Report of the Meeting

of the WMO CCl OPACE 2 Task Team on National Climate Monitoring products

12 – 14 September 2011

(John Kennedy)

Introduction

The WMO CCl OPACE2 Task Team on National Climate Monitoring Products met at the WMO, Geneva, from 12-14th September 2011. Ladislaus Chang'a, Prithiviraj Booneeady, Olga Bulygina, Mesut Demircan, Deke Arndt, Andrew Watkins, Mohammad Semawi and John Kennedy attended from the team. The co-chair of the OPACE2, Fatima Driouech, Hama Kontongomde and Omar Baddour from the WMO were also in attendance. Leslie Malone, Kumar Kolli and Peer Hechler joined the discussions. The opening remarks were provided by Peiliang Shi, director of WMO Information Systems branch providing context for the work particularly in light of the Global Framework for Climate Services (GFCS).

The aim of the task team is to produce and document a short list of National Climate Monitoring Products (NCMPs) which could be produced by all countries in a consistent manner. This would aid the production of summary reports on global climate and allow countries with fewer resources to utilise them more efficiently. The product is not intended to replace detailed comprehensive analyses of the climate within a country. It is intended to be a simple summary, that will sit alongside more detailed analyses, for use in reports and higher level assessments thereby providing a more balanced view of global climate and bringing greater attention to globally significant climate events in countries that have maybe not previously been given due prominence. By prescribing detailed reporting guidelines and establishing a list of focal points within countries, the team can enable efficient communication of NCMPs so they arrive in a timely manner for a wide range of societally important users. Because the task of designing and implementing NCMPs requires coordination of players at global, regional and national level, the team recognises the important role that WMO Regional Climate Centres (RCCs) will play in facilitating the coordination, creation and dissemination of NCMPs. The team also acknowledges the need to liaise with existing groups within the WMO including CBS.

The terms of reference of the task team are:

1. Consider existing NCMPs, determine which are most important from a scientific perspective and which generate most interest among the general public within those countries

2. Consider existing capabilities within developing countries to produce NCMPS documented in 1

3. Develop list of 2-6 NCMPs members are recommended to produce

4. Precisely document the construction of this priority list of NCMPs in a WCDMP publication

5. Determine need to develop software to create NCMPs. What language would be appropriate for the software.

6. If software appropriate, create the software or recommend that such software be created.

7. Report to OPACE 2 co-chairs

8. Develop guidelines with appropriate formats and mechanisms for the Members to submit their national contributions to the WMO annual statement on the Global Climate.

9. Task team lead to inform OPACE 2 co-chairs that the task is finished and that the team can be dissolved.

Preliminary discussion and work of the team was conducted via email. Members compiled lists of currently existing National Climate Monitoring Products from each of the WMO regions and prepared presentations focusing on the needs of key users of the climate data. Pithiviraj Booneeady attended the meetings of the CM-SAF users group in Rostock, Germany 6-8 September 2010. Mesut Demircan and Mohammad Semawi attended the WMO Region VI meeting on climate monitoring in October 2010. John Kennedy attended the Surface Temperatures Workshop in Exeter 7-9 September 2010.

Terms of reference 3 and 5 have been completed. Terms of reference 1, 2 and 8 have been partially completed. It is arguable that 6 has been completed given that the team has recommended that software be created, however it will still be necessary to assess the feasibility of the proposed means of doing this. The actions arising as a result of the meeting will move work forward on 1, 2, 4, 6 and 8.

User needs for NCMPs, general good practice and identified constraints

A number of key users, or potential users of NCMPs were identified. The WMO use climate monitoring information in reports such as the WMO annual Statement on the Status of the Global Climate produced each year as part of the WMO CSM. The requirement for the report is that climate information included in the report should have a high impact at the global or regional level, particularly those events likely to affect human welfare. However, it was also noted that there should be a clear distinction between significant weather or climate events and events that are significant chiefly for the devastation that they cause. A weather related event such as a flood might cause great loss of life from a rainfall event that is not climatically unusual due to a combination of other factors such as land surface change. Because the readership of the WMO reports includes people with expertise outside of the field of climate science there was considered to be a need to create NCMPs that are simple to understand and explain.

