

(出國類別：國際會議)

赴薩摩亞  
參與第 5 屆太平洋氣象理事會議(PMC5)  
出國報告

服務機關：交通部中央氣象局

姓名職稱：程家平副局長

派赴國家/地區：薩摩亞

出國期間：108 年 8 月 5 日至 11 日

報告日期：108 年 10 月 7 日



## 摘 要

索羅門群島氣象局為強化其觀測系統、提升氣象預報能力、發展氣候變遷調適應用，持續邀請我國中央氣象局專家以索國技術顧問的身分出席國際氣象理事會議，以協助深化對南太地區大氣與環境狀態的掌握。本次第 5 屆太平洋氣象會議(PMC5)於 2019 年 8 月 6 日至 9 日在薩摩亞的阿皮亞市舉行，中央氣象局程家平副局長奉派代表應邀參與，一方面可於 PMC5 會議中展現我國協助索國進行氣象與地震早期預警系統設置的相關成果，另一方面也能透過此參與：(1)瞭解南太氣象業務的重點、各國能力的狀況、如何各自發展與協力運作；(2)探查支援索國氣象業務的各主要國家/組織/計畫所提供的資源，以及渠等與索國如何互動。協助索國增進我國對南太平洋地區島國氣候狀態與氣候風險管理議題的瞭解，相關系統建置的過程亦對於將我國技術南向輸出至不同區域環境的能力發展有所助益。

關鍵詞：南太平洋、索羅門群島、氣候變遷調適、災害早期預警系統

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## 一、 背景與目的

氣候變遷是人類須共同面對的問題，極端氣候與全球暖化不僅對先進國家造成重大的衝擊與影響，更使得低度開發及小島嶼等弱勢國家，面臨國土流失與糧食短缺等生存問題，2015年9月在聯合國永續發展高峰會上，通過了17個永續發展目標(SDGs)(各簡寫對照見附錄一)，其中第13項氣候行動反映了聯合國落實對抗全球暖化的決心，也是全球氣候變遷議題的未來核心。為促成國際合作針對氣候衝擊尋求解決之道，並協助弱勢國家進行氣候調適行動，聯合國氣候變化綱要公約(UNFCCC)在2015年12月第21次協約國會議(COP21)中通過了巴黎協定，其中的第11條(能力建設)更揭櫫「各締約國應協助氣候脆弱國家建設氣候因應的能力，包括減緩與調適行動、技術移轉與發展、氣候財務、提供氣候認知之教育與訓練。」，提醒世界各國重視小島嶼國家因天然條件限制將遭遇的氣候變遷災難。

索羅門群島位於南太平洋南緯5~12度，東經152~170度附近，由999個島嶼組成，屬熱帶海洋性氣候，全年高溫高濕，大部分島嶼雨量充沛，且是南半球熱帶氣旋生成區域，更因位於環太平洋地震帶，地震、海嘯發生頻繁，使得當地經常出現嚴重的天然災害。例如，索羅門群島於2014年4月先後遭逢洪水及地震侵襲，造成首都荷尼阿拉2條主要河流和幾條小河潰堤，沖走好幾百戶民宅，景象怵目驚心，此事件使得首都荷尼阿拉7萬人中有1萬多人無家可歸；又如2015年7月受Raquel颱風帶來豪雨及海水倒灌的災害。2007年索國曾發生規模8.1地震，造成島嶼位移，更引發海嘯，造成52人死亡，成千上萬人無家可歸；又如2013年的規模8強烈地震，震央位於索羅門群島最東端的提摩度省聖塔克魯斯島，深度28.7公里，之後並有約20起餘震，其中最大規模達6.6，造成至少5人死亡，數十棟民宅受損或全毀，並引發2次約1.5公尺高的海嘯。所以無論是從海嘯、地震、或是對於熱帶氣旋來說，都與我國面對的災害議題有高度相似度，因此索國當地相關資料的蒐集對我國氣象與地震之作業及研究均有高度的價值。

索羅門群島自102年10月由該國環境部長率員來臺與我國進行首次氣象合作雙邊會談起，即持續表達對於觀測系統強化、氣象預報能力提升、人員訓練及氣候變遷調適發展的需求與急迫性。爰此，中央氣象局與衛福部、中研院、中原大學、中華民國氣象學會在科技部的支持下，自105年7月起開始執行索羅門群島的氣象與地震早期預警研究計畫，持續派員赴索國協助進行相關系統的設置工作。106年4月30日我國交通部與

索國環境部簽訂部級的氣象合作協議，協助其強化氣象與地震早期預警能力，具體落實雙邊的交流與合作發展事項。自此之後，索羅門群島氣象局為強化其觀測系統、提升氣象預報能力、發展氣候變遷調適應用。持續邀請我國中央氣象局專家以索國技術顧問的身分，出席每 2 年 1 次定期舉行之太平洋氣象理事會(Pacific Meteorology Council；PMC)會議，以協助該國深化其對於南太地區大氣與環境狀態的掌握。

太平洋氣象理事會是由南太平洋的小島國家以及相關的區域支援國家，於 2011 年 8 月 12 日在馬紹爾群島成立，為太平洋區域環境計畫秘書處(Secretariat of the Pacific Regional Environment Programme；SPREP)的附屬機構。SPREP 原為 1970 年代由聯合國環境規劃署 UNEP、SPC、SPEC、ESCAP 共同提出初步計畫，後為 UNEP 之區域海洋計畫(Regional Seas Programme)下之組織，1993 年起透由 SPREP 成立協議(Agreement Establishing the South Pacific Regional Environmental Programme)之簽訂，以區域國際組織形式獨立運作。

太平洋氣象理事會(PMC)的宗旨在於促進和協調區域氣象作業和服務的活動，以及相關氣象科學和技術的發展，並提供太平洋區域環境計畫秘書處(SPREP)政策諮詢及其成員國於氣象(天氣和氣候)相關領域的優先議題建議，由 SPREP 會員國之氣象相關部會首長組成。太平洋氣象理事會(PMC)的召開，除可增強國家氣象水文服務機構(NMHS)的能力，從而在提供天氣、氣候的過程中，為太平洋人民的安全、福祉及發展願望做出貢獻；並透過(1)為成員提供一個開放式論壇，以就與太平洋氣象服務發展有關的問題進行討論和合作，(2)利用互補的優勢，開發創新方法，以幫助維持每個國家提出的國家和地區發展目標。PMC 下設(1)太平洋島嶼氣候服務(PICS)小組；(2)太平洋島嶼教育，訓練和研究小組；(3)太平洋島嶼海洋服務小組；(4)太平洋島嶼通信和基礎設施小組；(5)太平洋島嶼航空氣象服務(PIAWS)小組；以及(6)太平洋水文服務(PHS)小組。6 個機構專家工作小組負責提供技術諮詢及協調工作，以實現該地區滿足會議服務的基本優先事項。目前會員包含：澳大利亞、庫克群島、斐濟、法國、吉里巴斯、密克羅尼西亞聯邦、紐西蘭、紐埃、巴布亞紐幾內亞、馬紹爾群島、薩摩亞、索羅門群島、東加王國、吐瓦魯、美國、萬那杜等，而世界氣象組織(WMO)、亞太經濟合作會議氣候中心(APCC)及日本國際協力機構 JICA 等國際組織為觀察員。

本次第 5 屆太平洋氣象會議(PMC5)於 2019 年 8 月 6 日至 9 日在薩摩亞的阿皮亞市舉行，索羅門群島氣象局長 Mr. David HiriAsia 來函邀請中央氣象局派專家以該國技術顧

問身份隨該國代表團參加會議，顧及一方面此可展現我國協助索國進行氣象與地震早期預警系統設置的相關成果，另一方面也能透過此參與：

- (1)瞭解南太氣象業務的重點(現象/觀測/預報/服務)，各國能力的狀況(作業/產品/問題/需求)? 如何各自發展與協力運作?
- (2)探查支援索國氣象業務的各主要國家/組織/計畫 所提供的資源(資料/產品/工具)? 與索國如何互動(提供設備/資料交流/協同作業/提供訓練)?

此活動之參與，有助於增進我國對南太平洋地區島國氣候狀態與氣候風險管理議題的瞭解，其中相關系統建置的過程亦對於將我國技術南向轉移至不同區域環境的能力發展有所助益。

## 二、 會議目標與議程經過

第 5 屆太平洋氣象理事會議(PMC5)是由薩摩亞政府的自然資源和環境部(MNRE)承辦，此會議除召集 PMC 各成員國的氣象局長外，並有 SPREP 秘書處和發展夥伴的高級政府官員、太平洋地區組織理事會(CROP)、聯合國機構(例如：世界氣象組織 WMO)、合作組織和機構一同參與，提供一個共同探索、討論和促進加強天氣、氣候、水及海洋永續服務發展的機會。

PMC5 主題是「以科學與服務打造有韌性的太平洋」。

會議的目標為：

- (1)繼續促進 PMC 成員、發展夥伴、太平洋區域組織理事會(Council of Regional Organizations of the Pacific; CROP)、聯合國機構、合作組織和機構之間，在天氣、氣候、水和海洋服務的現狀及發展方面的協調、聯網、資訊共享和討論支持國家發展及恢復力的太平洋；
- (2)討論國家氣象水文服務機構(NMHS)在實行韌性發展框架、仙台太平洋韌性發展框架(Framework for Resilient Development in the Pacific; FRDP)、太平洋氣候變化中心(PCC)、及最近的 WMO 重組方面的貢獻；
- (3)透過 PMC 小組工作的方式審查“太平洋島嶼氣象戰略”的實施進展；

會議的預期成果為：

- (1)瞭解 上次 PMC4 會議之後的共同進展和問題；
- (2)強化與發展夥伴、CROP 機構、協力組織和機構的伙伴關係及網絡；
- (3)增加人們對於直接獲取太平洋島嶼氣候服務(Pacific Islands Climate Services；PICS)的財務資源以發展和改善天氣、氣候、水及海洋服務之可能性的認知；
- (4)澄清提供給 NMHS 如何為實做太平洋韌性發展框架(FRDP)中列出的優先策略和其他相關策略做出貢獻的連結；
- (5)接受《太平洋氣候變化科學與服務研究路徑圖》並討論太平洋地區 PMC 參與的策略以及水文差距和需求評估；
- (6)更新由 PMC 各小組(PICS、PIAWS、PIMOS、PIETR、PICI、PHS)所提出有關天氣、氣候、水和海洋服務發展方面的進展，以及未來的工作及方向。

