

C3WE *Spring* NEWSLETTER

APRIL 2017, ISSUE 5

SPRING 2017 NEWSLETTER

As you read through this (Northern Hemisphere) Spring newsletter, you'll have an opportunity to learn more about the latest activities occurring within the Capacity Center for Climate and Weather Extremes and with our partners. Keep reading to learn about the **soon-to-be released global historical tropical cyclone wind footprint dataset**, which is helping answer key questions related to hurricane risk. Learn about a **weather typing** technique that is helping assess potential effects of future, regional environmental conditions. Also, take a look at a **recent analysis** that is **providing insights on the Center's strengths, areas for potential growth, and challenges** in the pages following.

ANNOUNCEMENTS & UPCOMING EVENTS

Following on the heels of the IAG-sponsored ECEP Southern Hemisphere workshop in Sydney, Australia, the C3WE team wants to remind you that the next Northern Hemisphere ECEP Workshop will take place **June 19-20 in Boulder, Colorado** (please note the slight change in timing). Also of interest, **Rising Voices 5, Collaborative Science with Indigenous Knowledge for Climate Solutions**, will be held at the National Center for Atmospheric Research **April 13-15, 2017**. The annual **C3WE tutorial on dynamical and statistical downscaling methods** will be held from July 10-12, 2017. Further details about these workshops will be posted via the C3WE listserv and on the web site.

We're excited to tell you that **content from the Engineering for Climate Extremes Partnership (ECEP) will be moving to the newly created [C3WE website](#)**. Already up and running, the C3WE site provides links to ECEP news and partnership efforts, as well as links to Rising Voices, and the Global Risk, Resilience, and Impacts Toolbox, which features GRRIT® updates and links to tools.

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HIGHLIGHTS FROM THE ECEP SOUTHERN HEMISPHERE WORKSHOP

About 50 gathered at the first annual ECEP Southern Hemisphere Workshop in Sydney, Australia on February 13-14, 2017. Sponsored by IAG, the meeting brought together leading thinkers on risk, resilience, and extreme events from industry, academia, and government and non-governmental organizations. Participants discussed first-hand experiences and future requirements related to developing greater societal resilience to natural hazards.

A kick-off welcome by Greg Holland, Director of C3WE, was followed up with a keynote address by Robert Tickner, the ambassador for Australia's Business Round Table and former Acting Under Secretary for the International Red Cross and Red Crescent Federation and former CEO and Secretary General for the Australian Red Cross. A series of lightning talks rounded out the late-afternoon gathering on the 13th, with about half of the event's participants having an opportunity to provide brief overviews of their areas of interest related to risk, resilience, and extreme events. This talk series facilitated initial introductions and conversations between participants, and paved the way for the full-day workshop the following day.

Jacki Johnson, IAG's Group Executive for People, Performance and Reputation kicked off the full-day meeting on the 14th, welcoming the workshop attendees. Greg Holland followed up with an introduction to ECEP, its goals and capabilities, inviting participants to join in the partnership and encouraging collaboration with ECEP members and those attending the meeting. Several key notes followed, including Scott Power, from the Australian Bureau of Meteorology speaking on variability and trends in tropical cyclones, flood frequency and associated deaths in coastal eastern Australia. Jean Palutikof, Director of the National Climate Change Adaptation Research Facility, spoke on ways in which Australia is adapting for the long haul – from resilience building to transformation in the face of changing



Jacki Johnson, IAG's Group Executive for People, Performance and Reputation, welcomed attendees to the IAG-sponsored ECEP Southern Hemisphere Workshop in February 2017.

environmental conditions. Beck Dawson, Sydney's Chief Resilience Officer, rounded out the talks discussing "The habit of collaboration and resilient Sydney."

Members of the Australian Business Roundtable contributed to the discussion, focusing on how to

respond to current and emerging risks in Australia. Moderated by Andy Pitman, Director of the Australian Research Council's Centre of Excellence for Climate System Science, speakers included Anna Kilmartin, IAG's Senior Manager for Corporate Affairs, Nina James, General Manager of Investa's Sustainability Group, Andrew Buay, Vice President of Group Sustainability for Singapore Telecommunications Ltd, and Andrew Coghlan, National Manager of Emergency Services for the Australian Red Cross.



