

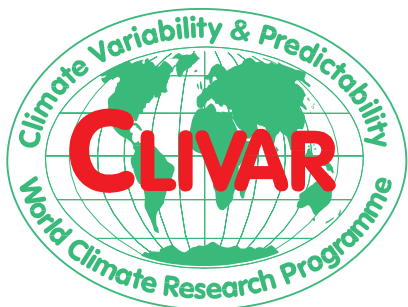
WCRP REPORT

World Climate Research Programme



ICSU

International Council for Science



Project Report

4th Session of CCI/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI)

Pacific Climate Impacts Consortium, University of
Victoria, Victoria, Canada, 23-25 Feb 2011

July 2011

WCRP Informal Report No. 26/2011

ICPO Publication Series No.159

CLIVAR is a component of the World Climate Research Programme (WCRP). WCRP is sponsored by the World Meteorological Organisation, the International Council for Science and the Intergovernmental Oceanographic Commission of UNESCO. The scientific planning and development of CLIVAR is under the guidance of the JSC Scientific Steering Group for CLIVAR assisted by the CLIVAR International Project Office. The Joint Scientific Committee (JSC) is the main body of WMO-ICSU-IOC formulating overall WCRP scientific concepts.

Bibliographic Citation

INTERNATIONAL CLIVAR PROJECT OFFICE, 2010:
Variability of the American Monsoon Panel. International CLIVAR
Publication Series No. 163 (not peer reviewed).

Recommendations and Action Items

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Links to other CCI Teams

Team on Climate Data Rescue (DARE):

1. Encourage that DARE is not the final goal, but part of an effort in which the newly digitized data are used for indices calculation, etc. (some success stories e.g. the Mediterranean Data Rescue Initiative (MEDARE)) (J Kimani, A. Klein Tank)
2. Interface by emphasizing at future ETCCDI workshops the importance of data rescue, development of high quality datasets, data preservation and data exchange (J. Kimani, O. Baddour, workshop organizers)
3. Recommend greater international communication and coordination in data rescue efforts (e.g. between the DARE task team and the Atmospheric Circulation Reconstructions over the Earth (ACRE) initiative), and bring to the attention of this group the potential of the huge data sources in the main libraries/archives (J. Kimani, R. Allan)

Task Team on National Climate Monitoring Products (TT-NCMP):

4. Link the TT-NCMP website containing the catalogue of national summary statistics to the ETCCDI website and vice versa (A. Pirani, X. Zhang, J. Kennedy)
5. Advise on the type of summaries, including anomaly maps, base periods, highest priority extremes statistics/indices, etc. (P. Zhai, A. Klein Tank, J. Kennedy)

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

6. ETCCDI will work together with ET-CRSCI in defining (and calculating) the indices (L. Alexander, P. Zhai, X. Zhang, A. Klein Tank)
7. Recommend a focus on agriculture/drought, health/heat waves (L. Alexander, P. Zhai, X. Zhang)

Indices developments

8. Be restrictive on expansion of the ET remit to other indices (e.g. tropical storms). The present outcomes of the team facilitate detection/attribution work (IDAG). Only explore other areas in which team members (or associated persons) are active already.
9. Finish/complete the review paper on indices (X. Zhang, T. Peterson, *et al.*, submitted)
10. Recommend homogenized datasets, but recognizing the difficulties for homogenizing daily data and work with groups outside the ETCCDI who are active in this area (e.g. EU-COST-HOME and the Land Surface Temperature initiative) (B. Trewin)
11. Explore (and propose specific) area-based indices (e.g. area above 90th percentile) (P. Jones, F. Zwiers, B. Trewin)
12. Evaluate drought indices such as PDSI, SPI variants as measure of surface aridity changes, working with the WCRP Drought Interest Group (DIG) (A. Dai, G. van der Schrier, P. Jones, R. Heim)
13. Adopt improved heat/cold spell indices (B. Trewin, L. Alexander, P. Zhai, G. Hegerl, M. Rusticucci)
14. Explore (and propose specific) new rainy season indices (X. Zhang, T. Peterson, A. Klein Tank, P. Zhai)

Global indices

ARC Linkage ClimdEX Project Overview

15. Support ARC Linkage ClimdEX and link ETCCDI websites to ClimdEX website when it goes live (A. Pirani, X. Zhang)
16. Recommend version control and inclusion of uncertainty information (P. Jones, L. Alexander)

Surface Temperatures Initiative

17. Recommend that the Land Surface Temperatures initiative gives an update at the next ETCCDI meeting (B. Trewin, P. Thorne)
18. Recommend that the Surface Temperatures Initiative stay abreast of developments by the CCI OPACE-II Task Team on Definitions of Extreme Weather and Climate Events (B. Trewin)

