出國報告(出國類別：研討會)

參加「第6屆NCEP/NWS系集預報使用者研討會及第38屆氣候診斷與預報研討會」

摘　　要

「氣候診斷與預報研討會」(Climate Diagnostics and Prediction Workshop)為美國國家海洋暨大氣總署(NOAA)每年以氣候為主題舉辦的盛會，作為促進作業單位與學術界和使用者之間的溝通平台，今年(102)兩組研討會議接續舉行，地點選擇在國家環境預測中心(NCEP)101 年 11 月才遷入位於馬里蘭大學校區內的新大樓。由於遇到美國部分政府關門，所以「第 6 屆 NCEP/NWS 系集預報使用者研討會」被迫取消，但「第 38 屆氣候診斷與預報研討會」仍照常舉行。雖然前一個會議取消，但仍安排與該會議主辦人氣候預報中心(CPC)的 Dr. Yuejian Zhu 與 Dr. Jun Du 討論有關全球系集預報模式的發展。相關討論都能夠提供本局未來全球模式系集預報系統及海氣耦合模式發展的重要參考資訊。另外也與環境模式中心(EMC)的 Dr. Henry Juang 討論本局全球波譜預報模式的平流層預報問題及有關半隱式-半拉格朗日全球預報模式發展的相關技術細節。

接著參加「第 38 屆氣候診斷與預報研討會」，該會議主要強調海氣耦合模式的重要性及能夠提升氣候預報的準確度。另外也參訪了海洋陸地大氣研究中心 (COLA)的研究團隊，了解到 COLA 的重要發展方向之一是和 NCEP 合作發展國際多重模式系集(NMME)預報實驗計畫。

茲就本次參加研討會之心得與建議如下

（一） 氣象局應該與 NCEP 建立緊密的合作關係，目前氣象局全球氣候模式，採用 NCEP-CFSR 與 CFSRR 來當作初始場或邊界場，全球預報模式及氣候模式的物理參數化大都跟 NCEP 一樣，所以與 NCEP 建立良好的合作關係對於本局未來模式的改進會有很大的助益。

（二） 全球模式系集預報系統是目前國際作業中心對於超過 7 天以上預報的使用工具。本局因受限於技術及電腦資源的不足，過去並沒有全球模式系集預報系統發展的規劃，在完成

新高速運算電腦建置後，將有能力建置全球模式系集預報系統，對於增進 2 週內的天氣預報準確度會有很大的幫助。

（三） 會議中不斷強調海氣耦合模式對於氣候預報的重要性，目前 NCEP 正推動國際多重模式系集(National Multi-Model Ensemble)預報實驗計畫，本局也應該積極思考加入此項計畫。

（四） 本局的作業模式從過去發展至今已有良好的成效，且已培養出具相當成熟度及技術能力的數值天氣預報發展人才，希望能夠在現有的基礎上持續改進發展，如此不僅在維護及改進作業上方便，也可以保有本局在國際作業中心的特色，更何況本局於 104 年在建置完成新電腦系統後，具有更高速運算電腦的計算能力，建議本局積極投入人力發展數值天氣預報，並加強與美國國家環境預報中心(NCEP)的合作，例如增加人員的互訪與參與國際合作計畫。

目次

壹、目的

　　系集預報是一種以統計方法取得多個預報模式或單一模式多個預報結果的預報資訊，它能提供更客觀、精準的天氣預報資訊給預報員參考，為了使統計分析結果有更好的信賴度，採用的樣本模式預報資料量，其樣本數越多越好。目前世界各作業中心都有全球模式系集預報系統的作業，例如歐洲中期天氣預報中心(ECMWF)用 32km 解析度的全球模式、51 個系集成員，提供 1 個月的預報資訊。日本氣象廳(JMA)用 37km 解析度的模式、51 個系集成員，提供 7 天以上的預報資訊。美國國家環境預報中心(NCEP)則是用 55km 解析度的模式、80 個系集成員，提供 16 天的預報資訊。本局因受限於技術及電腦資源的不足，過去並沒有全球模式系集預報系統發展的規劃，不過在 2014 年完成新高速運算電腦(HPC)系統建置後，也將建置全球模式系集預報系統，對於增進 2 週內的天氣預報準確度將有很大的幫助。

　　數值天氣預報模式的解析度通常與高速運算電腦(HPC)息息相關，本局自民國 95 年購置 IBM P5-575 高速運算電腦後，全球預報系統(GFS)作業的水平解析度從 110 公里陸續提升至 37 公里，預報模式的一些物理參數化模組及資料同化模組也陸續改用美國國家環境預報中心(NCEP)的模組，例如簡化版積雲參數化、行星邊界層模組及網格統計內差(GSI)模組。僅管如此，本局衛星觀測資料的使用率卻僅有美國國家環境預報中心的 13%左右。目前作業中的 GFS(T320L40)每日執行 4 次，於 06Z、18Z 提供 4 天的天氣預報，於 00Z 及 12Z 提供 8 天的天氣預報，至於更長時間(2 週以上)的預報是以低解析度(水平解析度約 70 公里)的全球預報系統(GFS T180L30)來提供。

　　目前國際主要數值預報作業中心所使用的全球預報模式其動力架構大都是半隱式-半拉格朗日(SISL)波譜法(spectrum)及地形-壓力混合垂直坐標，例如歐洲中期天氣預報中心(ECMWF)、日本氣象廳(JMA)、中國國家氣象局(CMA)、美國海軍(NAVGEM)

等。與國際作業中心的模式相比較，本局的全球模式解析度及動力架構(傳統的波譜模式、垂直為地形坐標)均落後國際很多，分析原因主要是本局過去高速運算電腦(HPC)的計算能量及人力資源不足且技術落後。然而未來完成新一代高速運算電腦(HPC)建置後，將會克服計算能量不足的問題，且模式發展也將參考國際作業中心的發展狀況，進行 SISL 模式的動力架構的發展。

目前世界各作業中心的氣候預報主要是以動力預報為主，所用的預報模式都是海氣耦合模式，所採用的預報方法可分為系集預報及多模式系集預報兩類。採用系集預報的單位有美國國家環境預報中心(NCEP)的氣候預報系統(CFSv2)、日本氣象廳(JMA)的系集預報系統，韓國氣象廳(KMA)長期預報系統等。採用多模式系集預報的單位有歐洲中期天氣預報中心的多模式系集預報系統(EUROSIP)及亞太經合會氣候預報中心的多模式系集預報系統等。目前本局的動力統計預報系統只使用單純的大氣環流模式，並未考慮大氣與海洋的交互作用，為了加強對東亞與西北太平洋氣候變化的了解與預報，本局正在積極發展全球海氣耦合模式。

展望未來，全球天氣及氣候預報系統的目標為(1)提升全球天氣預報模式 7-14 天預報準確度，(2)透過委外合作計畫改進預報系統並提升與學術界及作業單位的合作關係， (3)建立本局海氣耦合模式預報系統及全球模式系集預報系統，(4)提升短期氣候預報能力，(5)持續提供預報資料供預報參考，(6)提供全球氣候整合產品供應用單位參考。陳員此行之目的除搜集全球模式系集預報目前發展與使用狀況及增進氣候預報科學進展之外，並將於會後參訪國家氣候中心(CPC)及海洋陸地大氣研究中心(COLA)，討論本局全球模式、全球系集預報系統及全球海氣耦合模式未來發展的相關業務。

