年趨勢 | 運技中心委外<br>2017多參數<br>20年趨勢 | AVISO衛星<br>2017多參數<br>20年趨勢 | 成大近海水文<br>2022期刊<br>近20年趨勢<br>地表修正前/後 | 成大近海水文<br>2025交付程式<br>近20年趨勢<br>資料庫排程執行 | 台大海研所<br>2022報告<br>10年趨勢 | 台大海研所<br>2022報告<br>20年趨勢 |
|-----|----------------------------|----------------------------|-----------------------------|---------------------------------------|-----------------------------------------|--------------------------|--------------------------|
| 新竹  | 13.98±4.22                 | 2.01±0.72                  | 0.23±0.68                   | -0.9                                  | 4.37                                    | 1.32                     | -4.38                    |
| 箔子寮 | 11.58±3.25                 | 2.44±0.99                  | 0.82±0.51                   | ----                                  | ----                                    | 19.99                    | ----                     |
| 東石  | 26.78±4.84                 | 5.77±0.97                  | 0.93±0.50                   | 13.2                                  | 11.52                                   | 4.66                     | 7.69                     |
| 將軍  | 13.14±3.45                 | 5.48±0.88                  | 1.08±0.49                   | 6.2/-1.71                             | 8.95                                    | 21.36                    | 7.26                     |
| 東港  | 3.30±4.16                  | 3.00±1.24                  | 1.38±0.47                   | ----                                  | ----                                    | 9.14                     | ----                     |
| 後壁湖 | 11.69±4.76                 | 3.82±1.15                  | 1.47±0.47                   | ----                                  | ----                                    | -4.1                     | -0.69                    |
| 蘇澳  | 10.09±2.73                 | 1.59±0.64                  | 3.47±0.58                   | 4.6/-0.03                             | 3.62                                    | 3.31                     | 4.6                      |
| 花蓮  | 5.56±3.38                  | 1.58±0.95                  | 3.38±0.61                   | 6.83/1.73                             | 8.61                                    | 11.6                     | 10.51                    |
| 成功  | 13.23±3.29                 | 4.60±0.81                  | 3.16±0.66                   | ----                                  | 5.78                                    | 10.99                    | 3.9                      |
| 澎湖  | 6.32±3.00                  | -0.20±0.70                 | 0.78±0.82                   | ----                                  | 1.13                                    | -0.07                    | 1.46                     |
| 塭港  | 13.12±3.66                 | 3.56±1.10                  | 0.93±0.50                   | ----                                  | 13.09                                   | 15.25                    | 6.75                     |
| 台中港 | 10.27±3.20                 | 4.19±1.00                  | 0.33±0.61                   | 18.1                                  | 13.97                                   | 5.41                     | 3.44                     |
| 高雄  | 16.61±3.77                 | 3.58±0.77                  | 1.36±0.48                   | 1.03/0.12                             | 12.88                                   | 9.99                     | 3.94                     |
| 基隆  | 7.33±2.94                  | 4.91±0.65                  | 3.47±0.57                   | 1.2/-0.4                              | 3.87                                    | -3.39                    | 0.31                     |

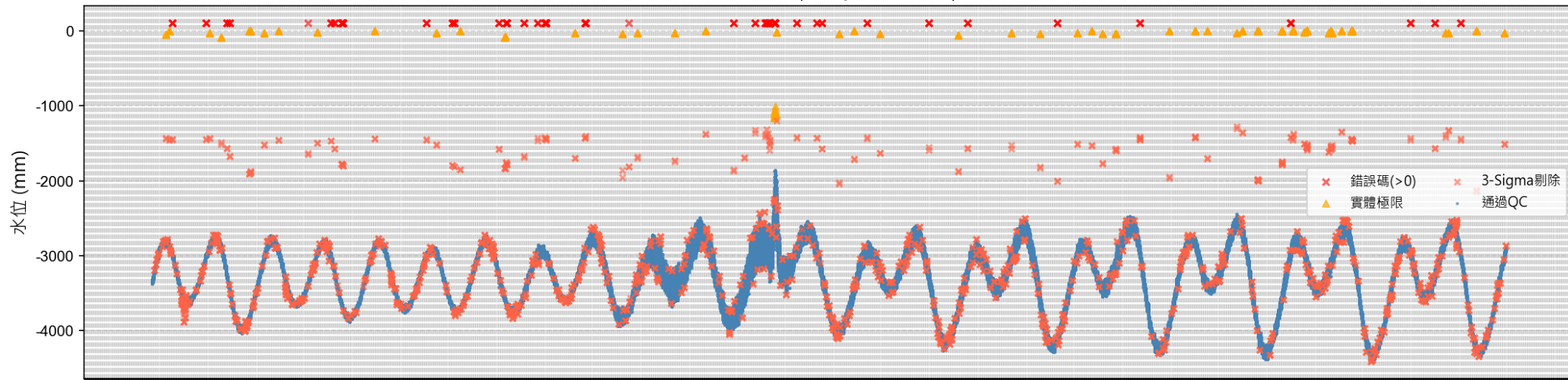
秒資料物理異常値

| STID_NE | INSTRUMENT<br>TYPE | DATATIME<br>(YYYYMMDDHHMMSS) | Column | Column | Column | Column | Column | Column | Column | Column | Column | Column | Column | Column | Column | Column | Column | Column |
|---------|--------------------|------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| C4N01   | S                  | 20250706233000               | -2312  | -2269  | -2227  | -2227  | -2227  | -2319  | -2412  | -2412  | -2412  | -2359  | -2307  | -2307  | -2307  | -2368  | -2430  |        |
| C4N01   | S                  | 20250706233015               | -2430  | -2430  | -2375  | -2321  | -2321  | -2321  | -2376  | -2431  | -2431  | -2431  | -2367  | -2303  | -2303  | -2303  | -1098  |        |
| C4N01   | S                  | 20250706233030               | 106    | 106    | 106    | -1161  | -2428  | -2428  | -2428  | -1161  | 106    | 106    | 106    | -1120  | -2347  | -2347  | -2347  |        |
| C4N01   | S                  | 20250706233045               | -2362  | -2377  | -2377  | -2377  | -1135  | 106    | 106    | 106    | 106    | 106    | 106    | 106    | 106    | 106    | 106    |        |
| C4N01   | S                  | 20250706233100               | 106    | -1149  | -2404  | -2404  | -2404  | -2389  | -2375  | -2375  | -2375  | -2354  | -2334  | -2334  | -2334  | -2338  | -2343  |        |
| C4N01   | S                  | 20250706233115               | -2343  | -2343  | -2330  | -2317  | -2317  | -2317  | -2290  | -2264  | -2264  | -2264  | -2344  | -2425  | -2425  | -2425  | -2415  |        |
| C4N01   | S                  | 20250706233130               | -2405  | -2405  | -2405  | -2427  | -2450  | -2450  | -2450  | -2519  | -2589  | -2589  | -2589  | -2443  | -2298  | -2298  | -2298  |        |
| C4N01   | S                  | 20250706233145               | -2321  | -2344  | -2344  | -2344  | -2266  | -2188  | -2188  | -2188  | -2266  | -2344  | -2344  | -2344  | -2284  | -2225  | -2225  |        |
| C4N01   | S                  | 20250706233200               | -2225  | -2174  | -2123  | -2123  | -2123  | -2235  | -2347  | -2347  | -2347  | -2184  | -2021  | -2021  | -2021  | -2211  | -2402  |        |
| C4N01   | S                  | 20250706233215               | -2402  | -2402  | -2380  | -2359  | -2359  | -2359  | -2284  | -2210  | -2210  | -2210  | -2205  | -2201  | -2201  | -2201  | -2175  |        |
| C4N01   | S                  | 20250706233230               | -2150  | -2150  | -2150  | -2122  | -2094  | -2094  | -2094  | -1984  | -1874  | -1874  | -1874  | -1982  | -2091  | -2091  | -2091  |        |
| C4N01   | S                  | 20250706233245               | -2162  | -2234  | -2234  | -2234  | -1064  | 106    | 106    | 106    | -1097  | -2301  | -2301  | -2301  | -2122  | -1943  | -1943  |        |
| C4N01   | S                  | 20250706233300               | -1943  | -2127  | -2311  | -2311  | -2311  | -2161  | -2012  | -2012  | -2012  | -1938  | -1865  | -1865  | -1865  | -2014  | -2164  |        |
| C4N01   | S                  | 20250706233315               | -2164  | -2164  | -2094  | -2024  | -2024  | -2024  | -2032  | -2041  | -2041  | -2041  | -2165  | -2290  | -2290  | -2290  | -2171  |        |
| C4N01   | S                  | 20250706233330               | -2053  | -2053  | -2053  | -2124  | -2195  | -2195  | -2195  | -2240  | -2286  | -2286  | -2286  | -2311  | -2336  | -2336  | -2336  |        |
| C4N01   | S                  | 20250706233345               | -2346  | -2357  | -2357  | -2357  | -2307  | -2257  | -2257  | -2257  | -2204  | -2151  | -2151  | -2151  | -2200  | -2249  | -2249  |        |
| C4N01   | S                  | 20250706233400               | -2249  | -2249  | -2250  | -2250  | -2250  | -2249  | -2249  | -2249  | -2249  | -2313  | -2377  | -2377  | -2377  | -2432  | -2488  |        |
| C4N01   | S                  | 20250706233415               | -2488  | -2488  | -2417  | -2346  | -2346  | -2346  | -2364  | -2383  | -2383  | -2383  | -2228  | -2074  | -2074  | -2074  | -2284  |        |
| C4N01   | S                  | 20250706233430               | -2494  | -2494  | -2494  | -2395  | -2296  | -2296  | -2296  | -2380  | -2465  | -2465  | -2465  | -2360  | -2256  | -2256  | -2256  |        |
| C4N01   | S                  | 20250706233445               | -2305  | -2354  | -2354  | -2354  | -2275  | -2197  | -2197  | -2197  | -2180  | -2164  | -2164  | -2164  | -2109  | -2055  | -2055  |        |
| C4N01   | S                  | 20250706233500               | -2055  | -2093  | -2132  | -2132  | -2132  | -2098  | -2065  | -2065  | -2065  | -2181  | -2298  | -2298  | -2298  | -2229  | -2161  |        |
| C4N01   | S                  | 20250706233515               | -2161  | -2161  | -2219  | -2277  | -2277  | -2277  | -2215  | -2154  | -2154  | -2154  | -2069  | -1985  | -1985  | -1985  | -2116  |        |
| C4N01   | S                  | 20250706233530               | -2247  | -2247  | -2247  | -2078  | -1909  | -1909  | -1909  | -1963  | -2018  | -2018  | -2018  | -2090  | -2162  | -2162  | -2162  |        |
| C4N01   | S                  | 20250706233545               | -2019  | -1877  | -1877  | -1877  | -1915  | -1953  | -1953  | -1953  | -2060  | -2168  | -2168  | -2168  | -2133  | -2099  | -2099  |        |

