

## Report to CLIVAR SSG-20

Panel or Working Group: ETCCDI

### 1. Contributions to developing CLIVAR science and fit, where appropriate, to the CLIVAR imperatives

*Anthropogenic Climate Change, and Science underpinning the prediction and attribution of extreme events:*

The ET's contribution includes: 1) The ET has been working with the support of the ClimDEX Project to produce global gridded indices of temperature and precipitation extremes. This activity has produced several global datasets of these indices including HadEX2 (an updated HadEX indices product). The analyses based on these datasets improved understanding of past changes in climate extremes, contributing significantly to the on-going AR5 assessment. The data products also form basic datasets for climate model validation and detection and attribution work. 2) The ET has also organized the computation of indices based on CMIP5 model simulations. Model indices data are disseminated through a website hosted at the Canadian Center for Climate Modelling and Analysis (<http://www.cccma.ec.gc.ca/data/climdex/index.shtml>) for the climate research community. This is especially important for those who have difficulties in downloading the vast volume of daily data and in processing the data. An analysis of these model data has been published in Journal of Geophysics Research and has been highlighted as AGU Research Spotlight. This activity contributes significantly to the IPCC AR5 assessment, several chapters of the AR5 WGI report will likely have figures based on these indices data. 3) The ET is also working closely with the International ad-hoc Detection and Attribution Group (IDAG) on detection and attribution. Several ET members are also IDAG members.

#### *Capacity Development*

A principal activity of the ET is maintaining a sustained programme of regional workshops that drive capacity development in less developed regions where both data availability is scarce and/or data accessibility is difficult, helping regional climate service. The results from the workshops are published in the peer-reviewed literature and will continue to be an important contribution to the IPCC assessments. The ET continues to develop this successful workshop formula, looking at ways to increase regional collaboration and participation in international activities of scientists involved in its capacity development activities. In addition to the workshops, software for indices calculation and data homogenization and indices data derived from observations and model simulations are freely available and are becoming important resources for research on climate extremes.

Donat, M. G., and et al, 2013: Updated analyses of temperature and precipitation extreme indices since the beginning of the twentieth century: The HadEX2 dataset. *J. Geophys. Res.*, doi: 10.1002/jgrd.50150.

Sillmann, J., V. V. Kharin, F. W. Zwiers, X. Zhang, and D. Bronaugh, 2013a: Climate extremes indices in the CMIP5 multi-model ensemble. Part 1: Model evaluation in the present climate. *J. Geophys. Res.*, doi:10.1002/jgrd.50203.

### 2. Briefly list any specific areas of your panel's activities that you think

**would contribute to the WCRP Grand Challenges as identified by the JSC at its most recent meeting<sup>1</sup>**

ETCCDI's activities are central to the Grand Challenges on the science underpinning the prediction and attribution of extreme events and provision of skillful future climate information on regional scales. Several ETCCDI members are involved in the development of WCRP Grand Challenges on climate extreme documents and implementation plan.

**3. Key new science findings in the context of the new ocean-atmosphere CLIVAR (1-3 suggestions)**

**4. Key science questions that you anticipate your community would want to tackle in the next 5-10 years within the context of the new ocean-atmosphere CLIVAR (1-3 suggestions)**

- a) Detection and attribution of anthropogenic influence on weather and climate extremes at regional scale and attribution to causes of extreme climate events.
- b) Mechanisms by which modes of ocean-atmosphere variability affecting weather and climate extremes.
- c) If and how these modes of ocean-atmosphere variability may change under global warming and possible impacts on future weather and climate extremes.

**5. Cooperation with other WCRP projects, other global change bodies (e.g. IGBP) and links to applications**

In addition to CLIVAR/GEWEX, ETCCDI has two sponsors – the WMO Commission for Climatology (CCI) and the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

The CCI perspective is that the work of ETCCDI is directed at improving climate change detection and indices with a strong focus on capacity development. ETCCDI contributes to the provision of climate services through its regional capacity development workshops and its continued recommendation of free observational data exchange.