Marine indices

19. Prepare a JCOMM position paper on marine indices, variability and extremes (E. Harrison, S. Woodruff, E. Kent, draft to be available around November 2011) which includes the following Action item topics:
20. Consider the usefulness of a selected set of place-based indices (e.g. develop indices for Giorgi-type regions for the ocean basins) (E. Kent, P. Jones, L. Alexander)
21. Consider teleconnection patterns/indices (E. Harrison, P. Jones, L. Alexander, O. Baddour)
22. Extend land-based indices to the ocean (using ICOADS data), e.g. linking SSTs in coastal areas to land surface temperature (E. Kent, P. Jones, L. Alexander, A. Klein Tank)
23. Explore the use of marine data to infer land indices where land observations are missing (e.g. for small islands) (E. Kent, P. Jones, L. Alexander)

Models

24. Continue the computation of indices based on CMIP5 model simulations, and make the results available (jointly with PCMDI) (F. Zwiers, X. Zhang, J. Sillmann, S. Kharin, G. Hegerl)
25. Inform others (AR5/WGCM community) about ongoing “indices from models” activities (X. Zhang, A. Klein Tank, A. Pirani)
26. Liaise with the groups involved on efficient calculation of the indices and software comparison/development (L. Alexander, X. Zhang, A. Klein Tank, J. Sillmann, F. Zwiers, G. Hegerl)
27. Redefine some indices, e.g. the definition of the base period for the number of wet days when comparing current and future climate simulations. Recommend testing sensitivity to base period and testing index properties with model data (L. Alexander, X. Zhang, J. Sillmann, G. Hegerl, M. Rusticucci)

Workshops

28. Recognize the need that future ETCCDI workshops be tailored to the needs of the region being targeted (language, local host responsibilities), emphasising the win-win situation
29. Make use of possibilities to have ETCCDI workshops in connection with other WMO activities (e.g. Data Management and Data Rescue) (O. Baddour)
30. Enhance regional collaboration and participation in international follow-on activities that involve multiple countries (e.g. as in Southeast Asia example <http://saca-bmkg.knmi.nl>)

31. Recommend that workshop software, RCLimDex, calculate indices for more indices on a monthly and seasonal basis (e.g. dry season) (X. Zhang, L. Alexander)
32. Explore feasibility of EU-COST-HOME developed homogenization for use in workshops (addition to the RHtest homogenization which is available now) (E. Aguilar, A. Klein Tank, X. Zhang, X. Wang, O. Mestre)

Outreach

33. Update and maintain the ETCCDI website on a regular basis (A. Pirani, X. Zhang)
34. Prepare a poster based on the findings from the most recent ETCCDI workshops held in Central Africa, SE Asia, and Indian Ocean Community. This poster will be useful for WCRP OSC and other conferences (A. Pirani, O. Baddour, A. Klein Tank, X. Zhang)
35. Prepare a flyer on ETCCDI organisational aspects and achievements primarily for the WMO Congress but it may also be useful for the OSC (A. Pirani, O. Baddour, A. Klein Tank, X. Zhang)

Recommendations and Action Items

1. Introduction

1.1 Sponsors' overview

2. Links to other CCI Teams

2.1 OPACE-I Task Team on Climate Data Rescue (TT-DARE)

2.2 OPACE-II Task Team on National Climate Monitoring Products (TT-NCMP)

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

3. Indices developments

4. Global indices

4.1 ARC Linkage ClimDEX Project Overview

4.2 Surface Temperatures Initiative

5. Marine indices

6. Calculation of Indices from Model Output

7. Workshops

8. Outreach

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Appendix 1: Agenda

Appendix 2: List of Participants

1. Introduction

The 4th Session of the CCI/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) was hosted by Francis Zwiers and the Pacific Climate Impacts Consortium at the University of Victoria in Victoria, Canada on 23-25 February 2011. The ETCCDI sponsors renewed the membership and term of the expert team in 2010 and this meeting served as a kick-off meeting, providing the setting to scope a work plan for the new ETCCDI four-year term. The work plan builds on earlier work plans of the team and is essentially summarized by the list of Action items. This report gives some background information to these Action items.