[C4N01\_merged] 局部放大：2025-06-05 ~ 2025-07-17

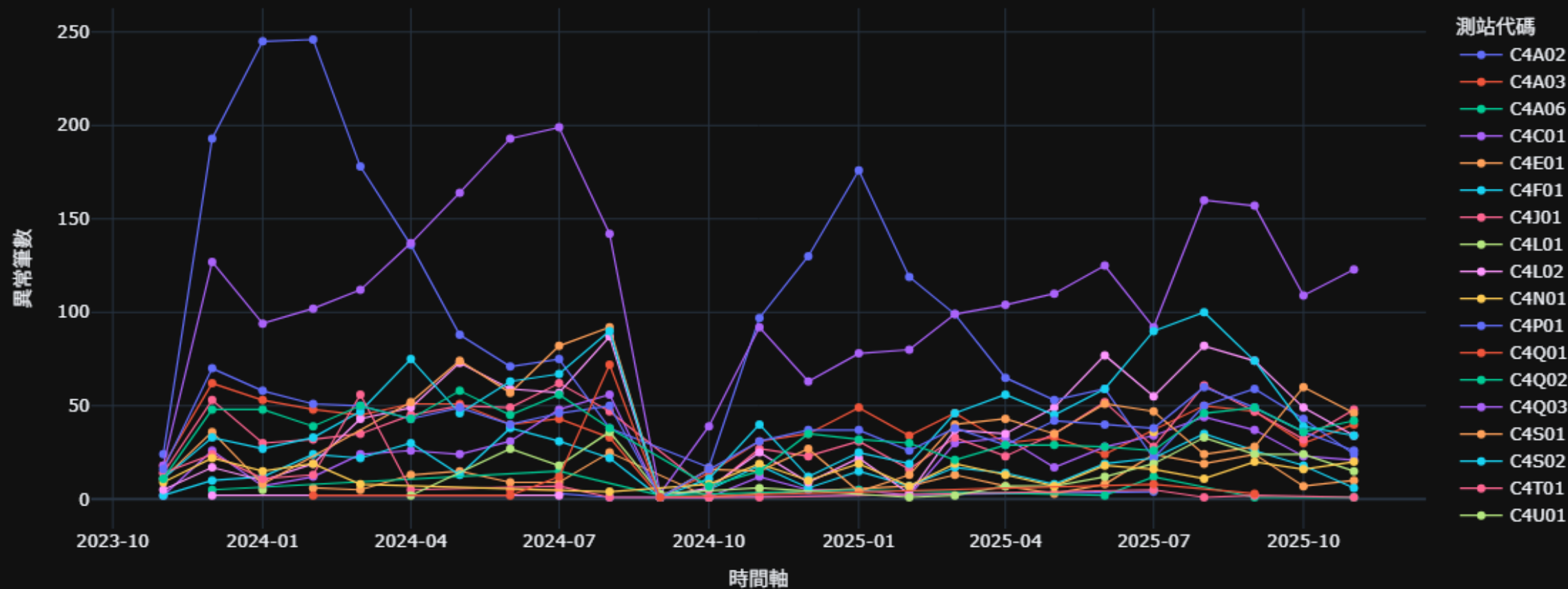


秒資料散佈 (依 QC 關卡著色)



## 秒資料物理異常値

### 各測站秒資料異常數值(>0)出現次數統計 (折線圖)



補充：「未校驗」的第二層意思

## 儀器環境效應在國際上都有標準

- 沒有一種水位計是零誤差的，所以才有「總誤差」的規範。這正是國際規範要求定期現場校驗的原因，而非反對校驗的理由。
- 主力音波式的誤差來源包含：靜水井（需水力響應測試）、聲速/溫度梯度校正。
- 其他儀器誤差來源：壓力式-海水密度；雷達式-海面波動、回波範圍障礙物。
- 現狀的問題不是出在「儀器不夠準」，而是「**沒有制度化的校驗追蹤機制去處理這個已知的不準**」。

補充：「未校驗」的第二層意思

## JMA 現場校驗實務

- 精密型檢潮儀（13站， $\pm 2\text{mm}$ 精度）：每半年一次「垂測點檢」。
- 其餘測站：每年執行一次校驗。
- 校驗方法：雷射測距儀量測潮位並與儀器讀值比對，容許誤差小於 5mm。
- 文獻出處：測候時報第 82 卷特別號 (2015)。

註：這是「單次比對容許誤差」，與 NOAA / GLOSS 常引用的「長期累積總誤差」是不同統計概念，不宜直接並列比較數字大小。

補充：「未校驗」的第二層意思

## 音波—壓力互校機制

現場人員為維持即時資料連續不中斷，備援壓力式感測器可切換上架，但日常維運時將其係數校正以音波式當下讀值為準對齊，而非各自獨立比對絕對基準。

## 2020年內政部委託成大空間測量團隊之計畫審查意見紀錄

審查委員：「可否就所提出臺灣潮位站建置標準草案，就目前蒐集到各單位 34 個潮位站進行分級？」

業務單位：「由於管理單位並無提供各潮位站之相關規範，目前無法對於 34 個潮位站進行分級。」

在國際上，任何觀測資料要進入科學用途以前都需要校驗。不論是模式同化、水利工程、海平面變化趨勢，本質上都是科學應用。

# 資料狀態歸類與應用範圍建議

| 等級      | 建議應用範圍                  | 核心技術指標                                                  |
|---------|-------------------------|---------------------------------------------------------|
| Class 4 | 氣候變遷、長期海平面上升研究、國家大地基準維護 | 準確度 < 1cm · 總誤差 ≤ 5cm (95% CI) · 19年以上連續資料 · 結合 GNSS 監測 |
| Class 3 | 水道測量、港灣工程、短期導航          | 總誤差 5–10cm · 2–19年連續資料 · 可引到鄰近 Class 4 站                |
| Class 2 | 數值模式驗證、一般性水文分析          | 總誤差 10–30cm · 1個月以上連續資料                                 |
| Class 1 | 長時間穩定觀察水位變化             | 總誤差 > 30cm 或未經現場校驗 · 有初步基準查測、metadata 留存                |
| Class 0 | 粗略觀察水位起伏、異常潮汐現象         | 無完整 metadata · 未經現場校驗及確實基準引測                            |