貳、研討會議題摘要

一、 過程

　　美國國家環境預測中心(NCEP)隸屬美國國家海洋暨大氣總署(NOAA)，該組織(NCEP)的任務是為國家及全球社群提供以科學為基礎的環境預測並與合作伙伴及客戶共同合作產製可靠的、即時的、與準確的分析、諮詢、預報及警報以保護人民的生命財產及促進國家的經濟。其下共有 9 個部門，分別是航空天氣中心(Aviation Weather Center (AWC))、氣候預測中心(Climate Prediction Center (CPC))、環境模式中心(Environmental Modeling Center (EMC))、NCEP 作業中心(NCEP Central Operations (NCO))、國家颶風中心(National Hurricane Center (NHC))、海洋預測中心(Ocean Prediction Center (OPC))、太空天氣預測中心(Space Weather Center (SWPC))、風暴預測中心(Storm Prediction Center (SPC))、天氣預測中心(Weather Prediction Center (WPC))等，詳如附錄 1 資料。

　　本「第 6 屆 NCEP/NWS 系集預報使用者研討會」及「第 38 屆氣候診斷與預報研討會」為氣候預測中心(CPC)所舉辦的會議，作為促進作業單位與學術界和使用者之間的溝通平台，今年(102)兩組研討會議接續舉行，地點選擇在國家環境預測中心(NCEP)101 年 11 月才遷入位於馬里蘭大學校區內的新大樓。氣候預測中心(CPC)主要的任務是提供短期氣候變異衝擊及極端天氣事件相關風險的評估與預報以減輕氣候變異與極端天氣所帶來的損失與促進經濟的繁榮。該中心有 50 位正式的職員，25 位駐點約雇人員與氣候與衛星等 2 個合作機構。詳細資料如附錄 2。環境模式中心(EMC)的任務是經由與研究社群的相關資料分析與模式合作發展計畫進行數值天氣、氣候、水文與海洋等模式的發展與改進。此次會議分別與該 2 中心的顧問討論相關問題。

在 10 月 16 日至 10 月 18 日預定參加「第 6 屆 NCEP/NWS 系集預報使用者研討會」，由於遇到美國部分政府關門，該研討會被迫取消，但仍分別與該會議主辦人美國國家氣候中心(CPC)的 Dr. Yuejian Zhu 與 Dr. Jun Du 討論有關全球系集預報模式的發展，了解全球模式如何使用 Breading 的方法製造初始場誤差，來增加系集預報的樣本數，或採用隨機多物理參數化方式產生多組預報結果等等，並了解美國國家環境預報中心(NCEP)決定在 2016-2020 年執行 MON4 海洋模式。相關的討論都能夠提供本局未來全球模式系集預報模式系統及海氣耦合模式發展的重要參考資訊。另外也與環境模式中心(EMC) Dr. Henry Juang 討論本局全球波譜預報模式的平流層預報問題及有關半隱式–半拉格朗日模式發展的相關技術細節。

在 10 月 21 日至 10 月 24 日參加「第 38 屆氣候診斷與預報研討會」，4 天研討會共計超過 100 篇發表論文及 50 篇張貼論文，其中本局科技中心盧孟明主任研究員發表論文：「Recent unusually high extremity of Taiwan rainfall extremes and the modulation of Interdecadal Pacific Oscillation」及張貼論文：「The Operational Monthly and Seasonal Climate Forecast System and Development at CWB Taiwan」各一篇。

10 月 25 日參訪海洋陸地大氣研究中心（COLA），該單位原位於馬里蘭大學校區內，今年遷移至喬治梅森大學校區內，它是由美國國家科學委員會(NSF)、美國國家海洋暨大氣總署(NOAA)、美國國家航空暨太空總署(NASA)所支持的研究機構，該中心的目標是經由動力海氣耦合模式來探討、建立及量化有關目前氣候狀態下的季內及年代際變化的可預測度及預報，並對於觀測資料及模式預報資料發展出新的分析技術。該中心主任 Dr. James Kinter 曾於今年 5 月來臺參加本局所舉辦的「臺灣與西北太平洋全球預報系統發展規劃研討會」，並於會後提出該次會議的總結及建議報告。

二、 內容

有關本次與 CPC 的顧問 Dr. Yuejian Zhu、Dr. Jun Du 及 EMC 的顧問 Dr. Henry Juang 之討論以及第 38 屆氣候診斷與預報研討會簡介內容，重點整理如下：

（一） 與 Dr. Yuejian Zhu、Dr. Jun Du 及 Dr. Henry Juang 之討論

1. 海洋資料同化非常的重要，好的資料同化會產生正確的海洋初始場資料，有助於提升海氣耦合模式的預報準確度。

2. 氣候模式的模擬結果中，除了看降水場的模擬之外，還需要看通量場的變化，來確定是否能量守恆。

3. 在模式發展的階段建議也要建立 SVN 系統，好處是組員都用同一套的模式(包括物理、動力…等等)，可以直接下載使用，也可以將更改的部分分享給大家。

4. 模式與氣候場的誤差如何做修正，將模式減去模式的氣候場(AMIP)，將觀測值減去觀測場的氣候值，隨後將模式加上觀測場的差值，進行誤差修正，這樣可以減少模式與觀測場之間的誤差。

5. Breading(養誤差):全球模式為了要產生不同的初始場資料，首先在初始場加上正負隨機值，這樣就有 3 個不同的初始資料，然後開始執時間積分後，再做 1 次正負隨機值，這樣就有 5 個初始場，依次下去，就可以產生不同的初始場來做系集預報的成員(members)。另外歐洲氣象中心所使用的奇異向量(singular vector)方式也是 1 種增加系集預報成員的方法。

6. 如何增加預報技術: 從預報場中，找尋過去(hindcast)的前後 5 天的結果，找到相似的天數後，對應到觀測值，將觀測值變成系集預報的成員來加入，產生機率預報的結果，這樣可提升預報技術，尤其是當天氣有發生特別現象時，此方法特別有效。其他如使用不同的物理參數化方法的系集預報也可以產生多組系集預報的結果。

7. 一般而言，系集預報的成員數以 40-80 個較為理想，過多的成員數對於預報得分並無有效的改進，反而會浪費電腦資源，對於天氣而言，解析度大於成員數，但對於氣候而言，反而是成員數大於解析度。

8. 如何延長預報模式的預報準確度:大氣的長波主導天氣的型態，保留長波(將高解度模式，預報 5 天之後，將保留的長波降解析度，再預報到 14 天)，理論上可以延長預報的時間長度。

9. 對於模式平流層溫度預報誤差過大的問題有可能是臭氧或水汽等溫室氣體處理不好所導致，目前氣象局的全球預報模式並未將臭氧納入預報變數，建議加入臭氧預報並使用 NCEP 的臭氧參數化模組。

