

出國報告（出國類別：會議）

赴日本參與
11th ACRE workshop 研討會議
出國報告

服務機關：交通部中央氣象局
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出國期間：107年11月11日~107年11月17日

報告日期：107年12月13日

摘要

氣候學家為了能夠理解氣候變化的科學原理以預估未來的氣候狀態，持續的發掘、蒐集、分析過去及當下的資料，修正氣候模式，期望對瞭解及預測氣候有所幫助，而歷史氣象資料回溯建檔後正可以提供氣候變遷評估、防救災單位、學研機構運用，同時在資料回溯過程中亦可以增加對於資料的理解，重新拼湊出歷史的大氣狀態。本次由 ACRE 邀請中央氣象局沈里音科長參加國際大氣環流重建組織 11th ACRE workshop 研討會議，透過與其他國家與會人員交換資料回溯處理經驗及技術，展現我國於氣候資料回溯的能力、作業完備性與成熟度。會議中各國專家分別就歷史氣象資料回溯技術、如何運用於不同領域、公民科學家計畫提出報告，並與美國、英國、澳洲、紐西蘭、日本、中國大陸、香港、馬來西亞、菲律賓等正在進行資料回溯的國家交換技術與心得分享，以擴大本局與國際其它單位、人員的連結與交流，成為未來人員邀訪、建立合作關係的基礎。

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一. 目的

臺灣自 1897 年開始即有臺北、臺中、臺南、恆春、澎湖 5 站進行氣象觀測，其後依序建立花蓮、臺東、彭佳嶼(前述 8 個觀測站設立至今均已超過 100 年)等 25 個氣象觀測站，這些珍貴的氣候資料完整紀錄以紙本型式保存於中央氣象局(以下簡稱氣象局)內。氣象局自民國 99 年開始規劃進行氣象觀測資料的數位化回溯建檔工作，已完成各氣象站自設站至今，包含小時、日的觀測資料和月統計值等主要觀測項目的數位化工作，並持續進行詮釋資料及天氣圖數位化工作。

氣候學家為了能夠理解氣候變化的科學原理以預估未來的氣候狀態，持續的發掘、蒐集、分析過去及當下的資料，修正氣候模式，期望對瞭解及預測氣候有所幫助。歷史氣象資料經回溯建檔後，可以提供氣候變遷評估、防救災單位、學研機構運用，在回溯過程中同時亦可以增加對於資料的理解，重新拼湊出歷史的大氣狀態。

氣象局於 104 年邀請 ACRE SE ASIA 計畫負責人 Dr. Fiona Williamson 來局進行交流訪問，期間 Dr. Fiona 就 The International ACRE project and Data Recovery in Asia 發表演講，介紹全球各國努力進行的氣候資料回溯計畫，並且邀請氣象局參加此計畫，成為 20 世紀大氣環流重分析的參與國家。

本次由 ACRE 邀請本局沈里音科長(邀請函如附錄 1)參加 107 年 11 月 12 日~11 月 16 日於日本舉行之國際大氣環流重建組織 11th ACRE workshop 會議，其目的為透過與其他國家與會人員交換資料回溯處理經驗及技術，展現出我國於氣候資料回溯的能力、作業完備性與成熟度，並與美國、英國、澳洲、紐西蘭、日本、中國大陸、香港、馬來西亞、菲律賓等正在進行資料回溯的國家交換技術與心得分享，以擴大本局與國際其它單位、人員的連結與交流，成為未來人員邀訪、建立合作關係的基礎。

二. 過程

11th ACRE workshop 會議由首都大學東京的校長 JUN UENO 致詞，歡迎來自於 ACRE OCEAN、ACRE SOUTH OCEAN、ACRE SE ASIA、ACRE CHINA 和 ACRE JAPAN 的 80 多位各國專家。隨後由主持人 JUN MUTSOMOTO、Met Office 的 Rob Allan 分別說明此次會議的目的(圖 1，議程如附錄 2)。來自 MET OFFICE 的 Rob Allan 另外介紹目前在全球進行的大氣環流重建計畫及各分區運作狀況，其後由各國學者專家依會議議程分享經驗及技術(氣象局人員簡報資料如附錄 3)，綜合歸納可以分為以下幾種類型：



圖 1 11th ACRE Workshop 主持人 JUN MUTSOMOTO 介紹 TMU 及 ACRE 會議目的。

(一) 政府、學校、組織回溯氣候資料

政府機關所保存的歷史氣候資料，在各國多半由氣象專業單位進行資料回溯，但是這項工作極其繁瑣，且需要大量人力、物力投入，因此部分經濟發展較緩慢的國家會由其他國家的學者或是經費資助以協助資料回溯。對於散落在各地的歷史資料，一般而言，學校或組織取得紙本的觀測資料後，面對龐大的歷史觀測紀錄，最直接、實際的做法就是開始鍵入資料，否則這些紙本資料很難運用在研究上。以學校、組織的做法多半由學生或是志工協助，少部分外包給專業打字人員處理，畢竟這個部分需要經費的支援，因此對於大多數的學校是無法負擔這樣的支出；民間組織則需要倚賴志工將紙本資料登打轉換成為數位資料，以利後續的研究應用。

(二) 詮釋資料建置

氣候資料的回溯，初期以觀測資料為主，將航海日誌、報紙或散佈於各處的天氣觀測資料儘可能轉成數位紀錄以分析應用。然而在資料分析的過程，開始需要點位資料、儀器資訊，做為資料分析依據。因此另外衍生出詮釋資料建置的回溯計畫。以 C3S(The Copernicus Climate Change Service Data Rescue Service，哥白尼氣候變遷服務資料