The BAMS State of the Climate report is another high-profile monitoring report produced each year by NOAA in collaboration with climate experts from around the world. The editors of the regional chapter have the job of distilling monitoring information from around the world into a coherent and useful account of the climate that year. They noted that the participation from around the world is not even. Some countries with stronger monitoring infrastructure are perhaps disproportionately represented in the report. A mechanism by which a wider range of countries could participate would provide a more rounded view of global climate. The regional chapter editors also highlighted the need for standardisation of products. They

provided a list of significant statistics which would help them to identify extreme events and to compare countries using a set of standard metrics. Unfortunately take up of the list was lower than hoped. If countries could provide a set of standard products then synthesising them would be an easier task providing a more cohesive and compelling account of global climate as it happens.

The GFCS highlights a number of routes by which the provision of climate services can be strengthened. They note for example the need to increase the temporal and spatial resolution of climate products over time reflecting the greater importance that extreme events have for a wide range of sectors. Kumar Kolli talked at the meeting about the plans for Global Seasonal Climate Updates (GSCU) a component of which involves describing the climate of the current season – implying a need for rapid production of monitoring data – alongside forecasts of the seasons ahead. Climate Watch Systems also need timely monitoring of events as they happen. These demands strengthen the need for near-real-time monitoring so that climate assessments can be carried out while the information is of greatest value to a wide range of users. Climate Watch Systems also require adequate historical data to help place current events in their long-term context.

At a more local level there is a need for efficient and effective communication of information. The data need to reach the right users whether they be in the agricultural, industrial, scientific or media sectors and the information needs to be comprehensible. This sets a premium on simple indicators where possible. For indicators which are somewhat more abstract than the tangible measurements that people are familiar with there will be need for guidance for interpretation. Some NCMPs might be turned, with a little ingenuity, into a range of secondary climate products which would help place events into context for a wider audience. A time series of temperatures can yield anomalies, which have the simple interpretation of warmer, or colder than average, but time series can also produce ranking information with 'the warmest year on record' clearly having instant and wide recognition as a significant event. Care must be taken however when applying rankings to records of different lengths – 10^{th} warmest year on record is interesting if the record spans 250 years, possibly less so if it spans 12. It was also noted that above and below average are loosely defined terms that are not used consistently and that guidance on these might be useful.

Climate data and the reporting of climate events are sensitive in many ways. Weather events can have large impacts on human welfare and the growing understanding that climate change can have impacts across a wide range of sectors mean that it is important that climate data sources should be reliable and consistent. Providing a standardised means for reporting national climate statistics could reduce the danger of inconsistent reporting of events. The data have economic value too. Many NMSs sell data to private companies in a range of sectors including energy, agriculture and insurance. The profits made from these activities are often used to expand, or maintain observing systems. This can place limits on the free dissemination of data, particularly high-temporal and spatial-resolution data. Derived products such as NCMPs or the indicies developed by the ETCCDI allow countries to protect the income from their data while participating in wider scientific exchanges.

There are a number of constraints that the team had to bear in mind when making its short list. The first was that of the disparity in observing network density and longevity. Long records are few and far between and many countries have very sparse observing networks, or have devoted resources to measuring variables that are locally of greatest importance. Precipitation, for example, is a more critical variable in the tropical regions than temperature so networks if rain gauges are often more closely space than networks of rain/temperature stations. NCMPs also need to deal with data that may be of varying quality with a possible mechanism for reporting this. NCMPs need to be relevant to large and small countries. A difficulty that small countries might face is homogenising station series with only a few

stations to work with. The ETCCDI via their workshops overcame this by providing the mechanism for nations to homogenise data by bringing together experts from neighbouring NMSs. Another constraint is that many countries use climate data to create profits that are fed back into improving, or maintaining infrastructure. Therefore it is not possible to demand that countries expose the underlying data. It is also important that appropriate recognition is given to countries that produce the data. Another constraint is that not all countries are equal in their ability to gather and process climate observations. This can be due to a combination of a lack of personnel, time or training. This means that in addition to guidance thought must also be given to whether additional training, or support (via software or contacts in other countries) is needed.