Andy Pitman, right, moderates a panel discussion by members of the Australian Business Roundtable including, from right Nina James, Anna Kilmartin, Andrew Coghlan, and Andrew Buay.

The afternoon included a networking lunch, a series of short talks on "Risk and Resilience in Practice" by those working on the front lines to enhance societal understanding and response to extreme events. A "speed dating" and break-out session rounded out the day, providing participants with an opportunity to address questions ranging from better understanding the requirements, information needs, and solution for quantifying and mitigating physical risks, to looking at how to ensure optimal societal response to the impacts of extreme events.

Mark Leplastrier, Senior Manager of IAG's Natural Perils group, closed the event, leading a summary discussion to identify research needs and next steps for the attendees. A workshop report with more detailed outputs from the day will be published on the C3WE site soon; an email will be sent to notify conference attendees and C3WE listserv subscribers of the report's availability. Sincere thanks to the IAG team for their incredible support of this workshop, we hope to make the Australian workshop a regularly occurring event.



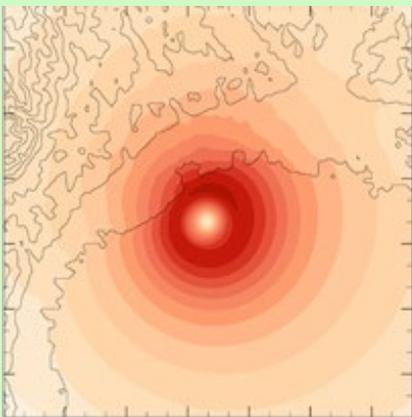
Mark Leplastrier wraps up the IAG-sponsored ECEP Southern Hemisphere Workshop.

C3WE AND WILLIS TOWERS WATSON TEAMS DEVELOP A GLOBAL HISTORICAL TROPICAL CYCLONE WIND FOOTPRINT DATASET

How do I assess Tropical Cyclone (TC) risk in regions of sparse historical wind observational data? How do I assess potential winds at critical sites to my business? In collaboration with C3WE partner Willis Towers Watson through the Willis Research Network, these questions are being explored through the development of a new dataset of global historical TC wind footprints.

The team models storm winds using the Tropical Cyclone Risk Model that C3WE has modified to include the Holland et al (2010) parametric wind field model and enable the effects of coastlines and mountains using the Kepert and Wang (2001) three-dimensional numerical boundary layer model. Based on the dry primitive equations, and using prognostic turbulence kinetic energy, the boundary layer model spins up a steady state boundary layer wind structure in balance with forcing from the Holland profile pressure gradient field and surface friction. Working with Dr. Yuqing Wang at the University of Hawaii, the team modified the boundary layer model – developed for TC simulation over the open ocean – to simulate land-falling TCs in regions of significant topography.

The resulting wind footprints for historical TCs compare favorably to surface station observations, existing analyses, and high-resolution numerical simulations using the Weather Research and Forecasting model. The figure below shows the simulated surface winds of Hurricane Ike (2008) just before landfall. The simulation captures the reduction of surface winds at the Texas coast and local terrain effects inland.



Planned next steps are to use this new simulation technology within the framework of Geoscience Australia's Tropical Cyclone Risk Model to build synthetic event sets and new views of global TC risk.

Figure: Simulation snapshot of Hurricane Ike's surface wind field (ms-1) just before landfall. Terrain height is contoured every 50m (black lines).



WEATHER TYPING: A NEW MEANS OF UNDERSTANDING EFFECTS OF FUTURE CLIMATE ON REGIONAL WEATHER PATTERNS

The American Meteorological Society defines climate as "...the slowly varying aspects of the atmosphere-hydrosphere-land surface system," where slow typically means changes over years to decades. For humans, this slow variance makes it challenging to understand what climate is and how it is changing.

At the C3WE, we think about climate as a series of weather events. This has the advantage that extreme events can be attributed to specific weather patterns or to a series of weather patterns, and allows us to assess changes in the frequency and intensity of these patterns. For example, the figure above shows the synoptic weather pattern during the Colorado flood of 2013 where a stationary low-pressure system over the Intermountain West transported record-breaking moisture into Colorado causing extreme rainfall and widespread flooding.