回溯)的計畫為例，C3S 目前僅做到測試版本，正式的版本預計在未來的數個月內可以完成。測試版本中的詮釋資料建置包含測站的基本資訊，可識別單站的地理資訊、簡易的儀器識別和觀測時間資訊，對於一般性的應用可能足夠，但對於資料均一化等需要較完整詮釋資料的研究似乎是不足的。由於詮釋資料的建立需要大量的人力和知識，當資料建立後，如何分析應用會是另外的課題。

(三) 資料檢核

資料經數位化之後，需要進一步檢核，以確保資料的正確性。在資料登打過程可能有鍵入失誤、資料辨識錯誤、觀測錯誤與統計錯誤等常見錯誤樣態。為了檢查、校正這些錯誤，各國使用的檢查技術常見的有範圍值檢查、利用已有之統計值例如日平均值、日總和值檢查，或是利用 2 組不同的登打人員同時將資料鍵入、比對，惟此種作業方是需要 2 倍的資源與經費，對於資源較不充足的單位是無法使用的。

(四) 資料重建、再分析

為了方便後續的資料應用，世界各國的歷史觀測資料在數位化後，科學家就可以用來做環流的重建和再分析(圖 2)，目前已知的有 20CR V2(NOAA 20TH-CENTURY REANALYSIS, VERSION 2 AND 2C, NOAA/NCAR/UCAR 共同發展之 20 世紀大氣環流重建資料集)的版本，在近年的資料收集之後，預計 2019 年會有 20CR V3 的版本釋出。此版本使用了更多的回溯資料，提升了對於天氣系統的辨識性，解析度由原來的 2 公里提升到 0.75 度(約 75 公里)，資料分析仍以海平面氣壓為主，另外包含降水資料。

(五) 公民科學

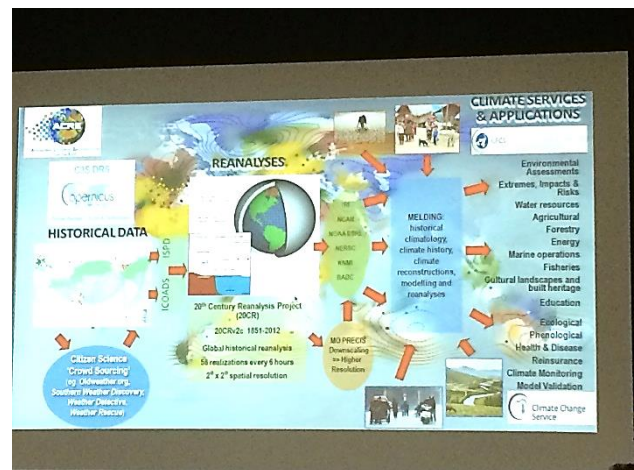


圖 2 資料回溯流程示意圖，由初階的資料拯救 (data rescuer) 到最終端的環流重建、資料應用。

歐、美國家如澳洲、英國和大多數發生在海面上的氣象資料回溯依賴著公民參與，當1本航海日誌整理成數位資料-照片檔案後，氣候學家需要的是日誌內被記錄下來的天氣資料，然而這些資料繁瑣，不易建檔。因此，氣候學家結合歷史學者、程式設計者，開始公民參與氣象資料填報的計畫。在這個計畫裡面，歷史學者負責講述故事、考證資料，氣象、氣候

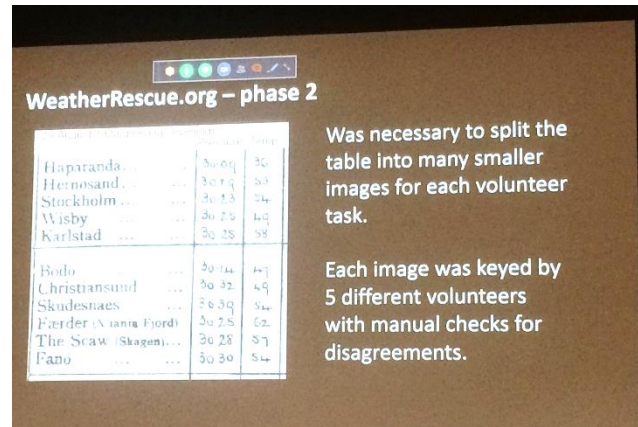


圖 3 公民科學實作方法介紹，將數位化後的觀測紀錄切割成較小的區塊，由公民科學家登打轉換成數位化資料。

學者則嘗試建立古氣候資料、重建當時的氣候環流，並且研究氣候變遷，程式設計師實作這個計畫，最後由公民參加數位化。公民參與氣象資料填報進度和品質不易掌控，惟公民科學可以引起民眾對於自然科學的興趣，更加理解如何與大自然和平相處。

公民科學在發展的過程需要將大量的紙本資料做前置處理，包含掃描、校正等，同時為顧及民眾的耐性，通常將資料切割成相當多的部分，1 頁完整的天氣報告可能要切割成 30 個部分(圖 3)，以便利民眾辨識、填報。在分割掃描資料的技術發展上仍以人工處理，平均 1 張已掃描的資料需要約 10 分鐘切割，不同的資量會依照民眾的耐心而適當的切割，一般而言約在 5 個欄位左右。

公民科學在歐美國家的發展狀況，以 WEATHERRESCUE.ORG 的範例，召集了 3500 位以上的公民科學家在 2 個月內拯救了約 100 萬筆的天氣觀測資料，成效算是相當良好。