10. NCEP 對於未來全球預報模式的改進策略是採漸進方式，以目前作業中的模式為基本架構逐步改進，目前使用傳統的波譜模式，但預計 2014 年就會將作業模式改為半隱式-半拉格朗日方法，水平解析度將提高到 13 公里。

（二）參加「第 38 屆氣候診斷與預報研討會」

1. 第 1 天的內容為開幕及邀請論文報告 2 篇，接著有 4 個主題，包括氣候監測(Climate Monitoring)、氣候歸因(Climate Attributions)、氣候模式診斷與改進(Climate Model Diagnosis and Improvement)、海氣耦合模式 CFSv2 的評估與診斷(CFSv2 Evaluation and Diagnosis)，共 25 篇報告論文。

2. 第 2 天有 4 個主題，包括季內氣候可預報度(Intraseasonal Climate Predictability)、季節及更長時間的氣候可預報度(Climate predictability on seasonal and longer time)、國際多模式系集預報(National Multi-Model Ensemble)計畫專題、張貼論文專題(Poster section)，共 28 篇報告論文、50 篇張貼論文。

3. 第 3 天有 3 個主題，包括季內至年代際預報

（Intraseasonal to Interannual Predictions）、颱風及災害性天氣的長期預測（Long-range forecasts of hurricane and severe weather）、座談會（包括與年輕科學家的座談、學生族群的座談、相關科學研究計畫的說明），共 25 篇報告論文。

4. 第 4 天有 4 個主題，包括預報評估（Forecast Evalutions）、應用與產品（Application and Product）、決策支援工具（Decision support tools）、衛星資料反演產品及氣候資料（Satellite-driven data products and climate data），共 25 篇報告論文。

5. 詳細的議程資料如附錄 3。

（三）參訪海洋陸地大氣研究中心（COLA）

1. 參加該中心研究員對於「國際多模式系集預報計畫」的研究成果報告。

2. 參加本局科技中心盧孟明主任研究員發表專題報告。

3. 與該中心主任座談：

(1) 了解參與「國際多模式系集預報計畫」應該注意及準備的事項。

(2) 了解該中心在喬治梅森大學校內的角色及研究師資、研究生及課程學習等狀況。

叁、心得及建議

一、 心得

此次出國參與 6th NCEP Ensemble user Workshop」與「38th Climate Diagnostic and Prediction Workshop，雖然第 6th NCEP Ensemble user Workshop 被迫取消，但 38th Climate Diagnostic and Prediction Workshop 仍照常舉行。參加會議主要心得：

（一） 氣象局應該與 NCEP 建立緊密的合作關係，目前氣象局

全球氣候模式，採用 NCEP-CFSR 與 CFSRR 來當作初始場或邊界場，全球預報模式及氣候模式的物理參數化大都跟 NCEP 一樣，所以與 NCEP 建立良好的合作關係對於本局未來模式的改進會有很大的助益。

（二）全球模式系集預報系統是目前國際作業中心對於超過 7 天以上預報的使用工具。本局因受限於技術及電腦資源的不足，過去並沒有全球模式系集預報系統發展的規劃，在完成新高速運算電腦建置後，將有能力建置全球模式系集預報系統，對於增進 2 週內的天氣預報準確度會有很大的幫助。

（三）會議中不斷強調海氣耦合模式對於氣候預報的重要性，目前 NCEP 正推動國際多重模式系集(National Multi-Model Ensemble)預報實驗計畫，本局也應該積極思考加入此項計畫。

二、　建議

　　本局的作業模式從過去發展至今已有良好的成效，且已培養出具相當成熟度及技術能力的數值天氣預報發展人才，希望能夠在現有的基礎上持續改進發展，如此不僅在維護及改進作業上方便，也可以保有本局在國際作業中心的特色，更何況本局於 104 年在建置完成新電腦系統後，具有更高速運算電腦的計算能力，建議本局積極投入人力發展數值天氣預報，並加強與美國國家環境預報中心(NCEP)的合作，例如增加人員的互訪與參與國際合作計畫。

NOAA's NCEP
National Centers for Environmental Prediction
Where America's Climate, Weather, Ocean and Space Weather Services Begin

OUR MISSION

NCEP delivers science-based environmental predictions to the nation and the global community. We collaborate with partners and customers to produce reliable, timely, and accurate analyses, guidance, forecasts and warnings for the protection of life and property, and the enhancement of the national economy.

WHAT WE DO

Aviation Weather Center (AWC): Provides aviation warnings and forecasts of hazardous flight conditions at all levels within domestic and international air space.
www.aviationweather.gov

Climate Prediction Center (CPC): Delivers assessments and forecasts of the impacts of short-term climate variability, emphasizing enhanced risks of weather-related extreme events for use in mitigating losses and maximizing economic gain. www.cpc.ncep.noaa.gov

Environmental Modeling Center (EMC): Develops and improves numerical weather, climate, hydrological and ocean prediction through a broad program of applied research in data analysis, modeling and product development in partnership with the broader research community.
www.emc.ncep.noaa.gov

NCEP Central Operations (NCO): Sustains and executes the operational suite of numerical analyses and forecast models and prepares NCEP products for dissemination.
www.nco.ncep.noaa.gov

National Hurricane Center (NHC): Provides official National Weather Service forecasts of tropical weather systems and issues the appropriate watches and warnings for the US and surrounding areas. Also responsible for a suite of marine products forecasting conditions in the tropical Atlantic and eastern Pacific.
www.nhc.noaa.gov

Ocean Prediction Center (OPC): Issues weather warnings and forecasts out to five days for the Atlantic and Pacific Ocean, north of 30 deg N.
www.opc.ncep.noaa.gov

Space Weather Prediction Center (SWPC): Provides space weather alerts and warnings for disturbances that can affect people and equipment working in space and on Earth. www.swpc.noaa.gov

Storm Prediction Center (SPC): Provides watches and outlooks for tornadoes and severe thunderstorms along with critical fire weather outlooks for the contiguous US. Also, assesses the mesoscale environment to forecast short term hazardous weather events for severe convection, heavy rainfall and extreme winter weather.
www.spc.noaa.gov

Weather Prediction Center (WPC): Provides analysis and forecast products, through the collaborative weather forecast process, specializing in quantitative precipitation forecasts to five days, weather forecast guidance to seven days, real-time weather model diagnostics discussions and surface pressure and frontal analysis.
www.wpc.ncep.noaa.gov

More About NCEP

RECENT ACCOMPLISHMENTS

- Weather and Climate Operational Supercomputing System transition on schedule for completion by September of 2013

- Five NCEP Centers move into new NOAA Center for Weather and Climate Prediction without missing a single deadline or product

- Aviation Weather Center (AWC) was certified as conforming to the International Organization of Standards (ISO) 9001:2008 standard for Quality Management Systems (QMS)

- New products, including qualitative precipitation forecasts through Day 7, and experimental Day 6 and Day 7 hurricane forecasts.