The success of the ETCCDI has benefited from strong support of sponsoring organizations, and from many individuals who are not members of the team for their time and effort to support and participate in various ETCCDI activities. This report summarizes ETCCDI interactions with other CCI Task Teams, the development of the ETCCDI indices and software, the application of the ETCCDI indices to model output in the run up to CMIP5, and an update on the continued success of the ETCCDI workshops. New indices products were presented including the ARC Linkage ClimdEX gridded indices dataset, the Land Surface Temperature Datasets for the 21st Century initiative (<http://www.surface temperatures.org/>), and the European and South-East Asian Assessment and Datasets (ECA&D and SACA&D, respectively). There was a presentation on ongoing extremes-related work in South America (CLARIS-LPB and the CLIVAR Variability of the American Monsoon System (VAMOS) Task Team on extremes). An extensive session was dedicated to marine indices and included a presentation on ocean heat content indices, an update on the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) and an overview of the ARGO program. New techniques and results in detection and attribution studies were also presented.

Not all the material presented at the meeting is summarized in this report but the meeting webpage has the full list of presentations:

<http://www.clivar.org/organization/etccdi/etccdi4/etccdi4.php>.

1.1 Sponsors' overview

The ETCCDI sponsors gave an overview of their vision for the ETCCDI contribution to their respective communities.

WMO Commission for Climatology (CCI)

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. WMO will discuss the UN Global Framework for Climate Services at its Congress in May 2011, an opportunity for a freer exchange of data and to push for the provision of data for the coordinated evaluation of indices in near-real time.

WCRP Climate Variability and Predictability (CLIVAR) Project and Global Energy and Water Cycle Experiment (GEWEX)

The CLIVAR mission is to “observe, simulate and predict changes in Earth’s climate system with a focus on ocean-atmosphere interactions, enabling better understanding of climate variability, predictability and change, to the benefit of society and the environment in which we live”.

Consistent with the evolution of the WCRP, CLIVAR is developing plans for the future of the program. Seven imperatives have been formulated that describe key areas of CLIVAR work that will continue over the next several years and, in some cases, beyond.

Anthropogenic climate change

- Natural variability versus forced change; climate sensitivity and feedbacks; regional phenomena; extremes.

Decadal variability, predictability and prediction

- Determine predictability; mechanisms of variability; role of the oceans including the impact of ocean variations on land temperature and precipitation; adequacy of the observing system; initialization; prediction uncertainty; drought.

Intraseasonal and seasonal variability, predictability and prediction

- Monsoons, ENSO, tropical Atlantic variability, intraseasonal variability; prediction uncertainty.

Improved atmosphere and ocean component models of Earth System Models

- Analysis and evaluation; coordinated experiments; climate process teams (process studies).

Data synthesis, analysis, reanalysis and uncertainty

- Ocean data; coupled data assimilation systems.

Ocean observing system

- Advocacy for sustained observations; development, implementation and system design.

Capacity building

- Topical workshops, summer schools, expert training.

The ETCCDI remit will be integrated across the imperatives and it will explore the expansion of its scope for example to ocean indices and tropical storms.

ETCCDI has acquired an additional member representing the GEWEX project since changes in extremes (heavy precipitation, floods and droughts) are a focus area of GEWEX. Many physical processes may lead to drier soils under global warming. The PDSI drought index and its variants are similarly correlated with observed soil moisture and streamflow over land. Recent surface warming appears to have enhanced drying over many land areas during the last 30 years. Both soil moisture and PDSI from model projections suggest severe drying over most land areas (except northern high-latitudes) in the 21st century.

The following are some initial recommendations from GEWEX:

- Homogenized daily data of T, P, etc. are needed for long-term change analyses of extremes. Currently, daily data are often used for change analyses without homogenization. This should be changed.
- Groups with access to daily station data should reach out and collaborate with groups working on methods to homogenize climate data.
- A new approach to homogenize daily radiosonde humidity data has been developed and there are plans to apply similar approaches to homogenize surface daily humidity, winds, and other variables.
- PDSI and its variants could be included as one of the climate indices for measuring aridity changes.

Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) 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. The International Comprehensive Ocean-Atmosphere

Data Set (ICOADS) is the most extensive collection of surface marine data spanning the past three centuries, together with simple gridded monthly summary products extending from 1800 forward. The ICOADS project also works on metadata development and data rescue. The GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC) and JCOMM Observations Programme Area continue to develop the State of the Ocean website (<http://stateoftheocean.osmc.noaa.gov/>) of ocean climate indices of ocean and lower atmosphere anomalies. In addition to indices that describe marine climate variability, there is JCOMM stakeholder interest in extremes indices such as in coastal sea level, wave height, and surface winds.