三. 心得及建議

本次參與於日本舉行之國際大氣環流重建組織 11th ACRE workshop 會議心得及建議如下：

(一) 持續資料回溯並推廣公民參與活動

國際環流重建對於氣候的研究有相當大的幫助，為了重建當時的全球環流，最

基本的就是將世界各地的歷史觀測資料由紙本資料，經過數位化的過程轉換成數位資料。紙本資料在數位化的過程，發展出另外幾個面向，支援資料回溯的工作，如資料掃瞄、建檔、資料辨識、偵錯與均一化。由於所需要回溯的資料數量過於龐大，因此有許多國家開始發展公民科學，利用公民參與方式，將已掃瞄的資料切割成適當的大小透過公民科學家進行數位化。公民參與氣象資料的回溯需要有大量的志工(公民科學家)參與，背後通常需要有個故事吸引民眾參與，並且透過媒體不斷地推廣，是個極具挑戰性的工作。對於需要掌控進度的研究者而言，公民科學家的活動雖然可能省下金錢，卻無法確實知道整批資料回溯的完整時間，且必須要發展出其他的資料檢覈工具，此種做法似乎無法滿足所有的需求。因此學者、公部門一般採用自行登打、外包方式進行數位化，此種方式需要有大量經費、人員挹注。

(二) 強化資料檢核，提升資料品質

資料經過數位化的過程，可能產生登打錯誤、原始觀測資料錯誤、資料處理錯誤等不同的狀況，如何有效地檢核、修補資料，成為資料回溯轉為數位化資料後的重要工作。檢核技術的開發各國的做法不相同，部分國家以紙本紀錄為唯一根據；部分國家則有補遺技術輔助。除了這些檢核資料技術外，若需要進一步做資料均一化檢測(圖 4)，需要建置完整的詮釋資料。應從現今的觀測資料開始強化

詮釋資料的收集與建置。詮釋資料應包括站名、站號、地理座標、海拔高度、管理者或者所有人、周圍土地利用概況、儀器佈設照片和圖表、站址及周邊地區、自動站類型、廠家、型號、觀測站的觀測基本資料(測量要素、觀測時間、觀測次數、氣壓資料的基準面)、聯絡人資訊，如姓名、地址、電子信箱、電話號碼等，以提供使用者

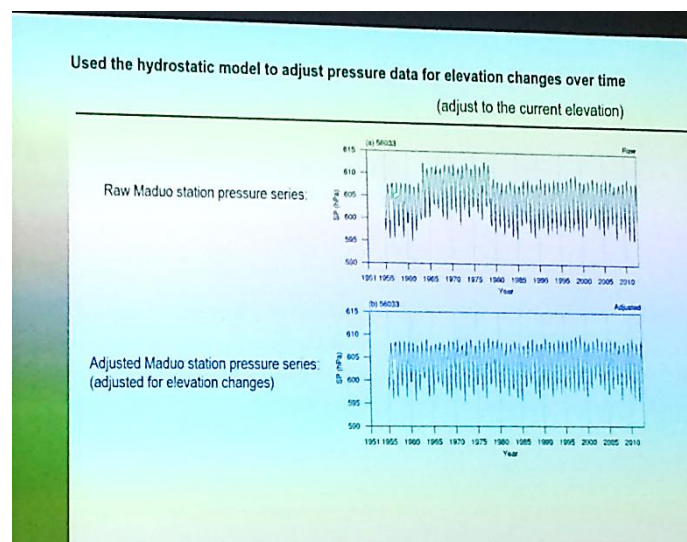


圖 4 資料均一化技術報告，應用靜力平衡檢測、修正氣壓資料。

有效的說明資訊，並做為資料檢核時的參考。整個資料回溯應由資料拯救做起，透過數位化使資料易於運算，搭配資料檢核、詮釋資料建置與分析，最後進行均一化檢測。

(三) 強化國際合作，加強技術交流

當各個地區的歷史資料回溯之後，除了各國自行分析區域特性之外，國際環流重建組織已針對 20 世紀的環流進行重建，目前各國拿到的分析資料與當地的歷史資料比較結果，仍以當地的資料解析度大幅勝出，然而，此類重建環流資料隨著收集到的歷史觀測資料數量增加，環流的表現逐漸提升。表現較佳的區域在歐洲、美洲地區。這和資料較早被數位化和觀測站數量充足有關係。目前較缺資料的地區在亞洲、南半球和海洋地區。尤其是南半球和海面的觀測資料，需要整集並且回溯。這個部分包含本國天氣圖中的部分資訊，是參與國際合作的機會。

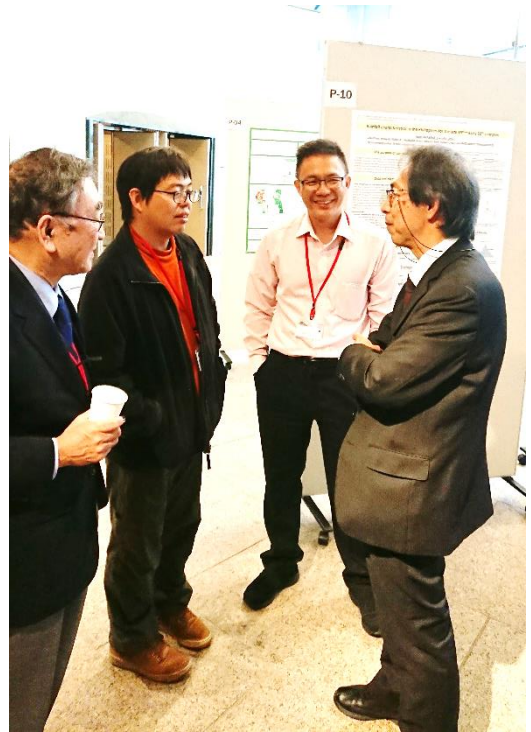


圖 5 與其他國家專家學者交流。

ACRE 邀請氣象局參與本次會議，除了介紹不同領域如何使用氣候資料、20 世紀環流重建計畫與各國氣候資料回溯進度、技術之外，並與我國氣象局與會人員討論資料回溯技術、資料檢核方法、公民參與等議題，於技術交流過程，擴大本國實作人員國際視野，瞭解國外的技術發展現況，同時允諾提供技術諮詢(圖 5)。

附錄 1. 邀請函



To ACRE related colleagues

LETTER OF INVITATION

3rd August 2018

Dear Sir, Maddam

This year, the International ACRE (Atmospheric Circulation Reconstructions over the Earth) Initiative's (<http://www.met-acre.org/>) 11th ACRE workshop will be held between 12th and 16th of November 2018 at Tokyo Metropolitan University in Japan. It will incorporate a Copernicus Climate Change Service (C3S) Data Rescue Workshop alongside global and regional ACRE activities across the Asian region.