Although, there is value in creating a short list of NCMPs, a number of limitations to the concept must be acknowledged. The first is that a short list can hope to capture only a small subset of the wide range of climate variables and variability. Second, events that are important in one country might not affect another country at all – snow storms are rare in the tropics and tropical storms rare in the Arctic. Third, countries do not necessarily form a single coherent climatological entity. A large country may contain several climatologically distinct zones. Conversely, a single coherent climate zone might well span several smaller countries. Finally, by choosing indicators that apply in a wide range of climates, the specific character of weather with which the people in that country are familiar might be lost.

Short list of National Climate Monitoring Products

Based on the considerations given in the previous section, the following products were selected by the team. The team member responsible for drafting detailed guidance is given in brackets. All team members on drafting team will liaise to ensure consistency and resolve possible inconsistencies. The phrase “or WMO preferred alternative” refers to the anticipated report of the task team on climate normals (see section on Climate Normals).

1 Monthly area-average mean temperature time series (max+min)/2. Anomaly to be defined relative to 1971-2000. (or WMO preferred alternative) with the actual normal temperature for 71-00 included in metadata. Units degC. (Olga Bulygina)

2. Monthly area-average of total precipitation anomalies expressed as percentages. Anomalies to be defined relative to 71-00 period (or WMO preferred alternative). Units none (A. Watkins)

3. Monthly area-average of standardised precipitation index (SPI) calculated for each station. Standardisation will be to the 71-00 period (or WMO preferred alternative). Based on proposed ETCCDI index definition. Units none (D. Arndt).

4 Monthly area-averaged Percent of Time Tmax > 90th Percentile of Daily Maximum Temperature 71-00 period for standardisation (or WMO preferred alternative). Based on ETCCDI definitions. Units none (P. Booneeady).

5 Monthly area-averaged Percent of Time Tmin < 10th Percentile of Daily Minimum Temperature 71-00 period for standardisation (or WMO preferred alternative). Based on ETCCDI definitions. Units none (P. Booneeady).

6 Significant climate and weather event relevant to the area or region. This product consists of zero or a number of these events coded from a predefined table: cold snaps, heat waves, snow storms, dust storms, wind storms, sea level or heavy swell events, flooding, heavy

rainfall, volcanic ash. Referring to guidance from the WMO task team on the definition of extreme weather and climate events. (J. Kennedy, D. Arndt and A. Watkins with input from WMO Region VI monitoring).

This task team will work in collaboration with other task teams to define and produce these products.

Supporting Metadata

In addition to the data themselves, it was recommended that metadata be produced as well. Where WMO guidance concerning metadata exists the metadata should adhere as far as possible to these standards. Some elements of the metadata were considered of sufficient importance to be mandatory. Additional elements were considered of lesser importance, but would aid in the interpretation of the NCMPs. Items of metadata that were considered of use were:

Mandatory

1. Number of stations for each parameter.
2. Length of record
3. Normal period
4. Quality assurance. Indicator would be based on a list of recommended practices defined by the task team. This would flag whether the station series as a whole had undergone quality control, homogenisation etc.
5. Description of the methods used. For example the name and version of the software used to QC, homogenise and area-average the data.
6. Focal point within country for NCMPs.

Additional

7. List of stations used
8. Description of climate zones within a country, or a link to where this might be found
9. URL for NMS website for climate monitoring products including NCMPs.

Some of these items would be updated regularly, others would be relatively static, changing only if the underlying methods, or network changed either because new stations opened, instrumentation changed, or old data were digitised.

Rationale

A total of six NCMPs were proposed by the team. Some of the considerations that went into these decisions are given below.

The first two were chosen to have immediate and intuitive appeal. Mean temperature anomalies are widely used for monitoring at regional and global levels. It was proposed that the average actual mean temperature be reported in the station metadata because the

actual temperature is often considered to have more meaning than the anomaly. The second NCMP reports area-average total precipitation anomalies expressed as a percentage of normal. This was included as a counterpart to the mean temperature that is likewise easy to interpret.

