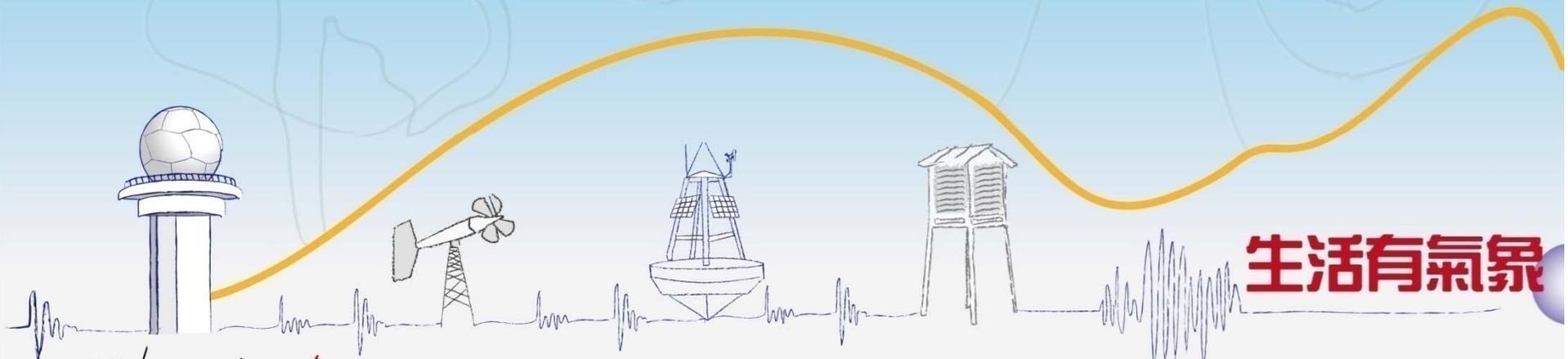




衛星反演大氣溫濕度剖面 與投落送觀測比較

章鶴群
鄭丞衡

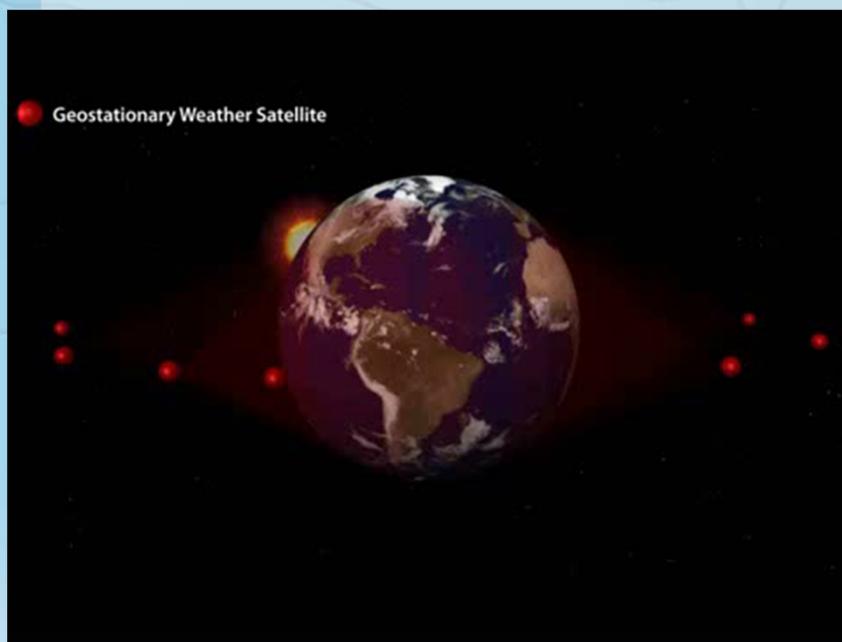
第四組第四科
氣象衛星中心



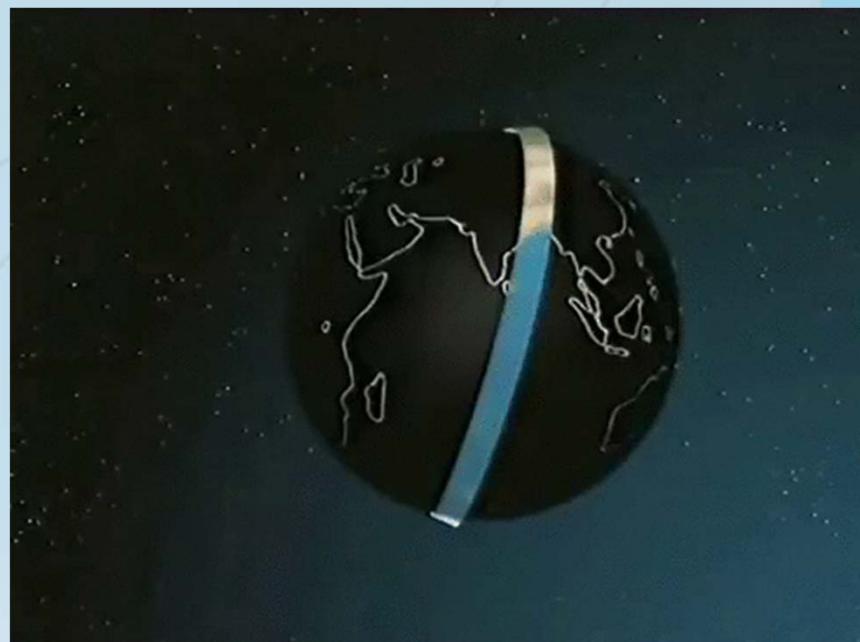
前言



✈️ 氣象衛星



地球同步衛星與繞極軌道衛星



繞極軌道衛星的示意動畫

Weather⁺

Service Observation Climate Forecasts Satellite Earthquakes Marine Radar Astronomy



前言

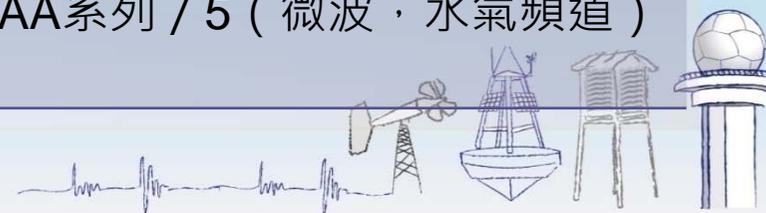


 繞極軌道衛星搭載的紅外線和微波頻道的觀測儀器。

儀器名稱	搭載衛星 / 頻道數目 波長範圍
Advanced Technology Microwave Sounder (ATMS)	NPP / 22 (微波)
Cross-track Infrared Sounder (CrIS)	NPP / 紅外線高光譜 SWIR (3.92 - 4.64 um), MWIR (5.71 - 8.26um) LWIR (9.14 - 15.38um)
The Atmospheric Infrared Sounder (AIRS)	AQUA / 紅外線高光譜 3.7 to 15.4 microns
The Advanced Microwave Sounding Unit-A (AMSU-A)	NOAA系列 / 15 (微波)
The Microwave Humidity Sounder (MHS)	NOAA系列 / 5 (微波 , 水氣頻道)

Weather⁺

Service Observation Climate Forecasts Satellite Earthquakes Marine Radar Astronomy



前言



✈ 反演工具

軟體名稱

用途

Microwave Integrated Retrieval System (MIRS)

針對微波頻道，反演出地表參數及大氣剖面。

HyperSpectral ReTrieVal (HSRTV) Software

針對超光譜頻道，反演出地表參數及大氣剖面。



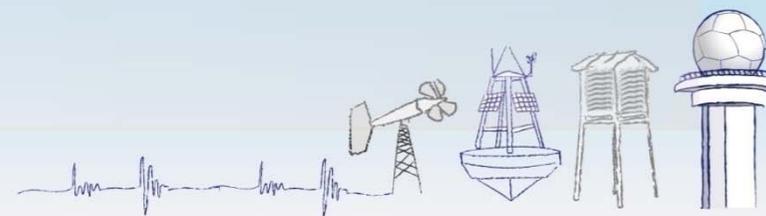
