Extremes Working Group perspective on the need for sustained and improved observations

US CLIVAR 2014 Summit

POS Panel

Matt Barlow

The P, The O, The S & CLIVAR

Going rogue: before getting to observations, a few words relating to the "P" and the "S" in our mandate, as well as intra-panel issues …

Primary Recommendations (1)

- Need to improve our dynamical understanding of observed short-term extremes

- The LSMP approach provides a very effective structure in which to advance this work from its present early stage

- Models' representations of extremes must be evaluated in terms of how well the model reproduces the synoptic-dynamics of the extremes (simply put: does the model have the right distribution for the right reason?)

- Develop new indices (beyond ETCCDI) that incorporate the synoptic-dynamics of extreme events. Develop metadata such as location, date, and intensity information for events.

Primary Recommendations (2)

- Expand or supplement CMIP database to include more daily and higher frequency fields, in a more easily accessible fashion (e.g. preprocessing of data prior to downloading)

- Foster more collaboration between different programs working on various aspects of extremes (from different topical areas, different regions, etc.)

- See also the detailed list in workshop report

Suggested Next Steps

•Fund additional work on the synoptic-dynamics of extremes both fundamental understanding but also to develop more informative indices and tests of simulation skill.

•Encourage modeling groups to assess model simulation of extremes in terms of the synoptic-dynamics

•Hold regular workshops on short-term extremes that mix researches and stakeholders in the five topical areas. Include both broad topics (to encourage wide interaction) and specific questions (such as developing particularly useful indices and definitions)

•Continue to improve observations over land and ocean regions, especially the three dimensional structure of moisture

Possible Follow-on Activity

Regional evaluations of how well current models capture the dynamics of short-term extremes over the US.

Critical problem: how much confidence to have in projections of extreme activity (e.g., as in NCA, IPCC)?

-LSMP approach would also give downscaling

-Key model evaluation issue

-Effort would greatly enhance our basic understanding of the events

-Could tie-in with existing efforts to diagnose extreme events

-Would leverage existing modeling and dataset efforts

-Perhaps link to applications/decision-makers/vulnerability efforts within each region

Possible parallels to DRICOMP effort but with data availability effort rather than new model runs … ?

Also …

Rumors of a WG proposal on Arctic - mid-latitude extremes

Would continue effort on extremes research challenge and also contribute to polar research challenge

Specific Obs. and Data Recommendations

-Develop indices specific to exploring the causes of extreme temperature and precipitation that exploit the high quality North American observations. These metrics would be supplemental to the ETCCDI indices designed for climate change detection purposes and sparse data. These indices should include measures of the LSMPs associated with various regional extreme events.

-Better quantify and present the uncertainties in observed datasets as part of the downloadable datasets.

-Increase investments in “Big Data” technologies focused on climate and weather applications. These investments should include both software and hardware technologies.

-Promote efforts to maintain current observing networks, especially those with long observing records.

-Enlist scientists to engage and provide strong encouragement to volunteers who are maintaining cooperative observing networks.

-Foster a community consensus approach to comparing model data at different model grid sizes with observational station data and/or observed gridded datasets. Should one interpolate all gridded data to a common grid (for example to the observed gridded dataset) to make easier metric comparisons? Should there be a common interpolator?

-Build a library of extreme climate events for each index (e.g., in ETCCDI) that includes the date and location of every event, so that it would be possible to go back to create and analyze the LSMPs of the events.

Useful Ocean Obs

- Observations related to better characterization of ocean modes (ENSO, PDO, etc.), as they modulate extreme events and are a potential source of predictability

- Observations of 3D structure of atmospheric moisture over the oceans, as this plays a role in the dynamics of some events

Objectives

- Assess and synthesize existing knowledge based on the links between Large Scale Meteorological Patterns (LSMPs) and short-term temperature and precipitation extremes

- Identify key questions and knowledge gaps

- Establish a methodology and research protocols for using the LSMP approach to analyzing extremes in observations and model output

- Provide a preliminary assessment of the ability of current models to reproduce the correct relationship between extremes and LSMPs for North America.

Main Activities

- Workshop in Berkeley, August 2013
- Workshop report, with detailed recommendations
- Contributed to CLIVAR Science Plan
- CLIVAR Variations issue
- 2 survey papers (in progress)

Main Conclusions

1. Analyzing the large-scale meteorological patterns (LSMPs) associated with short-term extreme events is a very useful for analyzing the dynamics and can provide a basis for down-scaling.

2. Understanding and predicting extremes requires interaction between researchers in these different topical areas:

-Extreme value statistics,
-observations,
-synoptic-dynamics
-modeling, and
-application sectors

The Berkeley workshop facilitated interaction amongst experts in the first four areas, and there was much interest in follow-on activities that also involved the fifth.

Relevance to Science Plan

CLIVAR Goals:

- Understand the role of the oceans in observed climate variability on different timescales.
- Understand the processes that contribute to climate variability and change in the past, present, and future.
- Better quantify uncertainty in the observations, simulations, predictions, and projections of climate variability and change.
- Improve the development and evaluation of climate simulations and predictions.
- Collaborate with research and operational communities that develop and use climate information.

Coupled variability has strong influence on LSMPs

LSMP approach useful for understanding dynamics

LSMP approach useful for evaluating models

Many different efforts on extremes could benefit from collab./coord.

Specific research challenge: Climate and extreme events (science plan section 5.2)