The next three indicators – the SPI based index, and the percentage of warm days and percentage of cold nights indices – were chosen to be widely representative of more extreme events. These were based on indices which are part of the ETCCDI RCLIMDEX package. These were preferred to fixed-threshold indices as they are adapted to the local climate taking into account both absolute temperature and its variability. Extreme temperatures and precipitation are both of wide interest for climate monitoring and these indicators capture extreme events across a range of climate regimes and naturally account for a range of climate zones that are found within some countries.

The final NCMP proposed is a significant climate and weather event indicator. With a short list of national climate monitoring products it is not possible to capture the full range of climatically interesting events that occur around the world. This was proposed as a mechanism, similar in character to the significant weather indicator used in synoptic reports, by which countries could highlight climatically interesting events not covered in detail by the other indicators.

Climate Normals

It is recommended that 1971-2000 is an appropriate period to use for NCMPs for the time being. There is better coverage during this period (than, say, 1961-1990) and many countries are already using 1971-2000 for the NCMPs and other products they produce. Station data are more complete and relatively stable during this period and metadata are likely to be more complete. We recommend that this period should be updated every ten years, considering the decision of the WMO task team on climate normals.

1961-1990 is a standard normal period defined by the WMO as being useful for assessments of climate change, but the proposed NCMPs are designed for the needs of real-time climate monitoring for which a more up to date period is appropriate. The period 1981-2010 is less favoured as few countries have recalculated the normal for this period.

The team is aware that WMO guidance is being prepared on the subject of climate normals and that the requirements suggested by the task team on NCMP are only one of many considerations. We wish to align the NCMP normal period with the periods used in other products therefore we have deferred the decision on the precise period to choose until the WMO have produced more concrete guidelines.

It was noted that for some products, relatively simple guidance could be provided for users to shift the normal period to their preferred choice.

Software

The team felt that it would be helpful to develop software to produce the first five NCMPs. This recognises that guidance, no matter how carefully written, is generally open to a range of interpretations. If consistency is important then standardised software would provide that.

The provision of software in conjunction with guidance or training would help to build capacity in countries with less comprehensive monitoring capabilities.

Members of the team have worked with the software produced by ETCCDI for the production of climate extreme indices. The experiences with this software have been positive. Therefore it was considered that the ETCCDI software would be a good platform from which to build NCMPs thus providing consistency across a wider range of indices and avoiding the need to write and test code from scratch. The ETCCDI code has been built to be flexible to allow redefinition of the thresholds and other parameters. ETCCDI also provide software for Quality Controlling and homogenising station data which are both considered important elements of a climate data set. If it will be possible to retool the code to produce NCMPs needs to be assessed in liaison with ETCCDI.

The NCMPs were chosen with this in mind and a number are based on ETCCDI defined indicators. By aligning the NCMPs chosen by the team with the ETCCDI, the natural choice for software languages would be those used by ETCCDI: the statistical scripting language R and FORTAN. R is preferred.

The provision of training was recommended to follow the model of ETCCDI and CLIMAT workshops organised by GCOS and CBS and design appropriate workshops (Action: Mesut Demircan and Secretatriat) for these kinds of NCMPs possibly organised under the RCC mandate. This would include: training in the software; guidance on how to disseminate the NCMPs on a monthly basis; and also to motivate the need to provide regular and timely updates. These would supplement the written guidance, on-line instructions and possibly the use of e-learning portals (following the example of e-SIAC http://www.reading.ac.uk/ssc/n/esiac.htm).

A number of points were highlighted to follow up after the meeting

1. Andrew contacted Lisa Alexander of ETCCDI to check the practicality of harmonising our software with theirs. Need to follow this up ACTION for co-chairs.

2. The ETCCDI software does not aggregate station data to a national level. Mesut Demircan, Mohammad Semawi, Deke Arndt and Andrew Watkins to forward information on systems for analysing spatial data as used in their institutions to the team. A more exhaustive literature review to be carried out to recommend a simple means of creating area-averages from point data. ETCCDI are also working on this, so we need to contact them too.