第 5 屆的太平洋氣象理事會議完整的議程(圖 1)包括會前會(7 月 29 日至 8 月 3 日)與專題會(至 8 月 5 日至 8 月 9 日)2 個部分。其中會前會包括：「IPCC 變遷氣候下的海洋與冰凍圈特別報告會」、「下一代氣候變遷推估會」、「氣象與水文領域的婦女領導會、氣候風險及早期預警系統(Climature Risk & Early Warning Systems；CREWS)之太平洋小島發展中國家(SIDS)計畫會」等系列科學與技術型會議；專題會則包括：「航空/海洋/氣候/水文專題小組會」、「捐助者與夥伴會」、「正式氣象局長會」等系列政策與工作型會議。



Pre-PMC Meeting 29 July - 2 August

			Sunday 28	Monday 29 & Tuesday 30	Wednesday 31 & Thursday 1	Friday 2	
Morning				IMPACT Regional Workshop on IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC)	Next Generation of Climate Change Projections for the Pacific & PIETR Panel Meeting	Women Leadership in Meteorology & Hydrology Workshop	Master Class Communication Training for Met Directors not attending Women in Leadership
Afternoon							
Evening							

PMC Panels, Donor Roundtable & PMC 3-9 August

	Saturday 3	Sunday 4	Monday 5	Tuesday 6	Wednesday – Friday 7-9		
Morning	Women Leadership in Meteorology & Hydrology Workshop		Aviation Panel	Tanoa Session with Donors and Partners	PMC Official opening	Drafting committee	
Lunch			Oceans Panel		Pacific Meteorological Council Meeting (PMC-5)		
Afternoon	Master Class Communication Training for Participants to the Women Leadership in Meteorology and Hydrology Workshop	3 <sup>rd</sup> Meeting of the CREWS Pacific SIDS Projects Steering Committee	Climate Panel		Side Events		
Evening			Comms Panel		Pacific Meteorological Council Meeting (PMC-5)		
					PMC opening function	ROK PI CLIPS-2 LAUNCH	

圖 1、PMC5 完整議程(實際的氣象局長正式會議是由 7 日至 9 日)

中央氣象局所參與的是 7 日至 9 日的正式氣象局長會議(附錄二為詳細議程,附件三為會議進行的照片,附件四為選錄的相關重要國際報導)。7 日上午由索國自然資源與環境部次長 Mr.Taefu Lemi Taefu 開場,次由 PMC 的現任主席/索國氣象局長 Mr. David Hiba Hiriasia 接續開場,隨後由 SPREP 的秘書長 Mr. Leota Kosi Latu,以及 WMO 發展暨區域活動部主任代表 WMO 秘書長分別發表關鍵議題演講。團體大合照後,隨即進行此次 PMC5 會議主席與副主席的選舉和整體會議議程的確認,以及此次會議目標和預期產出的報告,接著報告 PMC4 會議所產出各項議題的行動方案與部長宣言,以及此次會議中所觸及的主軸方向與議題,其重點包括:太平洋氣候變遷由科學至服務、WMO 議會與改革、太平洋韌性發展框架、太平洋氣候變遷中心的進展及其與 PMC 的關聯、PMC 與 WMO 革新的潛在配搭;7 日下午則是 21 個 PMC 會員國的國家氣象工作推展報告以及國家報告的綜合討論。

8日上午是各種專業技術與管理議題的報告與討論，其重點包括：航空天氣服務(PIAWS 小組的進展：包括區域與國際相關會議及調查的成果)、氣候服務(PICS 小組的進展、WMO 第五區太平洋區域氣候中心(RCC)網絡展示階段資訊更新)、多重災害早期預警系統(太平洋海嘯早期預警系統 PTEWS 更新資訊、海洋區域地震網路(The Oceania Regional Seismic NETwork；ORSNET)的進展、提升太平洋海岸溢淹早期警訊預報系統 PCIEWFS 的發展、太平洋小島發展中國家 SIDS 因應氣候變異與極端天氣事件的能力)、水文及泛流早期預警系統(太平洋水文服務 PHS 小組的進展及需求與差異分析更新、建立斐濟洪水指引系統 FijiFFGS)等。8日下午繼續各種專業技術與管理議題的報告及討論，其重點包括：海事天氣服務及海洋議題(太平洋小島海事及海洋服務 PIMOS 的進展、太平洋海洋酸化、提供海事氣象服務的國際義務、海洋科學太平洋社群中心及聯合國海洋科學十年)、通訊及基礎建設(太平洋島嶼通訊及基礎建設 PICI 小組的進展、國家緊急電訊計畫 NETP)、訓練、教育及研究(太平洋島嶼教育訓練研究 PIETR 小組的進展更新、區域訓練中心可行性研究的進展、太平洋氣候變遷科學與服務研究路徑圖)、氣象服務發展(韓國太平洋島嶼氣候預測服務計畫)。

9日上午延續各種專業技術與管理議題的報告及討論，其重點包括：氣候變遷之氣象服務的貢獻(連結氣候變遷科學至行動)、太平洋氣象桌夥伴關係及實施太平洋島嶼氣象策略 PIMS 的進展(實施 PIMS 及 PMDP 的進展、計畫提案的機會與挑戰、吐瓦魯/馬紹爾/帛琉/庫克群島/紐埃等國聯合國環境規劃署(UNEP)綠色氣候基金(GCF)計畫提案的進展)、PMC 互動策略、媒體支援氣象服務、PMC 章程評議、PMC6/PMMM3 會議地點、評議及採納 PMC5 報告等。

### 三、 我國—氣象與地震早期預警研究計畫

本次出席 PMC5 會議的重要任務之一，為在會中展現我國協助索國進行氣象與地震早期預警系統設置的相關成果。中央氣象局在科技部的支持下，與衛福部、中研院、中原大學、中華民國氣象學會、國際氣候發展智庫等機構之相關單位，共同規劃提出索羅門群島「氣象與地震早期預警」研究計畫(以下稱本計畫)，旨在協助索國充分運用環境監測或預報資訊進行相關風險的控管，針對氣象暴雨、地震海嘯及登革熱進行早期預警系統的建置，以達到預防、應變及減低災損的目標。此計畫自 105 年 7 月起開始執行，為期 3 年的計畫執行期間我國持續派員赴索國協助進行相關觀測系統的設置和資訊系統的發展，以及知識與技術的移轉訓練工作，綜整相關工作主要成果包括：(1)設置完成 3

套自動氣象觀測站和 5 套自動地震觀測站。(2)發展完成半自動氣象站的氣象電碼編製及傳送軟體，以及中心站的自動氣象電碼收集與電郵傳報軟體。(3)發展完成地震站的自動化地震傳報軟體，以及中心站的自動地震資料收集、地震波顯示及地震中心計算軟體。(4)發展完成客製化的索國區域模式預測系統、衛星降雨估算軟體和登革熱預警指標。(5)發展完成整合式的預警資訊匯集與顯示(SoSAFE)系統，提供作業應用。

中央氣象局建置的索羅門群島早期預警系統(EWS)，或稱 SoSAFE (Solomon Islands Synergistic Analysis For Environment)預警系統，旨在協助索國氣象、地震、公衛及防災相關機關，能針對特定的災害做早期偵測並提出預警訊息，使索國居民在面對氣候變遷災害的威脅時，能有適當的因應作為。現分別依氣象豪雨、地震海嘯及登革熱等預警作業簡要說明此系統建置與運作的重要概念：

### **(一)氣象豪雨監測預警作業**

SoSAFE 內各式產品的產製是利用虛擬主機(VM)環境來建置，該 VM 環境本身具有備援的能力，而顯示系統的環境則亦建置於 VM 環境中；同時考量索國網路頻寬有限的狀況，亦同時於索國氣象局預報中心(SIMS)辦公室中建置顯示系統，便於中央氣象局可同步將即時的各式產品傳送至 SIMS，使索國氣象局人員不需跨出該國網路即可快速看到本系統所提供的產品服務，即使在跨國之網際網路斷線後，SIMS 仍可提供最後的資訊進行服務。以索國而言，因其相關的基礎建設如電力、網路、儀器設備的保護並不夠完善，因此在建置自動觀測站及資訊系統建置時必需考量這些因素，圖 2 所示即為 SoSAFE 與索國氣象站的網路連線架構。

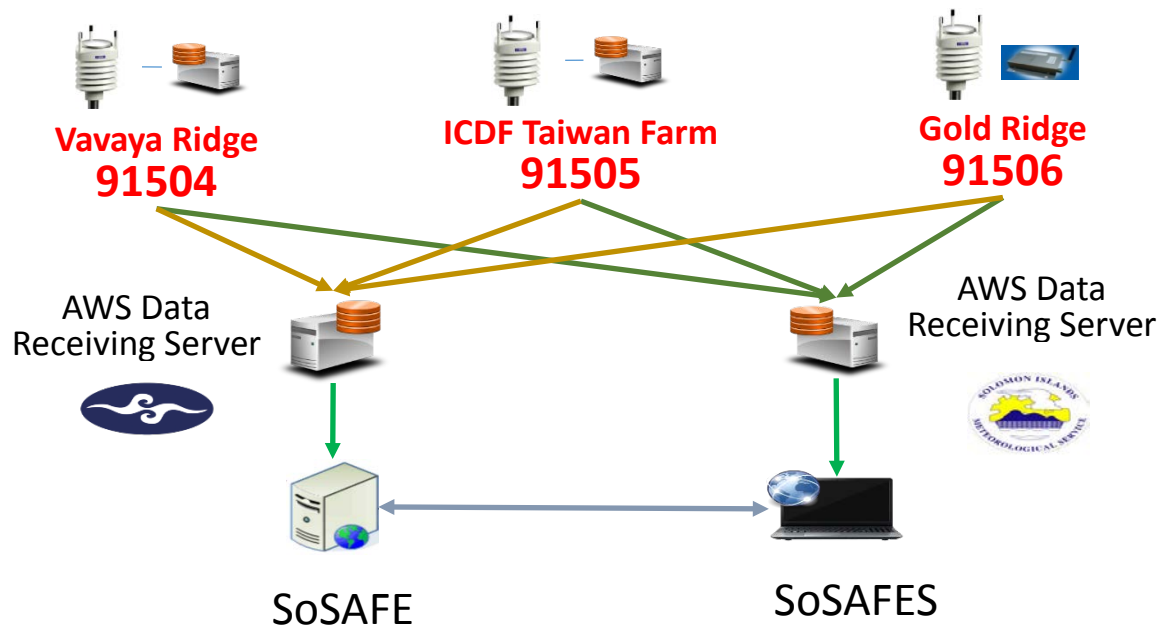


圖 2、SoSAFE 與索國氣象站網路連線架構

SoSAFE 系統整合並提供索國天氣分析與預報人員所需資源，包括衛星等各項氣象觀測、預報模式資料，可提升索國氣象預報單位對於天氣系統演化分析與監測能力，並進一步改善對於颱風、對流等劇烈天氣系統的位置、發展與降雨等相關致災警訊的發布能力。