- Research to Operations Activities - WPC Winter Weather Experiment, AWC Aviation Test Bed Summer and Winter Experiments, SPC Spring Forecast Experiment

- Outreach Events - CPC 37th annual Climate Diagnostics and Prediction Workshop, SPC National Severe Weather Workshop, SWPC Space Weather Workshop, EMC annual Product Review, NHC WMO RA-IV Meeting
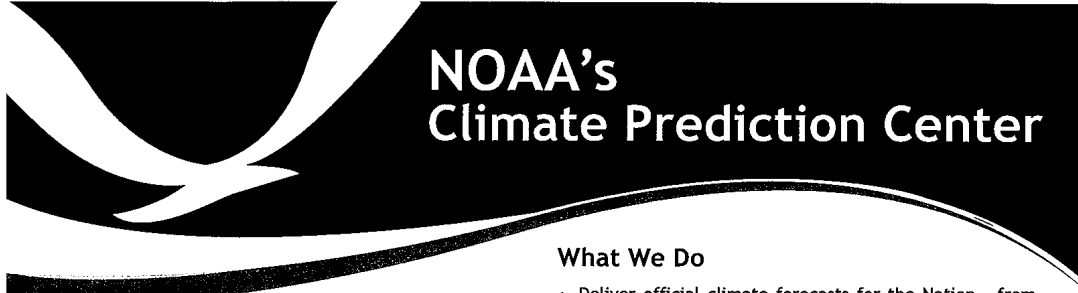
WHERE WE ARE
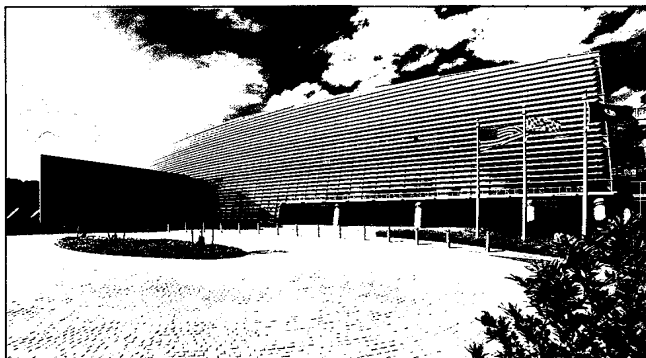
NOAA Center for Weather and Climate Prediction, College Park, MD

NCEP employs 428 federal employees, 170 contractors, and 6 NOAA Corps Officers at locations in College Park, MD (NCO, EMC, WPC, OPC, CPC), Miami, FL (NHC), Kansas City, MO (AWC), Norman, OK (SPC), and Boulder CO (SWPC). NCEP also hosts 30-40 visitors at any one time, including international meteorologists being trained at NCEP's International Training Desks.
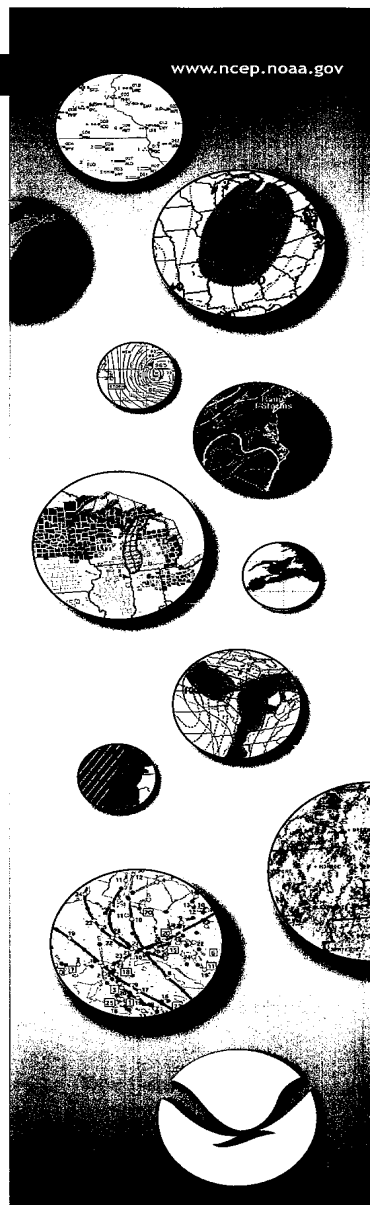
NOAA's Climate Prediction Center

Understanding the Present Predicting the Future

OUR MISSION

We deliver climate prediction, monitoring and diagnostic products for time scales from weeks to years to the Nation and the global community for the protection of life and property and the enhancement of the economy.

Location: College Park, Maryland

Staff: 50 federal employees; 25 on-site contracted employees; and 2 staff of the Cooperative Institute for Climate and Satellites
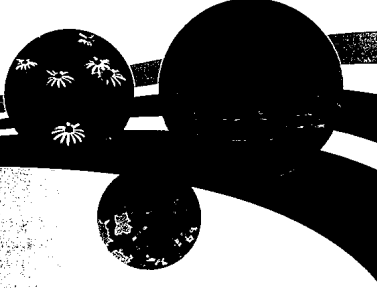
Background: In response to anomalous climate events in the 1960s and 1970s, NOAA organized the Climate Analysis Center (later the Climate Prediction Center or CPC) in 1979, to undertake and coordinate climate diagnostics and prediction. From these humble beginnings the CPC expanded its focus from gathering, analyzing, monitoring, and diagnosing climate data and information to providing climate predictions on time scales out to a year. Prediction of climate variability requires high quality data and models that are scientifically state-of-the-art. CPC has continually expanded its capabilities and expertise to provide users of climate information with, effective climate forecast products and tools to make informed decisions.

What We Do

- Deliver official climate forecasts for the Nation – from precipitation and temperature to hurricanes and drought – on weekly, monthly and seasonal time scales.

- Monitor atmospheric, oceanic, and land-surface climate variability, including phenomena such as El Niño/Southern Oscillation, monsoons, and droughts.

- Provide diagnoses of the state of the climate system, through the monthly Climate Diagnostics Bulletin and ENSO Diagnostics Discussion, weekly hazards outlooks for the U.S. and global tropics, and seasonal attribution of climate anomalies.

- Lead ground-breaking research focused on improving climate models, understanding atmospheric and oceanic variability and predictability, attribution of climate anomalies, weather-climate linkages and forecast tool development.

- Manage the Climate Test Bed to accelerate the transition of research advances into operations, especially to support development of climate models, multi-model ensemble prediction systems, and climate products that meet user needs.

- Develop collaborative products and services both within and outside NOAA, for applications tied to drought, agriculture, and hydrology aimed at improving regional predictions to minimize risks.

- Build partnerships with national and international partners, including the US Department of Agriculture via the "Joint Agriculture Weather Facility", and support humanitarian activities around the globe.

- Provide climate training through the CPC International Desks, educate users of climate information, and ensure consistency with NOAA and NWS training plans.

The CPC staff, pictured above, ready to support NOAA's mission and vision.

More About CPC

Recent Accomplishments:

- Delivered the CPC official climate forecasts to the Nation for 2012-2013 in support of National Weather Service goals related to the protection of life and property and the enhancement of the economy.

- Provided support and leadership to advance NOAA climate services, including requirements and project plans for the NOAA societal challenge focus areas (water, extremes, coasts, marine ecosystems).

- Led several climate workshops to advance collaborative partnerships and improve understanding of user needs, including the 37th annual Climate Diagnostics and Prediction Workshop.