以上標準為參考國際文獻後經調整版本，非直接引用

未校驗的資料，可以很好地完成它原本的任務——

—

但不該直接拿來產出海平面趨勢。



## Q&A/附錄

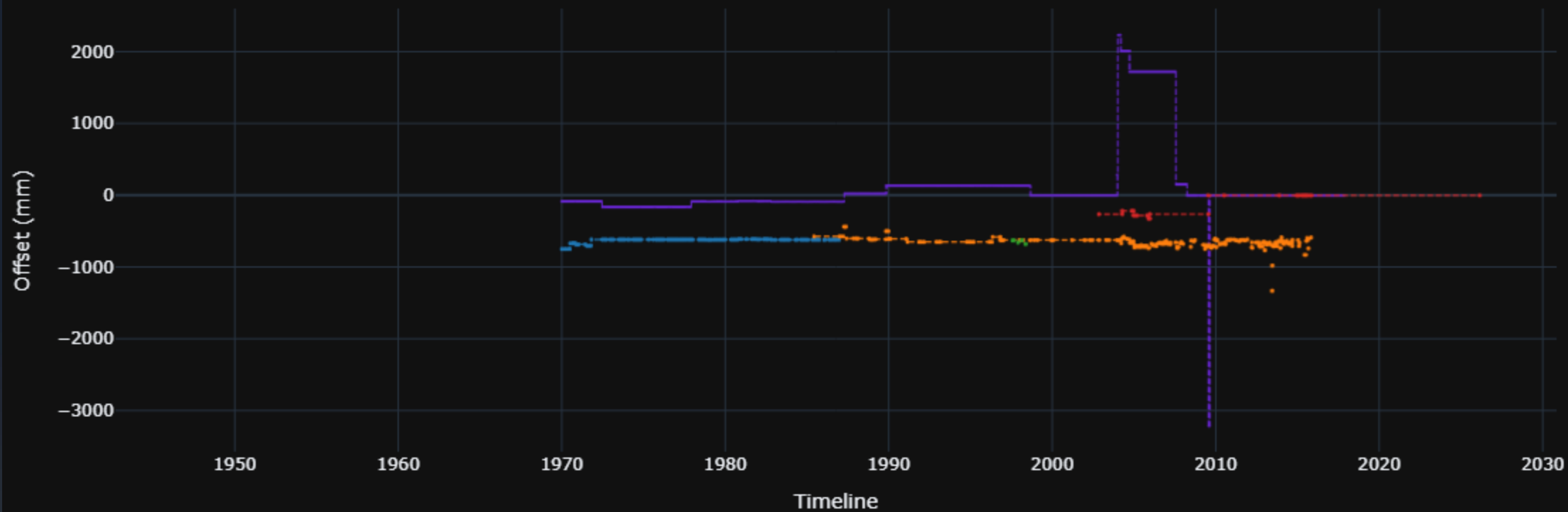
| A    | B |                 | C |                  | D |           | E |                             | F |                  |   |
|------|---|-----------------|---|------------------|---|-----------|---|-----------------------------|---|------------------|---|
| stid | ▼ | BEG             | ▼ | END              | ▼ | shift(mm) | ▼ | METHOD                      | ▼ | WHENS            | ▼ |
| 1486 |   | 2004/1/8 00:00  |   | 2007/8/2 23:59   |   | -1566     |   | Historical Datum Adjustment |   | 2007/8/3 10:22   |   |
| 1486 |   | 2004/1/8 00:00  |   | 2008/4/6 23:59   |   | 1566      |   | Historical Datum Adjustment |   | 2008/4/7 14:17   |   |
| 1486 |   | 2004/1/8 00:00  |   | 2008/4/6 23:59   |   | -1721     |   | Historical Datum Adjustment |   | 2008/4/7 14:18   |   |
| 1486 |   | 2004/1/1 00:00  |   | 2004/10/4 23:59  |   | -288      |   | Historical Datum Adjustment |   | 2008/4/30 16:04  |   |
| 1486 |   | 2009/8/1 00:00  |   | 2009/8/31 23:59  |   | 3207      |   | Historical Datum Adjustment |   | 2009/9/14 10:07  |   |
| 1486 |   | 2004/1/8 00:00  |   | 2009/7/28 14:00  |   | -261      |   | Moving Average Detect       |   | 2013/10/22 11:25 |   |
| 148  |   | 1987/1/1 00:00  |   | 1991/2/5 23:00   |   | 42        |   | Moving Average Detect       |   | 2013/10/22 13:34 |   |
| 1482 |   | 1947/5/16 00:00 |   | 1972/6/14 23:00  |   | -79       |   | Moving Average Detect       |   | 2013/10/22 14:21 |   |
| 1482 |   | 1947/5/16 00:00 |   | 1954/1/1 23:00   |   | -47       |   | Moving Average Detect       |   | 2013/10/22 14:25 |   |
| 1482 |   | 1947/5/16 00:00 |   | 1948/5/29 23:00  |   | 46        |   | Moving Average Detect       |   | 2013/10/22 14:26 |   |
| 1482 |   | 1947/5/16 00:00 |   | 1970/7/4 23:00   |   | 75        |   | Moving Average Detect       |   | 2013/10/22 14:34 |   |
| 1482 |   | 1947/5/16 00:00 |   | 1971/6/11 23:00  |   | -43       |   | Moving Average Detect       |   | 2013/10/22 14:42 |   |
| 1482 |   | 1947/5/16 00:00 |   | 1963/5/12 23:00  |   | -52       |   | Moving Average Detect       |   | 2013/10/22 14:44 |   |
| 1482 |   | 1947/5/16 00:00 |   | 1970/7/4 23:00   |   | 23        |   | Moving Average Detect       |   | 2013/10/22 14:49 |   |
| 148  |   | 1987/1/1 00:00  |   | 2012/11/19 23:00 |   | -121      |   | Moving Average Detect       |   | 2013/11/1 11:27  |   |
| 148  |   | 1987/1/1 00:00  |   | 2012/2/21 23:00  |   | 124       |   | Moving Average Detect       |   | 2013/11/1 11:30  |   |
| 148  |   | 1987/1/1 00:00  |   | 2009/9/29 00:00  |   | -5        |   | Moving Average Detect       |   | 2013/11/1 11:32  |   |
| 148  |   | 1987/1/1 00:00  |   | 2005/12/2 00:00  |   | 7         |   | Moving Average Detect       |   | 2013/11/1 11:39  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1978/7/7 23:00   |   | 49        |   | Moving Average Detect       |   | 2013/11/1 14:59  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1971/10/22 23:00 |   | -87       |   | Moving Average Detect       |   | 2013/11/1 15:23  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1971/6/25 23:00  |   | 63        |   | Moving Average Detect       |   | 2013/11/1 15:25  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1970/11/13 23:00 |   | 14        |   | Moving Average Detect       |   | 2013/11/1 15:28  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1960/10/18 23:00 |   | -45       |   | Moving Average Detect       |   | 2013/11/1 15:31  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1960/5/18 23:00  |   | 8         |   | Moving Average Detect       |   | 2013/11/1 15:32  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1952/8/31 23:00  |   | 41        |   | Moving Average Detect       |   | 2013/11/1 15:34  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1951/12/10 23:00 |   | -37       |   | Moving Average Detect       |   | 2013/11/1 15:35  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1950/11/20 23:00 |   | -26       |   | Moving Average Detect       |   | 2013/11/1 15:36  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1949/8/4 23:00   |   | 83        |   | Moving Average Detect       |   | 2013/11/1 15:37  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1947/11/29 23:00 |   | -54       |   | Moving Average Detect       |   | 2013/11/1 15:38  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1952/8/31 23:00  |   | 10        |   | Moving Average Detect       |   | 2013/11/5 14:08  |   |
| 1482 |   | 1947/5/16 00:00 |   | 1951/11/6 23:00  |   | -3        |   | Moving Average Detect       |   | 2013/11/5 14:12  |   |
| 1486 |   | 1990/1/1 00:00  |   | 2004/1/7 23:00   |   | -112      |   | Moving Average Detect       |   | 2013/11/6 16:27  |   |
| 1486 |   | 1947/5/16 00:00 |   | 2004/3/24 15:00  |   | -588      |   | Moving Average Detect       |   | 2013/11/13 15:35 |   |
| 1486 |   | 1947/5/16 00:00 |   | 1986/10/18 23:00 |   | 103       |   | Moving Average Detect       |   | 2013/11/13 17:08 |   |
| 1486 |   | 1947/5/16 00:00 |   | 1970/7/4 23:00   |   | -176      |   | Moving Average Detect       |   | 2013/11/14 10:55 |   |
| 1486 |   | 1947/5/16 00:00 |   | 2004/4/22 08:00  |   | -47       |   | Moving Average Detect       |   | 2013/11/14 12:05 |   |
| 1486 |   | 1947/5/16 00:00 |   | 1986/12/31 00:00 |   | 18        |   | Moving Average Detect       |   | 2013/12/5 11:06  |   |

|      |                  |                  |      |                                                                                                                                                                                                                                                                                                                                |                  |
|------|------------------|------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 1486 | 1986/10/19 00:00 | 1986/12/31 23:00 | 103  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2013/12/12 15:28 |
| 1486 | 1947/5/16 00:00  | 1986/12/31 22:00 | -149 | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2013/12/12 16:59 |
| 1486 | 1947/5/16 00:00  | 1987/6/1 00:00   | 93   | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2013/12/13 10:30 |
| 1486 | 1947/5/16 00:00  | 1987/6/1 00:00   | 71   | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2013/12/13 12:07 |
| 1486 | 1947/5/16 00:00  | 1970/11/13 23:00 | 85   | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/1/7 11:09   |
| 1486 | 1947/5/16 00:00  | 1969/12/26 23:00 | -113 | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/1/7 11:28   |
| 1486 | 1947/5/16 00:00  | 1978/7/7 23:00   | -47  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/7/24 16:52  |
| 1486 | 1947/5/16 00:00  | 1977/11/30 23:00 | 77   | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/7/25 11:08  |
| 1486 | 1947/5/16 00:00  | 1986/12/31 23:00 | -13  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/8/13 15:42  |
| 1486 | 1947/5/16 00:00  | 1986/12/31 23:00 | 64   | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/8/13 16:08  |
| 1486 | 1947/5/16 00:00  | 1986/12/31 23:00 | 43   | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/8/14 10:43  |
| 1486 | 1947/5/16 00:00  | 1986/12/31 23:00 | 22   | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/8/14 11:11  |
| 1486 | 1947/5/16 00:00  | 1986/12/31 23:00 | -98  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/8/14 11:45  |
| 1486 | 1947/5/16 00:00  | 1986/12/31 23:00 | 5    | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/8/14 13:50  |
| 1486 | 1947/5/16 00:00  | 1986/12/31 23:00 | 3    | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/8/14 14:35  |
| 1486 | 1947/5/16 00:00  | 2004/1/7 23:00   | 112  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/8/14 15:42  |
| 1486 | 1947/5/16 00:00  | 2004/1/7 23:00   | -38  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/8/14 17:10  |
| 1486 | 1947/5/16 00:00  | 1955/9/19 03:00  | -33  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/6 14:40  |
| 1486 | 1955/9/19 04:00  | 1969/12/27 23:00 | -106 | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/6 15:29  |
| 1486 | 1969/12/28 00:00 | 1970/11/15 23:00 | -219 | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/6 15:47  |
| 1486 | 1970/11/16 00:00 | 1979/12/31 23:00 | -134 | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/6 16:28  |
| 1486 | 1980/1/1 00:00   | 1987/4/1 00:00   | -132 | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/6 17:26  |
| 1486 | 1987/4/1 01:00   | 1988/10/26 00:00 | -111 | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/7 09:33  |
| 1486 | 1988/10/26 01:00 | 1989/12/31 23:00 | -122 | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/7 09:43  |
| 1486 | 1990/1/1 00:00   | 1996/5/16 23:00  | -117 | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/7 09:52  |
| 1486 | 1996/5/17 00:00  | 1996/11/6 23:00  | -48  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/7 09:55  |
| 1486 | 1996/11/7 00:00  | 1998/9/3 23:00   | -92  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/7 10:03  |
| 1486 | 1998/9/4 00:00   | 2005/1/1 00:00   | 45   | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/7 10:56  |
| 1486 | 2005/1/1 01:00   | 2005/12/2 00:00  | -20  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/7 11:26  |
| 1486 | 2005/12/2 01:00  | 2005/12/31 00:00 | -64  | Moving Average Detect                                                                                                                                                                                                                                                                                                          | 2014/10/7 11:45  |
| 1486 | 2019/10/15 00:00 | 2022/6/1 23:59   | 88   | Vertical datum alignment due to TGBM restoration. An inconsistency between the updated sensor height (from 1455 mm to 1547 mm) and the reference elevation parameters resulted in a vertical offset. Data has been re-processed with a systematic correction of 88 mm to restore datum continuity (theoretical offset: 92 mm). | 2022/7/11 09:30  |