在數值模式預報系統支援方面，針對索國之災變天氣現象，包括熱帶氣旋和豪雨事件，運用國際通用的 WRF 區域模式，並考慮中央氣象局可提供的計算資源，設計出索國適用的最佳數值模式組態，建立作業化的運作機制，並命名為 SWRF 模式。依此模式組態，選取適當的個案進行模式預報效能評估與必要之調校，並建置平行作業測試平台以利模式系統的壓力測試，同時發展模式預報產品以及網頁顯示介面，成為一套完整的區域模式運作系統。目前此模式系統已正式上線作業，並據以提供索國即時之中尺度數值模式預報產品。

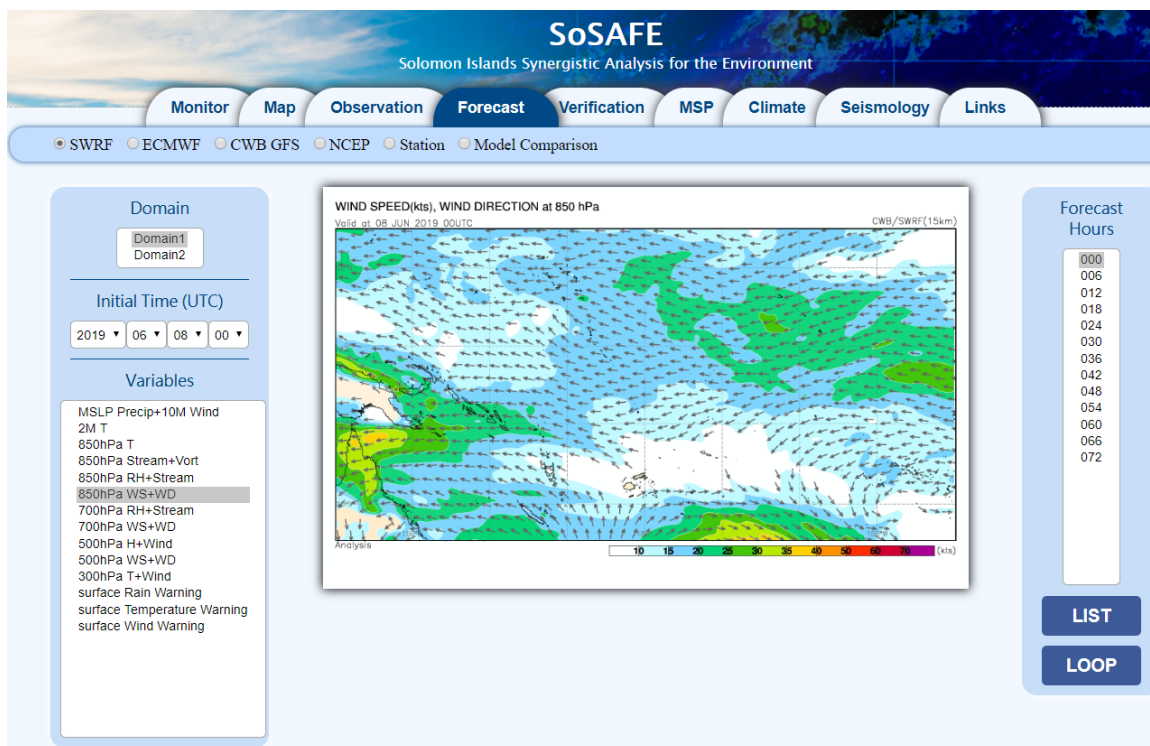
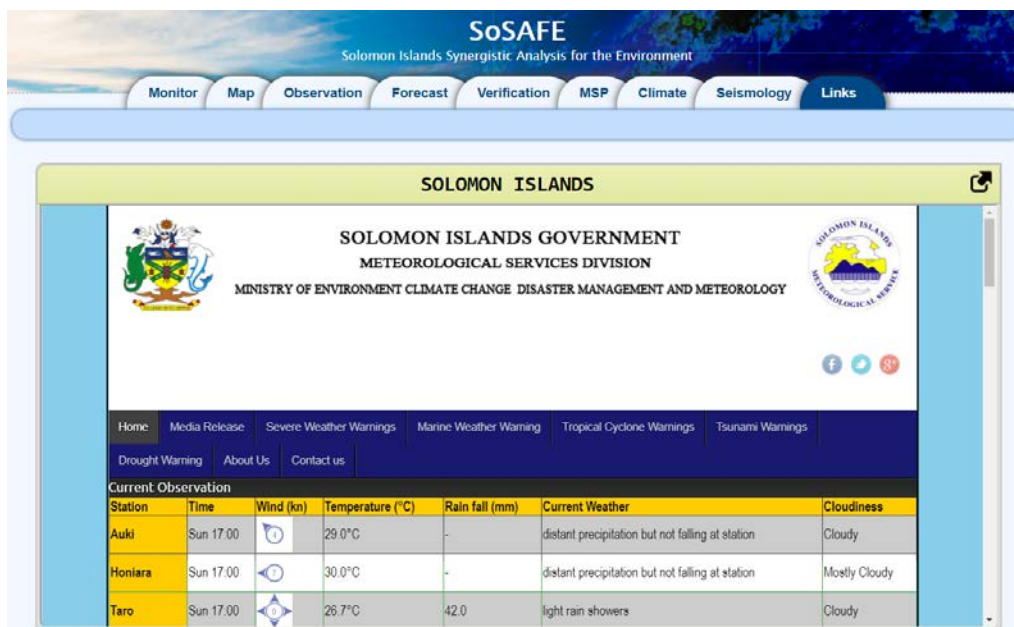


圖 3、SoSAFE 內的 SWRF 數值模式產品(850hPa 風場)

除上述作業功能外，SoSAFE 介面並提供客製化的外部網頁的連結與整合功能，以增加 SIMS 運用既有國際網路氣象測報資訊資源的能力。圖 4 所示即為 SoSAFE 網頁介面整合了 SIMS 的官網以及 ECMWF 的資料網頁的範例。



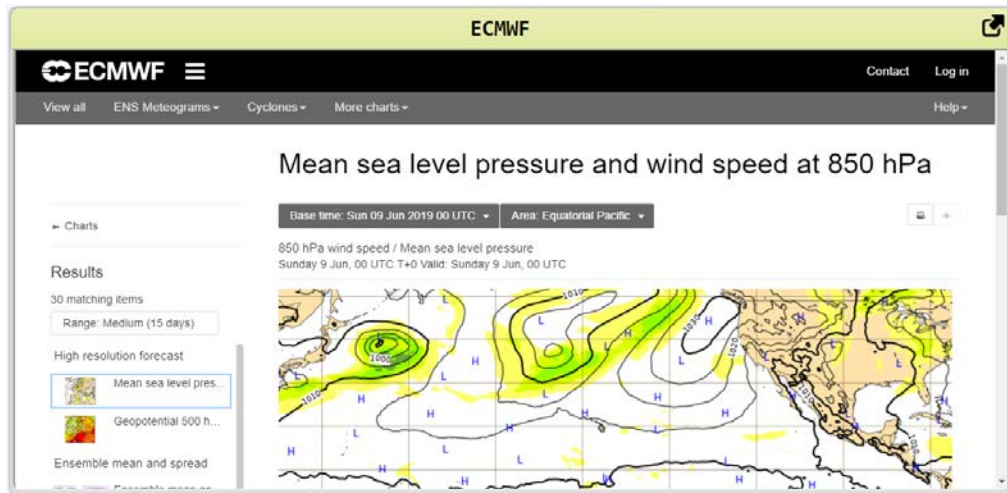


圖 4、SoSAFE 整合 SIMS 的官網以及 ECMWF 的資料網頁

## (二)地震海嘯監測預警作業

南太平洋的索羅門群島，由 999 個島嶼組成，處於太平洋板塊及印澳板塊之聚合型邊界，印澳板塊以每年 110mm 的速度隱沒至太平洋板塊之下，與臺灣地體構造環境類似，地震發生頻繁。從 USGS(United States Geological Survey)地震資料庫搜尋 2005 至 2015 年發生在索羅門群島附近規模大於 6.0 的地震，數量多達 140 個，其中 16 個規模介於 7.0 至 8.0 之間，更有 2 個規模 8 以上的強震。雖然索國地震頻繁發生，但缺乏區域型地震觀測網進行即時監測及記錄，地震觀測完全仰賴 USGS 全球地震網，其對於中小型地震沒有解析能力，更難看出強震之後的餘震分布與構造間的關聯。本計畫擬於索羅門群島建置地震監測網，並整合先前研究計畫之觀測設備，收錄高品質地震波訊號，架構出完整的地震測報系統，為未來研究工作開創新局。

為該國所規劃地震測報系統，引用中央氣象局地震速報工作發展的經驗，建立包含(1)即時加速度型地震觀測網、(2)地震自動定位技術、以及(3)地震訊息傳播技術等基礎工作。對於近域地震所引發的海嘯，先利用單位海嘯模擬方法，建立近海海嘯波浪的波形模擬資料庫，接著結合地震速報系統和海嘯警報系統，藉由地震速報系統迅速有效的地震偵測能力，並配合海嘯模擬資料庫，即可針對近域海嘯發出警報通知，圖 5 所示為索國地震海嘯作業的整體架構。根據過去赴索人員調查結果，雖然索國目前在人力、技術與設備等資源缺乏的情況下，較難建置標準且完善的地震海嘯作業流程，但在其國家災防體系的資源投入以及國際和區域國家的技術協助下，發展了一套地震規模大於 7 以上可能造成海嘯之標準作業流程(SIMS 負責)如下：