ETCCDI collaborates with the following CCI Task Forces:

- OPACE-I Task Team on Climate Data Rescue (TT-DARE)
- OPACE-II Task Team on National Climate Monitoring Products (TT-NCMP)

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<sup>1</sup>

1. Provision of skillful future climate information on regional scales (includes decadal and polar predictability)
2. Regional sea-level rise
3. Cryosphere response to climate change (including ice sheets, water resources, permafrost and carbon)
4. Improved understanding of the interactions of clouds, aerosols, precipitation, and radiation and their contributions to climate sensitivity
5. Past and future changes in water availability (with connections to water security and hydrological cycle)
6. Science underpinning the prediction and attribution of extreme events

- OPACE-IV Expert Team on Climate Risk and Sector specific Climate Indices (ET-CRSCI)

JCOMM provides the mechanism for international coordination, regulation and management of oceanographic and marine meteorological observing, data management and services systems. JCOMM is interested in the use of indices and in developing an improved suite of indices to provide information for its stakeholders.

Despite CLIVAR and JCOMM co-sponsorship, the ET recommended list of indices are currently only land based. However, JCOMM has made significant effort to address this issue. JCOMM has nominated three members (with the nomination for the 4<sup>th</sup> member pending) recently. They have developed a plan with tangible deliveries including: 1) investigation of climate indices and trends from the ICOADS data base, especially near coasts, as a complement to and comparison with existing land-based activities within ETCCDI; 2) Contribution from the COWCLIP project on historical and projected future changes in wave climate, and associated databases; 3) Contribution from the storm surge climatology activities of ETWCH, in particular in the initial stages, on historical data bases and climate analysis of sea level measurements including the GLOSS network.

There is also interest among the GODAE OceanView/JCOMM ETOOFS and the CLIVAR WGOMD and GSOP communities to create a Task Team to nominate a small number of ocean subsurface indices that could be of scientific and societal relevance for routine evaluation, updating and sharing with the wider community. Three different categories of indices are obvious: those that involve status reporting of the world ocean (e.g. ocean heat content over a specified depth range, world ocean sea level); those that are well correlated with the familiar surface repeating patterns of climate variability that are known to have societal impact (e.g., the warm water volume of the western tropical Pacific and ENSO) and those which are well correlated with significant regional climate phenomena but are not of basin scale (e.g., one imagines there might be one for the upwelling zone off Sumatra and the Tropical Indian SST anomaly region there.)

The TT would make use of a range of model generated data sets of different space and time extent that have been produced recently in the work of the different communities to explore possible index definitions and to agree on how best to evaluate these routinely. The WGOMD and GSOP have data sets of multi-decadal duration and nearly world-ocean coverage, while the GOV/ETOOFS have multi-year data sets of regional to near-world-ocean extent of quite high spatial resolution. Long time series would be prepared from the WGOMD and GSOP 20th century data sets and GOV/ETOOFS data sets would be used to extend these time series to the present and to keep them updated. Significant work would likely be expected to determine how best to make use of the several data sets and to construct time series that can be shared with the wider community.

It's envisioned that the TT would have a two-year duration and two to three members from each community. Progress would be reported to the CLIVAR SSG and ETCCDI leadership annually. If technical difficulties are difficult to surmount the TT duration might need to be extended for another two year period.

## **6. Activities in the context of scientific capacity building and career support?**

ETCCDI workshops and supporting software have been successful in enhancing scientific capacity in less developed world. There are more than 1000 registered users for ETCCDI software, many of the users are students. A large fraction of the users are from developing countries. The climate extreme indices derived from observations and model simulations are basic datasets for studying climate extremes for climate research community and beyond. ETCCDI is also been involved to develop WCRP Summer School on climate extremes.

ETCCDI organized or was involved in the organization of the following capacity building workshops: Caribbean workshop (Mona, Jamaica, May 2012), Pacific Island Countries workshop (New Caledonia, May 2012), WMO Region-II of Asia workshop (Nanjing, China, March 2013).

## **7. Activities in the context of knowledge exchange with societal actors?**

ETCCDI works with WMO OPACE-II Task Team on National Climate Monitoring Products (TT-NCMP) and OPACE-IV Expert Team on Climate Risk and Sector specific Climate Indices to enhance knowledge exchange with societal actors. ETCCDI is involved in the discussion with TT-NCMP on national climate monitoring products, two of six WMO recommended products for NHMSs are from ETCCDI defined indices.