- Reported research results in more than 40 peer reviewed journal articles.

- Implemented recommendations from the 2009 external review of CPC, resulting in improved operational climate outlooks, and enhancements to the collaborative forecast process across NCEP and with the NWS regions and field.

- With support from the NOAA Climate Program Office and the Climate Test Bed, implemented a real-time experimental National Multi-Model Ensemble prediction tool that adheres to the CPC forecast operations schedule.

- Provided the NWS Regions and Field with briefings, tools and climate information on impacts and conditions related to recent climate extreme events such as the central United States drought, resulting in improved coordination of climate information across the NWS.

- Provided global leadership in the exchange of climate products, and training opportunities by partnering with other meteorological services through bi-laterals with China, Taiwan, India, Korea and Mexico.

- Developed and implemented a new verification system for CPC's operational forecasts

- Launched an experimental upgrade to the CPC webpage that makes many of its prediction products available in a GIS format.

- Developed a CPC strategic plan for the period 2014-18 that envisions a transformation of the center into a dynamic organization providing the world's best climate products and information describing and predicting climate variability.

- Implemented improvements to the suite of drought prediction products, including the addition of a one-month outlook released on the last day of the month and modified drought outlook categories.

- Implemented an interactive web tool that provides an easy interface for users to understand the correct interpretation of its extended range climate outlooks.

For more information on NOAA's Climate Prediction Center, please visit www.cpc.ncep.noaa.gov

U.S. Winter Outlook
Temperature

La Niña

U.S. Drought Monitor   September 7, 2010
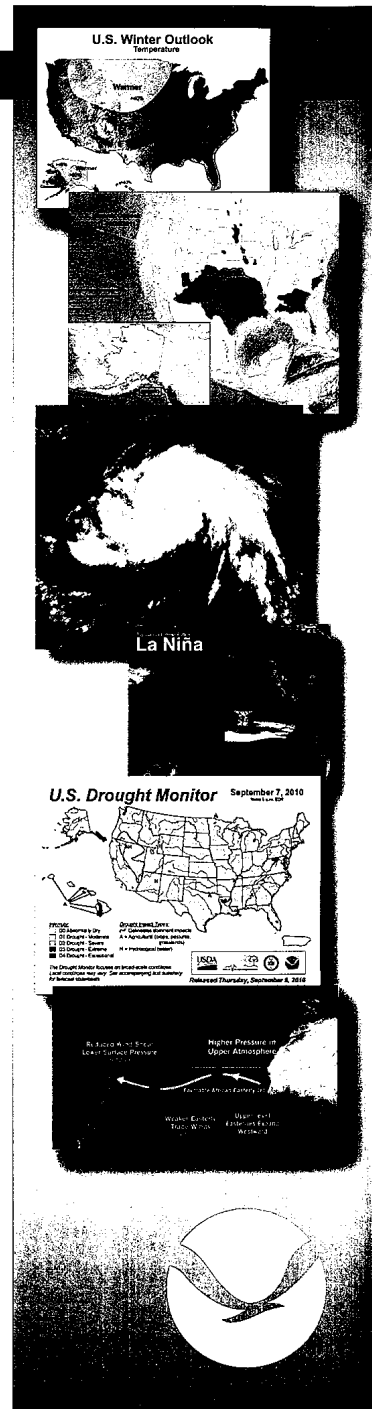
附錄 3：研討會議程

38th Climate Diagnostic and Prediction Workshop Oct 21 - 24, 2013			National Center for Weather and Climate Prediction Last Updated: 10/15/13
Day 1:	**Monday, October 21, 13**		
Time	**Speaker**		**Title**
7:00	9:00 Registration		
8:00	8:10 Mike Halpert		Welcoming Remarks
8:10	8:30 Wayne Higgins	Invited	Advancing Climate Science and Services at NOAA Climate Program Office
8:30	8:50 Tony Busalacchi	Invited	WCRP Grand Challenges
Session 1:	**Climate Monitoring**		**Moderator: Hugo Berbery**
8:50	9:10 Michelle L'Heureux and Anthony Barnston	Invited	Is the Nino-3.4 SST region optimal for monitoring ENSO and its impacts on North America?
9:10	9:25 Andy Chiodi		An OLR perspective on La Niña and El Niño seasonal weather impacts over North America
9:25	9:40 Pingping Xie		CPC High-Resolution Global Precipitation Analyses Suite for Improved Monitoring, Assessments and Diagnostics of Global Climate
9:40	10:00 John Bates	Invited	Climate Monitoring from Space
10:00	10:25		Break
Session 2:	**Climate Attributions**		**Moderator: Arun Kumar**
10:25	10:45 Marty Hoerling	Invited	Causes and Predictability of the 2012 Central Great Plains Drought
10:45	11:00 Bradfield Lyon		Tropical Pacific Forcing of a 1998-99 Climate Shift
11:00	11:15 Judith Perlwitz		The impact of the record 2011 Arctic ozone on the extreme spring Northern Annular Mode event
11:15	11:30 Mong-Ming Lu		Recent unusually high extremity of Taiwan rainfall extremes and the modulation of Interdecadal Pacific Oscillation
11:30	11:45 Daniel Barandiaran		Shifts in the low-level jet and associated precipitation patterns, and their effect on recent droughts in the Central U.S
11:45	12:00 Hailan Wang		Attribution of extreme dry conditions over the western United States during early 2013
12:00	13:30 Lunch		
Session 3:	**Climate Model Diagnosis and Improvement**		**Moderator: Dan Barrie**
13:30	13:50 Arun Kumar	Invited	NOAA Reanalysis
13:50	14:10 Robert Pincus	Invited	Evaluating clouds for ISI predictions
14:10	14:25 Rym Msadek		Assessing the predictive skill of Arctic sea ice extent on seasonal to inter-annual timescales using the GFDL forecast system
14:25	14:40 Yehui Chang		Improvement of the middle latitudes summer precipitation in the GEOS 5 model
14:40	14:55 Shan Sun		Global Coupled Atmosphere/Ocean Model for Climate and Seasonal Forecast Applications
14:55	15:10 Ruiyu Sun		A new cloud fraction scheme for the GFS – A CPT project transitioning to operations
15:10	15:25 Vasu Misra		Florida Climate Institute-FSU Seasonal Hindcasts at 50km (FISH50)
15:25	15:50 Break		
Session 4:	**CFSv2 Evaluation and Diagnosis**		**Moderator: Suru Saha**
15:50	16:05 Yan Xue		Prediction Skill and Bias of Tropical Pacific Sea Surface Temperatures in the NCEP Climate Forecast System Version 2
16:05	16:20 Rongqian Yang		Summer-Season Forecast Experiments with Upgrades in the Land Component of the NCEP Coupled Forecast System (CFS)
16:20	16:35 Ming Cai		CFSv2 Prediction Skill of Stratospheric Temperature Anomalies
16:35	16:50 Craig Long		Evaluation of the CFSv2 45 day forecasts to capture stratospheric-tropospheric eve
16:50	17:05 Emily Riddle		CFSv2 ensemble prediction of the wintertime Arctic Oscillation
17:05	17:20 Peitao Peng		Climate Mean, Variability and Dominant Patterns of the Northern Hemisphere Wintertime Mean Atmospheric Circulation in the NCEP CFSv2
Session 5:	**Ice Breaker**		
17:30	19:30		Conference Center