- (1)當有規模大於 7 以上的地震發生在離岸或沿岸附近，須盡速通知 SIMS 值班的預報員相關地震資訊，包含地震經緯度、深度、規模，並使用 NOAA 所開發的 MOST(Method of Splitting Tsunamis)工具執行海嘯預報模式。警告訊息必須自動寄送電子郵件至 SIMS 信箱，若欠缺相關地震資訊，須於掌握情況後告知 SIMS。
- (2)值班人員啟動 MOST 模式：此 MOST 版本較為簡易，只在當地發生規模大於 7 或遠洋有大地震時才啟動，此模式的輸入只有震源及規模（需預報員手動選擇表單），然後系統會針對索國各省份產出海嘯威脅程度（共 4 種等級，各區域以燈號顏色呈現），但不會產生海嘯抵達時間或海嘯高度等資料。
- (3)值班人員判斷資訊，同時由 PTWC 得知是否有海嘯侵襲可能後，傳訊給 NDMO、SIMS，再由這些單位視嚴重情形通知媒體、SIBC、民眾、發布警訊。
- (4)SIMS 通報 NDMO 流程：當地發生規模大於 7 地震及遠地地震造成之海嘯通報，對於無海嘯威脅的地震無通報流程。根據 USGS 網站上提供的地震報文進行地震報告驗證，若與地震資料庫中心產出的地震報告有些微差異，純屬正常。

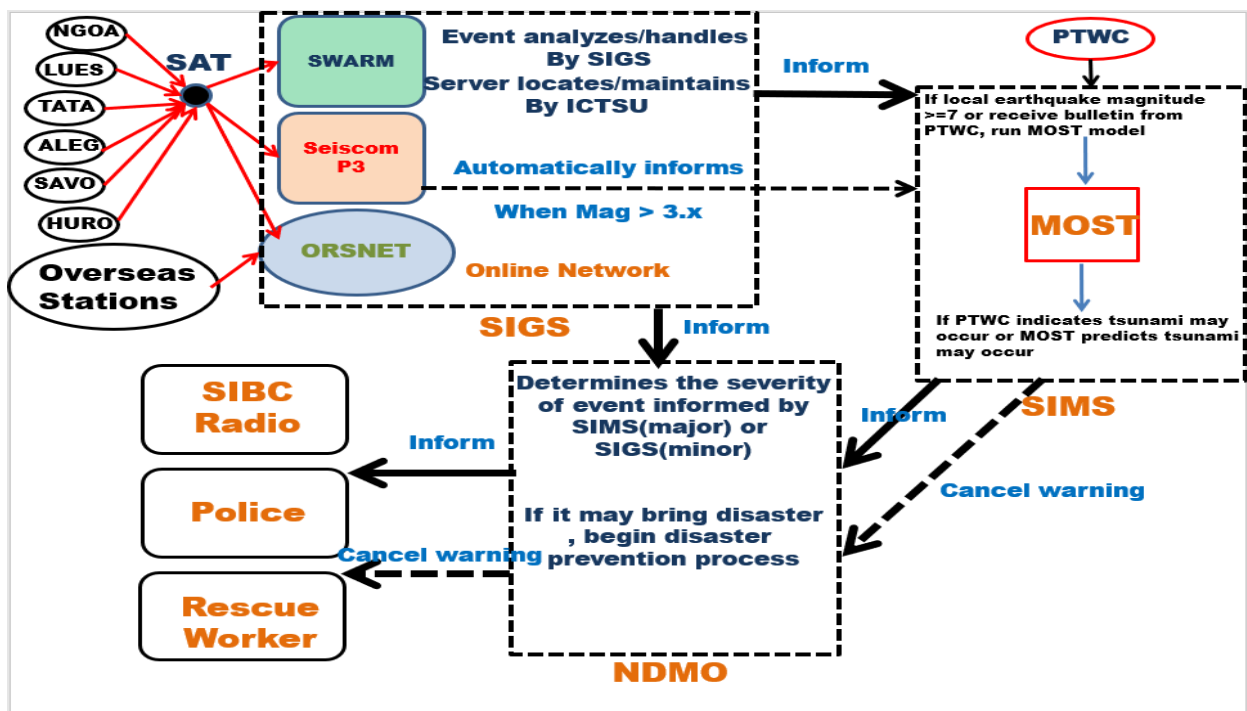


圖 5、索國地震海嘯作業架構圖

### (三)登革熱預警作業

世界衛生組織(World Health Organization, WHO)於 2019 年將登革熱疾病列入年度十大氣候變遷下之公共醫療威脅，而登革熱是一種以病媒蚊為傳播媒介之病毒性疾病，目

前已對全世界一半以上的人口造成公共衛生之危害，其中又以兒童所受到的危害最為嚴重，且近年來隨著氣候變遷造成全球平均溫度不斷提升，亦造成登革熱發病率及疫區急遽增加，每年全球的登革熱病例數約可達 3.9 億個案數。目前氣候變遷對於病媒疾病的影響趨勢可分為二，(1)在某些病媒疾病已是地方病的地區，若較高溫度、降雨及地表水窪等情況同時發生，將會延長病媒傳播季節。(2)在其他地區，卻可能因為氣候變遷造成低降雨或是過高環境溫度進而使得病媒疾病減少。因此，當地的公共衛生條件被認為是病媒疾病最重要的決定因子(IPCC, 2001)。氣象對登革熱的傳染病的影響是很複雜的，可能是讓登革熱增加也可能是讓登革熱減少，例如降雨增高、溫度增加將會導致登革熱傳染的增加，而乾旱造成群眾儲水亦會增加病蚊的孵育地。

2016 年底至 2017 年初，索國爆發大規模類登革熱疫情，本計畫為了強化索國公共衛生以及疾病方面應變之能力，一方面從索國的歷史個案資料來分析登革熱和氣象因子間的關聯性，另一方面透過與氣象預報結合，提供發生、流行機率或燈號的早期預警資訊，並結合 SoSAFE 的介面顯示，以方便操作，使其政府能據以預先施以應變防制措施來達到防患於未然，降低當地登革熱發生致死之風險，實際協助當地公共衛生之應變能力。圖 6 所示即為本計畫實際建置登革熱預警系統時的工作架構圖。

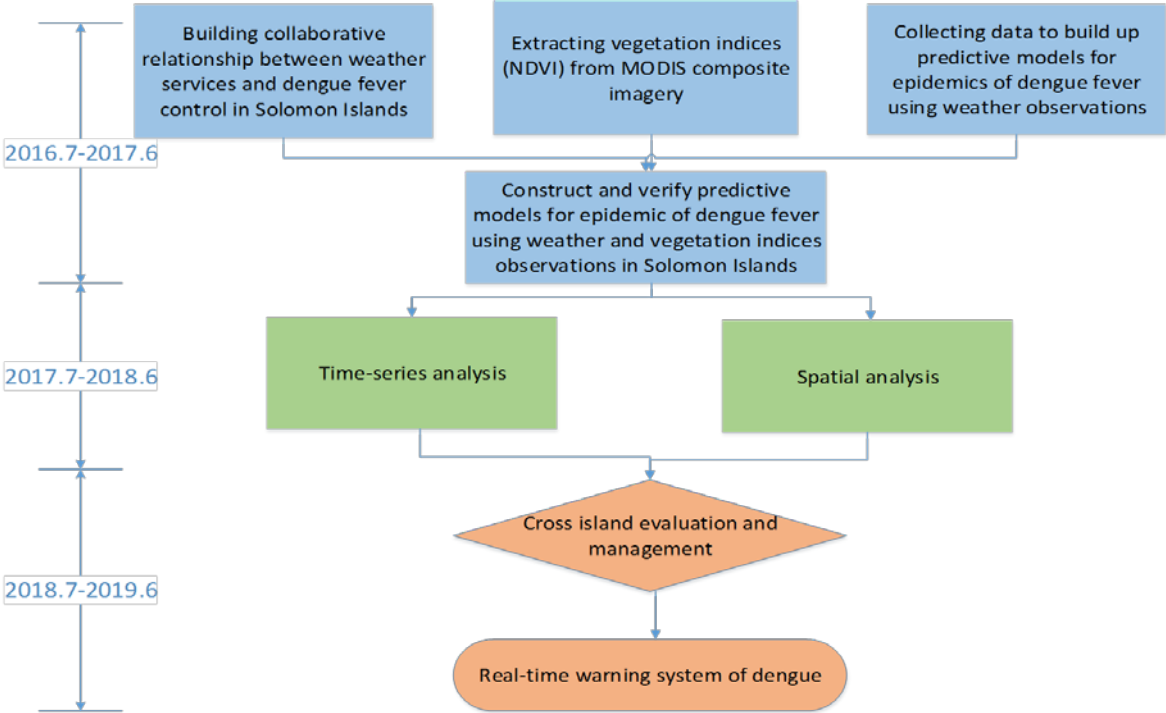


圖 6、索國登革熱預警系統工作架構圖

四、 全球環境機構－社區氣候與災害風險回復力計畫



國際上對索羅門群島的援助計畫相當多，其中性質與中央氣象局相近，未來有合作的可能是「社區氣候與災害風險回復力計畫」(Community Resilience to Climate and Disaster Risk Project for Solomon Islands；CRISP)，該計畫由全球環境機構 (Global Environment Facility；GEF)、全球減災與恢復基金 (Global Facility For Disaster Reduction And Recovery；GFDRR)所資助，總經費為 9.13 百萬美元。索國部分是由該國環境/氣候變遷/災害管理部(MECDM)及氣象部(SIMS)做為執行窗口，執行期間(2014 年 3 月 6 日至 2019 年 5 月 31 日)也與本計畫相近。其計畫重點如下：

(一)計畫起源：

CRISP 計畫是因應索國政府、世界銀行與全球環境機構對索羅門群島所做的評估報告而生的，內容包含索國政府的 2011~2020 年國家發展策略(National Development Strategy 2011~2020)、世界銀行 2013~2017 年國家合作關係發展策略(Country Partnership Strategy, CPS)(索國部分)與 UNFCCC 的國家調適行動計畫(National Adaptation Program of Action)等，這些報告指出：面對氣候變遷的影響，索國最迫切需要改善的目標為並提出核心理念在於降低極端貧窮，建設更多的公共財，避免氣候災難對居民造成嚴重的影響。

(二)計畫目標:

社區氣候與災害風險回復力計畫(CRISP)主要目標是增加鄉村社區抵擋天然災害和管理氣候變遷風險的能力。計畫包含 4 個面向：

- (1)將氣候變遷調適(CCA)與降低氣候風險(DRR)整合為政府政策，執行要點為協助發展政策、建構能力以及制度化，以期能將政務管理面與執行面作有效整合，同時顧及 CCA 與 DRM，預計投注經費 0.54 百萬美元，並包含 2 兩個作業要點：(a)須建構一個能整合 CCA 與氣候風險管理(DRM)的框架綱要；(b)強化相關能力，使 CCA 與 DRM 在計畫與投資部分能成為主流。
- (2)透過建立火山與地震災害的早期預警系統網絡及國內風險資訊整合平台，強化早期預警系統以及氣候與災害風險資訊蒐集能力，預計投注經費 1.33 百萬美元，並包含 2 項作業要點：(a)建立火山地震監測網絡(此需求為世界銀行全球減災與恢復基金 GFDRR 於 2009 年提出)；(b)建立國內風險資訊掌握能力的基礎，以改善風險管理；使之能應用於 CRISP 計畫，評估災害與氣候變遷可能造成的影響，進而制訂投資計