A CLIVAR ETCCDI member (L. Alexander) chairs the OPACE-IV Expert Team on Climate Risk and Sector specific Climate Indices to ensure maximum exchange between the two groups. This Expert Team aims to develop methods and tools including standardized software for, and to generate, sector-specific climate indices, including their time series based on historical data, and methodologies to define simple and complex climate risks. The indices should emphasize climate variability and trends that are particularly relevant for economic sectors and help characterize the climate susceptibility of these sectors. The team will develop the training materials needed to raise capacity and promote uniform approaches in applying these techniques. It will work with the relevant WMO Technical Commissions to facilitate the use of climate information in users' decision-support systems for climate risk management and adaptation strategies.

## **8. New activities being planned, including timeline, request for endorsements, potential for new funding opportunities**

ETCCDI is actively involved in the organization of WCRP Summer School on climate extremes. WCRP is preparing in collaboration with the ICTP: a jointly sponsored Summer School on Extreme Event Attribution and Prediction in 2014. The Summer School will train the participants in indices, extreme value theory, and event attribution, in each case with the objective of gaining understanding, and tools, for the analysis of the past, and the evolution of the future (in terms of both prediction and projection).

ETCCDI is also chairing a task group to coordinate activities to address WCRP GC

on climate extremes across WCRP projects.

## **9. Workshops / meetings planned**

A meeting is planned for Feb. 2012 involving all members of the ET. The objective of the meeting is to scope the work for the next few years in view of new CLIVAR/WCRP priorities/grand challenges.

## **10. Issues for the SSG**

## **Annex A**

### **Proforma for CLIVAR Panel and Working Group requests for SSG approval for meetings**

Requests should be made through D/ICPO ([Catherine.beswick@noc.ac.uk](mailto:Catherine.beswick@noc.ac.uk)), against the following headings:

- 1. Panel or Working Group: ETCCDI**
- 2. Title of meeting or workshop: ETCCDI Scoping meeting for next term**
- 3. Proposed venue: Toronto, Canada**
- 4. Proposed dates: Feb 24-26, 2014**
- 5. Proposed attendees, including likely number:**  
ETCCDI members (4 from CLIVAR, 4 from CCI, 4 from JCOMM, 1 from GEWX). 1 CLIVAR/WCRP Rep, 1 CCI Rep, 2-3 invited non-member experts.
- 6. Rationale, motivation and justification, including: relevance to CLIVAR themes & JSC cross cutting topics and any cross-panel/working group links and interactions involved:**  
This is scoping meeting to discuss future work of the ET in light of new priority of WCRP and new CLIVAR project, and ETCCDI's contribution to WCRP Grand Challenge on climate extremes.
- 7. Specific objectives and key agenda items:**  
To develop ETCCDI work plan for the next 4-yrs.
- 8. Anticipated outcomes (deliverables):**  
Detailed work plan.
- 9. Format:**  
Short presentation by members but most of time will be devoted to discussion.
- 10. Science Organising Committee (if relevant)**
- 11. Local Organising Committee (if relevant)** X. Zhang
- 12. Proposed funding sources and anticipated funding requested from WCRP:**

CCI to cover CCI members and Rep

JCOMM to cover expenses for JCOMM members

WCRP to cover expenses for members representing WCRP projects, ETCCDI  
CLIVAR staff member and 2-3 invited non-member experts (7-10 people in total)

Environment Canada (EC) will cover logistic expenses (meeting room, coffee breaks  
etc.)

## Annex A

### Proforma for CLIVAR Panel and Working Group requests for SSG approval for meetings

**1. Panel or Working Group:** ETCCDI

**2. Title of meeting or workshop:**

WCRP-ICTP Summer School on Attribution and Prediction of Extreme Events

**3. Proposed venue:** ICTP, Trieste, Italy

**4. Proposed dates:** Summer 2014

**5. Proposed attendees, including likely number:**

30 rigorously selected students, at least half selected from developing world countries and around 10+ teaching/mentoring scientists, likely split between week 1 and 2.