As this is the first time the annual ACRE meeting has been hosted in Asia, and so Asian chapters of the initiative will be given prominence. These include the inaugural ACRE Japan Workshop, the 2nd ACRE SE Asia meeting, and the 3rd ACRE China Workshop.

We would like to invite you to attend and present at these interlinked workshops.

Details about these interlinked workshops, logistics, accommodation options, the program and registration can be found at <https://tmu-rao.jp/event/4307/>.

Best Regards, Rob Allan and Jun Matsumoto

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附錄 2. 會議議程

THE 11TH ANNUAL ACRE MEETING,
ACRE JAPAN, ACRE SE ASIA-2, ACRE CHINA-3, AND C3S DATA RESCUE SERVICE (DRS)
WORKSHOPS
HOSTED BY TOKYO METROPOLITAN UNIVERSITY, MINAMI-OSAWA CAMPUS
12-16 NOVEMBER 2018 (Updated on 10 Nov. 2018)
PROGRAM
UNDERLINED REMOTE ONLINE PRESENTATIONS

ACRE-11 MEETING

DAY 1: MONDAY 12TH NOVEMBER

09.15–09.45 Arrival and Registration

09.45–10.30 Opening Session

09.45–10.00 Introduction and Welcome from TMU Hosts/ Prof. Jun Ueno, President of TMU and Prof. Jun Matsumoto

10.00–10.30 Rob Allan (ACRE & C3S DRS/Met Office): ACRE Overview and Current Status Report

10.30–11.00 Group Photo & Break

11.00–11.40 SESSION 1: REGIONAL/NATIONAL DATA STATUS REPORTS (Chair: Rob Allan)

11.00–11.20 Pablo Canziani (UTN/ACRE Argentina & C3S DRS): ACRE/C3S DRS Argentina - ONLINE

11.20–11.40 Stefan Grab (Univ. Witwatersrand/ACRE South Africa & C3S DRS): Developments with ACRE South Africa during 2018 and Going Forward

11.40–12.40 SESSION 2: REGIONAL ACRE STATUS REPORTS (Chair: Clive Wilkinson)

11.40–12.00 Petra Pearce (NIWA/ACRE Pacific/ACRE Antarctica & C3S DRS): Southern Weather Discovery: Data Rescue on an Open Source Platform

12.00–12.20 Drew Lorrey (NIWA/ACRE Pacific/ACRE Antarctica & C3S DRS): ACRE Pacific and ACRE Antarctica: NIWA's Recent Activities

12.20–12.40 Joelle Gergis (Univ. Melbourne/ACRE Australia) An update from ACRE Australia

12.40–14.00 LUNCH

14.00–15.00 SESSION 3 OCEANS (Chair: Petra Pearce)

14.00–14.20 Clive Wilkinson (Univ. East Anglia/ACRE/C3S DRS/CSSP China): ACRE Oceans Annual Review and Future Plans

14.20–14.40 Sally Wilkinson (CSSP China): French Marine Archives and the French 'Bounty Ships' in the Pacific

14.40–15.20 SESSION 4: INVENTORIES AND COLLABORATIONS (Chair: Julie Jones)

14.40–15.00 Stefan Brönnimann (Univ. Bern/C3S DRS/ACRE): A Global Inventory of Early Instrumental Series

15.00–15.20 Maria Antonia Valenté (IDL, Univ. Lisbon & C3S DRS) The C3S Data Rescue Registry Developed by Instituto Dom Luiz and Partners

15.20–15.40 Omar Baddour (WMO, Read by Rob Allan): WMO' s Role in Global Data Recovery.

15.40–16.10 Break

16.10–17.30 SESSION 5: INVENTORIES, DIGITISATION, HOMOGENISATION
(Chair: Maria Antonia Valenté)

16.10–16.30 Steve Penny (Univ. Maryland): Machine Learning for Reading Handwritten Logs or Printed Materials -ONLINE

16.30–16.50 Xiaolan Wang (Env Canada/ACRE): Data Homogenization Methods for Records from Data Sparse Networks, Including Old Weather Records

16.50–17.10 Julie Jones (Sheffield Univ.): Use of Historical Observations to Constrain Southern Annular Mode Variability and to Evaluate Reanalyses at High Southern Latitudes

17.10–17.30 Elizabeth Bradshaw (BODC/GLOSS): Records Rescue – Risks and Rewards: The Importance of Preserving Long-term Sea Level Data

17.40 ICE BREAKER AT THE INTERNATIONAL HOUSE HALL

19.00 End of Day 1

Day 2: TUESDAY 13TH NOVEMBER

ACRE-11 MEETING (Continued)

09.15–10.15 SESSION 1: 20CR3 (Chair: Rob Allan)

09.15–09.35 Gil Compo (Univ. Colorado/ESRRL/ACRE/CSSP China): Results from the 20th Century Reanalysis Version 3 (1836–2014)

09.35–09.55 Ed Hawkins (Univ. Reading/ACRE): WeatherRescue.org: Using Volunteers to Rescue Millions of Victorian-era Observations

09.55–10.15 Philip Brohan (Met Office/ACRE/C3S DRS/CSSP China): New UK Observations and 20CR3+

10.15–10.45 Break

10.45–11.45 SESSION 2: WORKSHOP

Mac Benoy (ACRE/MERIT): A Review and Critique of a Proposed Image Portal for ACRE Members Workshop (1 hour) NB You will need to bring your personal laptops to this workshop.