2. Links to other CCI Teams

2.1 OPACE-I Task Team on Climate Data Rescue (TT-DARE)

The DARE team will monitor data rescue activities world-wide and provide support to the Atmospheric Circulation Reconstructions over the Earth (ACRE) Project, the Mediterranean Data Rescue Initiative (MEDARE), and similar initiatives in other regions. The DARE team will emphasize the need for climate data rescue and digitization, the apparent lack of some digitized data in the international databases, and the techniques and procedures for recovery, digitizing, composing, formatting, archiving, and disseminating climate data and metadata. An International Data Rescue portal (I-DARE) will be developed based on the Mediterranean Data Rescue (MEDARE) experience. Data rescue is not itself the final objective, rather to be able to arrive at providing climate indices information both at the national and international level.

Data rescue issues arise with restrictive data exchange policies, particularly in the terrestrial domain, that make international and regional work difficult. Even at the national scale difficulties arise when data exchange within a country is subject to a data policy, where a request to the originator has to occur before data are made available. Obtaining funding for data rescue activities is problematic so their inclusion as a component of a research project or workshop is recommended. Various projects have a data rescue component and there is probably a need for greater coordination across regions. Another recommendation is that the success of such an activity is enhanced by strong collaboration between National Hydrological and Meteorological Services (NHMS) and academic participants. The value and importance of data rescue, as well as data preservation and archival, can be stressed as part of the ETCCDI regional workshops, with the possibility of including a focus on data rescue, particularly when a series of workshops is planned in a given region.

- Action 1: Encourage that DARE is not the final goal, but part of an effort in which the newly digitized data are used for indices calculation, etc. (some success stories e.g. the Mediterranean Data Rescue Initiative (MEDARE)) (J Kimani, A. Klein Tank)
- Action 2: Interface by emphasizing at future ETCCDI workshops the importance of data rescue, development of high quality datasets, data preservation and data exchange (J. Kimani, O. Baddour, workshop organizers)
- Action 3: Recommend greater international communication and coordination in data rescue efforts (e.g. between the DARE task team and the Atmospheric Circulation Reconstructions over the Earth (ACRE) initiative), and bring to the attention of this group the potential of the huge data sources in the main libraries/archives. (J. Kimani, R. Allan)

2.2 OPACE-II Task Team on National Climate Monitoring Products (TT-NCMP)

A NCMP is a summary climate statistic for a country that can be of a range of complexity and is generally tuned to the country's climate. Examples include annual and decadal mean temperature from Australia, annual precipitation from the UK or a composite extremes index from the US. These are relatively complex creations, but a NCMP might be as simple as the maximum temperature recorded in the country during the year, or month, or the onset date of the seasonal rains at a particular location. Derived products are also possible based on these products such as temperature rankings e.g. in Australia, 2005 was the warmest year on record.

The many inconsistencies between methods used by different countries make comparisons difficult, or impossible. Some countries produce many tens of NCMPs, whilst others produce a handful or none. The Task Team (http://www.metoffice.gov.uk/hadobs/opace2_tt_ncmp/) has collected a catalogue of NCMPs from over 40 countries and is working to select a subset that is most commonly calculated, as well as most scientifically relevant, that will be recommended for adoption by WMO member countries. Guidelines will be developed with appropriate formats and suitable mechanisms for the Members to follow when submitting their national contributions to the WMO annual statement on the Global Climate. The possibility of developing standardized software to calculate the NCMPs will also be explored.

Action 4: Link the TT-NCMP website containing the catalogue of national summary statistics to the ETCCDI website and vice versa (A. Pirani, X. Zhang, J. Kennedy)

Action 5: Advise on the type of summaries, including anomaly maps, base periods, highest priority extremes statistics/indices, etc. (P. Zhai, A. Klein Tank, J. Kennedy)

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

The 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.

ACTION 6: ETCCDI will work together with ET-CRSCI in defining (and calculating) the indices (L. Alexander, P. Zhai, X. Zhang, A. Klein Tank)

ACTION 7: Recommend a focus on agriculture/drought, health/heat waves (L. Alexander, P. Zhai, X. Zhang)

3. Indices developments

ETCCDI currently recommends 27 core indices that are based on daily temperature values or daily precipitation amount (http://ccma.seos.uvic.ca/ETCCDI/list_27_indices.shtml). X. Zhang is leading an ETCCDI review paper on Indices for Monitoring Changes in Extremes based on Daily Temperature and Precipitation Data that will be submitted to WIRES this year¹. The paper gives an overview of the ETCCDI indices and reflects the issues that the ET will address over the next four years of mandate. This includes the development of gridded indices data sets, the use of ETCCDI and related workshops to expand global coverage, and how this process contributes to the IPCC assessments. Data issues important for indices calculation, such as the production of homogenized data sets, are emphasized. There is an ongoing discussion on new indices

¹ Submitted to WIRES in May 2011

developments, including more process-based indices, such as those related to droughts and the rainy season. The expansion of the core list of ETCCDI indices will depend on the areas of expertise in which current ETCCDI members are active.