畫。子計畫(2)中的作業要點(a) 建立火山地震監測網絡，將透過專業人力資源發展 (PHRD) 底下的子計畫：南-南(South-South) 支援與交流，與鄰近國家萬那杜合作。CRISP 計畫則負責確認最終的需求、安排採購、監督、安裝與試運行設備。

(3)CCA 與 DRR 的投資計畫將同時支持結構性與非結構性的災害風險調適計畫，包含當地社區層級與省政府層級，預計投注經費 6.33 百萬美元，並包含 3 項作業要點：(a) 鄉村基礎建設投資與災害氣候風險管理，包含風險研究、顧問諮詢與監控服務；(b) 透過社區基金的導入，發展和執行以社區為主的鄉村投資計畫；(c) 發展和執行以省政府為主的鄉村投資計畫，且投資計畫須以降低氣候與災害風險為目的，例如建造社區避難所、改善水資源供給與儲存系統、強化建物抗震與抗氣旋之功能、防洪與海岸防護系統。

(4)專案管理與績效評估：(a) 聘用長期計畫專員協調，建置在 MECDM 底下，提供對應之其他部門必要的協助；(b) 聘用專家顧問，協助中央以及省政府將 CBDRM 與 V&A 脆弱度分析工具，確實導入現場工作小組的實務應用中。

### (三)技術重點:

CRISP 計畫之技術能力建構主要用以開發及應用風險資訊系統，並將風險資訊應用至鄉村基礎建設的設計規範與建造方法，來提升當地社區回復力和控管風險。風險資訊系統將主要以地理資訊系統(Geographic Information System, GIS)來建構，所有的製圖技術與資料庫技術將建置在目前索國各部會以及區域組織(SPC 與 SPREP)所使用的系統上(如 MapInfo)，風險管理以及地理資訊系統將在 MECDM 底下運行。資深技術顧問將直接與索國 MECDM 團隊共同工作，再陸續與其他相關部門合作，工作內容包含：(1) 提供規格建議(採購)；(2) 發展技術操作相關的知識與技能；(3) 協助 MECDM 團隊培養相關技能，使其能應用地理空間資訊，做為政策規劃、決策、風險管理的參考資料；(4) 協助建置標準與研究方法。

PHRD 與 GEF/GFDRR 等基金根據其本身計畫，聘用長期計畫專員，建置在 MECDM 底下，提供對應之其他部門必要的協助，此外，這些專員與 CRISP 計畫以及 RDP 計畫的第一線工作人員(當地社區)與工程師緊密合作，將風險資訊確實納入試點投資與社區規劃的考量中。地理空間資訊將透過各個區域的訊息來源蒐集取得，目前，MECDM 已有專案(歐盟捐助)社會融合與社區啟動計畫(Social Inclusion and Community Activation

Programme；SICAP)負責整合從各個部會取得的地理空間資訊。此外，此計畫會另聘 1 位專家顧問(或 NGO)，協助其中央以及省政府將 CBDRM 與 V&A 脆弱度分析工具確實導入現場工作小組的實務應用中。

為了強化既有的政府各部會能力，各部會將依其權責，分配所屬風險資訊類別，國家災難管理辦公室(NDMO)將負責災難資訊；環境、氣候變遷、災害管理及氣象部(MECDM)負責氣候與天氣相關的風險資訊；地質災害和水資源災害相關的資訊以及地理空間資訊將儲存在 MapServer 中；國土資源、住房和調查部(MLHS)負責土地資訊與地理空間資料；統計局(Statistics Office)負責人口普查數據。

為求整合國內與區域範圍內的數據及資訊，CRISP 計畫將奠基在國內既有計畫以及其他太平洋區域性倡議或計畫上，如太平洋災難風險評估與融資倡議(PCRAFI)、太平洋-澳洲氣候變遷科學與調適規劃計畫(Pacific-Australia Climate Change Science and Adaptation Planning Programme, PACCSAP)、索國災難資訊管理系統 DesInventar 以及首都 Honiara 城市脆弱度評估等等。

#### (四)預期成果:

預計 2019 年(1)達到 7 萬 9 千居民受惠，其中 48%為女性；(2)70%以上的目標社區有能力執行以社區為主的災難風險管理與調適計畫。在火山地震早期預警系統方面：(1)預計 2016 至 2019 年間架設完成 2 座火山地震觀測站，並整合至全球觀測網絡；(2)以 GIS 為架構的風險管理系統，預計 2016 年系統能整併大部份索國數據資料，且能供 CRISP 計畫運用；2017 年，預計系統能整併且應用太平洋災難風險評估與融資倡議(Pacific Catastrophe Risk Assessment and Financing Initiative, PCRAFI)的數據。2018 至 2019 年，預計系統整併索國衛星圖像資料。

## 五、 結論與建議

太平洋地區島嶼國家不但是受全球氣候變遷影響最巨地區，同時多數島嶼國亦為發展中國家 (Small Island Developing State；SIDS)。受限於有限的技術與財政能力，來自國際的各類型軟硬體與經費支援，對於太平洋島國在發展面對氣候變遷的減緩(mitigation)

與調適(adaption)上都不可或缺。本次參與 PMC5 會議除了展現我國協助索國的計畫成果外，也實際瞭解太平洋地區各國的合作組織架構與互動方式，以及在索國或與索國高度相關的一些國際支援計畫。除前述由世界銀行經費支持在索國執行的 CRISP 計畫負責人員表達非常有興趣瞭解我國使用之地震感測傳輸與運算機制，亦樂意與我方就此計畫所預期佈設的地震觀測設施與資料進行互動交換，補強南太平洋環地震帶的站網配置與密度。此外，尚有下列計畫可進行合作：

- (一) 由聯合國 UNDP 的氣候變遷與糧食安全相關專案經費支持的氣象站設置計畫，此計畫由紐西蘭國家水及大氣研究院(National Institute of Water and Atmospheric Research；NIWA)與索國氣象局(SIMS)合作執行，目前已完成 11 處自動雨量站和 6 處自動氣象站的設置，以及完整傳輸系統、資料庫及網頁顯示介面。惟設站以雨量觀測為主，且尚非全部省分都有。中央氣象局及 NIWA 均瞭解若要蒐集較完整氣象資訊，合作增加觀測網的測站資料是必要的，因此，在會議期間已與 NIWA 進行討論建立資料交換與技術互動的方式。
- (二) 韓國亞太氣候中心(APEC Climate Center；APCC)延伸其既有的工作框架，自 2015 年啟動太平洋島嶼氣候預測服務計畫(ROK-PI CLIPS)，提供太平洋島嶼國家客製化、在地化的季節性氣候預報資訊，並協助各國應用。本研討會中 APCC 與會人員報告其 2018 至 2020 年進行的第 2 期計畫，與澳紐等國緊密合作，提供太平洋島國氣候預測資訊，並加強協助太平洋島嶼各國進行客製化的氣候應用，充分展現了其拓展技術援外的企圖心。中央氣象局與 APCC 本即簽有合作協議，是 APCC 多模式預報的模式資料提供者之一，也與 APCC 合作舉辦多次知識與技術交流研討會，對於協助我國於太平洋地區邦交國的氣候測報應用，可考慮增加合作事項加以運用。

我國協助索國的「氣象與地震早期預警研究計畫」全期計畫執行至今已近尾聲。此計畫不僅能增進我國對南太平洋地區島國氣候狀態與氣候風險管理議題的瞭解，同時也能實質協助索國建立初步的自然災害早期預警作業能力，相關系統建置的過程亦對於將我國技術南向轉移至不同區域環境的能力發展有所助益。

綜觀本次會議的各項議題與會中討論，可知道因應氣候變遷的衝擊並結合聯合國的永續發展目標是國際合作與發展的重要趨勢，我國協助索國的計畫有明確的成果，並與

此趨勢有相當程度的扣合，因此美、澳、紐、日、韓等國皆表達有興趣與我進行交流合作，也開啟了我國進一步國際參與的機會。

附錄一、英文簡寫對照表

英文簡寫	英文全名	中文譯名
APCC	APEC Climate Center, APCC	亞太經濟合作會議氣候中心
APEC	Asia-Pacific Economic Cooperation	亞太經濟合作會議
CCA	Climate Change Adaptation	氣候變遷調適
COP21	Conference of the Parties	第 21 次協約國會議
CPS	Country Partnership Strategy	國家合作關係發展策略
CREWS	Climate Risk & Early Warning Systems	氣候風險及早期預警系統
CRISP	Community Resilience to Climate and Disaster Risk Project for Solomon Islands	所羅門社區氣候與災害風險回復力計畫
CROP	council of regional organisations in the pacific	太平洋地區組織理事會
DRM	Disaster Risk Management	氣候風險管理
DRR	Disaster Risk Reduction	降低氣候風險
ECMWF	European Centre for Medium-Range Weather Forecasts	歐洲中期天氣預報中心
ESCAP	Economic and Social Commission for Asia and the Pacific	亞洲及太平洋經濟社會委員會
FijiFFGS	Fiji Flash-flood Guiding System	斐濟洪水指引系統
FRDP	Framework for Resilient Development in the Pacific	太平洋韌性發展框架
GCF	Green Climate Found	綠色氣候基金
GEF	Global Environment Facility	全球環境機構
GFDRR	Global Facility For Disaster Reduction And Recovery	全球減災與恢復基金
GIS	Geographic Information System	地理資訊系統
IPCC	Intergovernmental Panel on Climate Change	政府間氣候變化專門委員會
JICA	Japan International Cooperation	日本國際協力機構
MECDM	Ministry of Environment, Climate Change, Disaster Management and Meteorology	環境、氣候變遷災害管理及氣象部
MLHS	Ministry of Land Resources, Housing and suvey	國土資源、住房和調查