3. Deke has Perl software to calculate SPI which he is happy to share and will work with whoever runs the coding.

4. John Kennedy to contact Steve Palmer and Roger Stern and Ian Dale at Reading University to find out more about the provision of e-learning.

Guidance

Specific, detailed guidance still needs to be written for each of the six recommended products and their metadata. These will need to be followed up after the meeting based on input from ETCCDI, and the literature review. Writing guidance should be started as soon as possible and there are specific actions on team members to start writing that guidance.

Some aspects can be completed immediately and later guidance can be provided through the CCl guide for climatological practices.

There is a balance between increasing the number of stations for improving the accuracy and representiveness of NCMPs whilst maintaining the quality of individual station records. The team recommends that stations used adhere to WMO standards for station siting. The team also encourages countries to develop national climate networks to supplement RBCN and GSN networks. Countries are further encouraged to provide a catalogue of these stations for WMO publication.

The team discussed the need to standardise terms used to describe the data. For example, it is common to refer to a temperature as being above normal if it is in the upper tercile, but it is also common to refer to a temperature as being above normal if its anomaly is positive. It is somewhat outside of our terms of reference to define standard language and this ought to be left to the discretion of the users. The team will provide guidance on how the NCMPs might be interpreted in terms used by key users, for example converting the SPI index into tercile or other class categories.

The languages used to describe data and provide the metadata was also discussed. It was suggested that when additional information on the NMS website is provided in the nation's language, it is encouraged that for the international exchange of information it should also be provided in one of the WMO official languages, preferably English.

Formats, reporting and reporting mechanisms

One of the difficulties encountered in gathering an inventory of existing products was finding suitable contacts within (NMS). The great value of making personal contacts was highlighted by a number of team members. The team recommended the creation of an official list of focal points for climate monitoring within each country. These focal points would be designated by the PRs of the countries (considering existing regional and global focal point networks for climate monitoring). Such a network could be used to efficiently manage communication between the NCMP producers and their users.

It was suggested that a short survey be sent to focal points (once established) to assess current monitoring capabilities. Action: Ladislaus Chang'a to put together survey for later dissemination to national focal points through the WMO.

The task team would develop the terms of reference for these focal points. Bearing in mind that extensive networks, both formal and informal already exist, the team will assemble a list of known contact points which could be sent along with the request to PRs. Deke Arndt to provide a list of reliable monitoring focal points within countries based on experience with BAMS and other NOAA Climate Monitoring work. Peer Hechler will provide a list of RAVI contacts. Task team chairs will contact other WMO region leads.

The team would encourage countries to expose the NCMPs and metadata via their own websites and to keep those up to date.

The format envisaged for the dissemination of NCMPs involves two components. The first is for the storage and transmission of the whole series, the second for the transmission of regular updates. These need not be more elaborate than simple text messages, and the

updates could follow a similar model to CLIMAT messages, containing a succinct summary of the 6 NCMP values and attendant metadata, for example the number of stations. We would need to define a code table or template for NCMP 6 on significant climate and weather events in discussion with CBS. CBS can also advise on metadata creation, registry and transmission (Action- Mohammad Semawi and Omar Baddour to investigate the mechanisms within CBS and report back to the team). Task team to nominate focal point to liaise with CBS Expert team on data representation and codes. Contact co chairs to select focal points to attend the meeting.

Two mechanisms of dissemination were discussed.

1. RCCs will collect information from individual countries, collate the information and pass it on to global collecting centres as well as transmitting it back to NMSs to encourage participation. WIS infrastructure at global regional and national level will be the means for dissemination and discovery of NCMPs (WIS infrastructure including GISCS and DCPC and RCCs).

2. A report for NCMPs similar to a CLIMAT report would be a succinct way to transmit the NCMP updates and attendant metadata. The format would also need to allow for updates to the whole series of monthly values where station networks were improved or large changes to the series were implemented e.g by homogenisation. This would need to be raised with the CBS and any format would need to be defined in liaison with them. This would provide a possible formal mechanism for reporting on the regularity of data dissemination comparable to current CLIMAT report monitoring and allow a timeliness constraint to be applied. For CLIMAT messages this is 8 days, but a plausible latency will need to be assessed for NCMPs once the processing overhead is known.