500 hPa Height Contour [km] at 12:00 UTC Sep. 12. 2013

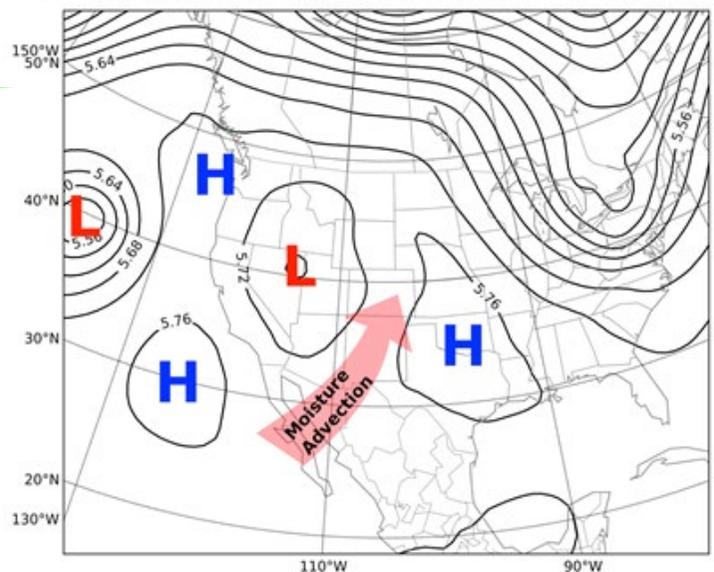


Figure: The synoptic weather pattern that led to the 2013 Colorado Front Range flood. A stationary low-pressure system over the Intermountain West transported record-breaking moisture into Colorado causing extreme rainfall and widespread flooding.

[In a 2016 paper](#), C3WE's Andreas Prein and his co-authors used weather typing to assess observed changes in U.S. water resources. Andreas' weather-typing approach showed that the frequency of weather patterns leading to rainfall in the U.S. Southwest has significantly decreased during the last 35 years, which substantially increases the region's risk for severe droughts such as the 2012-2016 drought in California. Future research will focus on the classification of weather patterns that are causing extreme precipitation and the representation of these patterns in weather and climate simulations. Current work also focuses on the implementation of weather typing capabilities into the Global Risk, Resilience, and Impacts Toolbox (GRRIT), to make this method easily accessible to a large user community.

CAPACITY CENTER SWOT ANALYSIS

Last winter, C3WE intern Leah Bolin provided an analysis of the Center's strengths, weaknesses, opportunities, and threats to evaluate where it sits in the broad realm of existing resilience programs and available risk-management capabilities. This analysis is helping the C3WE team better understand the utility of the program, and will inform and help shape strategic next steps.

Among the findings, C3WE's strengths include its scientific expertise, which is brought to the fore by experts within the group and with external collaborations. C3WE's affiliation with the National Center for Atmospheric Research, and its breadth of scientific capabilities and infrastructure are seen as an advantage. C3WE partnerships and community involvement around the world, as well as the utility and flexibility of its tools were also perceived as strengths. Challenges to our relatively new center, include need for steady sources of funding, and a more sophisticated online presence. The latter may contribute to a lack of media awareness of the Center and its abilities.

Growth opportunities include bring in a greater number of graduate and post-doc students; students could help develop tools identified by partners and collaborators as useful, as well as provide insights on the latest

technological capabilities and approaches that could help expand the GRRIT framework. A number of opportunities were identified to boost funding. In terms of threats, one concern was the difficulty of creating "one-size-fits-all" tools to meet the needs of many users, and concern exists that any given tool could be underutilized if not actively promoted and updated to meet user needs. Several threats were seen as both threat and opportunity. For example, organizations providing similar capabilities could also be perceived as a partnering/collaboration opportunity.

The bottom-line: C3WE excels at the science related to extreme events and developing decision-making tools to address societal requirements, but the science depends on effective communication of the tool capabilities and societal value to end users. To achieve C3WE's goal of reducing impacts of environmental extremes on society, focus has to be on partnerships and tool development. Center staff is working on further incorporating each aspect of the analysis into its strategic planning, tool development, and outreach efforts.