Community Satellite Processing Package

<http://cimss.ssec.wisc.edu/cspp/>

CIMSS的CSPP網站可下載繞極軌道衛星的各種應用程式，提供一個E-Mail即可依照需求下載程式，並有說明文件。

Weather

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前言

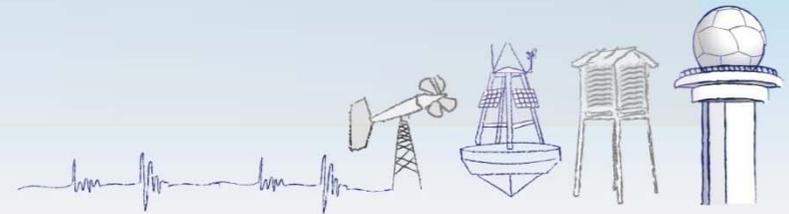


✈ 反演的變數

- ✓ **atmospheric temperature [K] at 101 pressure levels**
- ✓ atmospheric humidity [g/kg] at 101 pressure levels
- ✓ atmospheric ozone [ppmv] at 101 pressure levels
- ✓ atmospheric relative humidity [%] at 101 pressure levels
- ✓ **atmospheric dew point temperature [K] at 101 pressure levels**
- ✓ surface skin temperature [K]
- ✓ surface emissivity at instrument spectral resolution [cm-1]
- ✓ total precipitable water (vertically integrated from 100 hPa to surface) [cm]
- ✓ precipitable water [cm]
- ✓ total ozone amount (vertically integrated) [dobson units]
- ✓ lifted index [deg celsius]
- ✓ convective available potential energy [J/kg]
- ✓ CO2 amount [ppmv]
- ✓ cloud top pressure [hPa]
- ✓ cloud top temperature [K]
- ✓ cloud optical thickness
- ✓ effective cloud emissivity
- ✓ cloud mask (values: 0 clear, 1 cloud)