## Kaohsiung Datum Comparison Audit

Legend:

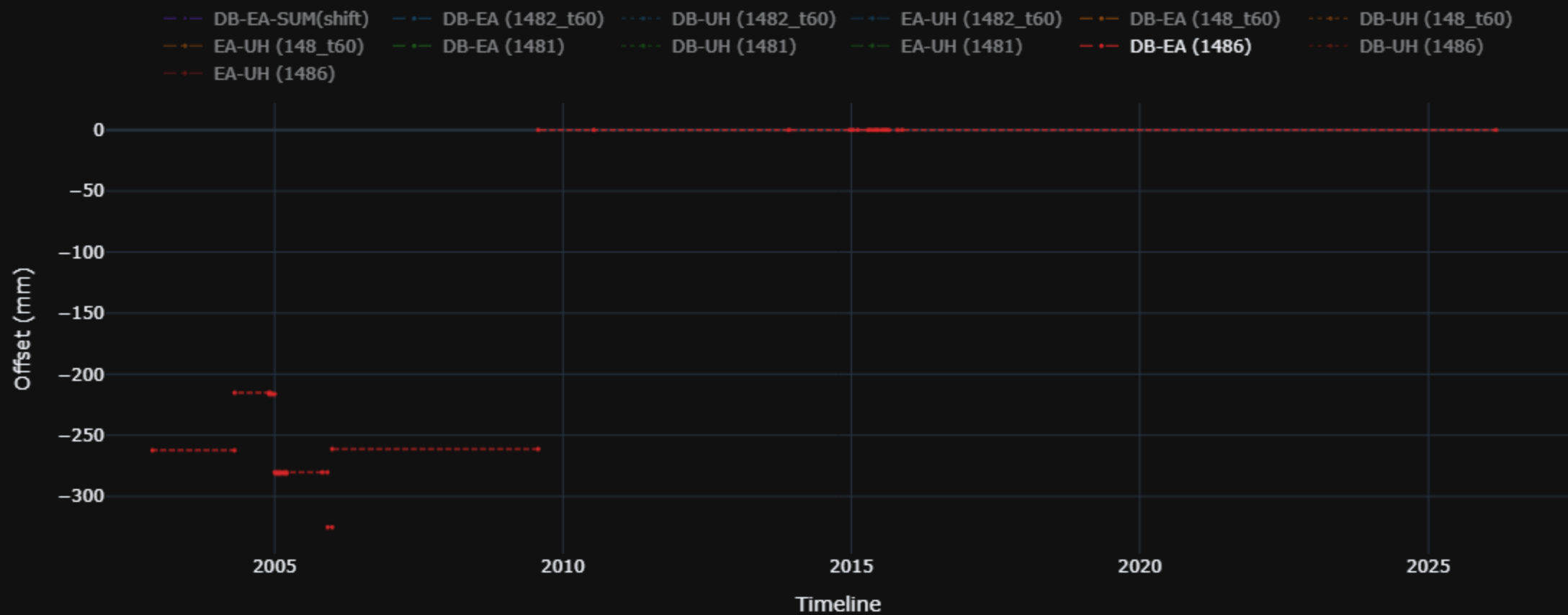
- DB-EA-SUM(shift)
- DB-EA (1482\_t60)
- DB-UH (1482\_t60)
- EA-UH (1482\_t60)
- DB-EA (148\_t60)
- DB-UH (148\_t60)
- EA-UH (148\_t60)
- DB-EA (1481)
- DB-UH (1481)
- EA-UH (1481)
- DB-EA (1486)
- DB-UH (1486)
- EA-UH (1486)



# Kaohsiung Datum Comparison Audit

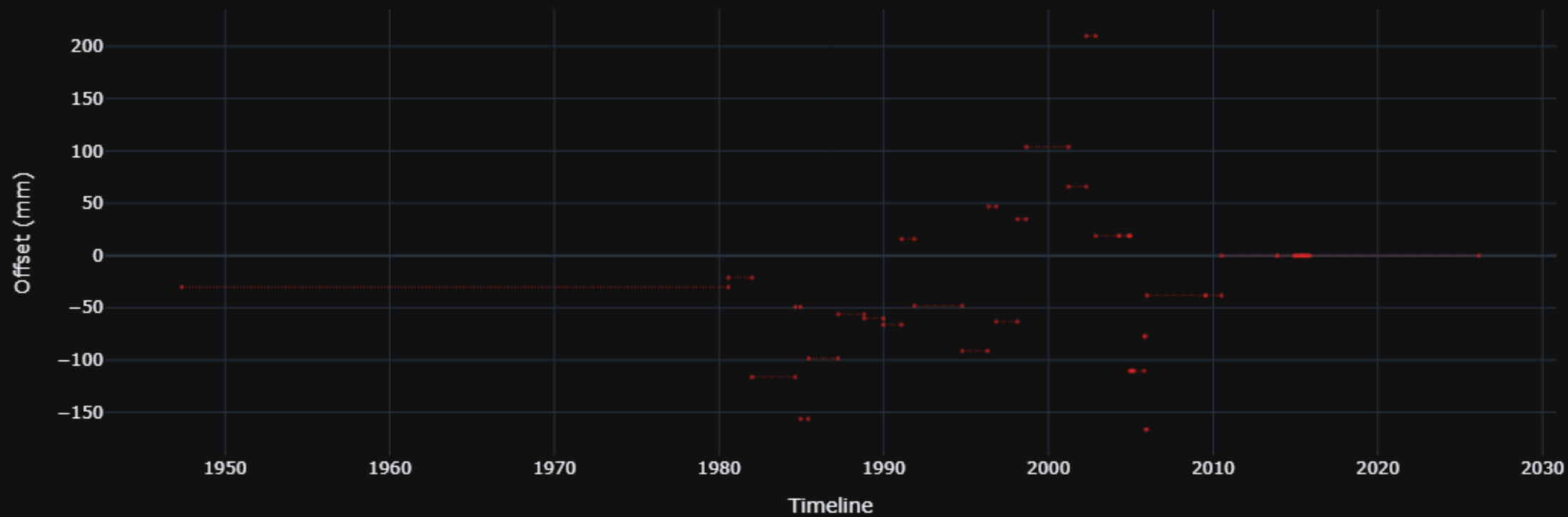
# Kaohsiung Datum Comparison Audit

## Kaohsiung Datum Comparison Audit



## Kaohsiung Datum Comparison Audit

DB-EA-SUM(shift) DB-EA (1482\_t60) DB-UH (1482\_t60) EA-UH (1482\_t60) DB-EA (148\_t60) DB-UH (148\_t60)  
EA-UH (148\_t60) DB-EA (1481) DB-UH (1481) EA-UH (1481) DB-EA (1486) DB-UH (1486)  
EA-UH (1486)



## Kaohsiung Datum Comparison Audit

## Kaohsiung Datum Comparison Audit

Legend:

- DB-EA-SUM(shift)
- DB-EA (1482\_t60)
- DB-UH (1482\_t60)
- EA-UH (1482\_t60)
- DB-EA (148\_t60)
- DB-UH (148\_t60)
- EA-UH (148\_t60)
- DB-EA (1481)
- DB-UH (1481)
- EA-UH (1481)
- DB-EA (1486)
- DB-UH (1486)
- EA-UH (1486)