The world data centres are a natural final home for the updated series, as WMO has no mechanism for long term storage. Deke Arndt offered to inform the world data centre at NCDC of this as they may have formatting and archival mechanisms that need to be taken into account.

Capacity Building

The team suggested to add to the role of the RCCs (and other existing WMO mechanism) to facilitate in organising workshops for training climate experts from the NMS in the production of the NCMPs, the use of any software developed and in the use and dissemination of the NCMPs. As mentioned above the design of a suitable workshop format has been tasked to Mesut Demircan and the WMO secretariat. Further provision for providing e-learning options will also be explored as well as detailed guidance notes.

Using satellite and reanalysis data in the generation of NCMPs.

Reanalysis and satellite data both provide a means to monitor the climate in a consistent way at all scales. However, reanalyses are still not proven as a reliable means for regular climate monitoring, although they are continually improving. Furthermore, reliance on

reanalysis data could undermine efforts to improve the in situ networks that are essential – among many other uses – for providing validation data used to assess the quality of reanalyses. The position of the team was that the NCMPs ought to be derived from station measurements made within a country.

In the initial documentation the team was asked to consider the future use of satellite data for climate monitoring. Prithiviraj Booneeady attended a meeting of the Satellite Applications Facility for Climate Monitoring in 2010 and presented the work to the team. Although the CM-SAF monitors variables that would be appropriate for NCMPs – Raj showed an example of solar irradiance for Mauritius – the data are not produce quickly enough to meet the user needs for NCMPs. For climate quality CM-SAF products the latency is between 2 and 3 years. In the future the latency will be reduced and the team notes that because satellite data must be used in conjunction with surface networks for calibration and validation it does not undermine attempts to improve surface networks to the same extent as reanalyses.

Other business

The original plan was for the task team to complete its work within a short period and then dissolve. Hama Kontongomde noted that the work of the team may need to be extended however, there is still much work to do within the original terms of reference.

Presentations from the meeting, this report and Olga Bulygina's updated list of Region II NCMPs will be placed on the team website:

(http://www.metoffice.gov.uk/hadobs/opace2_tt_ncmp/)

Dependencies

The proposed process for creating NCMPs relies on many elements of existing WMO structure and infrastructure. For clarity these are listed here:

WIS and CBS: the proposed code for disseminating NCMPs will need to be developed in liaison with the Commission for Basic Systems.

ETCCDI: because the definitions of the NCMPs use ETCCDI definitions and it is proposed that the software be harmonised with the ETCCDI RClimDex packages, the task team will need to work with ETCCDI, particularly the team led by Xiaolin Wang and Xueben Zhange on software.

RCC and GCC: Regional Climate Centres and Global Collecting Centres will be the means by which information will be transmitted and training will be provided.

World Data Centre: long-term archival of NCMPs would be the responsibility of the world data centres. NCMPs will need to conform to WDC standards. Deke Arndt will raise this with the US WDC

Users of the data include NMSs, WMO annual statements on global climate and regional statements, BAMS State of the Climate report, GSCU, CWS and other processes within the GFCS.

Actions

JK and **LC** to contact CBS to establish a focal point to attend meeting of CBS.

OB to draft detailed guidance for NCMP 1 (Mean temp)

AW to draft detailed guidance from NCMP 2 (Total precip percentage)

DA to draft detailed guidance for NCMP 3 (SPI)

RB to draft detailed guidance for NCMP 4 and 5 (Warm days, Cold nights)

JK, DA, AW to draft detailed guidance for NCMP 6 (Significant Climate Event)

OB, AW, DA, RB to cooperate on production of detailed guidance

LC and **RB** to draft short survey of current climate monitoring capabilities to be sent to NMSs

DA to talk to world data centre and feedback world data centre guidelines to the team.

MS and **OB(WMO)** to investigate the mechanisms within CBS for metadata definition and dissemination and report back to the team

DA to provide list of reliable monitoring focal points within countries.