Weather

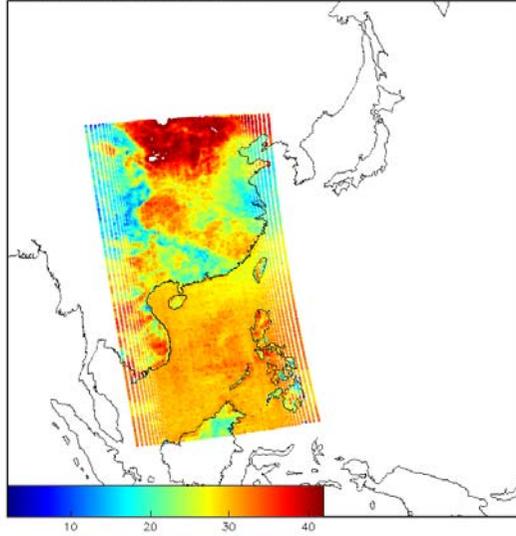
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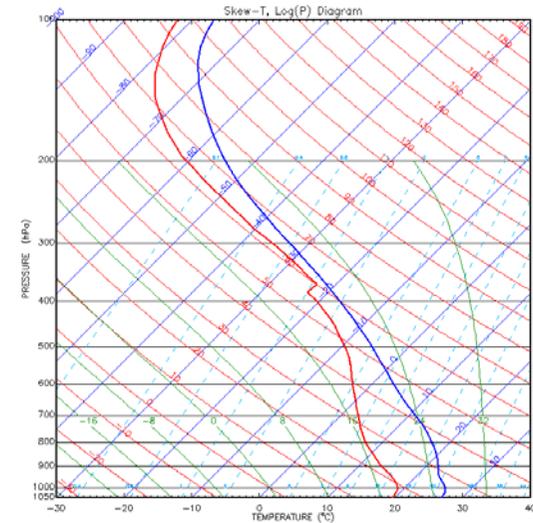
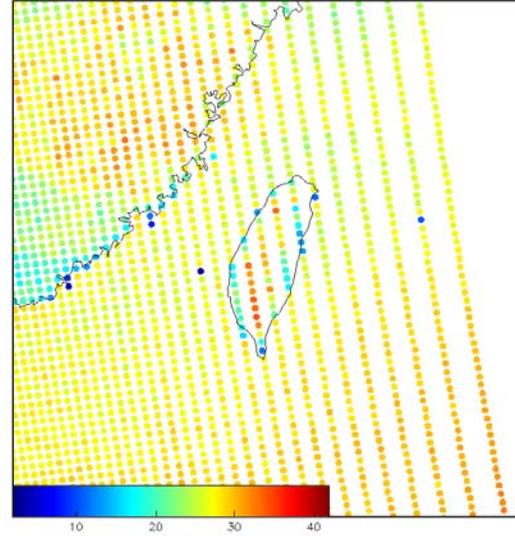
繞極軌道衛星的反演