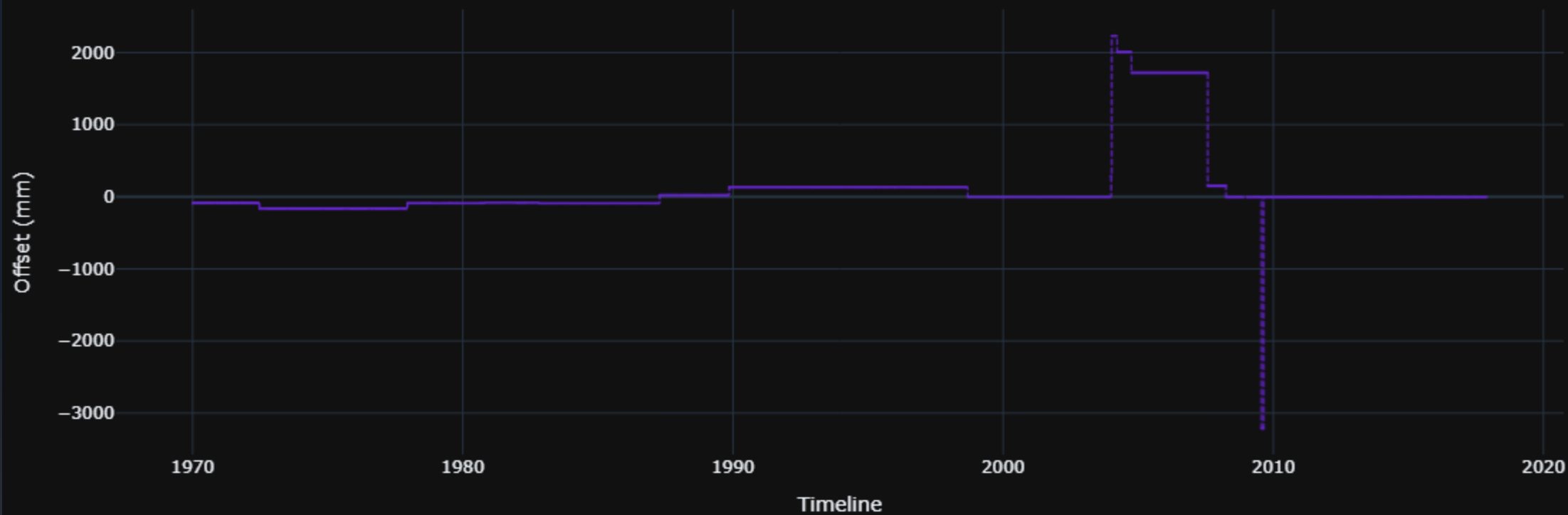


表 4.1 平均海平面永久服務中心(PSMSL)潮位站資料經海潮改正後所  
估算之海平面上升速率

| Country     | Station Name  | Sea level trends with Ocean tide correction |
|-------------|---------------|---------------------------------------------|
| China       | Zhapo         | 2.53±0.72                                   |
|             | Xi Sha        | 4.49±0.78                                   |
|             | Kanmen        | 3.72±0.70                                   |
|             | Waglan Island | 3.23±1.36                                   |
|             | Quarry Bay    | 1.92±0.79                                   |
|             | Tai Miu Wan   | 2.75±1.53                                   |
|             | Tai Po Kau    | 2.56±0.76                                   |
|             | Tsim Bei Tsui | 3.48±0.85                                   |
| Japan       | Shek Pik      | -0.42±1.09                                  |
|             | Nase          | 2.56±0.63                                   |
|             | Nakano Sima   | 4.23±0.55                                   |
|             | Okinawa       | 3.35±0.64                                   |
|             | Naha          | 3.55±0.67                                   |
| Philippines | Ishigaki      | 3.68±0.70                                   |
|             | Legaspi       | 7.97±0.79                                   |
|             | Cebu          | 6.26±0.82                                   |
| Mean        |               | 3.49                                        |

表 4.2 中央氣象局潮位站資料經海潮改正後所估算之海平面上升速率。  
Raw、Harmonic analysis 與 Moving average 分別表示原始資料、調和  
分析與移動平均

| Station Name  | Sea level trends (mm/yr) |                   |                |
|---------------|--------------------------|-------------------|----------------|
|               | Raw                      | Harmonic analysis | Moving average |
| Keelung       | 0.72±0.62                | 0.78±0.59         | 0.77±0.59      |
| Gengfang      | -13.10±0.99              | -11.39±0.92       | -13.10±0.96    |
| Su-ao         | 9.54±0.91                | 9.61±0.85         | 9.43±0.86      |
| Hualien       | 1.53±0.84                | 1.59±0.84         | 1.33±0.83      |
| Chenggong     | 4.75±0.56                | 4.69±0.55         | 4.76±0.53      |
| Fugang        | 0.05±0.61                | 0.06±0.61         | 0.06±0.59      |
| Houbihu       | 17.11±1.37               | 16.99±1.37        | 16.97±1.32     |
| Syunguangzui  | 9.13±0.70                | 10.03±0.69        | 9.22±0.67      |
| Donggang      | 14.25±1.10               | 13.97±1.07        | 14.29±1.04     |
| Kaohsiung     | -37.11±1.94              | -37.23±1.92       | -37.13±1.93    |
| Jiangjun      | 5.50±0.62                | 5.62±0.59         | 5.24±0.60      |
| Dongshi       | 22.89±0.99               | 23.04±0.95        | 22.96±0.96     |
| Wengang       | 32.88±1.34               | 32.31±1.35        | 33.16±1.31     |
| Penghu        | 9.72±0.78                | 9.56±0.73         | 9.74±0.74      |
| Boziliao      | 26.66±1.31               | 27.03±1.23        | 26.79±1.26     |
| Taichung Port | 10.06±0.80               | 9.30±0.76         | 10.84±0.77     |
| Hsinchu       | 5.63±0.76                | 3.90±0.71         | 5.12±0.71      |
| Jhuwei        | 26.20±1.24               | 27.81±1.16        | 26.85±1.22     |
| Mean          | 8.13                     | 8.20              | 8.18           |

表 4.3 平均海平面永久服務中心(PSMSL)潮位站資料經海潮與逆氣壓  
效應改正後所估算之海平面上升速率

| Country     | Station Name  | Sea level trends with Ocean tide and IB corrections |
|-------------|---------------|-----------------------------------------------------|
| China       | Zhapo         | 1.96±0.72                                           |
|             | Xi Sha        | 3.97±0.76                                           |
|             | Kanmen        | 3.27±0.70                                           |
|             | Waglan Island | 2.36±1.36                                           |
|             | Quarry Bay    | 1.34±0.78                                           |
|             | Tai Miu Wan   | 2.57±1.51                                           |
|             | Tai Po Kau    | 1.97±0.76                                           |
|             | Tsim Bei Tsui | 2.88±0.83                                           |
| Japan       | Shek Pik      | -0.51±1.09                                          |
|             | Nase          | 2.11±0.60                                           |
|             | Nakano Sima   | 3.74±0.54                                           |
|             | Okinawa       | 3.01±0.62                                           |
|             | Naha          | 3.29±0.63                                           |
| Philippines | Ishigaki      | 3.18±0.69                                           |
|             | Legaspi       | 7.96±0.64                                           |
|             | Cebu          | 6.18±0.69                                           |
| Mean        |               | 3.08                                                |

表 4.4 中央氣象局潮位站資料經海潮與逆氣壓效應改正後所估算之海  
平面上升速率

| Station Name  | Sea level trends with Ocean tide and IB corrections |
|---------------|-----------------------------------------------------|
| Keelung       | 0.38±0.54                                           |
| Gengfang      | -12.02±0.94                                         |
| Su-ao         | 8.53±0.77                                           |
| Hualien       | 1.37±0.91                                           |
| Chenggong     | 4.25±0.52                                           |
| Fugang        | -0.41±0.58                                          |
| Houbihu       | 16.58±1.49                                          |
| Syunguangzui  | 9.37±0.66                                           |
| Donggang      | 13.76±0.98                                          |
| Kaohsiung     | -37.62±1.90                                         |
| Jiangjun      | 5.21±0.56                                           |
| Dongshi       | 22.55±0.98                                          |
| Wengang       | 31.80±1.36                                          |
| Penghu        | 9.21±0.69                                           |
| Boziliao      | 27.02±1.22                                          |
| Taichung Port | 9.10±0.73                                           |
| Hsinchu       | 3.46±0.69                                           |
| Jhuwei        | 25.95±1.18                                          |
| Mean          | 7.69                                                |

表 4.3 平均海平面永久服務中心(PMSL)潮位站資料經海潮與逆氣壓

效應改正後所估算之海平面上升速率

| Country     | Station Name  | Sea level trends with Ocean tide and IB corrections |
|-------------|---------------|-----------------------------------------------------|
| China       | Zhapo         | 1.96±0.72                                           |
|             | Xi Sha        | 3.97±0.76                                           |
|             | Kanmen        | 3.27±0.70                                           |
|             | Waglan Island | 2.36±1.36                                           |
|             | Quarry Bay    | 1.34±0.78                                           |
|             | Tai Miu Wan   | 2.57±1.51                                           |
|             | Tai Po Kau    | 1.97±0.76                                           |
|             | Tsim Bei Tsui | 2.88±0.83                                           |
| Japan       | Shek Pik      | -0.51±1.09                                          |
|             | Nase          | 2.11±0.60                                           |
|             | Nakano Sima   | 3.74±0.54                                           |
|             | Okinawa       | 3.01±0.62                                           |
|             | Naha          | 3.29±0.63                                           |
| Philippines | Ishigaki      | 3.18±0.69                                           |
|             | Legaspi       | 7.96±0.64                                           |
|             | Cebu          | 6.18±0.69                                           |
| Mean        |               | 3.08                                                |

