Climate and Extreme Events: Subseasonal Predictability and Prediction

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Extreme Events
US CLIVAR Research Challenge: Climate and Extreme Events

Future research

- Identify dynamical processes that underlie precipitation and temperature extremes
- Investigate how short-term processes interact with the larger-scale, slower, and potentially-predictable climate fluctuations linked to the ocean
- Determine metrics and analysis tools most relevant for extremes
- Investigate what properties of extremes, if any, are changing under global warming
Sources of Subseasonal Predictability

- MJO
- Strat-Trop/Polar Vortex
- Soil Moisture
Tropical Cyclones

MJO

ARs & Extreme Precip

Maloney & Hartmann 2000

Pegion and Kirtman 2008

Ralph et al. 2011
Stratosphere-Troposphere Interactions

SSW

Composite of 18 Weak Vortex Events

Baldwin & Dunkerton 1999

Wavy polar vortex configuration

Cold Air Outbreaks, Snowstorms

January 5, 2014

NASA
Soil Moisture

Low soil moisture => reduced ET => “Flash” drought or exacerbates heat wave & drought

Source: Kelly Helm Smith, National Drought Mitigation Center
Current State of Subseasonal Predictions
CPC Subseasonal Products

Global Tropics Hazards and Benefits Outlook - Climate Prediction Center

Week 1 - Valid: Jul 29, 2015 - Aug 04, 2015

Week 2 - Valid: Aug 05, 2015 - Aug 11, 2015

U.S. Monthly Drought Outlook
Drought Tendency During the Valid Period

Valid for July 2015
Released June 30, 2015

Author: Anthony Artusa
NOAA/NWS/NCEP/Climate Prediction Center

Development of a tropical cyclone (tropical depression, tropical storm, or hurricane) in the upper third of the world. Weekly total rainfall in the upper third of the world. Weekly total rainfall in the lower third of the world.

Day 8-14 U.S. Hazards Outlook
Made: 07/31/2015 3PM EDT
Valid: 08/08/2015-08/14/2015

NWS Preliminary

http://go.usa.gov/h6jh
Challenges

• Predictability is limited

• Don’t know how to quantify skill for extremes and “forecasts of opportunity”

• Often difficult to predict source of predictability; teleconnections even harder.

• Extremes research requires infrastructure to support “big data” (from US Clivar Extremes WG report)
**Relevant Programs, Projects, & Datasets**

**WCRP/WWRP S2S Project**
- Implementation Plan Document
- Series of Workshops
- Re-forecast Database

**NMME**
- Monthly re-forecast database w/daily data
- Monthly real-time predictions
- Subseasonal effort underway

**Intraseasonal Variability Hindcast Experiment**
- Series of hindcasts from collection of CGCM and AGCMs

**NRC Reports**
- Assessment of Intraseasonal to Interannual Climate Prediction and Predictability (2010)
- Developing a U.S. Research Agenda to Advance Subseasonal to Seasonal Forecasting (expected 2016)

**NOAA/CPO/MAPP FY15 Funded Projects NMME Evaluation & focus on Extremes**

**NOAA/MAPP FY16 S2S, subseasonal NMME & S2S Task Force**
Discussion

What can PPAI do to advance the prediction of extremes on subseasonal timescales?

Some Ideas:

• Webinars to review the NRC ISI Report and the new NRC report when it comes out to identify critical research areas that PPAI can endorse

• MAPP FY15 NMME extremes evaluation projects: sponsor special issue or CLIVAR Variations

• Given community focus both nationally and internationally on S2S, should train the next generation: ASP workshop?

• Utilize US CLIVAR Project Office to highlight extremes work by PPAI panel members on website, twitter, etc.: who is doing work on extremes already?