NPP-ATMS SURFACE TEMPERATURE



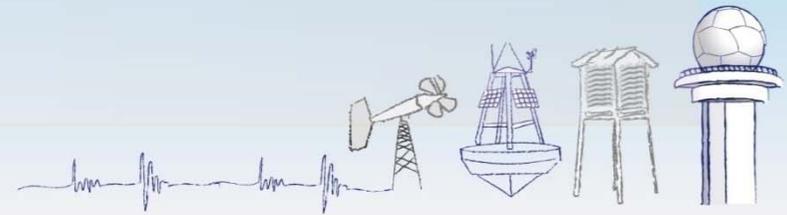
NPP-ATMS SURFACE TEMPERATURE



ATMS (微波頻道) 反演的表面溫度及垂直的溫溼度剖面。

Weather⁺

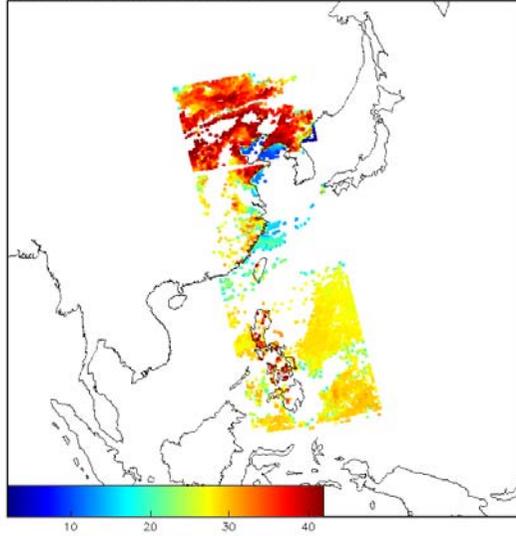
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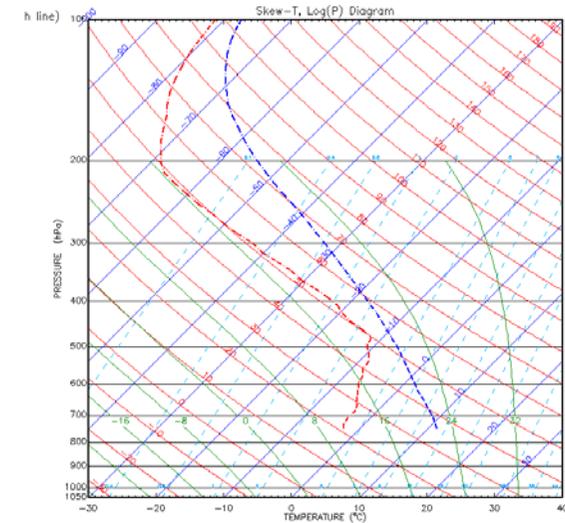
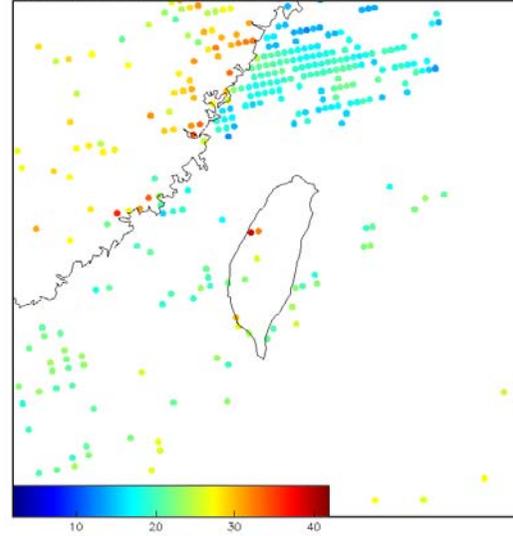
繞極軌道衛星的反演



AQUA AIRS SURFACE TEMPERATURE



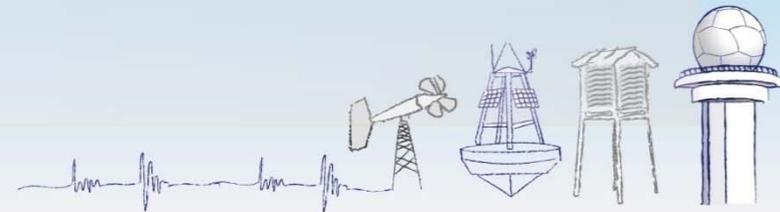
AQUA AIRS SURFACE TEMPERATURE



AIRS (紅外線高光譜頻道) 反演的表面溫度及垂直的溫溼度剖面。

Weather⁺

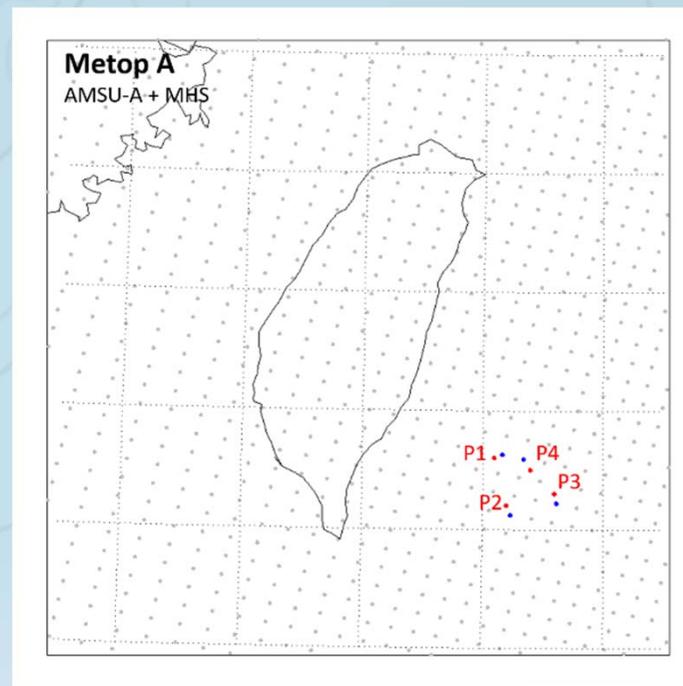
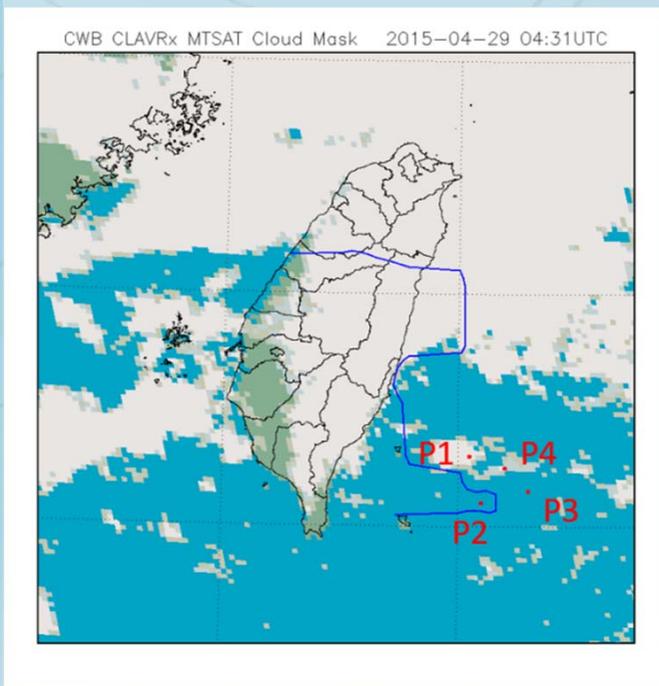
Service Observation Climate Forecasts Satellite Earthquakes Marine Radar Astronomy