表 4.4 中央氣象局潮位站資料經海潮與逆氣壓效應改正後所估算之海平面上升速率

| Station Name  | Sea level trends with Ocean tide and IB corrections |
|---------------|-----------------------------------------------------|
| Keelung       | 0.38±0.54                                           |
| Gengfang      | -12.02±0.94                                         |
| Su-ao         | 8.53±0.77                                           |
| Hualien       | 1.37±0.91                                           |
| Chenggong     | 4.25±0.52                                           |
| Fugang        | -0.41±0.58                                          |
| Houbihu       | 16.58±1.49                                          |
| Syunguangzui  | 9.37±0.66                                           |
| Donggang      | 13.76±0.98                                          |
| Kaohsiung     | -37.62±1.90                                         |
| Jiangjun      | 5.21±0.56                                           |
| Dongshi       | 22.55±0.98                                          |
| Wengang       | 31.80±1.36                                          |
| Penghu        | 9.21±0.69                                           |
| Boziliao      | 27.02±1.22                                          |
| Taichung Port | 9.10±0.73                                           |
| Hsinchu       | 3.46±0.69                                           |
| Jhuwei        | 25.95±1.18                                          |
| Mean          | 7.69                                                |

表 4.5 平均海平面永久服務中心(PMSL)潮位站資料經海潮、逆氣壓

效應與基準偏移改正後所估算之海平面上升速率

| Country     | Station Name   | Sea level trends with Ocean tide, IB, and datum shifts corrections |            |
|-------------|----------------|--------------------------------------------------------------------|------------|
|             |                | AVISO                                                              | RADs       |
| China       | Zhapo          | 1.96±0.72                                                          | 1.96±0.72  |
|             | Xi Sha         | 3.97±0.76                                                          | 3.97±0.76  |
|             | Kanmen         | 3.27±0.70                                                          | 3.27±0.70  |
|             | Waglan Island* | 16.86±1.12                                                         | 17.74±1.11 |
|             | Quarry Bay     | 1.34±0.78                                                          | 1.34±0.78  |
|             | Tai Miu Wan    | 2.57±1.51                                                          | 2.57±1.51  |
|             | Tai Po Kau     | 1.97±0.76                                                          | 1.97±0.76  |
|             | Tsim Bei Tsui  | 2.88±0.83                                                          | 2.88±0.83  |
| Japan       | Shek Pik       | -0.51±1.09                                                         | -0.51±1.09 |
|             | Nase           | 2.11±0.60                                                          | 2.11±0.60  |
|             | Nakano Sima    | 3.74±0.54                                                          | 3.74±0.54  |
|             | Okinawa        | 3.01±0.62                                                          | 3.01±0.62  |
| Philippines | Naha           | 3.29±0.63                                                          | 3.29±0.63  |
|             | Ishigaki       | 3.18±0.69                                                          | 3.18±0.69  |
|             | Legaspi        | 7.96±0.64                                                          | 7.96±0.64  |
|             | Cebu           | 6.18±0.69                                                          | 6.18±0.69  |

\*為潮位資料中有偏移量情形

表 4.6 中央氣象局潮位站資料經海潮、逆氣壓效應與基準偏移改正後所估算之海平面上升速率

| Station Name  | Sea level trends with Ocean tide, IB, and datum shifts corrections |            |
|---------------|--------------------------------------------------------------------|------------|
|               | AVISO                                                              | RADs       |
| Keelung       | 2.73±0.40                                                          | 3.00±0.40  |
| Gengfang      | -1.08±0.61                                                         | -1.02±0.61 |
| Su-ao         | 5.20±0.50                                                          | 5.75±0.50  |
| Hualien       | 5.43±0.71                                                          | 6.12±0.71  |
| Chenggong*    | 4.25±0.52                                                          | 4.25±0.52  |
| Fugang        | 0.20±0.43                                                          | 0.21±0.44  |
| Houbihu       | 25.16±0.98                                                         | 25.11±1.00 |
| Syunguangzui  | 14.02±0.52                                                         | 13.11±0.52 |
| Donggang      | 6.41±1.00                                                          | 7.36±0.98  |
| Kaohsiung     | 2.50±0.51                                                          | 3.08±0.50  |
| Jiangjun*     | 5.21±0.56                                                          | 5.21±0.56  |
| Dongshi       | 28.95±0.61                                                         | 29.84±0.61 |
| Wengang       | 26.35±0.73                                                         | 26.44±0.72 |
| Penghu        | 1.66±0.46                                                          | 1.38±0.46  |
| Boziliao      | 29.04±0.67                                                         | 30.28±0.66 |
| Taichung Port | 16.20±0.52                                                         | 15.84±0.51 |
| Hsinchu       | 4.37±0.47                                                          | 4.89±0.46  |
| Jhuwei        | 32.79±0.83                                                         | 32.84±0.83 |
| Mean          | 11.63                                                              | 11.87      |

\*為潮位資料中有偏移量情形

表 4.13 利用潮位站資料估算 1993-2012 臺灣周圍絕對海平面上升速率。  
Six-parameters 與 Multivariable 分別為在擬合時未考慮與考慮海平面  
資料中氣候因子影響。AVISO 與 RADs 分別表示改正測站地表垂直變  
動時所使用的測高資料來源

| Country     | Station | Sea level trends (mm/yr) |               |            |                    |               |            |
|-------------|---------|--------------------------|---------------|------------|--------------------|---------------|------------|
|             |         | AVISO                    |               |            | RADs               |               |            |
|             |         | Six-parameter<br>s       | Multivariable | Difference | Six-parameter<br>s | Multivariable | Difference |
| China       | ZP      | 2.36±0.73                | -0.28±1.11    | -2.64      | 2.17±0.73          | -0.47±1.11    | -2.64      |
|             | XS      | 6.24±0.76                | 2.36±1.11     | -3.88      | 4.74±0.76          | 0.86±1.11     | -3.88      |
|             | KM      | 2.40±0.69                | 0.65±1.14     | -1.75      | 2.20±0.69          | 0.45±1.14     | -1.75      |
|             | WGI     | 2.39±1.12                | -1.34±1.63    | -3.73      | 2.13±1.12          | -1.25±1.62    | -3.38      |
|             | QB      | 1.83±0.78                | -1.25±1.19    | -3.08      | 1.44±0.78          | -1.64±1.19    | -3.08      |
|             | TMW*    | 1.98±1.52                | -3.43±1.77    | -5.41      | 0.96±1.52          | -4.45±1.77    | -5.41      |
|             | TPK     | 2.31±0.76                | 1.56±1.18     | -0.75      | 1.63±0.76          | 0.88±1.18     | -0.75      |
|             | TBT     | 2.34±0.83                | -1.10±1.33    | -3.44      | 1.78±0.83          | -1.66±1.33    | -3.44      |
|             | SP*     | 1.28±1.10                | -1.51±1.26    | -2.79      | -0.17±1.10         | -2.96±1.26    | -2.79      |
| Taiwan      | KL      | 3.47±0.40                | 4.91±0.65     | 1.44       | 3.09±0.40          | 4.59±0.65     | 1.50       |
|             | GF*     | 3.76±0.61                | 3.22±0.69     | -0.54      | 3.45±0.61          | 2.90±0.69     | -0.55      |
|             | SA*     | 1.37±0.49                | 1.59±0.64     | 0.22       | 0.86±0.49          | 1.21±0.64     | 0.35       |
|             | HL*     | 1.05±0.71                | 1.58±0.95     | 0.53       | 0.49±0.71          | 1.17±0.95     | 0.68       |
|             | CHG     | 2.79±0.52                | 4.60±0.81     | 1.81       | 2.18±0.52          | 3.99±0.81     | 1.81       |
|             | FG      | 3.66±0.43                | 3.97±0.68     | 0.31       | 2.89±0.44          | 3.28±0.69     | 0.39       |
|             | HBH*    | 3.46±0.98                | 3.82±1.15     | 0.36       | 3.11±1.00          | 3.66±1.14     | 0.55       |
|             | SGZ     | 4.95±0.52                | 3.23±0.81     | -1.72      | 5.04±0.52          | 3.64±0.81     | -1.40      |
|             | DG*     | 6.77±1.00                | 3.00±1.24     | -3.77      | 6.17±0.98          | 2.80±1.24     | -3.37      |
|             | KS      | 4.99±0.51                | 3.58±0.77     | -1.41      | 4.94±0.50          | 3.74±0.76     | -1.20      |
|             | JG      | 4.78±0.56                | 5.48±0.88     | 0.70       | 4.73±0.56          | 5.43±0.88     | 0.70       |
|             | DS      | 4.70±0.61                | 5.77±0.97     | 1.07       | 4.62±0.62          | 5.99±0.96     | 1.37       |
|             | WG      | 3.92±0.73                | 3.56±1.10     | -0.36      | 4.00±0.72          | 4.14±1.09     | 0.14       |
|             | PH      | 2.23±0.46                | -0.20±0.70    | -2.43      | 0.91±0.46          | -1.47±0.72    | -2.38      |
|             | BZL*    | 4.44±0.67                | 2.44±0.99     | -2.00      | 4.27±0.66          | 2.32±0.96     | -1.95      |
|             | TCP     | 4.48±0.52                | 4.19±1.00     | -0.29      | 4.05±0.51          | 4.44±0.98     | 0.39       |
|             | HSC     | 2.92±0.47                | 2.01±0.72     | -0.91      | 2.43±0.46          | 1.96±0.72     | -0.47      |
| Japan       | NS      | 2.41±0.59                | 3.52±0.97     | 1.11       | 2.82±0.59          | 3.93±0.97     | 1.11       |
|             | NKNS    | 2.84±0.54                | 0.92±0.86     | -1.92      | 2.95±0.54          | 1.03±0.86     | -1.92      |
|             | OKNW    | 2.92±0.62                | 4.06±0.99     | 1.14       | 2.67±0.62          | 3.81±0.99     | 1.14       |
|             | NH      | 2.52±0.63                | 3.27±1.00     | 0.75       | 2.23±0.63          | 2.98±1.00     | 0.75       |
|             | IGK     | 3.25±0.70                | 4.38±1.09     | 1.13       | 1.82±0.70          | 2.95±1.09     | 1.13       |
| Philippines | LGSP    | 7.61±0.64                | 4.07±0.73     | -3.54      | 7.02±0.64          | 3.48±0.73     | -3.54      |
|             | CB      | 7.88±0.69                | 3.48±0.81     | -4.40      | 7.27±0.69          | 2.87±0.81     | -4.40      |
| All regions |         | 3.52                     | 2.31          | -1.22      | 3.06               | 1.96          | -1.10      |