**6. Rationale, motivation and justification, including: relevance to CLIVAR themes & JSC cross cutting topics and any cross-panel/working group links and interactions involved:**

Attribution and prediction of extremes is a topic that touches on all aspects of climate in one way or another (it crosses space and timescales, climate system components, interlinks the full range of physical processes, and so on). Obtaining robust and reliable observational data and model simulations for extremes is a 'Grand Challenge' for the climate science research community, as defined by the WCRP. As such, the topic is very timely and the aim here is to train young scientists on the state-of-the-art techniques that are being used for analysis, detection and attribution, and event attribution, to engage in thinking about how the whole topic could be better conceptualized and organized, as well as to improve techniques, etc.

#### Relevance to developing countries

Weather and climate-related extreme events have major impacts on human and natural systems, including loss of lives, damage to buildings and other infrastructure, and damage to ecosystems. The benefits of advancing the knowledge and capacity in extreme event prediction and attribution include more confident decision-making in regional and national planning to adapt to and mitigate the impacts of global climate change. This is particularly relevant in developing countries, where the impact of climate variability and change is often acutely felt by society and the economy.

The process of climate change adaptation policy development/planning relies on the production of robust climate change projections and understanding, and the attribution of the role of climate change in observed extreme events. There is a growing tendency to attribute all climate extremes to the effects of global anthropogenic change; this is unhelpful in policy-making because natural variability and, for example, local land-use changes can also play dominant roles. Further assessment and refinement of methodologies for near-real-time attribution of climate events is needed to provide timely analysis to governments/decision makers. For example, in Africa an important focus is to improve the understanding of changes in the Greater Horn of Africa region, where recent drying trends and



drought episodes appear counter to the predicted longer-term change to wetter conditions.

### **7. Specific objectives and key agenda items:**

Extremes indices, extreme value theory, and event attribution, in each case with the objective of gaining understanding, and tools, for the analysis of the past, and the evolution of the future (in terms of both prediction and projection).

### **8. Anticipated outcomes (deliverables):**

The Summer School will train the participants in indices, extreme value theory, and event attribution, in each case with the objective of gaining understanding, and tools, for the analysis of the past, and the evolution of the future (in terms of both prediction and projection). The Summer School will build long term capacity and we envisage the development of an open source analysis package (extending existing tools currently available for the analysis of indices) that students will be able to continue using when they return home and which will be available to interested users at large.

### **9. Format:**

2-week summer school with lectures, discussion sessions and practical computer lab sessions that would build on the ETCCDI extremes indices package. This would contribute to the bigger objective for the students of understanding something about how to analyze the indices

A games technique may also be applied, for example loaded dice (for example, the Red Cross and/or ELHRA resource) and discussion of what constitutes "substantial cause" to share ideas about how attribution of individual weather events could be explained.

### **10. Science Organising Committee (if relevant)**

Francis Zwiers (co-Chair, CLIVAR), Pacific Climate Impacts Consortium, Canada

Sonia Seneviratne (co-Chair, GEWEX), ETHZ, Switzerland

Albert Klein Tank, KNMI, Netherlands

Peter Stott, Hadley Center UK Met Office, UK

Judith Perlwitz, NOAA, USA

Philippe Naveau, CNRS-IPSL, France

Xuebin Zhang, Environment Canada, Canada

Lisa Alexander, University New South Wales, Australia

Eric Gilleland, NCAR, USA

Gabi Hegerl, University of Edinburgh, UK

David Stephenson, University of Exeter, UK

Myles Allen, Oxford University, UK (pending confirmation)

### **11. Local Organising Committee (if relevant)** A. Pirani, A. Tompkins

**12. Proposed funding sources and anticipated funding requested from WCRP:**

ICTP: ~20K USD (15K Euros) - *confirmed*

TWAS: 5K USD

WCRP: 10,784 USD (10K CHF) - *confirmed*

~ 35K USD – To fund participation by students from developing countries (average 3K USD/person = 11/12 participants)

CLIVAR: 20K USD

GEWEX: 20K USD

40K USD → 10K USD - 3/4 students from developing countries

15K USD - 15 students from developed countries

15K USD - 10 lecturers.