		部
MNRE	Ministry of Natural Resources and Environment	自然資源和環境部
MOST	Method of Splitting Tsunamis	海嘯分裂方法
NDMO	National Disaster Management Office	國家災難管理辦公室
NETP	National emergency telecommunications plan	國家緊急電訊計畫
NGO	Non-Governmental Organization	非政府組織
NIWA	National Institute of Water and Atmospheric Research	紐西蘭國家水及大氣研究院
NMHS	National Meteorological and Hydrological Services	國家氣象水文服務機構
NOAA	National Oceanic and Atmospheric Administration	美國國家海洋暨大氣總署
ORSNET	The Oceania Regional Seismic NETwork	海洋區域地震網路
PACCSAP	Pacific-Australia Climate Change Science and Adaptation Planning Programme	太平洋-澳洲氣候變遷科學與調適規劃計畫
PCC	Pacific Climate Change Center	太平洋氣候變化中心
PCIEWFS	Pacific Coastal Inundation Early Warning Forecast System	太平洋海岸溢淹早期警訊預報系統
PCRAFI	Pacific Catastrophe Risk Assessment and Financing Initiative	太平洋災難風險評估與融資倡議
PHRD	Professional Human Resource Development	專業人力資源發展
PHS	Pacific Hydrological Services	太平洋水文服務
PIAWS	Pacific Islands Aviation Weather Services	太平洋島嶼航空氣象服務
PICI	Pacific Island Communications and Infrastructure	太平洋島嶼通訊及基礎建設
PICS	Pacific ISLANDS Climate Service	太平洋島嶼氣候服務
PIETR	Pacific Island Education, Training and Research	太平洋島嶼教育訓練研究
PIMOS	Pacific Island Marine and Oceans Services	太平洋島嶼海洋服務
PIMS	Pacific Islands Meteorological Strategy	太平洋島嶼氣象策略
PMC	Pacific Meteorological Council	太平洋氣象理事會
PMDP	Pacific Meteorological Desk Partnership	太平洋氣象台合作夥伴

PMMM	Pacific Ministerial Meeting on Meteorology	太平洋部長級氣象會議
RCC	Regional Climate Center	區域氣候中心
PTEWS	Pacific Tsunami Early Warning System	太平洋海嘯早期預警系統
PTWC	Pacific Tsunami Warning Center	太平洋海嘯預警中心
SDGs	Sustainable Development Goals	永續發展目標
SIBC	Solomon Islands Broadcasting Corporation	所羅門群島廣播公司
SICAP	Social Inclusion and Community Activation Programme	社會融合與社區啟動計畫
SIDS	Small Islands Developing State	小島發展中國家
SIMS	Solomon Islands' Meteorological Services	索羅門氣象局預報中心
SoSAFE	Solomon Islands Synergistic Analysis For Environment	所羅門島早期預警系統
SPC	South Pacific Cooperation	南太平洋合作局
SPEC	South Pacific Economic Cooperation	南太平洋經濟合作局
SPREP	Secretariat of the Pacific Regional Environment Programme	太平洋區域環境計畫秘書處
SWRF	Solomon Islands Weather Research and Forecasting	索羅門中尺度氣象模式
UNEP	United Nations Environment Programme	聯合國環境規劃署
UNFCCC	United Nations Framework Convention on Climate Change	聯合國氣候變遷綱要公約
USGS	United States Geological Survey	美國地質調查局
VM	virtual machine	虛擬主機
WHO	World Health Organization	世界衛生組織
WMO	World Meteorological Organization	世界氣象組織
WRF	Weather Research and Forecasting	中尺度氣象模式



附錄二、PMC5 正式局長會議議程

Time		PMC5 Agenda Item	Working Papers
Monday 5th August		PMC Panel Meetings @ TATTE	N/A
Tuesday 6th August	8.00-9.00	Varysian Working Breakfast: Best practice in public and private sector @ TATTE	N/A
	9.00-5pm	Tanoa Session with Donors and Partners @ TATTE	N/A
	5-7pm	Varysian Cocktail Reception @ TATTE	N/A
Wednesday 7th August		PMC OPENING SESSION	<a href="#">Program</a>
		Registration at TATTE Conference Centre	N/A
	Agenda Item 1:	Opening Ceremony	N/A
	1.1	Opening Prayer	N/A
	1.2	Opening Address by the Associate Minister of Natural Resource and Environment, Honorable Taefu Lemi Taefu	
	1.3	Address by the Current PMC Chairman, Mr David Hiba Hiriasia	
	1.4	Key Note Remarks from the Director General of the Secretariat of the Pacific Environment Programme (SPREP), Mr Leota Kosi Latu	
	1.5	Key Note Remarks from the WMO Secretary General Representative & Director of Development and Regional Activities Department, Ms Mary Power	
		Group Photo and Morning Tea	
	Agenda Item 2:	Organization of the Fifth Meeting of the Pacific Meteorological Council (PMC-5)	
	2.1	Election of Chair and Vice Chair for PMC-5	<a href="#">WP 2.1</a> <a href="#">2.1 Att 1</a> <a href="#">2.1 Att 2</a>
	2.2	Adoption of Agenda and Program of Work	<a href="#">WP 2.2</a> and <a href="#">WP 2.3</a>
	2.3	Establishment of a Drafting Committee	<a href="#">WP 2.2</a> and <a href="#">WP 2.3</a>
	Agenda Item 3:	Setting the Scene for PMC-5: Objectives and Expected Outcomes	<a href="#">WP 3.0</a> <a href="#">3.0 Att 1</a>
	Agenda Item 4:	Report on Actions Taken on Matters Arising from the 4th Meeting of the Pacific Meteorological Council (PMC-4) and the Honiara Ministerial Statement	<a href="#">WP 4.0</a> <a href="#">4.0 Att 1</a> <a href="#">4.0 Att 2</a>

	Agenda Item 5	Pacific Climate Change Science to Services	<a href="#">WP 5.0</a>
	Agenda Item 6	WMO Congress and Reform	WP 6.0
	Agenda Item 7	The Framework for Resilient Development in the Pacific and the Pacific Resilience Meeting	<a href="#">WP 7.0</a> <a href="#">7.0 Att 1</a>
	Agenda Item 8	Progress on the Pacific Climate Change Centre and relevance to the PMC	<a href="#">WP 8.0</a>
	Agenda Item 9	Potential alignment of the PMC to the WMO Reform	<a href="#">WP 9.0</a>
		Lunch Side Events Room 1- Side Event 1: MOEJ Room 2 – Side Event 2: Framework for Resilience Development in the Pacific (FRDP)	
	Agenda Item 10	Countries' Reports from National Meteorological and Hydrological Services	<a href="#">Reporting template</a>
	10.1	American Samoa	<a href="#">Report</a>
	10.2	Cook Islands	Report
	10.3	Federated States of Micronesia	Report
	10.4	Fiji	<a href="#">Report</a>
	10.5	French Polynesia	Report
	10.6	Kiribati	<a href="#">Report</a>
	10.7	Marshall Islands	Report
	10.8	Nauru	<a href="#">Report</a>
	10.9	New Caledonia & Wallis and Futuna	Report
		Afternoon Tea	
	10.10	Niue	<a href="#">Report</a>
	10.11	Palau	<a href="#">Report</a>
	10.12	Papua New Guinea	<a href="#">Report</a>
	10.13	Samoa	Report
	10.14	Solomon Islands	Report
	10.15	Tokelau	Report
	1016	Tonga	<a href="#">Report</a>
	10.17	Tuvalu	Report
	10.18	Vanuatu	<a href="#">Report</a>
	10.19	Australia	<a href="#">Report</a>
	10.20	New Zealand	<a href="#">Report</a>
	10.21	United States of America	Report
	10.22	General Discussion on the Countries Reports	N/A

6.30-9.30pm		Opening Function Hosted by Government of Samoa (Robert Louis Stevenson Museum, Vailima)	N/A
<b>Thursday 8th August</b>		<b>Agenda Item</b>	<b>N/A</b>
8.00-9.00am		Meeting of the Drafting Committee Varysian Working Breakfast: Data Integration	N/A
	Agenda Item 11	Aviation Weather Services	N/A
	11.1	Progress on the PIAWS Panel including outcomes of related regional and international meetings and surveys	<a href="#">WP 11.1</a> <a href="#">11.2 Att 1</a> <a href="#">11.3 Att 2</a> <a href="#">11.4 Att 3</a> <a href="#">11.5 Presentati on</a>
	Agenda Item 12	Climate Services	N/A
	12.1	Progress on the Pacific Island Climate Services (PICS) Panel	<a href="#">WP 12.1</a>
	12.2	Update on the demonstration phase of the WMO RA-V Pacific Regional Climate Centre (RCC) Network	<a href="#">WP 12.2</a>
		Discussions, Questions and Answers	N/A
		Morning Tea	N/A
	Agenda Item 13:	Multi-Hazard Early Warning System (MHEWS)	N/A
	13.1	Update on the Pacific Tsunamis Early Warning System	<a href="#">WP 13.1</a>
	13.2	Progress from ORSNET	<a href="#">WP 13.2</a>
	13.3	Upscaling the Development of Pacific Coastal Inundation Early Warning Forecast Systems	<a href="#">WP 13.3</a>
	13.4	Capacity of the Pacific SIDS to respond to Climate Variability and Extreme Weather Events	<a href="#">WP 13.4</a>
	Agenda Item 14	Hydrology and Flood Early Warning System	N/A
	14.1	Progress on the Pacific Hydrological Services (PHS) Panel including updates on the Needs and Gaps Analysis	<a href="#">WP 14.1</a>
	14.2	Establishment of Flash Flood Guidance System for Fiji (FijiFFGS)	<a href="#">WP 14.2</a> <a href="#">14.2 Att1</a>
		Lunch Side Events	N/A