投落送資料

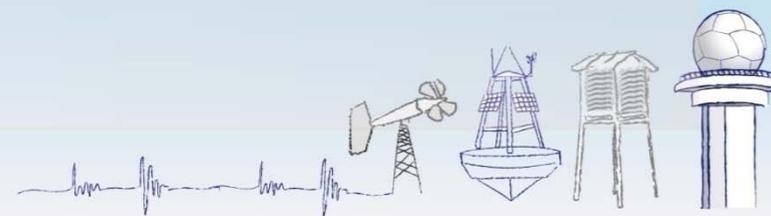


✈️ 投落送的測試飛行

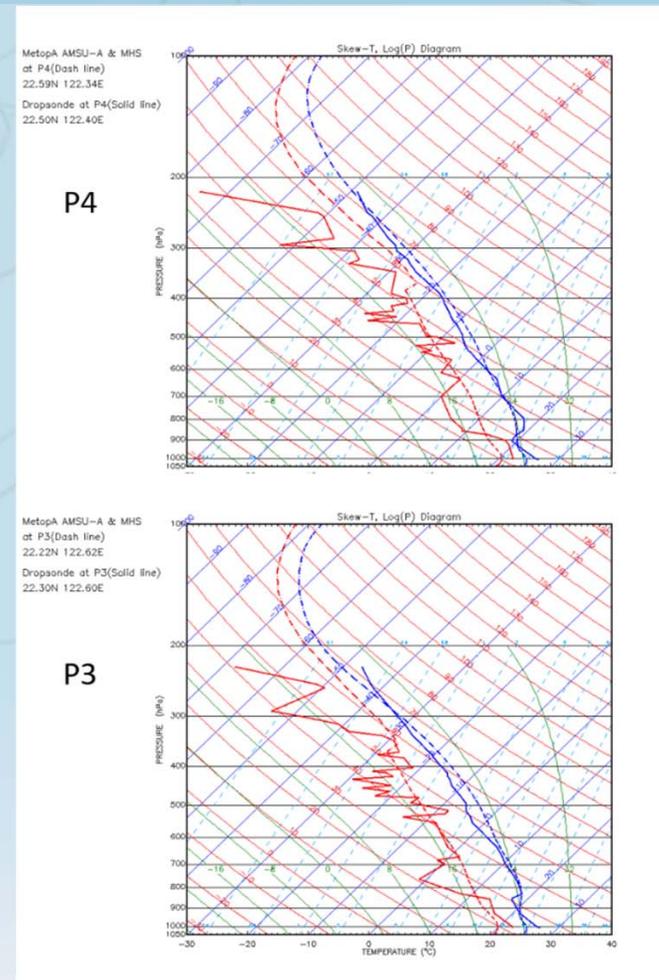
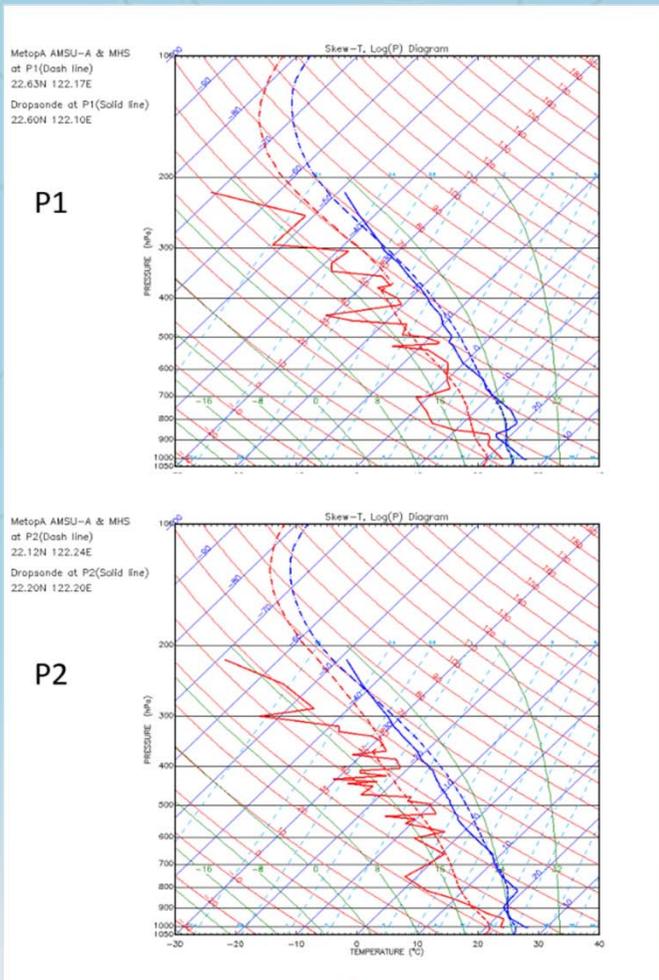