Agenda:

- o Intro to system and structure
- o Guided tour of features
- o Critique from participants

11.45–13.45 Lunch (11.45-12.30: C3S Lot 1 and WP3 meeting)

13.45–15.15 Session 3 DATA RESCUE WORKSHOP: Motivating Data Owners to Actively Participate in Rescuing and Digitizing Their Data

Richard Crouthamel (IEDRO/C3S DRS) and Dona Cuppett (IEDRO/C3S DRS)

15.15–15.45 Break

C3S WORKSHOP

15.45–17.35 Session C3S (Chair: Phil Brohan)

15.45–16.15 Paul van der Linden (Met Office/C3S DRS): Data Rescue in Support of the Copernicus Climate Change Service (presented by Rob Allan)

16.15–16.35 Stefan Brönnimann (Univ. Bern/C3S DRS/ACRE): Data Rescue Tools

16:35–16:55 Phil Jones (UEA & C3S DRS): Assessing the Digitized Data and What It Can Be Used for -ONLINE

16.55–17.15 Maria Antonia Valente (IDL, Univ. Lisbon & C3S DRS) Instituto Dom Luiz contribution to the C3S Data Rescue Service

17.15–17.35 Peter Siegmund (KNMI & C3S DRS): The C3S Data Rescue Service Portal - ONLINE

EXCURSION GUIDE

17.35–17.50 Excursion guide for excursion participants on Wednesday (Jun Matsumoto)

17.50 End of Day 2

DAY 3: WEDNESDAY 14TH NOVEMBER

Excursion-1 Central Tokyo: Start at 09.00 from Tama Center

Excursion-2 Tea Garden in the Northern Suburb Area: Start at 09.00 from Tama Center

DAY 4: THURSDAY 15TH NOVEMBER

ACRE JAPAN WORKSHOP (MORNING)

09.10–10.30 SESSION 1: DATA RESCUE ACTIVITIES (Chair: Masumi Zaiki)

09.10 – 09.30 Hisayuki Kubota (Hokkaido Univ.): Overview and Recent Progress of ACREJapan, and Data Rescue of Typhoons and Ship Logs

09.30 – 09.50 Jun Matsumoto (TMU): Recent Japanese Data Rescue Activities in monsoon Asia

09.50 – 10.10 Takehiko Mikami (Teikyo Univ.): Meteorological Observations at Japanese Lighthouses in the 19th Century

10.10 – 10.30 Togo Tsukahara (Kobe Univ.): Preliminary Research in Japan' s War-time Meteorological Record

10.30–11.00 Break

11:00–12:40 SESSION 2: INVESTIGATION AND REANALYSIS (Chair: Hisayuki Kubota)

11.00–11.20 Masumi Zaiki (Seikei Univ.): Reconstruction of Climatic Conditions and Typhoons around Japan in the Late 19th Century Based on Instrumental Meteorological Records

11.20–11.40 Toru Terao (Kagawa Univ.): Detection of Impact of SST Variability over Indian-Pacific Ocean on Rainfall over the Northeastern Indian Subcontinent Using 120-year Bangladesh Rainfall Data

11:40–12.00 Haruhiko Yamamoto (Yamaguchi Univ.): The Meteorological Observation Network of the Empire of Japan – Governor General’ s Office of Taiwan

12.00–12.20 Masayoshi Ishii (MRI/JMA): Data Rescue and Reanalyses at JMA

12.20–12.40 Panduka Neluwala (Univ. Tokyo): Reconstruction of Historical Weather Using Personal Weather Diaries

12.40–14.00 Lunch

THE 2ND ACRE SOUTHEAST ASIA WORKSHOP (AFTERNOON)

14:00–15.20 SESSION 1: HISTORIC DATA FOR THE MALAY ARCHIPELAGO AND INDONESIA (Chair: Richard Crouthamel)

14.00–14.20 Fiona Williamson (ACRE SE Asia/CSSP China/SMU): Overview of ACRE SEA Activities and Pre-1950s Data Recovery for Malaysia and Singapore

14.20–14.40 Fariza Yunus (MMD): Climate Data Records of Malaysia

14.40–15.00 Sunaryo Hasan (BMKG): Historical Data Recovery and Update Data SACA&D for Climate Monitoring in the ASEAN Countries

15.00–15.20 Ryosuke Kajita (RIHN): Historical Rainfall Data of Indonesia in the Late 19th Century by Using Dutch Colonial Materials

15.20–15.50 Break

15.50–17.20 SESSION 2: DATA RECOVERY FOR THE CHINA SEAS AND MAINLAND SOUTH AND SOUTHEAST ASIA (Chair: Guoyu Ren)

15.50–16.10 Rex Abdon Jnr (PAGASA): Climate Data Rescue Activities in the Philippines

16.10–16.40 Christa Pudmenzky (CACS, USQ/ACRE Australia) and Roger Stone (USQ): Climate Data Requirements for the International Climate Initiative Project in Cambodia, Lao PDR, Myanmar and Vietnam

16:40 – 17.00 Arvind Kumar Srivastava (IMD): Status of Data Archival in India Meteorological Department with Reference to the Historical Data

17.00 – 17.20 Hui Shi (Univ. Hawaii): Multi-scale Variability of the Asian Summer Precipitation Revealed by a 544-year Reconstruction with Tree Rings and Historical Documents

17.20–18.20 POSTER SESSION (Chair: Jun Matsumoto)

P-01 Masashi Kiguchi (Univ. Tokyo): Change of Rainfall Characteristics in Bangladesh Using 126-years Record

P-02 Masashi Kiguchi (Univ. Tokyo): Activities on Rainfall Data Rescue in Cambodia and Laos

P-03 Masashi Kiguchi (Univ. Tokyo): Development of a Gridded Precipitation Dataset Using High Dense Historical Observation Data in Japan