		Room 1- National Adaptation Plans Room 2 - Riskcape (NIWA)	
	<b>Agenda Item 15:</b>	<b>Marine Weather Services and Ocean Issues</b>	N/A
	15.1	Progress on the Pacific Island Marine and Ocean Services (PIMOS) Panel	<a href="#">WP15.1</a> <a href="#">Att 1</a> <a href="#">Att 2</a>
	15.2	Oceans Acidification in the Pacific	<a href="#">WP15.2</a>
	15.3	International obligations for the delivery of Marine Meteorological Services	<a href="#">WP15.3</a>
	15.4	Pacific Community Center for Ocean Science and UN Decade of Ocean Science	<a href="#">WP15.4</a> <a href="#">Att 1</a> <a href="#">Att 2</a>
	<b>Agenda Item 16:</b>	<b>Communications and Infrastructure</b>	N/A
	16.1	Progress on the Pacific Island Communication and Infrastructure (PICl) Panel	<a href="#">WP 16.1</a> <a href="#">Att 1</a> <a href="#">Att 2</a> <a href="#">Att 3</a>
	16.2	National Emergency Telecommunications Plans (NETP)	WP 16.2
		Discussions, Questions and Answers	N/A
		Afternoon Tea	N/A
	<b>Agenda Item 17</b>	<b>Training, Education and Research</b>	N/A
	17.1	Progress update from the Pacific Island Education, Training and Research (PIETR) Panel	<a href="#">WP 17.1</a> <a href="#">Att 17.1</a>
	17.2	Progress on the Regional Training Centre Feasibility Study	<a href="#">WP 17.2</a> <a href="#">Att.1</a> <a href="#">Presentation</a>
	17.3	Pacific Climate Change Science and Services Research Roadmap	<a href="#">WP 17.3</a>
	<b>Agenda Item 18</b>	<b>Meteorological Services Developments</b>	N/A
	18.1	The Republic of Korea – Pacific Island Climate Prediction Services Project	<a href="#">WP 18.1</a> <a href="#">18.1 Att</a>
7:00 – 9:00pm		Sunset Event POSTECH & SPREP – Launch of the Republic of Korea – Pacific Island Climate Prediction Services Project Phase 2 (Taumeasina Island Resort)	N/A
<b>Friday 9th August</b>		<b>Agenda Item</b>	N/A

8:00-9:00am		Meeting of the Drafting Committee	N/A
	Agenda Item 19	Meteorological Services Contribution to Climate Change	N/A
	19.1	Connecting Climate Change Science to Action	<a href="#">WP 19.1</a>
	Agenda Item 20	The Pacific Meteorological Desk Partnership and Progress in Implementing the PIMS	N/A
	20.1	Progress in Implementing the PIMS and the PMDP	<a href="#">WP 20.1</a> <a href="#">20.1 Att 1</a>
	20.2	Opportunities' and Challenges in project proposals	<a href="#">WP 20.2</a>
	20.3	Progress of the UNEP GCF Project Proposal for Tuvalu, Marshal Islands, Palau, Cook Islands and Niue	<a href="#">WP 20.3</a> <a href="#">WP</a> <a href="#">20.3 Att1</a>
	Agenda Item 21	PMC Engagement Strategy	<a href="#">WP 21.0</a> <a href="#">21.0 Att 1</a>
	Agenda Item 22	Media Supporting Meteorological Services	WP 22.0
	Agenda Item 23	Review of PMC Terms of Reference	<a href="#">WP 23.0</a> <a href="#">23.0 Att 1</a> <a href="#">23.0 Att2</a>
	Agenda Item 24	Venue of the Sixth Meeting of the Pacific Meteorological Council (PMC-6) and the 3rd Pacific Ministerial Meeting on Meteorology (PMMM-3)	<a href="#">WP 24.0</a>
	Agenda Item 25	Review and Adopt the Report of PMC-5	
		Lunch Side Events Room 1- Side Event 5: ACCESS-S (COSPPac) Room 2 - Side Event 6: TBC	N/A
	Agenda Item 25:	Continue Review and Adopt the Report of PMC-5	
	Agenda Item 26:	Closure of PMC-5	

### 附錄三、會議進行照片



PMC5 開幕團體大合照



索國 Samoa 總理(左 2)、自然資源與環境次長(左坐 3)與 SPREP 秘書長(左坐 4)主持開幕



會議議事片段



太平洋區域環境計畫(SPREP)秘書長 Mr.Kosi Latu 報告



世界氣象組織(WMO)發展活動暨區域辦公室主任 Ms.Mary Power 報告



索羅門氣象局長 Mr.David Hiba Hiriasia 進行報告



## 附錄四、選錄 PMC5 相關重要國際報導

### (1) 索國環境部長 Samuel Manetoali 發言報導

#### [Solomon Islands Meteorology Minister Urges Counter Parts in Tonga and The Region to Build a Resilient Pacific](#)



*Radio & TV Tonga, Nuku'alofa, 15/08/2017*

The Solomon Islands Minister for Environment, Climate Change, Disaster Management and Meteorology, Hon. Samuel Manetoali is appealing Pacific Island Countries to build their respective meteorological and hydrological services due to their vulnerability to impacts of climate change.

He highlighted this while opening the 4th Pacific Meteorological Council (PMC) in Honiara.

In his address he said the National Meteorological and Hydrological Services play a vital role in monitoring of weather and climate to provide necessary services to ensure that the whole population is informed before an event occurs.

The meeting are discussing ways and opportunities to strengthen and ensure required services are provided for the safety of the people and their properties as well as a more economically vibrant society.

Meanwhile, the outgoing Chairman of the 4th PMC and Director of Tonga's Meteorological Services 'Ofa Fa'anunu, told the meeting, the council started with little hope of being supported and the profile of Met Services were very low on the development agenda.

But now, they have witnessed progress in its work through various activities. This includes the current enhancement of National Meteorological and Hydrological Service capacity in weather

forecasting, early warning system, long term projections and improved climate services to support decision making through the Pacific Meteorological Council.

That is one of the Key Regional Goals of SPREP in its 2017-2026 Strategic Plan.

‘Ofa said that PMC also established expert panels to enhance sustainable weather, climate, oceans and water services for a resilience Pacific in the areas of Aviation, Marine and Oceans, Climate, Communication and Infrastructure and Education, Training and Research to assist its respective members.

He added that PMC has developed a roadmap on climate services to guide its work in the delivery of climate services as well as the Pacific Island Meteorological Strategy (PIMS) whose mid-term review was recently completed.

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## (2)索國氣象局長 David Hiba 發言報導

### [Solomons Face Ongoing Tsunami Risk](#)

#### REPORT

from [Secretariat of the Pacific Regional Environment Programme](#)

Published on 08 Aug 2019—[View Original](#)

BY LEANNEM

8 August 2019, Apia, Samoa - According to Solomon Islands' Meteorological Service (SIMS) Director David Hiba, the SIMS faces infrastructure challenges and the ongoing risk of tsunamis hitting Solomon Islands.

Mr. Hiba said the SIMS had expanded its network of seismographic equipment and tsunami detection in recent years. Further, work on tsunami inundation modelling for populated areas is to be done with Taiwan National University.

“In terms of the tsunamis, we are partnering with our national disaster office,” Mr. Hiba said. “It looks like we have tsunamis every three years.”

Mr. Hiba presented a report on the status of the SIMS to the fifth meeting of the Pacific Metrological Council (PMC-5), on 7 August in Apia Samoa.

According to Mr. Hiba, in the last few years the SIMS has also made significant progress in partnering with other Solomon Islands' departments, installing seismographic equipment, and connecting with traditional knowledge systems about weather.

Mr. Hiba reported that the SIMS has expanded the capacity of its research stations, its operations and observations capacity, the climate section for collecting and archiving climate data, public forecasts for tropical cyclones, strong winds and wave swell advisories.

As part of its best practices SIMS has, according to Mr. Hiba, boosted its connection with other organisations across Solomon Islands in collecting and use of traditional weather observation data and techniques.

“We are working with partners on incorporating traditional knowledge with modern early warning systems,” Mr. Hiba said. “We (SIMS) are also partners with the local water Resources Division. We are also partnered with the Ministry of Health.”

### (3)薩國環境部次長 Ulu Bismark Crawley 發言報導

#### [Fifth Pacific Met Council Meeting To Open In Apia](#)



AUGUST 6, 2019 BYANGELICAS

#### [Climate Change Resilience](#)

*6 August 2019* – “*Science to services for a resilient Pacific*” is the theme of the Fifth Pacific Meteorological Council (PMC-5) opening this week in Apia, Samoa. The meeting will bring together Pacific Met Directors, partners and stakeholders to strengthen climate and weather services in the Pacific region.

“Samoa is pleased to be able to host our Pacific family on this very important occasion. It is the opportunity for Samoa to showcase the critical role of Meteorology and hydrology services in informing actions and policies to address some of the most pressing issues of our time Climate Change, Natural Disasters , Green Growth and Sustainable Development,” said Chief Executive Officer of the Ministry of Natural Resources and Environment (MNRE), Mr Ulu Bismark Crawley.

“The engagement strategy provides the platform to build partnership with private sector, public sector, communities and development partners ensuring clear focus on role and responsibilities at the regional and national level as well as promoting evidence based outcomes and outputs that encourage synergies through sector plans linking back to relevant national policy statements. The work of our Pacific meteorological and hydrological services is crucial to the everyday lives of our Pacific communities. Everything that we can do to be better at our job will ultimately help strengthen our resilience.”

The aim of the PMC is to help coordinate facilitation of meteorological services in support of development agendas, contributing to the strengthening of community resilience. It will also discuss ways to continue to implement the Pacific Island Meteorological Strategy (2012-2021).

“The meeting of the Pacific Met Council is of great importance not only for Pacific National Meteorological Services (NMS), but also for Pacific communities and people, as weather events continue to become more frequent or severe due to the increased vulnerability of our islands as a result of climate change,” said Ms Tagaloa Cooper Halo, Director of Climate Change Resilience of the Secretariat of the Pacific Regional Environment Programme (SPREP).

“The priorities set by the Pacific Met Council will guide the World Meteorological Organizations in its implementation of projects in the region. WMO aims for greater integration and participation of the Pacific Islands in its work,” said Ms Mary Power, Director of Development and Regional Associations at World Meteorological Organisation (WMO).

“This in turn makes the involvement, partnership and collaboration of all partners present at this meeting, vital in ensuring effective, relevant and resilient services being provided for our Pacific is-lands.”

Globally, 90 per cent of natural disasters are caused by weather, climate and water-related hazards, and the majority of these hazards will occur in the Asia and Pacific region.

“The PMC provides an open forum for members to discuss and collaborate on issues related to the advancement of meteorological and hydrological services in the Pacific,” said Mr Henry Taiki, WMO Representative for the South West Pacific.

“By building on mutual and complementary strengths, we can develop innovative approaches to help sustain national and regional development goals prioritised by Pacific countries.”

The Fifth Pacific Meteorological Council (PMC-5) follows a range of pre-PMC meetings which were held in Apia, Samoa from 29 July - 6 August, 2019. The PMC-5 is supported by a strong partnership between the following: The Government of Samoa, the Secretariat of the Pacific Regional Environment Programme (SPREP), World Meteorological Organization (WMO), Government of Australia through the Department of Foreign Affairs and Trade, Government of Canada, Government of Korea, Climate Risk Early Warning Systems (CREWS), Commonwealth Scientific and Industrial Research Organisation (CSIRO), IMPACT Project, Varysian, United Nations Development Programme (UNDP), United Nations Educational, Scientific and Cultural Organization (UNESCO), Climate and Oceans Support Programme in the Pacific (COSPPac), and National Oceanic and Atmospheric Administration (NOAA).

