WMO WORKSHOP ON ENHANCING CLIMATE INDICES FOR SECTOR-SPECIFIC APPLICATIONS IN THE SOUTH ASIA REGION

Pune, India
3-7 October 2016

Vision: To enhance the use of sector specific climate information in various sectors (e.g. agriculture, water, health) for Climate Risk Management and adaptation, through interdisciplinary analysis and interpretation of sector-specific climate indices.

WORLD METEOROLOGICAL ORGANIZATION

INDIAN INSTITUTE OF TROPICAL METEOROLOGY

An activity under the Programme of Implementing the Global Framework for Climate Services on Regional and National Scales, funded by Environment Canada

Workshop Lead:

Dr Nicholas Herold
University of New South Wales (Australia)

1.   Background

Substantial progress has been made in developing globally standardized indices for assessing climate extremes under the leadership of WMO Commission for Climatology (CCl) through its joint Expert Team on Climate Change Detection and Indices (ETCCDI) along with other partners. The work of ETCCDI made major contributions to the Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC). However, little work to date has focused on the development of such indices that can be directly used in sectoral applications. With the advent of the Global Framework for Climate Services (GFCS), with an overarching goal to provide climate information and services to meet user requirements, CCl has taken up a new initiative to develop climate indices with targeted sectoral applications, building on the indices and associated software developed by ETCCDI.

CCl has established an Expert Team on Sector-Specific Climate Indices (ET-SCI), which, in cooperation with sectoral experts in agricultural meteorology, water resources and health, is working to identify and evaluate additional sector-specific indices, both single- and multi-variable types, to define both simple and complex climate risks of interest to user groups. Relying on the principles of the ETCCDI, this work will focus on systematic and globally-consistent approaches using high quality data and appropriate statistical methods to help characterize the susceptibility of various sectors to climate variability and change in an authoritative manner. ET-SCI has developed a new software package called "*ClimPACT2*" for this purpose, and has successfully organized a proof of concept workshop in 2013 for six countries in western South America (http://www.wmo.int/pages/prog/wcp/ccl/opace/opace4/meetings/WorkshopEnhancingClimIndices. php).

The ET-SCI has undertaken this workshop on Sector-specific Climate Indices for South Asia as part of the Programme of Implementing GFCS on Regional and National Scales funded by Environment Canada. It brings together experts from NMHS's along with representatives from one of the GFCS priority sectors (agriculture and food security, water, health, disaster risk reduction and energy) in the South Asia region. The workshop will comprise key note lectures, plenary discussions and hands-on training on the application of the *ClimPACT2* software in the countries/territories of the region, and will serve as an interdisciplinary approach to its application.

This workshop will begin a process in the region that builds the necessary partnerships for interdisciplinary knowledge development, that facilitates and promotes the use of climate information in users' decision-support systems for climate risk management and adaptation strategies, and that develops the requisite training materials and tools.

2.   Workshop Structure

This workshop will be a combination of

- seminars
- country and sector presentations
- hands-on data analysis
- open discussions

The agenda below is annotated to indicate details about the seminars and analyses. The suggested timings are approximate. If seminars and discussions take less time there will be more time for hands-on data analyses.

The technical leads/resource persons for the workshop are:

1) **Dr Nicholas Herold,** Research Associate, Climate Change Research Centre and ARC Centre of Excellence for Climate Systems Science, University of New South Wales, Sydney, Australia;

2) **Ms Acacia Pepler**, Climatologist, Bureau of Meteorology, Melbourne, Australia;

3) **Dr Jayashree Revadekar,** Senior Scientist, Indian Institute of Tropical Meteorology (IITM), India;

4) **Dr Tosiyuki Nakaegawa**, Senior Researcher, Meteorological Research Institute, Japanese Meteorological Agency, Japan and co-Chair, CCl Expert Team on Sector-specific Climate Indices (ET-SCI);

5) **Dr Xiaomao Lin**, Assistant Professor, Department of Agronomy, Kansas State University, USA;

6) **Mr David Hein-Griggs**, Climate Information for International Development team, Met Office, Exeter, UK;

7) **Dr Shubhayu Saha,** Assistant Professor, Emory University, USA;

8) **Dr Rupa Kumar Kolli**, Chief, World Climate Applications and Services Division, WMO, Geneva, Switzerland;

9) **Ms Anahit Hovsepyan**, Scientific Officer, World Climate Applications and Services Division, WMO, Geneva, Switzerland.