P-04 Tomoshige Inoue (TMU): Long-term Variations of Precipitation in Myanmar (Burma) for Recent 121 Years (1891 – 2011)

P-05 Fumie Murata (Kochi Univ.): Difference in Rainfall Distribution over Bangladesh between 1891-1946 and 1989 – 2016

P-06 Fumie Murata (Kochi Univ.): Rainfall Trend in 1891 – 2017 over Shikoku Island, Japan

- P-07 Hironari Kanamori (Nagoya Univ.): Interannual Variability of Intraseasonal Oscillation Based on Rain Gauge Data from the Late 1890s to the Present over Bangladesh
- P-08 Azusa Fukushima (Kobe Gakuin Univ.): A Data Rescue Project of Private Tea Gardens in Assam
- P-09 Nobuhiko Endo (NARO): Brief History of Meteorological Observations in French Indochina
- P-10 Ikumi Akasaka (Senshu Univ.): Rainfall Characteristics in the Philippines for the late 19th and early 20th Centuries
- P-11 Sunaryo Hasan (BMKG): SACA&D Gridding Data as a Tool for Climate Monitoring and Information Services
- P-12 Hamada Jun-Ichi (TMU): Interdecadal variations of monsoon rainfall in Batavia/Jakarta, Indonesia during the past 150 years
- P-13 Kengo Matsumoto (Okayama Univ.): Climatological Analysis on the Daily Precipitation Features and Their Seasonal Evolution from China to Japan in the Baiu Season
- P-14 Kae Takarabe (Chubu Univ.): Meteorological Observation by Americans Employed as Oyatoi
- P-15 Masumi Zaiki (Seikei Univ.): Meteorological Observations Taken at Seikei Gakuen in Tokyo, Japan since 1925
- P-16 Yasushi Ishigooka (NARO): Construction of Long-term Temperature Dataset from the Historical Meteorological Data in Japan
- P-17 Hirotaka Kamahori (MRI/JMA): Evaluation of Extremeness of Western Japan Flood in July 2018 Base on Data Rescue for Precipitation Observation over 100 Years
- P-18 Kuranoshin Kato (Okayama Univ.): Long-term Variation of Precipitation in Japan in Warm Season with Attention to Its Seasonal Progress and Some Regional Contrast
- P-19 Ho-Jiunn Lin (National Taiwan Normal Univ.): The Snow Days of Dr. Mackay' s Diary
- P-20 Hiroshi Takahashi (TMU): 55-yr Trends in Snowfall over Japan
- P-21 Junpei Hirano (Teikyo Univ.): An Attempt to Reconstruct Typhoon Track in 1856 Based on Historical Weather Documents
- P-22 Fumiaki Fujibe (TMU): Revisiting Typhoon-induced Record High Winds in Japan around 1900
- P-23 Atsushi Okazaki (Riken Center): Millennium Reanalysis Using Proxy and Data Assimilation
- P-24 Shigeru Kobayashi (Osaka Univ.): A Study of Japanese Network of Meteorological Observation for the Search of Wartime Data in East Asia

18.30 Reception

20.00 End of Day 4

DAY 5: FRIDAY 16TH NOVEMBER

THE 3RD ACRE CHINA WORKSHOP

09.15–10.05 SESSION 1: INTRODUCTION TO ACRE CHINA (Chair: Xiaolan Wang)

09.15 – 09.45 Guoyu Ren (CUG/NCC/CMA): Recent Progress in ACRE China

09.45–10.05 Rob Allan (ACRE & C3S DRS/Met Office/ CSSP China): Overview of CSSP and

ACRE China

10.05–10.45 Session 2: ‘New’ Historic Data for China Region (Chair: Fiona Williamson)

10.05 – 10.25 Mark E. Frank (Univ. Illinois) Chinese Meteorology in Eastern Tibet During the 1940s
-ONLINE

10.25–10.45 Tatiana Feklova (RAS): Russian Magneto-meteorological Observatory in Beijing in the Second Half of the XIX Century: Stations, Observations and History.

10.45–11.15 Break

11.15–12.10 SESSION 3: RECOVERING HISTORIC DATA FOR MAINLAND CHINA

(Chair: Hui Kin Chung)

11.15–11.35 Yuyu Ren (NCC/CMA): Preliminary Results of Digitization of Mid-18th France Observations in Beijing

11.35–11.55 Xiaohui Ju (NMIC/CMA): Digitization of Early-year Observations Kept in Chinese Meteorological Archives

11.55 – 12.10 Kangmin Wen (CUG/Wuhan): Surface Air Temperature Observations during First Half of the 20th Century in East Asia

12.10–13.20 Lunch

13.20–14.10 SESSION 4: ANALYSIS AND COMPARATIVE WORK (Chair: Guoyu Ren)

13.20–13.40 Xiaolan Wang (Env. Canada): Homogenization of Climate Data in China

13.40 – 13.55 Siqi Zhang (NCC/CMA): Comparison of 20CR and Observations in East Asia

13.55 – 14:10 Liu Chang (Univ. Tokyo): Reconstruction of 1931 Flood in Yangtze River Basin

14.10–14.40 Break

14.40–16.00 Session 5: Historical Data for Hong Kong and Taiwan (Chair: Togo Tsukahara)

14.40 – 15.00 Hui Kin Chung (HKO): The Meteorological Observations from 1850s to 1940s in Hong Kong

15.00 – 15.20 Lee Yin Shen (CWB): Historical Data Recovery in Taiwan

15.20 – 15.40 Chih-wen Hung (National Taiwan Normal Univ.): A 300-year Typhoon Records in Taiwan and Its Relationship with Solar Activity

15.40 – 16.00 Chia-Chi Wang (Chinese Culture Univ.): Brief Introduction to Citizen Participation in Meteorological Data (CPMD) Project, Taiwan