- Action 8: Be restrictive on expansion of the ET remit to other indices (e.g. tropical storms). The present outcomes of the team facilitate detection/attribution work (IDAG). Only explore other areas in which team members (or associated persons) are active already.
- Action 9: Finish/complete the review paper on indices (X. Zhang, T. Peterson, *et al.*, submitted)
- Action 10: Recommend homogenized datasets, but recognizing the difficulties for homogenizing daily data and work with groups outside the ETCCDI who are active in this area (e.g. EU-COST-HOME and the Land Surface Temperature initiative) (B. Trewin)
- Action 11: Explore (and propose specific) area-based indices (e.g. area above 90th percentile) (P. Jones, F. Zwiers, B. Trewin)
- Action 12: Evaluate drought indices such as PDSI, SPI variants as measure of surface aridity changes, working with the WCRP Drought Interest Group (DIG) (A. Dai, G. van der Schrier, P. Jones, R. Heim)
- Action 13: Adopt improved heat/cold spell indices (B. Trewin, L. Alexander, P. Zhai, G. Hegerl, M. Rusticucci)
- Action 14: Explore (and propose specific) new rainy season indices (X. Zhang, T. Peterson, A. Klein Tank, P. Zhai)

4. Global indices

4.1 ARC Linkage ClimdEX Project Overview

The ARC Linkage ClimdEX Project is underway to develop the next generation data sets of global gridded indices of climate extremes including an update of HadEX. The project will use quality controlled daily in situ temperature and precipitation observations from multiple sources (e.g. NOAA Global Historical Climatology Network (GHCN-Daily), ECA&D, SCA&D and data generated through the ETCCDI training workshops and related regional activities), and calculate climate extremes indices using the ETCCDI set of indices and software. The output will be available via a web interface as station and gridded data to serve the research needs of climate variability, model evaluation, detection and attribution, process studies and ultimately to inform the impacts community and relevant stakeholders.

The project will include a process of benchmarking to assess parametric (in observations) and structural (gridding) uncertainties by implementing multiple quality control (QC) and homogenization methods, gridding methodologies and grid sizes, input parameter settings and window sizes. The benchmarking will follow the guidelines produced by the Land Surface Temperature initiative Benchmarking and Assessment Working Group, for example the use of blind tests of QC and homogenisation methods. The sensitivity of whether indices are calculated at stations or as gridded products will also be assessed. Benchmarking will ensure transparency of the methods used and traceability of the input data, except where nations do not release the raw data and just provide processed data. The software used in the project will be freeware where possible and will implement version control so that more indices can be added and to increase traceability and the tracking sources of errors.

The project will serve the following products through a web interface:

- HadEX (multiple versions)
- StatdEX - Station-only data GHCN-Daily plus all other available sources
- GhcndEX -Gridded fields GHCN-Daily only
- ClimdEX1 - Gridded fields GHCN-Daily plus all other available data sources

Where possible, products will be available with the associated uncertainties and updated in real time. The ARC Linkage ClimdEX project will facilitate the evaluation of extreme climate indices in CMIP5 models, since the grid size can be selected to match each model grid, and studies of detection and attribution.

Some issues that are being discussed are:

- How to combine data sources and duplicate stations
- Whether ECA&D will be incorporated in GHCN-Daily
- There are still considerable data sparse regions
- How will ETCCDI workshop data be incorporated and how to handle the lack of traceability when the raw data is not released by participating nations
- How to automate and incorporate ETCCDI workshop data
- When to issue dataset releases e.g. v1, v2 etc.

Action 15: Support ARC Linkage ClimdEX and link ETCCDI websites to ClimdEX website when it goes live (A. Pirani, X. Zhang)

Action 16: Recommend version control and inclusion of uncertainty information (P. Jones, L. Alexander)

4.2 Surface Temperatures Initiative

For the first time, a single comprehensive international databank of the actual land surface meteorological observations taken globally at monthly, daily and sub-daily resolutions will be developed. This databank will be version controlled and seek to ascertain data provenance, preferably enabling researchers to trace the data back to the original data record. It will also have associated metadata including images and changes in instrumentation and practices to the extent known. The databank effort will be run internationally and for the benefit of all. The effort required in creating and maintaining such a databank is substantial and the task is envisaged as open ended both because there is a wealth of data to recover and incorporate and because the databank will need to be updated in real-time. Novel approaches to data recovery such as crowd sourcing digitisation may be pursued. In the interests of getting subsequent parts of the work underway it is envisaged that a first version of the databank will be ready in 2011. See here for more information on the initiative: <http://www.surface temperatures.org>.