Weather⁺

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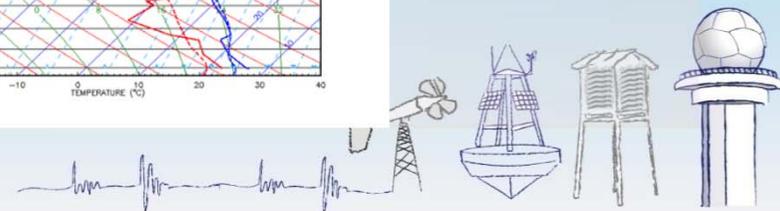


投落送v.s.微波頻道 (AMSU-A + MHS)

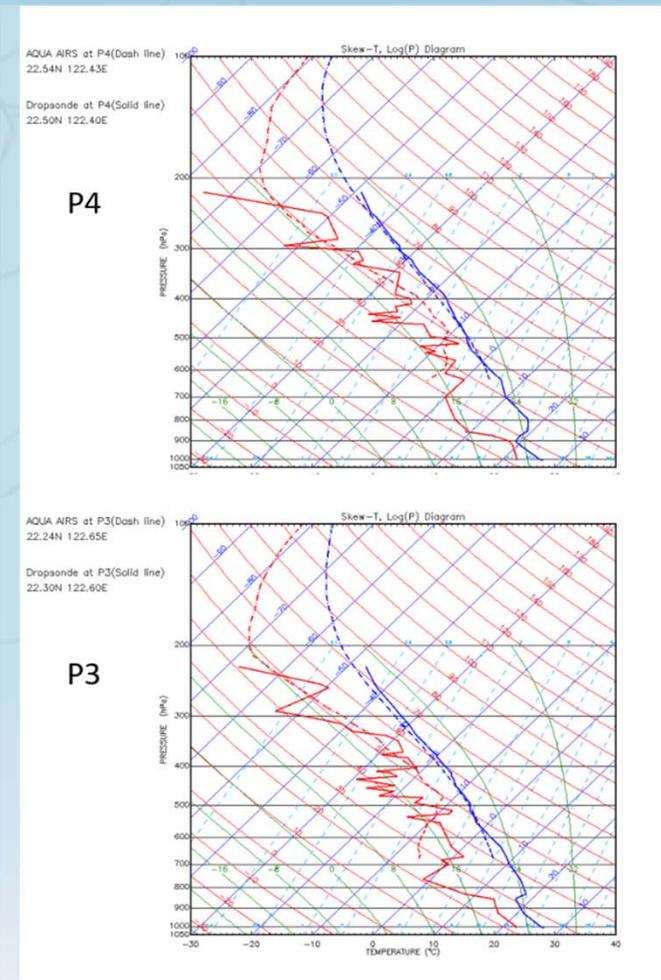
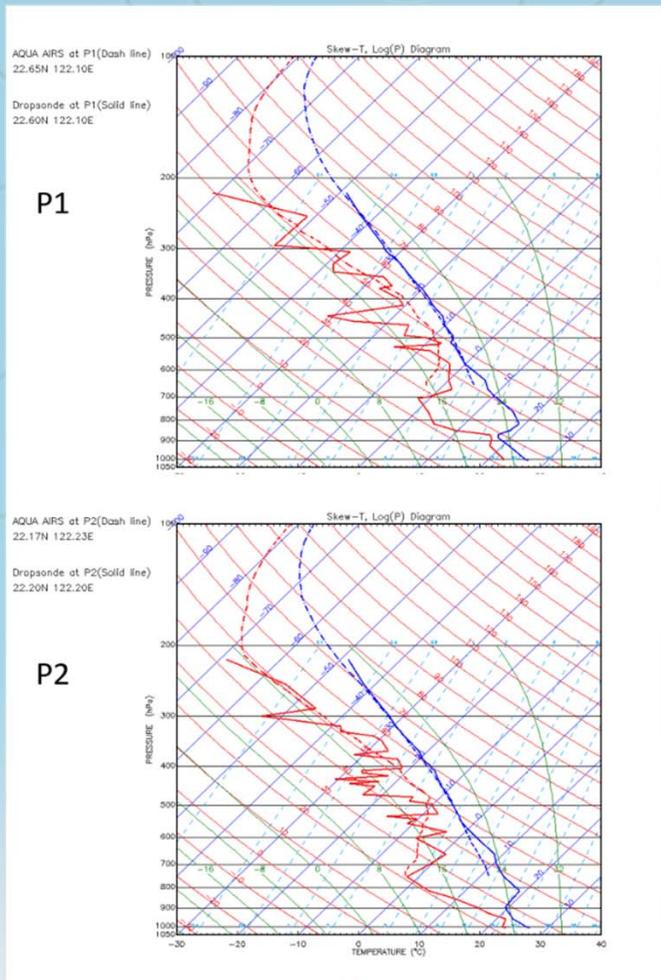