\*表示資料無完整涵蓋 1993-2012 年

表 4.15 利用潮位站資料估算 2003-2012 臺灣周圍絕對海平面上升速率。  
Fitting6 與 Multivariable 分別為在擬合時未考慮與考慮海平面資料中  
氣候因子影響。AVISO 與 RADs 分別表示改正測站地表垂直變動時所  
使用的測高資料來源

| Country     | Station | Sea level trends (mm/yr) |               |            |                    |               |            |
|-------------|---------|--------------------------|---------------|------------|--------------------|---------------|------------|
|             |         | AVISO                    |               |            | RADs               |               |            |
|             |         | Six-paramet<br>ers       | Multivariable | Difference | Six-paramet<br>ers | Multivariable | Difference |
| China       | ZP      | 5.88±2.08                | 9.44±5.97     | 3.56       | 2.45±2.08          | 6.01±5.97     | 3.56       |
|             | XS      | 7.98±2.27                | -4.74±6.67    | -12.72     | 6.30±2.27          | -6.42±6.67    | -12.72     |
|             | KM      | 2.55±1.93                | 10.38±5.48    | 7.83       | 0.07±1.93          | 7.90±5.48     | 7.83       |
|             | WGI     | 9.78±2.53                | 2.92±7.29     | -6.86      | 6.90±2.53          | -0.03±7.29    | -6.93      |
|             | QB      | 5.91±2.25                | 14.96±6.38    | 9.05       | 2.87±2.25          | 11.92±6.38    | 9.05       |
|             | TMW     | 7.55±2.52                | 17.56±6.95    | 10.01      | 4.49±2.52          | 14.50±6.95    | 10.01      |
|             | TPK     | 6.32±2.04                | 12.24±5.81    | 5.92       | 3.20±2.04          | 9.12±5.81     | 5.92       |
|             | TBT     | 6.79±2.31                | 9.13±6.58     | 2.34       | 3.53±2.31          | 5.87±6.57     | 2.34       |
|             | SP      | 6.52±1.98                | 8.22±5.56     | 1.7        | 3.39±1.98          | 5.09±5.56     | 1.7        |
| Taiwan      | KL      | -0.31±1.06               | 7.33±2.94     | 7.64       | -1.04±1.06         | 6.49±2.94     | 7.53       |
|             | GF*     | -3.48±1.62               | -2.52±4.59    | 0.96       | -3.20±1.62         | -2.24±4.59    | 0.96       |
|             | SA      | 1.00±1.08                | 10.09±2.73    | 9.09       | 0.11±1.08          | 9.15±2.73     | 9.04       |
|             | HL      | 0.40±1.30                | 5.56±3.38     | 5.16       | -0.53±1.30         | 4.39±3.37     | 4.92       |
|             | CHG     | -0.81±1.28               | 13.23±3.29    | 14.04      | -1.75±1.28         | 12.29±3.29    | 14.04      |
|             | FG      | 0.76±1.26                | 1.78±3.62     | 1.02       | -0.23±1.27         | 0.14±3.66     | 0.37       |
|             | HBH     | 9.46±1.68                | 11.69±4.76    | 2.23       | 7.88±1.69          | 10.23±4.78    | 2.35       |
|             | SGZ     | 10.32±1.24               | 8.35±3.58     | -1.97      | 8.58±1.25          | 6.52±3.59     | -2.06      |
|             | DG      | 11.11±1.59               | 3.30±4.16     | -7.81      | 9.20±1.59          | 1.53±4.17     | -7.67      |
|             | KS      | 10.28±1.32               | 16.61±3.77    | 6.33       | 8.70±1.31          | 15.09±3.76    | 6.39       |
|             | JG      | 9.98±1.21                | 13.14±3.45    | 3.16       | 8.28±1.21          | 11.44±3.45    | 3.16       |
|             | DS      | 9.56±1.71                | 26.78±4.84    | 17.22      | 7.86±1.71          | 24.87±4.85    | 17.01      |
|             | WG      | 9.70±1.26                | 13.12±3.66    | 3.42       | 8.08±1.26          | 11.56±3.67    | 3.48       |
|             | PH      | 8.54±1.06                | 6.32±3.00     | -2.22      | 1.55±1.05          | 3.99±3.02     | 2.44       |
|             | BZL     | 9.23±1.14                | 11.58±3.25    | 2.35       | 6.86±1.13          | 8.87±3.24     | 2.01       |
|             | TCP     | 8.53±1.11                | 10.27±3.20    | 1.74       | 5.01±1.07          | 5.35±3.21     | 0.34       |
|             | HSC     | 8.15±1.46                | 13.98±4.22    | 5.83       | 5.35±1.46          | 10.64±4.23    | 5.29       |
| Japan       | NS      | 0.28±1.52                | 1.25±4.36     | 0.97       | 0.28±1.52          | 1.25±4.36     | 0.97       |
|             | NKNS    | 0.76±1.55                | -2.00±4.48    | -2.76      | -0.07±1.55         | -2.83±4.48    | -2.76      |
|             | OKNW    | -0.86±1.49               | 2.45±4.19     | 3.31       | -1.37±1.49         | 1.94±4.19     | 3.31       |
|             | NH      | -1.84±1.52               | -0.30±4.30    | 1.54       | -2.52±1.52         | -0.98±4.30    | 1.54       |
|             | IGK     | -0.68±2.18               | -2.87±6.42    | -2.19      | -2.14±2.18         | -4.33±6.42    | -2.19      |
| Philippines | LGSP    | 15.13±1.63               | 20.51±4.52    | 5.38       | 12.00±1.63         | 17.37±4.52    | 5.37       |
|             | CB      | 17.76±1.40               | 22.38±4.04    | 4.62       | 11.19±1.40         | 15.81±4.04    | 4.62       |
| All regions |         | 5.83                     | 8.85          | 3.03       | 3.68               | 6.74          | 3.07       |

\*表示資料無完整涵蓋 2003-2012 年

表 3.1 1993-2012 臺灣周圍絕對海平面上升速率。Six-parameters 與 Multivariable 分別為在擬合時未考慮與考慮海平面資料中氣候因子影響。AVISO 與 RADs 分別表示衛星測高之資料來源