Action 17: Recommend that the Surface Temperatures Initiative give an update at the next ETCCDI meeting (B. Trewin, P. Thorne)

Action 18: Recommend that the Surface Temperatures Initiative stay abreast of developments by the CCI OPACE-II Task Team on Definitions of Extreme Weather and Climate Events (B. Trewin)

5. Marine indices

Despite CLIVAR and JCOMM co-sponsorship, the ET recommended list of indices are currently only land based. Whether these should expand to include marine indices is a topic of continuing discussion and will be expanded upon by a JCOMM position paper that is in preparation. Work on marine indices generally considers better characterizing variability and ocean-land links, rather

than marine extremes. While the ET is not limited to considering extremes indices, there is reluctance to expand its charter to include indices that are not place-based, in other words, indices on global teleconnections. The expertise within other parts of the CLIVAR community is better suited to make recommendations on these types of indices and to use such indices to understand teleconnection patterns. How these indices are linked to extremes over land is an important research area, for example the attribution of long-term trends in land extremes in relation to the longer timescales of ocean variability.

Indices that include marine place-based indices that describe variability and the development of joint terrestrial-ocean indices are being considered. Monthly marine indices would be appropriate for example based on the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) data set and model output. Monitoring and attributing surface temperature variability is the most obvious terrestrial-land linkage. The definition of sub-surface indices such as ocean heat content is an active research area and is constrained by limitations in the coverage of observations. The latter would require recommendations on which data sets should be used and best practices on how to combine data sets since there are intrinsic differences between land and marine data. Marine data could also be useful to derive land variability in the absence of land observations, such as for small islands. The usefulness of combining marine and land datasets is best explored in well-observed regions including Europe and North America.

- Action 19: Prepare a JCOMM position paper on marine indices, variability and extremes (E. Harrison, S. Woodruff, E. Kent, draft to be available around November 2011) which includes the following Action item topics:
- Action 20: Consider the usefulness of a selected set of place-based indices (e.g. develop indices for Giorgi-type regions for the ocean basins) (E. Kent, P. Jones, L. Alexander)
- Action 21: Consider teleconnection patterns/indices (E. Harrison, P. Jones, L. Alexander, O. Baddour)
- Action 22: Extend land-based indices to the ocean (using ICOADS data), e.g. linking SSTs in coastal areas to land surface temperature (E. Kent, P. Jones, L. Alexander, A. Klein Tank)
- Action 23: Explore the use of marine data to infer land indices where land observations are missing (e.g. for small islands) (E. Kent, P. Jones, L. Alexander)

6. Calculation of Indices from Model Output

The ETCCDI indices software FCLimDex, normally used with station data, has been modified for use with gridded climate model data sets in netcdf format. Time series are calculated over the Giorgi regions and compared with HadEX and reanalyses (ERA40, ERAINT and NCEP). The analysis has been completed for the CMIP3 output and will be repeated for CMIP5. The CMIP3 analysis has shown that the definition of some indices, such as the warm spell duration index, is problematic and should be redefined for use with model data to take into account the presence of model biases. The sensitivity to the choice of base period for indices calculations over future projections is being explored.

- Action 24: Continue the computation of indices based on CMIP5 model simulations, and make the results available (jointly with PCMDI) (F. Zwiers, X. Zhang, J. Sillmann, S. Kharin, G. Hegerl)
- Action 25: Inform others (AR5/WGCM community) about ongoing “indices from models” activities (X. Zhang, A. Klein Tank, A. Pirani)

- Action 26: Liaise with the groups involved on efficient calculation of the indices and software comparison/development (L. Alexander, X. Zhang, A. Klein Tank, J. Sillmann, F. Zwiers, G. Hegerl)
- Action 27: Redefine some indices, e.g. the definition of the base period for the number of wet days when comparing current and future climate simulations. Recommend testing sensitivity to base period and testing index properties with model data (L. Alexander, X. Zhang, J. Sillmann, G. Hegerl, M. Rusticucci)

7. Workshops

Two ETCCDI-type (not directly organized by ETCCDI) workshops were held recently: in Puebla, Mexico (March 2009) and in Guayaquil, Ecuador (January 2011), covering the whole of Mexico and South America, respectively.

The workshop held in Mexico was organized by INE/UIP and funded by the British Embassy in Mexico under the project “Strengthening Mexican capabilities for climate change detection in Mexico. The ETCCDI website was translated into Spanish and guidance material for calculating and using extreme indices was published in Spanish.