3.   Preparing for the workshop

Participants will also be expected to prepare a 10 minute presentation (1 per country) during the workshop for presentation on the last day. A template will be provided during the workshop.

NMHS/Water Sector participants are required to bring data relevant to climate and water in 'RClimDex' format, containing both historical and more recent records where available and ideally with as long records as possible (30 years plus).

Agriculture/Health sector participants should bring information/data from their sector that could be relevant for the indices that will be calculated during the workshop. These data can be qualitative. For example you might have historical information on e.g. streamflow records, reservoir storage and lake levels, crop yields, data related to fertilizer use and irrigation, mortality and morbidity public health data in regions at or near the meteorological stations for which data will be provided by the NMHS participants.

4.   At the workshop

On the first two days of the workshop, meteorologists will be preparing high quality meteorological data by performing quality and homogeneity checks using the *ClimPACT2* software. For the final three days the meteorologists will be joined by sector participants to calculate and interpret the indices to characterize the susceptibility of various sectors to climate variability and change.

MONDAY, 3 OCTOBER 2016

SESSION I:	WELCOME AND INTRODUCTION

09:00 – 09:15   Welcome Addresses
- **Rupa Kumar Kolli**, WMO
- **Nicholas Herold,** Workshop lead

09:15 – 09:30   *Tour de table*: Self-introductions of participants

09:30 – 09:50   Introduction to the CCI ET-SCI
Includes where ET-SCI sits within the WMO structure, the history of the Expert Team; the terms of reference and expected deliverables of the Expert Team; the importance of this workshop as a milestone within the Global Framework on Climate Services.
- **Anahit Hovsepyan,** WMO

9:50 – 10:10   Previous workshops and expected outcomes from this workshop
Introduction to previous ET-SCI workshops held in Fiji and Barbados and outcomes. What outcomes we can expect from this workshop.
- **Nicholas Herold**

10:10 – 10:40   Regional Variability and Change and Indices in India
An overview of regional climate variability and change in the region and the application of climate indices regionally.
- **Jayashree Revadekar**

10:40 – 11:00   Coffee Break

SESSION II:	Introduction to *ClimPACT2* Chair: Rupa Kumar Kolli

11:00 – 11:30   Introduction to *ClimPACT2*
An overview of ClimPACT2, including its features, required inputs, and outputs. This software uses a programming language known as "R", available free of charge from http://www.r-project.org.
- **Nicholas Herold**

11:30 – 12:00   Install and check software and data formats
People to install R and ClimPACT2 (USB keys will be passed around). Everything up to and including sourcing the climpact2.gui.r file should be achieved. More time will be available after lunch if necessary.

12:00 – 13:00   **Lunch**

SESSION III:	**Data Quality Control**
	Chair: Acacia Pepler

13:00 – 14:00 Quality control of climate data and data issues
This session involves using ClimPACT2 to check climate data for errors including duplicated dates, unphysical values, outliers, repeated values and more. While it is important to remove false values from your data it is also important not to remove valid values. Some extreme values may be genuine and hence absolutely necessary to keep. The QC features of ClimPACT2 will be shown and how to make changes to your data will be demonstrated.
  o **Nicholas Herold**

14:00 – 15:00 **QC checks of station data**

15:00 – 15:15 Coffee Break

15:15 – 17:00 **QC checks of station data**

TUESDAY, 4 OCTOBER 2016

SESSION IV: Hands-on data quality and homogeneity assessment
Chair: Jayashree Revadekar

09:00 – 09:45 Introduction to homogeneity
Introduces participants to the concept of homogenisation, why it's necessary, how it's done and an introduction to and demonstration of the software that will be used to perform homogeneity checking at the workshop, RHTest.
  o **Acacia Pepler**

09:45 – 10:30 Homogeneity checks

10:30 – 10:45 Coffee Break

10:45 – 12:00 Homogeneity checks (continued)

12:00 – 13:00 **Lunch**

13:00 – 15:00 Homogeneity checks (continued)

15:00 – 15:15 Coffee Break

15:15 – 17:00 Homogeneity checks (continued)

WEDNESDAY, 5 OCTOBER 2016

SESSION V:	**The use of climate information in sector-specific analysis** Chair: Rupa Kumar Kolli

09:00 – 09:15   Welcome Addresses
- **Director IITM**
- **Rupa Kumar Kolli**, WMO
- **Toshiyuki Nakaegawa**, ET-SCI co-Chair