Beginning of Joint Meeting with Climate Prediction Task Force

Day 2:		Tuesday, October 22, 13		
Time		Speaker		Title
7:00	9:00	Registration		
Session 1:		Intraseasonal Climate Predictability		Moderator: Jon Gottschalck
8:00	8:10	Annarita Mariotti		MAPP Prediction Task Force overview
8:10	8:25	Matt Newman		Diagnosing subseasonal predictability of tropical atmospheric anomalies
8:25	8:40	Stefan Tulich		Some hindcast simulations of an ensemble of MJO events
8:40	8:55	Augustin Vintzileos		Predictability and forecast of the MJO: Beyond the RMM index
8:55	9:10	Philip Klotzbach		The surprisingly quiet 2013 Atlantic basin hurricane season
9:10	9:25	Hyemi Kim		Potential and limitations for the MJO prediction in operational dynamical models
9:25	9:40	Neena Joseph Mani		Predictability of Tropical Intrasesonal variability (ISV) in the ISV Hindcast Experiment (ISVHE)
9:40	9:55	Ravi Shukla		On the Leading Mode of Intraseasonal Variability of the South Asian Summer Monsoon in 19 CMIP5 Models
9:55	10:25			Break
Session 2:		Climate predictability on seasonal and longer time		Moderator: Tony Barnston
10:25	10:45	Siegfried Schubert	Invited	Drought Predictability on Intraseasonal to Seasonal and Longer Time Scales
10:45	11:00	Dan Collins		Climate change and the predictability of extreme events
11:00	11:15	Paul Dirmeyer		Validation and Attribution of Summer 2013 CFSv2 Forecasts Given Observed Spring Boundary Anomalies
11:15	11:30	Jieshun Zhu		The role of air-sea coupling in seasonal prediction of Asia-1 Pacific summer monsoon
11:30	11:45	Bohua Huang		Mechanism and predictability of Southern Subtropical Pacific Dipole Mode in the NCEP CFSv2
11:45	12:00	Zeng-Zhen Hu		Why Were Some La Niñas Followed by Another La Niña?
12:00	13:30	Lunch		
Session 3		NMME Special Session		
Session 3a		Assessment of predictability and Prediction Skills		Moderator: Jim Kinter
13:30	13:45	Jin Huang		NMME update and next steps
13:45	14:00	Ben Kirtman		The Diversity of ENSO in the NMME Prediction Experiment
14:00	14:15	Timothy DelSole		Does the Multi-Model Ensemble Enhance Skill?
14:15	14:30	Kathy Pegion		A Preliminary look at MJO Forecast Skill in the NMME
14:30	14:45	Huug van den Dool		Aspects of land surface hydrology in the NMME
14:45	15:00	Bertrand Denis		Soil moisture biases and their correction in CanSIPS operational forecasts.
15:00	15:15	Emily Becker		The North American Multi-Model Ensemble: verification of real-time monthly-mean forecasts:
15:15	15:30	Qin Zhang		On the upward temperature trend (1982-present) in the NMME hindcasts
15:30	15:45	Suranjana Saha		Gauging Systematic Errors of NMME models
15:45	16:15			Break
Session 3b		NMME Applications		Moderator: Ben Kirtman
16:15	16:30	Eric Wood		A NMME-based global seasonal hydrologic forecasting system
16:30	16:45	Kingtse Mo		Predictability of Hydroclimate Forecasts over the United States
16:45	17:00	Li-Chuan Chen		Meteorological Drought Prediction Using a Multi-Model Ensemble Approach
17:00	17:15	J. Brent Roberts		Evaluating NMME seasonal forecast skill for use in NASA SERVIR hub regions
17:15	17:30	Wassila M. Thiaw		Precipitation interannual variability and predictions for Africa from the National Multi-Model Ensemble dataset
Session 5:		Poster Session		
17:30	19:30	See you in the Conference Center		

38th Climate Diagnostic and Prediction Workshop			National Center for Weather and Climate Prediction	
Oct 21 - 24, 2013			Last Updated: 10/15/13	
Day 3:	Wednesday, October 23, 13			
Time		**Speaker**	**Title**	
7:00	9:00	Registration		
Session 1:	**Intraseasonal to Interannual Predictions**		**Moderator: Siegfried Schubert**	
8:00	8:20	Jon Gottschalck	Invited	CPC operational outlooks: Current methods and recent verification
8:20	8:40	Jim Kinter	Invited	ISI Climate Prediction: Requirements for High-Resolution Coupled Models and Large Ensembles
8:40	8:55	Anthony Barnston		Developing a More Reliable and Usable ENSO Prediction Plume
8:55	9:10	Nathaniel C. Johnson		Skillful wintertime, intraseasonal North American temperature forecasts based on the state of ENSO and the MJO
9:10	9:25	Robert E Livezey		Revisiting OCN and the Hinge for Seasonal Prediction and Interannual Detrending Signal Separation
9:25	9:40	Laifang Li		Southeastern United States Summer Rainfall Framework and its implication for seasonal Forecast
9:40	9:55	Erik Swenson		Scaled SVD Analysis and its application to tropical-extratropical teleconnections
9:55	10:10	Muthuvel Chelliah		Towards filling the gap in NOAA's seamless suite of forecast products. Prospects of "useful" predictions for weeks 3 & 4?
10:10	10:40		Break	
Session 2:	**Long-range forecasts of hurricane and severe weather**		**Moderator: Matthew Rosencrans**	
10:40	11:00	Dan Eleuterio		Earth System Prediction Capability (ESPC) Demo Projects
11:00	11:20	Gabriel A. Vecchi	Invited	NOAA/GFDL Predictions of Hurricane Activity
11:20	11:35	Jae-Kyung Schemm		Evaluation of the NCEP CFSv2 45-day Forecasts for Predictability of Intraseasonal Tropical Storm Activities
11:35	11:50	David Meyer		Using Ensembled, Statistical-Dynamical Forecasting Methods to Skillfully Forecast Tropical Cyclone Formation in the Western North Pacific: Capitalizing on the Strengths and Mitigating the Weaknesses of CFS Version 2
11:50	12:05	Scott Weaver		Advancing the Nation's Capability to Anticipate Tornado and Severe Weather Risk
12:05	13:30	Lunch		
Session 3:	**Parallel Sessions**			
Breakout 1:	**Young Professionals: The session provides knowledge and**			
Topic 1:	**Program and Institution Knowledge**		**Moderator: Jin Huang**	
13:30	13:45	TBD		NWS Overview
13:45	14:00	Jim Todd		NOAA CPO Post-doc program
14:00	14:15	Dan Barrie		NOAA CPO grants programs
14:15	14:30	Larry Weber		NSF funding opportunities for students and early career scientists
14:30	14:45	Jared Entin		Early career opportunities with NASA Earth Science Program
14:45	15:00	Renu Joseph		DOE
15:00	15:15	Mike Patterson		US CLIVAR
15:15	15:45		Break	
	Program and Institution Knowledge (Cont.)		**Moderator: Kathy Pegion**	
15:45	16:00	Hugo Berbery		Role of NOAA Cooperative Institutes
16:00	16:15	Sky Yang		Career Opportunities for Young Scientists
Topic 2:	**Science overviews**			
16:15	16:30	Matt Newman	Invited	ISI predictability overview
Topic 3:	**Student Presentation**			
16:30	16:45	Boniface Opoku Fosu		Bay of Bengal Monsoon Onset and Cyclones in a Changing Climate
16:45	17:30		Networking	
Breakout 2:	**MAPP Climate Prediction Task Force closed session**		**Group Discussion**	
13:30	17:30	MAPP - CPTF		LOCATION: Conference Center
Breakout 3:	**User Engagement and Communication Meeting**			
Topic 1:	**Session on Climate User Engagement**		**Moderator: TBD**	
13:30	14:00	Maibach, Ed	Invited	Extreme Weather and Climate in American Minds
14:00	14:15	Hartmann, Holly		Challenges in Supporting Climate-Sensitive Decision
14:15	14:30	Wang, Simon		Climate Prediction Needs: State Climate Office Experience
14:30	14:45	Herring, David		Engagement of Different Users through Climate.gov
14:45	15:00	Timofeyeva. Marina		Customer Satisfaction Survey of NOAA NWS Climate Services
15:00	15:30		Break	
Topic 2:	**Climate Communication Panel**		**Moderator: TBD**	
15:30	17:00	Panelists: TBD		Panel Objectives: Provide guidance for climate information communication. Format: each panelist provide 12 min answers for the panel topics following Q&A discussion. Discussion Topics: TBD