16:00 – 16:55 SESSION 6: DISCUSSION ON COLLABORATION AMONG ACRE

CHINA, ACRE SOUTHEAST ASIA AND ACRE JAPAN (Chair: Rob Allan)

16.55–17.00 Closing Remarks Jun Matsumoto and Rob Allan

17.00 End of Day 5

Historical Data Recovery in Taiwan

CWB, TAIWAN
Lee-Yin(Leon), Shen

Outline

- ✦ Weather observation in Taiwan
 - ✓ Manned weather station
 - ✓ AWS
- ✦ Data Recovery at CWB
 - ✓ Weather data recovery
 - ✓ Weather maps recovery
 - ✓ Metadata
 - ✓ Climate data archived information
- ✦ Data homogeneity

CWB's weather station

- ✦ Manned station 27
- ✦ Observational practice follows surface observation guidebook of CWB
(based on Guide to Meteorological Instruments and Methods of Observation, WMO 1996)
- ✦ The guidance include observer, observed elements, observing times etc.
- ✦ AWS about 500 stations

Manned station

- ✦ Weather observation
- ✦ Calibration of instruments
- ✦ Instruments maintenance
- ✦ Basic statistics
- ✦ Extreme weather warning

中央氣象局測站分布圖

Calibration /Control chart

Pressure control chart ($\pm 0.5\text{hPa}$) ○ 0800 ● 1400

RCTP 201503 control chart

Temperature control chart ($\pm 0.5\text{ }^\circ\text{C}$) ○ 0900 ● 2100

Instruments maintenance

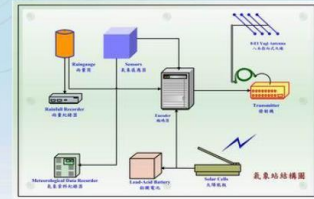
Inspection of stations

- ✦ The siting and exposure of instruments are known, acceptable.
- ✦ Instruments are in good order, and regularly verified against standards.
- ✦ There is uniformity in the methods of observation and the procedures for calculating derived quantities from the observations.
- ✦ The observers are able to carry out their duties.

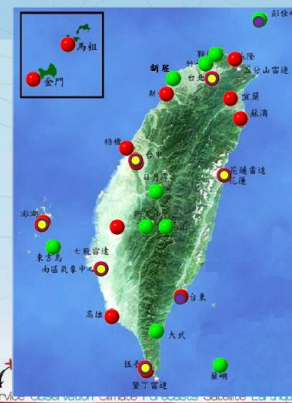
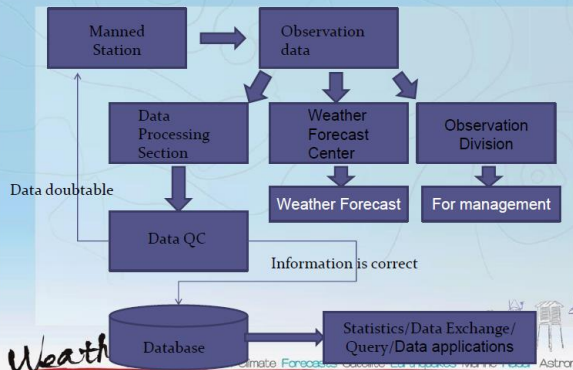
AWS



- ✦ SOLAR PANEL/battery
- ✦ RAIN GAUGE /weather sensor
- ✦ Telemetry
- ✦ Data logger



Observation Data Processing

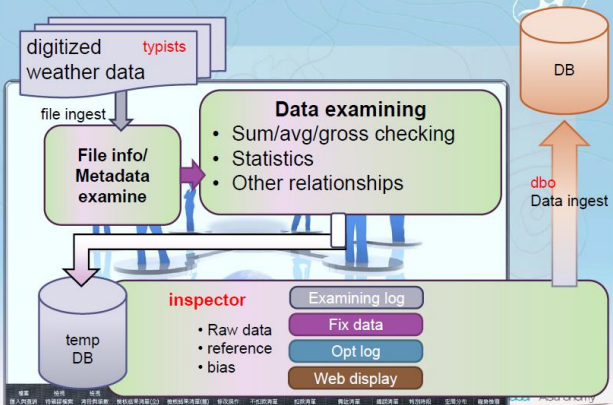


Data digitization

- ✦ 1st stage(2011)
 - ✓ Precipitation, daily data
 - ✓ Gross check/sum check
- ✦ 2nd stage(2012~2014)
 - ✓ Pressure, temperature, RH%, Wd, Ws ,sunshine duration
 - ✓ Gross check/sum check
- ✦ 3rd stage(2014~present)
 - ✓ Double key in
 - ✓ Gross check/sum check
 - ✓ Data examining system
 - ✓ Weather maps scanning(2016)

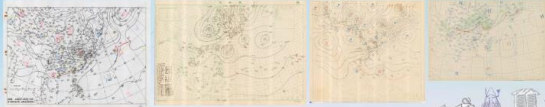


Examining digitized weather data



Weather maps

- Weather maps 1,084,091 pictures.
- The oldest weather map is since 1896/7/31.
- About 600,000 weather maps have been digitized from 2016 to 2018.



Weather+ Service Observation Climate Forecasts Satellite Earthquakes Marine Radar Astronomy

Metadata

✦ Good metadata are needed to ensure that the final data user has no doubt about the conditions in which data have been recorded, gathered and transmitted.