The Guayaquil workshop was organized by CIIFEN and C3 and funded by the WMO. It followed on directly to a workshop held in Brazil in 2004, with the aim of spatially and temporally extending and updating the former observational networks used in the Brazil workshop. The workshop was preceded by nearly two months of pre-workshop guidance by the instructors. Representatives of all NHMSs in South America (except Guyana and French Guyana) participated and all the participants agreed to the importance of sharing their regional data to contribute to the global data set. After going through the quality control procedure, the participants also saw the value of increasing the number of stations and committed to providing data from extra locations. Problems with metadata that were encountered during the analysis also demonstrated the value of data and metadata rescue activities.

The participants of the Guayaquil workshop developed a Regional Action Plan towards the preparation and submission of one or more articles for peer review and for assessment as part of the Fifth IPCC Assessment (AR5). The participants will play a protagonist role in coordinating the analysis and preparation of the final publications, with the assistance of the workshop instructors.

The following lessons have been learned from these experiences:

- It is important to ensure that the local organiser is very active, understanding and sharing the need for the workshop to take place and willing to take a leading role in its organisation.
- Pre- and post-workshop interaction is essential for the workshop success (both for capacity building and enhancing knowledge).
- Follow up activities are highly requested by trainees (former workshop participants have always requested more training on homogenisation).
- Fostering an active role of the participants is important, particularly after the workshop (making them protagonists of the analysis), with the instructors closely monitoring and supporting the progress.
- It can be extremely beneficial to enlist a well-trained native speaker to help build up confidence and avoiding misinterpretations.

The ETCCDI regional workshop formula is very much alive and successful. For example, ETCCDI indices are being adopted for use in national communications to the UNFCCC: e.g. in Colombia, Peru. Besides ensuring an enhanced knowledge base on changes in regional extremes and other key climate change issues (e.g. data traceability, strengthening cooperation and data sharing), it gives the participants a unique opportunity for getting closer, sharing worries and strengthening their links. All will benefit climate knowledge at lower than global spatial scales.

- Action 28: Recognize the need that future ETCCDI workshops be tailored to the needs of the region being targeted (language, local host responsibilities), emphasising the win-win situation
- Action 29: Make use of possibilities to have ETCCDI workshops in connection with other WMO activities (e.g. Data Management and Data Rescue) (O. Baddour)
- Action 30: Enhance regional collaboration and participation in international follow-on activities that involve multiple countries (e.g. as in Southeast Asia example <http://saca-bmkg.knmi.nl>)
- Action 31: Recommend that workshop software, RCLimDex, calculate indices for more indices on a monthly and seasonal basis (e.g. dry season) (X. Zhang, L. Alexander)
- Action 32: Explore feasibility of EU-COST-HOME developed homogenization for use in workshops (addition to the RHtest homogenization which is available now) (E. Aguilar, A. Klein Tank, X. Zhang, X. Wang, O. Mestre)

8. Outreach

ETCCDI will continue to provide information, guidelines on indices and software by means of its webpage. Outreach material will be prepared for WMO Congress and the WCRP Open Science Conference.

- Action 33: Update and maintain the ETCCDI website on a regular basis (A. Pirani, X. Zhang)
- Action 34: Prepare a poster based on the findings from the most recent ETCCDI workshops held in Central Africa, SE Asia, and Indian Ocean Community. This poster will be useful for WCRP OSC and other conferences (A. Pirani, O. Baddour, A. Klein Tank, X. Zhang)
- Action 35: Prepare a flyer on ETCCDI organisational aspects and achievements primarily for the WMO Congress but it may also be useful for the OSC. (A. Pirani, O. Baddour, A. Klein Tank, X. Zhang)

Appendix 1: Agenda

DAY 1 - Wednesday 23 February

09:00 Start

- 09:00 Welcome, introductions and review of the meeting agenda - Co-chairs
- 09:10 WMO/CCI perspective for the ET - Tom Peterson
- 09:20 WCRP/CLIVAR perspective for the ET - Anna Pirani
- 09:40 JCOMM perspective for the ET – Ed Harrison
- 09:50 GEWEX perspective for the ET - Aiguo Dai
- 10:00 Review of work conducted by the ET during the previous term, and status of Action items - Co-chairs

11:00 Coffee break

- 11:30 CCI Task Team on National Climate Monitoring Products - John Kennedy (presented by Albert Klein Tank)
- 11:50 CCI Expert Team on Climate Risk & Sector Specific Climate Indices - Lisa Alexander
- 12:10 CCI Task Team on Data Rescue - Joseph Kimani