Conclusion of Joint Meeting with Climate Prediction Task Force

Session 5:	Reception			
				Greenbelt Marriott
18:00	21:00	Guillermo Accame		From Diamonds to Climate

38th Climate Diagnostic and Prediction Workshop			National Center for Weather and Climate Prediction	
Oct 21 - 24, 2013				Last Updated: 10/15/13
Day 4:	Thursday, October 24, 13			
Time		**Speaker**		**Title**
Session 1:	**Forecast Evaluations**			**Moderator: Tim Delsole**
8:00	8:20	Holly Hartmann	Invited	Linking forecast applications and evaluations
8:20	8:40	Barbara Brown	Invited	Progress and prospects in forecast evaluation methods: Spanning weather, sub-seasonal and
8:40	8:55	Lisa Goddard		Estimating Forecast Uncertainty in Seasonal-to-Decadal Predictions
8:55	9:10	Huug van den Dool		A more nuanced view of the climatological annual cycle
9:10	9:25	Sanjiv Kumar		CFSv2 Reforecasts: Where is the observation in the Forecast Ensemble Space?
9:25	9:40	Wanqiu Wang		An assessment of the CFSv2 real-time seasonal forecasts for 2011-2013
9:40	9:55			
9:55	10:25			Break
10:25	10:40	David Unger		Verification of CPC's Degree Day Outlooks
10:40	10:55	Mike Charles		Using Reforecasts to Improve CPC's Week 2 Forecasts
10:55	11:10	Hannah Aizenman		Evaluating ensemble seasonal forecasts using information metrics
11:10	11:25	Melissa Ou		Sensitivity study of the skill of the CPC Week-2 Reforecast Tool to Reforecast Sampling
11:25	11:40	Jennifer Adams		New Graphics Capabilities in GrADS
11:40	13:00			Lunch
Session 2:	**Application and Products**			**Moderator: Marina Timofeyeva**
13:00	13:15	Nelun Fernando		Developing a framework to incorporate climate change projections in water availability modeling for Texas
13:15	13:30	Hans-Peter Plag		Observations as Decision Support for Coastal Management in Response to Local Sea Level Changes.
13:30	13:45	Kirsti Hakala		Hydrologic and Climatologic Conditions That Shape Interior West's Groundwater Resources
13:45	14:00	Huan Wu		Real-time Global Flood Forecasting Using an Enhanced Land Surface Model with Satellite-based and NWP Forcings
14:00	14:15	Jiarui Dong		Accurate Downscaling Application of Temperature Data in High Spatial Resolution Land Surface Modeling for in Support of US Drought Monitoring Efforts
14:15	14:30	John T. Allen		Associating Hail Occurrence and Large Scale Environment for the Continental United States
Session 3:	**Decision support tools**			**Moderator: Fiona Horsfall**
14:30	14:50	Eugene Petrescu	Invited	Supporting decision support in Arctic
14:50	15:05	Marina Timofeyeva		NWS Climate Information and Tools for Decision Support Services
15:05	15:20	Jack Settelmaier		Using the NOAA Weather and Climate Toolkit to Aid in Preparing and Evaluating Weather and Climate Model Forecast Output while Collaboratively Engaging Decision-Making Users
15:35	16:00			Break
Session 4:	**Satellite-driven data products and climate data**			**Moderator: Pingping Xie**
16:00	16:15	Thomas M. Smith		Analysis of Oceanic Precipitation before the Satellite Era
16:15	16:30	Viviana Maggioni		An Error Model for High-Time Resolution Satellite Precipitation Products
16:30	16:45	Jian-Jian Wang		Climatological Means and Variations of Tropical Precipitation and Its Relationship With Surface Temperature from 15 years of TRMM Data
16:45	17:00	Karen Grissom		Improvements to Real-Time Quality Control of TAO High-Resolution Data
17:00	17:15	Daniel Tong		Development long-term climatology of giant dust storms for national climate assessment in the western U.S.