Weather⁺

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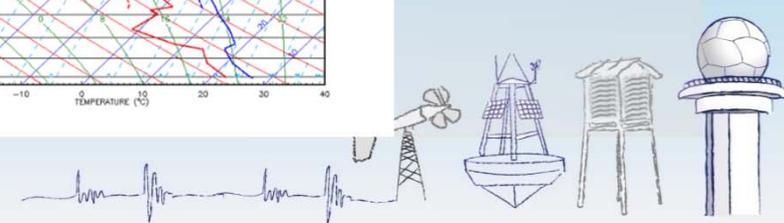


投落送v.s.紅外線高光譜頻道 (AIRS)



Weather⁺

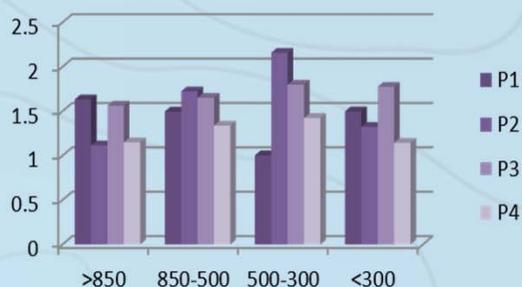
Service Observation Climate Forecasts Satellite Earthquakes Marine Radar Astronomy