✦ metadata

- ✓ Station identifiers
- ✓ Geographical data
- ✓ Local environment
- ✓ Instrumentation

Weather+ Service Observation Climate Forecasts Satellite Earthquakes Marine Radar Astronomy

Station No.	Station Name	Station Name	Year	Lat (N)	Lon (E)	Height of Barometer above Sea Level (M)	Height of Therm. above Ground (M)	Height of Rain gauge above Ground (M)	Anem. above Ground (M)	Altitude (M)
466920	臺北	Taipei	1971-1980	25°02'	121°31'	9.3	1.2	0.2	23.4	8
466920	臺北	Taipei	1981-1986	25°02'	121°31'	9.3	1.2	0.2	23.4	8
466920	臺北	Taipei	1987						33.8	
466920	臺北	Taipei	1988-1989		121°30'	6.7	1.5			5.5
466920	臺北	Taipei	1990				1.1 (1.5)	0.2 (0.7)		
466920	臺北	Taipei	1991-1992.1	25°02'	121°30'	6.7	1.1 (1.5)	0.2 (0.7)	33.8	5.5
466920	臺北	Taipei	1992.2-1997.8			16.6			23.7	6.1
466920	臺北	Taipei	1997.9-1999			7.1		0.2 (0.5)	34.9	5.3
466920	臺北	Taipei	2000			6.61				
466920	臺北	Taipei	2001-2005							
466920	臺北	Taipei	2006-2009	25°02'	121°30'	6.61	1.2(1.7)	0.2 (0.5)	34.9	5.3
466920	臺北	Taipei	2010				1.21(1.7)			

Weather+ Service Observation Climate Forecasts Satellite Earthquakes Marine Radar Astronomy

Manned Weather Observation Data inventory in CWB

Weather Station		1897~1949	1950~1960	1961~1989	1990~1999	2000~present
Hourly	STATUS	✓	✓	✓	✓	✓
	OBS item	31	31	31	31	37
Daily	STATUS	✓	✓	✓	✓	✓
	OBS item	39	49	55	55	55
Monthly	STATUS	✓	✓	✓	✓	✓
	OBS item	61	67	69	69	76

- Hourly (sub-daily) data up to 31 parameters at all stations.
- Status ✓: The data has been digitalized and archived.
- Time periods of observation and observation items vary from stations and time.

Weather+ Service Observation Climate Forecasts Satellite Earthquakes Marine Radar Astronomy

Automatic Weather Station Data inventory in CWB

AWS	1987~1991	1992~1995	2000~2007	2008~
Site NO. **	~84	~228	324~385	385~5XX
Hourly	✓	✓	✓	✓
	5*	6*	6*	7*
Daily	✓	✓	✓	✓
	5*	6*	7*	15
Monthly	✓	✓	✓	✓
	7	8	14	17

*: 5/6/7 items
precipitation/temperature/pressure/relative humidity/wind direction/wind speed/duration of sunshine (by site)
**: AWS site numbers (rain & weather)

Weather+ Service Observation Climate Forecasts Satellite Earthquakes Marine Radar Astronomy

Homogeneity

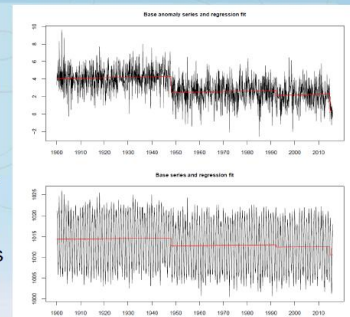
Methodology :
PMF(Wang,2008,WMO)
Station : Taipei(46692)

Variables :

Stn Pressure,
Sea level Pressure

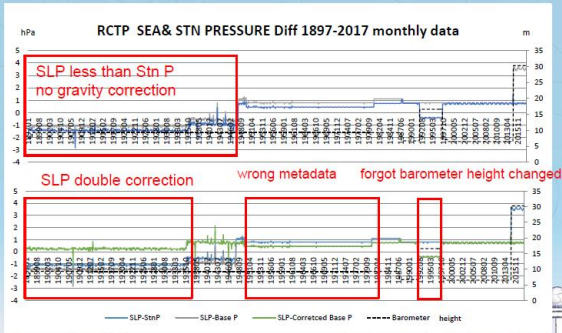
Sample:

Monthly, 1897-2017
3 change points in series
194801, 199202, 201410

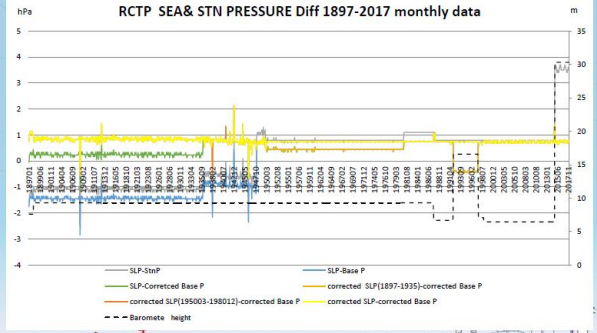


Weather+ Service Observation Climate Forecasts Satellite Earthquakes Marine Radar Astronomy

Homogeneity

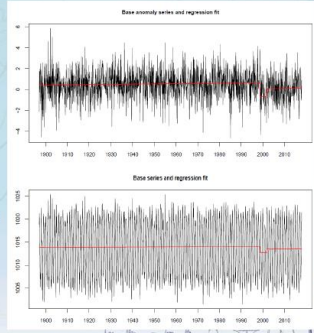


Homogeneity



Homogeneity

Methodology :
PMF(Wang,2008,WMO)
Station : Taipei(46692)
Variables :
Stn Pressure,
Sea level Pressure
Sample:
Monthly,1897-2017
2 change points in series



Thank you for your time
and attention.

附錄 4. 參考資料

氣候重建相關網站

1. NOAA ESRL - 20 Century Reanalysis
https://www.esrl.noaa.gov/psd/data/20thC_Rean/
Review Article : The Twentieth Century Reanalysis Project
<http://onlinelibrary.wiley.com/doi/10.1002/qj.776/pdf>
2. Advancing Reanalysis
<http://reanalyses.org/>

公民參與相關網站

1. Weather Detective
<http://www.weatherdetective.net.au/>
2. Old Weather
<https://www.oldweather.org/>