## BACKGROUND

The PMC meeting started in 1993 as the Regional Meteorological Services Directors (RMSD). They first met in Port Vila, Vanuatu, to discuss how National Meteorological and Hydrological Services (NMHSs) of the Pacific can be better supported to help strengthen the resilience and security of Pacific people and communities to the impacts of climate change.

After fourteen RMSD meetings, in 2011, the First Pacific Meteorological Council Meeting was held in Majuro, Republic of Marshall Islands, and endorsed the Pacific Islands Meteorological Strategy (PIMS) 2012-2021 and the Pacific Meteorological Desk Partnership (PMDP). This is hosted and based within the Secretariat of the Pacific Regional Environment Programme (SPREP). This continued the tradition of close collaboration and partnership for Pacific NMHSs to work together to build their capacity and improve their climate and weather services for Pacific communities.

For more information on the PMC-5 please visit the Pacific Met Desk website <https://www.pacificmet.net/pmc/meetings/pmc-5> or email Salesa Nihmei [salesan@sprep.org](mailto:salesan@sprep.org) or Azarel Mariner-Mai [azarelm@sprep.org](mailto:azarelm@sprep.org)

(4)薩摩亞氣象局長 Mulipola Ausetalia Titimaea 發言報導

[Samoa Meteorological Services Growing From Strength To Strength](#)



AUGUST 8, 2019 BY LEANNEM

### Climate Change Resilience

**8 August 2019, Apia, Samoa** – The Samoa Meteorological Services (SMS) continues to grow from strength to strength, with several recorded achievements since the last meeting of the Pacific Meteorological Council (PMC) held in Honiara, Solomon Islands in 2017.

Mulipola Ausetalia Titimaea, Director of SMS, presented Samoa’s country report on the first day of the 5th meeting of the PMC, being held in Apia, Samoa, which sets out the country’s national priority actions of the Pacific Islands Meteorological Strategy (PIMS) 2017-2026.

Mulipola highlighted several key outcomes from the SMS, including improved meteorological services for air navigation, improved marine weather services and the establishment of ocean services, improved public weather services and strengthened capacity to implement multi-hazard early warning systems for tropical cyclones, coastal inundation and tsunamis.

“Samoa Meteorological Services has made steady progress in its operations, infrastructure and networks maintenance over the last two years. A major highlight is the Samoa Meteorological Bill which is scheduled to be tabled in Parliament at the end of this year,” Mulipola said.

With regards to the improvement of meteorological services for air navigation, SMS developed a Quality Management System which has enabled them to develop products that have been disseminated to airlines including Air New Zealand, with upgrades continually taking place.

SMS has also increased the use of marine products such as tide-gauges and portals in their work and are also working on developing a Quality Management System in Marine together with Marine counterparts of the Government of Samoa.

Capacity and knowledge building training programmes by the World Meteorological Organizations and the Government of Japan, have greatly improved public weather services and weather operations of SMS.

Collaboration between meteorological and hydrological services has also been strengthened, with SMS collaborating with the Water Resources Division of the Ministry of Natural Resources and Environment of Samoa to develop a Flood Forecasting system, utilising existing real-time rainfall and water level data in flood advisories and warnings.

Climate information and prediction services have also improved over the last two years, through the implementation of the Pacific Roadmap for Strengthened Climate Services, as well as support from the Climate and Oceans Support Programme in the Pacific (COSPPac) and Republic Of Korea-Pacific Islands (ROK-PI) Climate Prediction which has extended the prediction time to six months outlooks for the Pacific, and downscaled to national outlooks.

Mulipola concluded by acknowledging the invaluable support of SMS' partners, which enables its successful operation.

“With limited resources and in spite of a moderate budget increase, the Samoa Met Service is most grateful to our bilateral donor partners, mainly Australia, Japan and New Zealand, as well as regional bodies such as the Secretariat of the Pacific Regional Environment Programme, Pacific Community and other Pacific regional agencies, as well as United Nations agencies for their continued support.”

The PMC-5 continues today at the TATTE Convention Centre.

*For more information please visit our website <https://www.pacificmet.net/pmc/meetings/pmc-5> or email [Salesa Nihmei@sprep.org](mailto:Salesa.Nihmei@sprep.org) or [Azarel Mariner-Maia@sprep.org](mailto:Azarel.Mariner-Maia@sprep.org).*

(5)韓國 ROK-PI CliPS 第二階段計畫重點報導

[ROK-PI CliPS Phase 2 To Strengthen Meteorological Services In The Pacific](#)



AUGUST 9, 2019 BY LEANNEM

### Climate Change Resilience

**9 August 2019, Apia, Samoa** – “Increasing the resilience of the Pacific islands through enhanced capacity using high-quality climate change prediction information.”

This is the main objective of the Republic of Korea-Pacific Islands Climate Prediction Services (ROK-PI CliPS) Phase-2 project, which was officially launched yesterday evening at Taumeasina Island Resort in Apia, Samoa.

The launch concluded the second day of deliberations for the Fifth meeting of the Pacific Meteorological Council (PMC), which is being held from 7 – 9 August at the Tui Atua Tupua Tamasese Efi Convention Centre.

The ROK-PI CliPS Phase 2 project follows on from the ROK-PI CliPS Phase 1 which was completed in December 2017.

Phase 1 of the project successfully strengthened the adaptive capacity of vulnerable communities to climate risks at the seasonal timescale and resulted in the development of two important tools – the Climate Information ToolKit for the Pacific (CLIK-P) and the Pacific Island Countries Advanced Seasonal Outlook (PICASO).

Upon completion of Phase 1 however, NMHS at PMC-4 identified the existence of two particular needs to be addressed.



The first was the need to develop a user-friendly integrated approach to determine the optimal prediction for higher quality forecast information. The second is the need for more capacity building and training of NMHSs and in-country stakeholders to ensure that the tools and products developed by ROK-PI CliPS are taken up for decision making in sectors such as Agriculture, Health and Disaster Risk Reduction.

The ROK-PI CliPS Phase 2 project aims to address some of these needs through two separate outputs – the development of an integrated forecast function in PICASO, and the conducting of regional, sub-regional and in-country training programmes.

Speaking at the launch, Director General of the Secretariat of the Pacific Regional Environment Programme (SPREP), Mr Kosi Latu, expressed his gratitude to the Republic of Korea, the APEC Climate Centre (APCC) and Pohang University of Science and Technology (POSTECH) for their support to the region through the project.

“What is quite evident is that this project has the full backing of our Pacific region, following the endorsement at the highest level by our Pacific leaders. We, Directors of Meteorological Services and the PMC, must recognise the opportunity that’s been presented to us, and make use of it for the benefit of our Pacific people.”

Professor Jong-Seong Kug, who is leading the team from POSTECH implementing the project said, “I am excited to continue this work and to build on the successes of Phase 1. It is my hope that the ROK-PI CliPS project will contribute to building a more resilient Pacific island region.”

Phase 2 was officially signed in October 2018 for the duration of two years – from 2018-2020 – and will target 14 Pacific island countries.

Through Phase 2, PICASO, the tailored, region-specific climate prediction service developed during Phase 1 will be updated and enhanced, with the insertion of an integrated forecast function named the “Consensus of Climate Outlooks” or CoCO, eliminating the need for a separate system and streamlining services.

Regional and national trainings will also be organised as part of Phase 2 activities, with the first training workshop on PICASO to be held in conjunction with the Pacific Islands Climate Outlook Forum in October 2019.

ROK-PI CliPS Phase 2 is funded by the Government of the Republic of Korea through the Pacific Islands Forum Secretariat and is being implemented by POSTECH and SPREP, with support from APCC.

*For more information please visit our website <https://www.pacificmet.net/pmc/meetings/pmc-5> or email [Salesa.Nihmeisalesan@sprep.org](mailto:Salesa.Nihmeisalesan@sprep.org) or [Azarel.Mariner-Maiaiazarelm@sprep.org](mailto:Azarel.Mariner-Maiaiazarelm@sprep.org).*

## (6)PMC5 會議主題與重點綜合報導

### PMC Address Need For Climate Change Science And Services Research

AUGUST 9, 2019 BYANGELICAS

#### Climate Change Resilience

*8 August, Apia, Samoa* – The final draft of a Research Roadmap was tabled before the Fifth Pacific Meteorological Council (PMC-5) for endorsement.

Officially titled the Pacific Climate Change Science and Services Research Roadmap, its main purpose is to develop and support a strategic approach in prioritising, coordinating and delivering important climate change science and services research in the Pacific.

For Pacific National Meteorological and Hydrological Services (NMHSs), key actors, partner organisations, and institutions – this Research Roadmap will help to guide and inform relevant priorities of key structures such as the Framework for Resilient Development in the Pacific (FRDP, 2017-2030), the Pacific Islands Meteorological Strategy (PIMS 2017-2026), and the Pacific Roadmap for Strengthening Climate Services (PRSCS).

The Research Roadmap specifically addresses priority climate science and services research, such as traditional knowledge (that remains relevant over multiple-decade timescales) for both present and future climate change impacts and events.

“During PMC-3 and PMC-4, it was highlighted that there was a need for more climate science and services research,” said Ms Azarel Maiiai, SPREP Capacity Development Officer of the Climate and Oceans Support Program in the Pacific (COSPPac) Project.

“This Research Roadmap is a direct response to the request by National Meteorological and Hydrological Services on how we can bridge existing gaps and limitations in order to address the needs of our Pacific islands.”

The goal of the Research Roadmap is to provide strategic guidance for development and implementation of climate change science and services research in the Pacific. This will ensure more informed decision-making relevant to climate change adaptation and disaster risk management in the Pacific and enhance the resilience of our Pacific communities to climate change.

The Research Roadmap is based on six pillars, that will be accompanied by fixed term action plan to prioritise implementation across each pillar. These pillars are 1) climate change science; 2) climate change services; 3) traditional knowledge; 4) capacity development; 5) data and information management and; 6) governance: oversight and administration.

The Research Roadmap was endorsed by the PMC with many members, including partner organisations in the meeting, emphasising its importance.

The PMC-5 wraps up this Friday, 9 August where an outcomes statement is expected to inform the way forward for Pacific NMHSs over the next couple of years until the meeting convenes again in 2021.