Root Mean Square Error

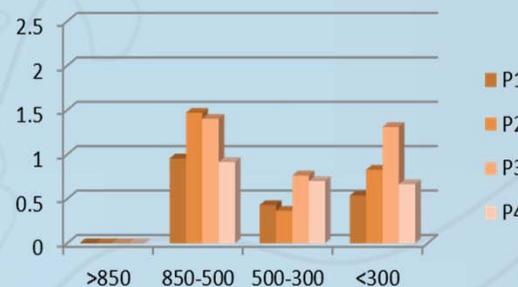


MetopA



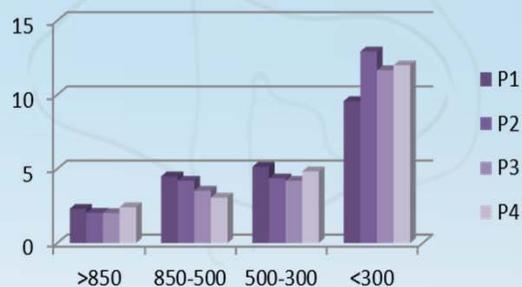
溫度的RMSE

AQUA-AIRS



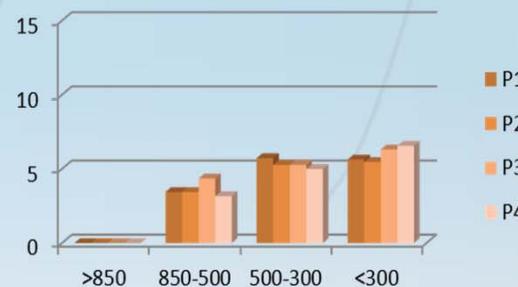
溫度的RMSE

MetopA



露點溫度的RMSE

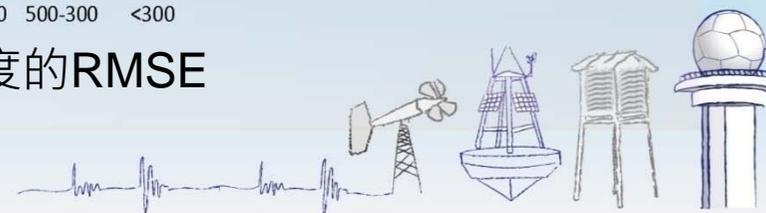
AQUA-AIRS



露點溫度的RMSE

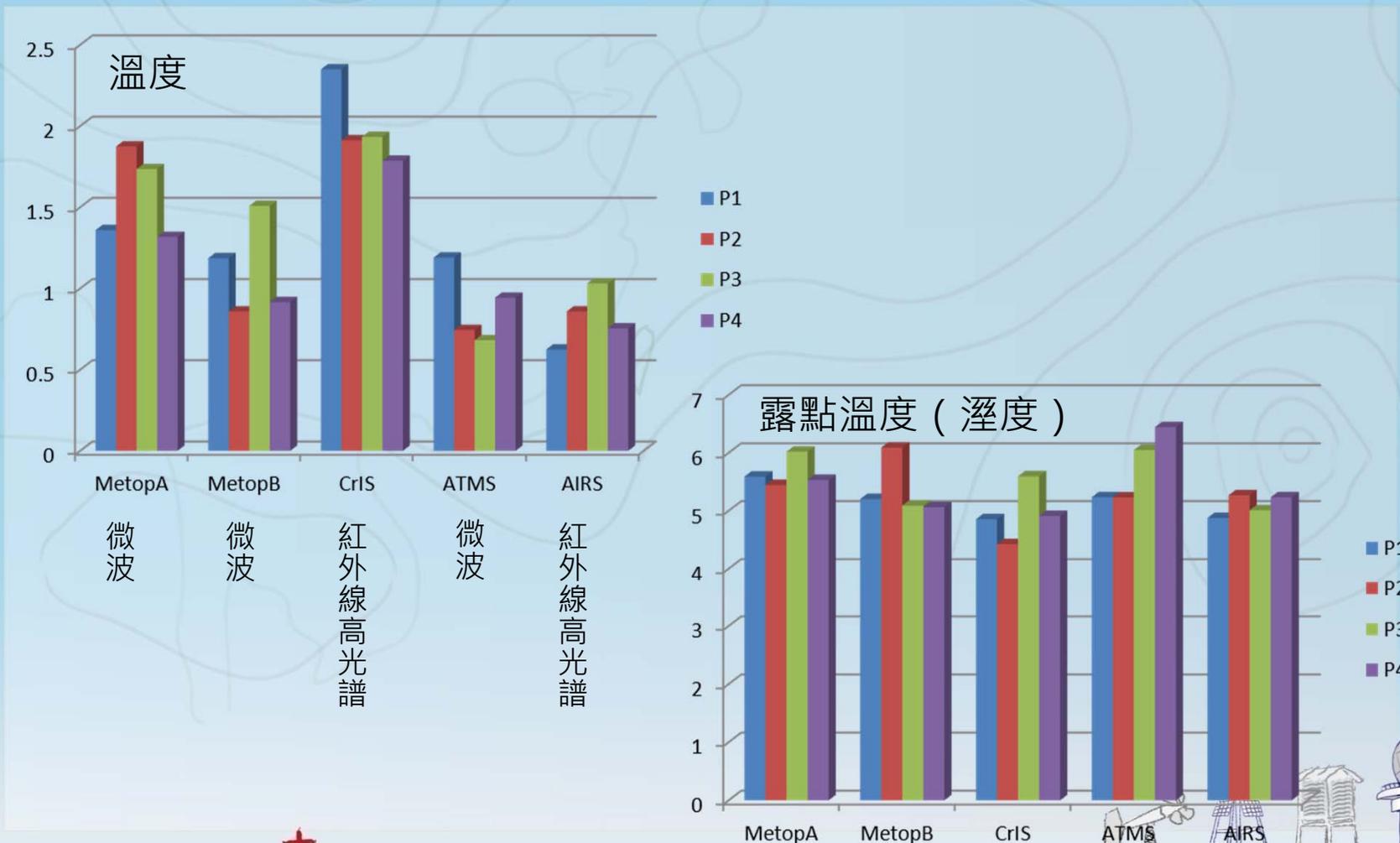
Weather⁺

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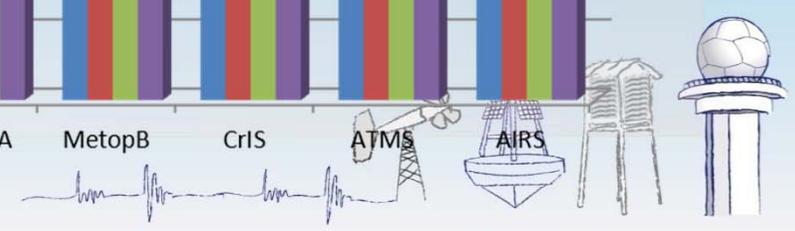


Root Mean Square Error



Weather⁺

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研究結果與討論



- ✎ 衛星資料反演大氣參數具有一定的準確性。
- ✎ 觀測資料密集，可以得到一個三度空間的反演結果。
- ✎ 可應用於天氣分析的研究，其他反演技術的驗證及同化於數值預報之中。



NOAA COMPREHENSIVE LARGE ARRAY-DATA STEWARDWHIP SYSTEM

<https://www.avl.class.noaa.gov/saa/products/welcome>
NOAA的CLASS網站可下載繞極衛星的各種產品，範圍涵蓋全球，提供一個E-Mail即可依照需求下載資料，十分方便。

Weather⁺

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