| Country     | Station | Sea level trends (mm/yr) |               |            |                    |               |            |
|-------------|---------|--------------------------|---------------|------------|--------------------|---------------|------------|
|             |         | AVISO                    |               |            | RADs               |               |            |
|             |         | Six-paramet<br>ers       | Multivariable | Difference | Six-paramet<br>ers | Multivariable | Difference |
| China       | ZP      | 2.63±0.54                | 0.14±0.81     | -2.49      | 2.63±0.56          | 1.31±0.86     | -1.32      |
|             | XS      | 5.89±0.57                | 3.83±0.88     | -2.06      | 4.44±0.57          | 1.99±0.90     | -2.45      |
|             | KM      | 2.94±0.43                | 1.85±0.68     | -1.09      | 2.73±0.43          | 2.34±0.69     | -0.39      |
|             | WGI     | 2.32±0.51                | 0.01±0.75     | -2.31      | 2.02±0.51          | 0.57±0.77     | -1.45      |
|             | QB      | 2.30±0.52                | -0.06±0.77    | -2.36      | 1.90±0.52          | 0.41±0.79     | -1.49      |
|             | TMW     | 2.29±0.52                | -0.07±0.77    | -2.36      | 1.99±0.52          | 0.55±0.79     | -1.44      |
|             | TPK     | 2.34±0.53                | 0.00±0.79     | -2.34      | 1.80±0.53          | 0.27±0.82     | -1.53      |
|             | TBT     | 2.40±0.54                | 0.03±0.81     | -2.37      | 1.80±0.54          | 0.27±0.83     | -1.53      |
|             | SP      | 2.44±0.52                | 0.16±0.77     | -2.28      | 1.82±0.52          | 0.31±0.80     | -1.51      |
| Taiwan      | KL      | 3.16±0.36                | 3.47±0.57     | 0.31       | 2.92±0.36          | 3.40±0.57     | 0.48       |
|             | GF      | 3.24±0.37                | 3.57±0.57     | 0.33       | 2.88±0.37          | 3.32±0.58     | 0.44       |
|             | SA      | 3.20±0.37                | 3.47±0.58     | 0.27       | 2.78±0.38          | 3.15±0.59     | 0.37       |
|             | HL      | 3.20±0.39                | 3.38±0.61     | 0.18       | 2.68±0.40          | 2.92±0.63     | 0.24       |
|             | CHG     | 3.34±0.42                | 3.16±0.66     | -0.18      | 2.65±0.44          | 2.67±0.67     | 0.02       |
|             | FG      | 3.27±0.44                | 3.18±0.68     | -0.09      | 2.67±0.45          | 2.59±0.69     | -0.08      |
|             | HBH     | 4.58±0.35                | 1.47±0.47     | -3.11      | 4.44±0.35          | 1.77±0.49     | -2.67      |
|             | SGZ     | 4.59±0.35                | 1.48±0.47     | -3.11      | 4.45±0.35          | 1.79±0.49     | -2.66      |
|             | DG      | 4.50±0.36                | 1.38±0.47     | -3.12      | 4.40±0.36          | 1.73±0.50     | -2.67      |
|             | KS      | 4.49±0.36                | 1.36±0.48     | -3.13      | 4.40±0.36          | 1.72±0.50     | -2.68      |
|             | JG      | 4.22±0.37                | 1.08±0.49     | -3.14      | 4.22±0.37          | 1.57±0.51     | -2.65      |
|             | DS      | 4.04±0.37                | 0.93±0.50     | -3.11      | 4.03±0.37          | 1.38±0.52     | -2.65      |
|             | WG      | 4.04±0.37                | 0.93±0.50     | -3.11      | 4.03±0.37          | 1.38±0.52     | -2.65      |
|             | PH      | 2.45±0.52                | 0.78±0.82     | -1.67      | 1.23±0.53          | -0.34±0.85    | -1.57      |
|             | BZL     | 3.92±0.38                | 0.82±0.51     | -3.1       | 3.87±0.38          | 1.24±0.53     | -2.63      |
|             | TCP     | 3.45±0.43                | 0.33±0.61     | -3.12      | 3.14±0.44          | 0.40±0.64     | -2.74      |
|             | HSC     | 3.11±0.46                | 0.23±0.68     | -2.88      | 2.44±0.49          | -0.09±0.73    | -2.53      |
|             | JW      | 3.23±0.36                | 3.51±0.57     | 0.28       | 2.91±0.37          | 3.33±0.58     | 0.42       |
| Japan       | NS      | 3.03±0.55                | 3.45±0.87     | 0.42       | 3.06±0.54          | 3.19±0.85     | 0.13       |
|             | NKNS    | 2.86±0.52                | 1.37±0.83     | -1.49      | 2.79±0.57          | 2.48±0.89     | -0.31      |
|             | OKNW    | 2.63±0.70                | 3.16±1.10     | 0.53       | 2.53±0.72          | 3.36±1.13     | 0.83       |
|             | NH      | 2.44±0.68                | 2.65±1.07     | 0.21       | 2.28±0.69          | 2.64±1.09     | 0.36       |
|             | IGK     | 3.50±0.59                | 4.82±0.93     | 1.32       | 2.07±0.60          | 3.25±0.95     | 1.18       |
| Philippines | LGSP    | 7.61±0.61                | 2.91±0.75     | -4.70      | 6.47±0.64          | 2.82±0.83     | -3.65      |
|             | CB      | 8.50±0.65                | 2.53±0.67     | -5.97      | 8.01±0.77          | 3.02±0.93     | -4.99      |
| All regions |         | 3.60                     | 1.75          | -1.85      | 3.20               | 1.80          | -1.40      |

表 3.3 2003-2012 臺灣周圍絕對海平面上升速率。Six-parameters 與 Multivariable 分別為在擬合時未考慮與考慮海平面資料中氣候因子影響。AVISO 與 RADs 分別表示衛星測高之資料來源

| Country     | Station | Sea level trends (mm/yr) |               |            |                    |               |            |
|-------------|---------|--------------------------|---------------|------------|--------------------|---------------|------------|
|             |         | AVISO                    |               |            | RADs               |               |            |
|             |         | Six-paramet<br>ers       | Multivariable | Difference | Six-paramet<br>ers | Multivariable | Difference |
| China       | ZP      | 6.53±1.46                | 8.67±4.18     | 2.14       | 3.16±1.52          | 4.61±4.35     | 1.45       |
|             | XS      | 8.49±1.84                | -0.28±5.20    | -8.77      | 6.81±1.84          | -2.22±5.22    | -9.03      |
|             | KM      | 3.45±1.22                | 8.77±3.45     | 5.32       | 1.10±1.20          | 5.57±3.55     | 4.47       |
|             | WGI     | 6.43±1.35                | 9.08±3.82     | 2.65       | 3.59±1.39          | 6.88±3.96     | 3.29       |
|             | QB      | 6.46±1.38                | 9.19±3.92     | 2.73       | 3.46±1.42          | 6.76±4.05     | 3.30       |
|             | TMW     | 6.48±1.37                | 9.22±3.90     | 2.74       | 3.52±1.41          | 6.87±4.03     | 3.35       |
|             | TPK     | 6.54±1.42                | 9.47±4.02     | 2.93       | 3.48±1.46          | 6.89±4.17     | 3.41       |
|             | TBT     | 6.59±1.45                | 9.50±4.11     | 2.91       | 3.42±1.49          | 6.82±4.24     | 3.4        |
|             | SP      | 6.36±1.38                | 8.97±3.92     | 2.61       | 3.26±1.42          | 6.37±4.06     | 3.11       |
| Taiwan      | KL      | 0.39±1.08                | -3.81±3.07    | -4.20      | -0.36±1.08         | -5.23±3.05    | -4.87      |
|             | GF      | 0.10±1.10                | -4.83±3.12    | -4.93      | -0.58±1.10         | -6.22±3.10    | -5.64      |
|             | SA      | -0.03±1.13               | -5.66±3.15    | -5.63      | -0.78±1.13         | -7.28±3.15    | -6.50      |
|             | HL      | -0.17±1.19               | -6.99±3.29    | -6.82      | -1.03±1.21         | -8.97±3.29    | -7.94      |
|             | CHG     | -0.01±1.29               | -8.29±3.45    | -8.28      | -0.99±1.31         | -10.68±3.47   | -9.69      |
|             | FG      | 0.09±1.33                | -8.72±3.54    | -8.81      | -0.91±1.36         | -11.24±3.56   | -10.33     |
|             | HBH     | 9.72±0.81                | 7.56±2.32     | -2.16      | 8.06±0.83          | 5.63±2.38     | -2.43      |
|             | SGZ     | 9.72±0.81                | 7.57±2.32     | -2.15      | 8.06±0.83          | 5.67±2.38     | -2.39      |
|             | DG      | 9.65±0.82                | 7.61±2.35     | -2.04      | 8.03±0.84          | 5.83±2.40     | -2.20      |
|             | KS      | 9.64±0.82                | 7.64±2.35     | -2.00      | 8.04±0.84          | 5.86±2.41     | -2.18      |
|             | JG      | 9.32±0.84                | 7.71±2.41     | -1.61      | 7.65±0.86          | 5.59±2.48     | -2.06      |
|             | DS      | 9.09±0.85                | 7.75±2.45     | -1.34      | 7.38±0.88          | 5.56±2.53     | -1.82      |
|             | WG      | 9.09±0.85                | 7.75±2.45     | -1.34      | 7.38±0.88          | 5.58±2.53     | -1.80      |
|             | PH      | 5.01±1.40                | 8.91±4.02     | 3.90       | 1.04±1.39          | 3.00±4.00     | 1.96       |
|             | BZL     | 8.95±0.86                | 7.84±2.49     | -1.11      | 7.20±0.89          | 5.59±2.57     | -1.61      |
|             | TCP     | 8.40±1.01                | 8.28±2.91     | -0.12      | 6.29±1.07          | 5.49±3.07     | -0.80      |
|             | HSC     | 7.72±1.08                | 9.33±3.23     | 1.61       | 4.97±1.21          | 5.72±3.48     | 0.75       |
|             | JW      | 0.73±1.07                | -2.91±3.06    | -3.64      | 0.03±1.07          | -4.16±3.06    | -4.19      |
| Japan       | NS      | -0.29±1.37               | 4.50±3.94     | 4.79       | -0.33±1.45         | -1.98±4.30    | -1.65      |
|             | NKNS    | 0.15±1.56                | -0.58±4.64    | -0.73      | -0.59±1.55         | -4.17±4.42    | -3.58      |
|             | OKNW    | -0.03±1.73               | -1.56±4.92    | -1.53      | -0.53±1.81         | -1.86±5.13    | -1.33      |
|             | NH      | -1.23±1.64               | -5.58±4.64    | -4.35      | -1.88±1.72         | -6.30±4.84    | -4.42      |
|             | IGK     | -0.26±1.68               | -6.25±4.79    | -5.99      | -1.70±1.69         | -7.77±4.83    | -6.07      |
| Philippines | LGSP    | 14.65±1.64               | 2.10±4.30     | -12.55     | 10.59±1.72         | -2.66±4.60    | -13.25     |
|             | CB      | 18.62±1.59               | 4.68±3.70     | -13.94     | 12.66±2.07         | -5.84±5.22    | -18.5      |
| All regions |         | 5.62                     | 3.62          | -2.00      | 3.62               | 0.84          | -2.78      |