PH will provide list of RAVI contacts.

JK and **LC** to contact other WMO region leads (I, II, III, IV, V).

JK and **LC** to follow up on Andrew Watkins email to Lisa Alexander of ETCCDI to check the practicality of harmonising our software with theirs including the question of area-averaging.

MD, MS, DA and **AW** to forward to the team information on systems for aggregating spatial data to a representative area-average as used in their institutions. A more exhaustive literature review to be carried out to recommend a simple means of creating area-averages from point data.

JK to contact Steve Palmer and Roger Stern and Ian Dale at Reading University to find out more about the provision of e-learning.

MD and WMO Secretariat to provide skeleton design for training workshops.

Acronyms

BAMS: Bulletin of the American Meteorological Society. They publish the annual State of the Climate report. (http://www.ncdc.noaa.gov/bams-state-of-the-climate/)

Capacity-building (http://www.wmo.int/pages/themes/cbuilding/index_en.html)

CBS: Commission for Basic Systems (http://www.wmo.int/pages/prog/www/BAS/CBS-info.html)

CCl: WMO Commission for Climatology:
(http://www.wmo.int/pages/prog/wcp/ccl/index_en.html)

CLIMAT: A type of coded message used to transmit monthly summaries of climate data over the Global Telecommunication System.

CM-SAF: The Satellite Application Facility on Climate Monitoring (http://www.cmsaf.eu/bvbw/appmanager/bvbw/cmsafInternet).
CWS: Climate Watch Systems (http://www.wmo.int/pages/prog/wcp/wcdmp/CWS_3.php)
DCPC: Data Collection or Production Centre (http://www.wmo.int/pages/prog/www/WIS/centres_en.html)

ETCCDI: Expert Team on Climate Change Detection and Indices (http://www.clivar.org/organization/etccdi/etccdi.php)

GCOS: Global Climate Observing System (http://www.wmo.int/pages/prog/gcos/index.php?name=AboutGCOS)

GFCS: Global Framework for Climate Services (http://www.wmo.int/hlt-gfcs/)

GISC: Global Information System Centres (http://www.wmo.int/pages/prog/www/WIS/centres_en.html)

GSCU: Global Seasonal Climate Updates (http://www.wmo.int/pages/prog/wcp/wcasp/GSCU.html)

GSN: Global Surface Network

NOAA: National Oceanic and Atmospheric Administration (http://www.noaa.gov/)

NCMP: National Climate Monitoring Products

NMS: National Meteorological or Hydrometeorological Service

OPACE: Open Panel of CCl Experts: (http://www.wmo.int/pages/prog/wcp/ccl/cclxvStructure.html) OPACE-2 is Climate Monitoring and Assessment.

QA: Quality Assurance

QC: Quality control

PR: Principal Representative

R: An open-source programming language widely used by the statistics community

RA VI: WMO Regional Association VI covers Europe and the Middle East.

RBCN: Regional Basic Climate Network

RCC: WMO Regional Climate Centre

RCLIMDEX: Software written in the R programming language by the ETCCDI to calculate climate indices

SIAC: Statistics in Applied Climatology (http://www.reading.ac.uk/ssc/n/esiac.htm)

SPI: Standardised Precipitation Index

URL: Uniform Resource Locator often referred to as a web address

WCDMP: (http://www.wmo.int/pages/prog/wcp/wcdmp/index_en.php)

WMO CSM: WMO Climate System Monitoring

(http://www.wmo.int/pages/prog/wcp/wcdmp/CA_1.php)

WDC: World Data Centre

WIS: WMO Information System (http://www.wmo.int/pages/prog/www/WIS/centres_en.html)

WMO: World Meteorological Organisation (http://www.wmo.int)

Acronyms of members' names

JK: John Kennedy

LC: Ladislau Chang'a

AW: Andrew Watkins

DA: Deke Arndt

RB: Raj Bonneady

MD: Mesut Demircan

OB: Olga Bulgyna

MS: Mohammed Semawi

Acronyms of WMO staff

OB(WMO): Omar Baddour

PH : Peer Helcher