09:15 – 09:25   Climate Services Information System (CSIS)
- **Rupa Kumar Kolli**

09:25 – 09:35   Introduction to the value of Climate Indices for Sector applications
Introduces participants to the concept of a climate index and why they're useful, the history of the ETCCDI and the need for more sector-relevant indices and the creation of the ET-SCI.
- **Nicholas Herold**

09:35 – 09:50   Climate information for Agriculture and Food Security
- **Xiaomao Lin**

09:50 – 10:05   Climate information for Water Resources
- **Toshiyuki Nakaegawa**

10:05 – 10:20   Climate information for Health
- **Shubhayu Saha**

10:20 – 10:50   Coffee Break and group photo

SESSION VI:	**Introduction to the Expert Team on Sector-specific Climate Indices (ET-SCI) and their indices** Chair: Xiaomao Lin

10:50 – 11:10   Introduction to the CCl ET-SCI and the ET-SCI indices
Includes where ET-SCI sits within the WMO structure, the history of the Expert Team and previous meetings; the terms of reference and expected deliverables of the Expert Team; the importance of this workshop as a milestone within the Global Framework on Climate Services and a broad overview of types of indices that are calculated with sector-relevance.
- **Anahit Hovsepyan**

11:10 – 11:25   Introduction to drought indices
Brief introduction to drought concepts and widely used drought indices. Includes a more detailed description of the Standardized precipitation Index (SPI) and Standardized Precipitation Evapotranspiration Index (SPEI) included in ClimPACT2.
- **Xiaomao Lin**

11:25 – 11:40   Introduction to heatwave indices

Includes discussion of a global framework for defining heatwaves and warm spells – and a brief overview of the three different definitions used in ClimPACT2 and the various heatwave aspects measured for each definition. Participants will be able to decide which definitions and characteristics are best suited for their sector.

- o **Shubhayu Saha**

11:40 – 12:00 Distribute software and data to new participants. Ensure R and Panoply installed on everyone's laptop.

12:00 – 13:00 **Lunch**

SESSION VII:	Introduction to *ClimPACT2* and interactive session
	Chair: Acacia Pepler

13:00 – 13:30 Introduction to *ClimPACT2* including demonstration
Introduction, history and demonstration of the main software package being used at the workshop.
- o **Nicholas Herold**

13:30 – 15:00 Ensure software is installed, and interactive *ClimPACT2* session. Participants commence calculating indices and comparing to their country's sector data. *Following along with N. Herold. Using quality controlled data from Met Services.*

15:00 – 15:30 Coffee Break

15:30 – 17:00 Participants continue to calculate indices for their country's station(s).

18:00 – 19:30 Social event: Dinner hosted by Director of IITM.

THURSDAY, 6 OCTOBER 2016

SESSION VIII:	Interactive session
	Chair: Nicholas Herold

09:00 – 09:05 Activity thus far and day's objectives

09:05 – 10:30 Calculate indices and analyse results

10:30 – 10:45 Coffee Break

10:45 – 12:00 Calculate indices and analyse results

12:00 – 13:00 **Lunch**

13:00 – 15:15 Calculate indices and analyse results

15:15 – 15:30 **Coffee Break**

SESSION VIII:	**Regional modelling and climate indices** Chair: Toshiyuki Nakaegawa

15:30 – 16:00	Regional modelling and climate indices o **David Hein-Griggs**
16:00 – 17:00	Continue calculating indices and analysing results, including regional model data and commence preparation of country presentations. o **David Hein-Griggs**

FRIDAY, 7 OCTOBER 2016

SESSION XII:	**Country and region presentations** Chair: Rupa Kumar Kolli

09:00 – 10:15	Completion of country presentations
10:15 – 10:30	Coffee Break
10:30 – 12:30	Country presentations *Each country group to give a 10 minute presentation describing any interesting relationships they have found between their climate indices and sector data.*
12:30 – 13:30	**Lunch**

SESSION XIII:	**Next steps and conclusion** Chair: Anahit Hovsepyan

13:30 – 13:45	Presentation on regional series *Some of the computed indices will be aggregated into preliminary regional series to provide the participants with a general perspective of their joint evolution in the analysed area.* o **Nicholas Herold**
13:45 – 15:00	Discussion *Includes the future of the indices for sector applications, where to next, publications.*
15:00 – 15:30	Summary of the Discussion and the main conclusions and decisions o **Rupa Kumar Kolli**
15:30	Workshop closure