		38th Climate Diagnostic and Prediction Workshop	
	POSTER SESSION		**October 22, 2013**
Number	Presenter	Presenter Affiliation	Title
1	Michael Natoli	ESSIC/CICS-MD	Regional responses to the MJO over South America in the CFS Reanalysis
2	Dan Gianotti	Boston University	Potential Predictability of Precipitation: Occurrence or Intensity?
3	Hitoshi Sato	Japan Meteorological Agency	Performance of the new JMA one-month EPS
4	Pingping Xie	NOAA/CPC	NOAA In Situ – Satellite Blended Analysis of Sea Surface Salinity:Development of a Prototype Technique
5	KANTE Ibrahima Kalil	KANTE Ibrahima Kalil	Comparative study of the West African Continental, Coastal and Marine, Atmospheric Profiles of during the Summer of 2006
6	Joong-Bae Ahn	Division of Earth Environmental System, Pusan National University, Busan, South Korea	Improvement of 1-month lead predictability of the wintertime AO using a realistically varying solar constant for a CGCM.
7	Yan Xue	Climate Prediction Center/NCEP/NOAA	The NCEP/GFDL Observing System Experiments for Tropical Pacific Observing System: Early Results
8	Xingren Wu	EMC/NCEP/NWS/NOAA and IMSG	Sea Ice in the NCEP Climate Forecast System Reanalysis
9	Mong-Ming Lu	Central Weather Bureau, Taiwan	The Operational Monthly and Seasonal Climate Forecast System and Development at CWB Taiwan
10	Jesse Meng	NOAA/NCEP/EMC	Improving the land surface climatology of the Climate Forecast System Reanalysis
11	Marcio Cataldi	Operador Nacional do Sistema Eterico (BRAZILIAN POWER SYSTEM OPERATION PLANNING) Brasileiro	PRELIMINARY RESULTS OF THE APPLICATION OF NCAR / CAM 3.0 IN THE BRAZILIAN POWER SYSTEM OPERATION PLANNING
12	Sojiro Sunako	Sophia Graduate School of Global Environmental Stadies	Numerical Study on Global Warming with Heat Fluxes over Glaciers in the 10 to 300km Domain
13	Li Xu	Center for Ocean-Land-Atmosphere studies	The Differences in cloud response and cloud radiative feedback by explicit resolved cloud and conventional cloud parameterization
14	Joong-Bae Ahn	Division of Earth Environmental System, Pusan National University, Busan, South Korea	The anomalous structures of atmospheric and oceanic variables associated with the frequency of North Pacific winter blocking.
15	Corredor Llano X. and Sánchez Rodriguez I. C.	Institute of Hydrology, Meteorology and Environmental Studies of Colombia (IDEAM)	Jaziku - Statistical inference software for the teleconnections analysis
16	Anushiya Jeganathan	Research Scholar	Influences and predictability of Global Climate Indices over South Peninsular Indian Rainfall
17	Guojun Gu	ESSIC, University of Maryland	Long-term global precipitation changes and patterns: Global warming vs interdecadal climate variability
18	Qingyun ZHANG	Institute of Atmospheric Physics, Chinese Academy of Sciences,Beijing 100029,China.	The Study on Anomalous Blocking High over the Ural Mountains area and Its related to AO in Boreal Winter
19	Meng-Pai Hung	CPC/NCEP/NWS/NOAA	Prediction of the MJO events from CFSv2 during DYNAMO Intensive Observing Period
20	Ricardo Fonseca	Earth Observatory of Singapore, Nanyang Technological University, Singapore	Evaluation of Regional Climate Downscaling over the Maritime Continent
21	Laifang Li	Duke University	Atlantic origins of summer rainfall prediction skill over the Southeastern United States
22	Jiayu Zhou	NWS/OST	Recent Science Advancement for Guidance on Weather-Climate Service
23	Kenneth Rumi Ayadiani	School of Integrated Climate System, Univerisity of Hamburg Germany. Nigerian Meteorological Society (NMS)	TROPICAL STORMS CYCLOGENESIS: THE SOUTH ATLANTIC PARADOX
24	Simon S.-Y. Wang	Utah State University	COULD THE 2012 DROUGHT HAVE BEEN ANTICIPATED? – A NASA NEWS INITIATION ON EXTREMES
25	Bahaga Titike Kassa	Climate Variabilty, Predictabilty and Prediction	Assessment on the Predictability and Prediction of the Seasonal Mean Short Rain over Equatorial East Africa using APCC Multi-Model Ensemble

26	Bhaskar Jha	Climate Prediction Center	Climate Mean, Varibility and Predictability during wintertime in the NCEP CFSv2 AMIP simulation
27	Laifang Li	Duke University	Dynamic origins of WRF bias in simulating Southeastern United States summer precipitation
28	José Antonio Aravéquia	Center for Weather Forecast and Climate Studies / National Institute for Space Research (CPTEC / INPE)	Analysis study of rainy season onset in the Southeast and Midwest of Brazil
29	Charles Jones	University of California Santa Barbara	The Madden-Julian Oscillation and extratropical cyclogenesis
30	Ehsan Erfani	Desert Research Institute/ University of Nevada, Reno	Mechanisms for the Onset and Evolution of North American Monsoon
31	Ruping Mo	National Lab for Coastal and Mountain Meteorology, Environment Canada, Vancouver, BC, Canada	Some similarity indices with possible meteorological applications
32	Martina Ricko	University of Maryland/ESSIC, College Park, MD	Assessment of precipitation extremes observed in satellite data
33	Joong-Bae Ahn	Division of Earth Environmental System, Pusan National University, Busan, South Korea	Improvement of multi-model ensemble seasonal prediction skills over East Asian summer monsoon region using a climate filter concept.
34	Sudhir Raj Shrestha	NOAA Climate Prediction Center	Improving Data Discovery and Access through Interoperable System in Climate.gov
35	Ni Dai	AOSC-UMD, CICS	ENSO Representation in CMIP5 Models
36	Laifang Li	Duke University	Improvements in WRF Climate Prediction of Southeastern United States Summer Rainfall: Physical Parameterization and Horizontal Resolution
37	Kyong-Hwan Seo	Pusan National Univ.	Physical processes for the Northern Hemisphere wintertime temperature anomalies induced by the Madden-Julian oscillation
38	Woo-Sung Lee	Canadian Centre for Climate Modelling and Analysis	CanSIPS Prediction of NAO and PNA for the NH Winter
39	Stephen Baxter	Climate Prediction Center	Forecast Circulation and Teleconnection Skill in the CFSv2 Beyond Week-2
40	Youlong Xia	IMSG at NCEP/EMC	Objective Blends of Multiple NLDAS Drought Indices over the Continental United States (CONUS): Development and Application
41	Ahmed Tawfik	Center for Ocean-Land-Atmosphere Studies	A process-based framework for isolating large-scale and surface forcing during convection
42	Emily Riddle	NOAA CPC	A generalized framework for estimating the effect of ensemble size on forecast skill
43	Ricardo Fonseca	Earth Observatory of Singapore, Nanyang Technological University, Singapore	Tropical Vorticity Budget in ECMWF (Re)analyses
44	Joong-Bae Ahn	Division of Earth Environmental System, Pusan National University, Busan, South Korea	Possible impact of the autumnal North Pacific SST and November AO on the East Asian winter temperature.
45	Scott Weaver	NOAA CPC	Factors Associated with Decadal Variability in Great Plains Summertime Surface Temperatures
46	Mónica Rodrigues	Department of Geography, University of Coimbra, Coimbra, Portugal	Modeling of Monthly Air Temperature in Portuguese Metropolitan Areas with ARIMA Models in time Series Analysis
47	Aston Chipanshi (1), Hai Lin (2)	1. Agriculture and Agri-Food Canada, Science and Technology Branch, Regina, Saskatchewan. 2. Atmospheric Numerical Weather Prediction Research, Environment Canada, Dorval, Quebec.	The prediction of extreme agrometeorological indices using the Canadian Meteorological Centres's medium range forecasts
48	Barrie Bonsal	Environment Canada	An Assessment of Canadian Prairie Drought: Past, Present, and Future
49	Chaihong Wen (1), Arun Kumar (1), Yan Xue (1), M.J. McPhaden (2)	1. NCEP/CPC, 2. NOAA/Pacific Marine Environmental Laboratory (PMEL)	Understanding Causes for Changes in ENSO Characteristics after 1999: an Oceanic Perspective
50	Ying Li	Colorado State University	The signature of the Northern Annular Mode in tropospheric clouds, and the cloud radiative effect on the climate variability