13:00 Lunch

- 14:00 Discussion on links between these other CCI teams and the ETCCDI
- 15:00 South American initiatives related to extremes (Clarif EU project, VAMOS extremes group) - Matilde Rusticucci (by phone)
- 15:20 Detection and Attribution - Francis Zwiers and Gabi Hegerl

15:40 Coffee break

- 16:00 CLIMDEX project for updating the global dataset of extremes indices - Imke Durre / Lisa Alexander
- 16:20 ECA&D for Europe now also available as ICA&D for the Indonesian region - Albert Klein Tank
- 16:40 Calculation of indices from model simulations - Jana Sillmann and Slava Kharin
- 17:00 The use of ET indices for climate model validation - Gerd Buerger

17:40 End

DAY 2 - Thursday 24 February

08:30 Start

- 08:30 Indices on ocean heat content - Matt Palmer (by phone, on behalf of Peter Stott)

08:50 Climate indices from marine data (including relation to ICOADS version 2.5) and MARCDAT - Scott Woodruff

09:10 Update on ARGO - Howard Freeland

10:30 Coffee break

11:00 Discussion on plans for ocean and surface marine climate indices, including ocean heat content (to address suggestions from the CLIVAR-SSG)

13:00 Lunch

14:00 Global surface temperature dataset initiative (Exeter workshop) - Blair Trewin

14:20 Global data availability (title to be confirmed) - Phil Jones

14:40 Discussion on data traceability (access to the primary sources as advocated in the Exeter workshop) versus data completeness (use whatever available) in relation to future workshops, and discussion on R-software developments, etc.

15:30 Coffee break

16:00 Regional workshop status report - Tom Peterson & Manola Brunet

16:20 Future regional workshops, WMO Climate data and related projects - Omar Baddour

16:40 Status of review paper - Xuebin Zhang

17:00 Discussion on climate indices developed and used in the past by the ET and suggestions for future changes

18:00 End

19:00 *Dinner hosted by the Pacific Climate Impacts Consortium at the [University Club of Victoria](#)*

DAY 3 - Friday 25 February

08:30 Start

08:30 The future of the ETCCDI - Co-chairs

10:30 Coffee break

11:00 Discussion on the future strategy, including the relevance to CLIVAR themes & JSC cross cutting topics, focus on climate extremes, links to GEWEX (or successor), etc.

13:00 Lunch

14:00 Finalizing the work plan for the coming years and assignment of Action items and deliverables for this term (including contributions to IPCC-AR5, BAMS State of the Climate, WCRP Open Science Conference, etc.)

Adjourn

Appendix 2 – Participants

ETCCDI members:

Xuebin Zhang, co-chair (Environment Canada)
Albert Klein-Tank, co-Chair (KNMI)
Blair Trewin (Bureau of Meteorology,)
Panmao Zhai (China Meteorological Administration)
Lisa Alexander (University of New South Wales)
Francis Zwiers (Pacific Climate Impacts Consortium)
Elizabeth Kent (UK National Oceanography Center)
Ed Harrison (University of Washington)
Aiguo Dai (NCAR)

Invited Experts:

Phil Jones (CRU, University of East Anglia)
Thomas Peterson (NOAA/NCDC, President CCI)
Joseph Kimani (Kenya Meteorological Department, co-Chair for the CCI Task Team on Data Rescue)
Manola Brunet (Center for Climate Change, co-Chair of OPACE II, CCI)
Fatima Driouech (National Meteorological Service of Morocco, co-Chair of OPACE II, CCI)
Scott Woodruff (NOAA/ESRL)
Greg Flato (Environment Canada)
Slava Kharin (Environment Canada)
Jana Sillmann (Environment Canada and University of Victoria)
Howard Freeland (IOS, Fisheries and Oceans Canada)
Gerd Buerger (Pacific Climate Impacts Consortium)

Phone Link:

Matilde Rusticucci (University of Buenos Aires, ETCCDI)
Imke Durre (NOAA National Climatic Data Center)
Matt Palmer (UK Met Office)

Sponsor Support:

Anna Pirani (CLIVAR)
Omar Baddour (WMO, CCI)

Absent Participants:

Several individuals were not able to participate the meeting in Victoria, but they have been active in various discussion prior to the meeting, and some of them also gave presentation remotely through tele-conference facility. They include Gabriele Hegerl (University of Edinburgh, ETCCDI), Eric Lindstrom (NASA, ETCCDI), Peter Stott (UK Met Office, ETCCDI), Val Swail (Environment Canada), Aryan van Engelen (KNMI, co-Chair for the CCI Task Team on Data Rescue), John Kennedy (UK Met Office, CCI Task Team on National Climate Monitoring Products), David Stephenson (University of Exeter), Edgard Cabrera (WMO)