CLIMATE NORMALS

(Omar Baddour)

Annex I: Discussion paper by William Wright (attached), WMO technical regulations WMO No 49)

Annex II: Compilation of relevant WMO technical regulations and recommended practices

10.1 CCl-MG reviewed the discussion paper developed by William Wright on the revision of the climatological standard normals. CCl-MG noted that these standard normals were published formally by WMO in the past (CLINO 1961-1990 WMO No 847, and CLINO1931-1960, WMO No 117). The CLINO publication is listed as a WMO mandatory publication (Annex to Resolution 21 (Cg-XIII))

10.2 In his paper, Wright argued in favour of a dual normals standard. CCl-MG concurred with the conclusion that there is a need for making frequent updates in computing the normals for climate applications (prediction and climatology purposes), based on the need to base fundamental planning decisions on average and extreme climate conditions in non stationary climate conditions. Under this model, a set of 30 year Normals updated every 10 years is proposed. For example, 1981-2010 becomes the current base-period, until 2021, when 1991-2020 will become the new base period, and in 2031, that 2001-2030 become the base period and so on;

10.3 CCl-MG concurred also on the need for keeping the current 30 year updates of the climatological standard normals as a recommended practice for long term climate assessment, i.e retain 1961-90 as the reference period until 2021, when 1991-2020 will become the new base period;

10.4 CCl-MG also noted the recommendation of the Task Team on National Climate Monitoring products which recommended that 1971-2000 is an appropriate period to use for NCMPs for the time being. The TT-NCMP noted that 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. TT-NCMP recommended that this period should be updated every ten years, considering the decision of the CCl task team on climate normals. For the time being the TT-NCMP recommends that the period 1981-2010 is less favoured as few countries have recalculated the normal for this period.

CCL- MG DECISIONS

Scenario A: (Amending WMO technical regulations)

10.5 MG endorsed the concept of dual standard normal and the proposed (30/10) model for its computation and decided:

a- Develop a peer reviewed technical document (which will be reviewed by other stakeholders, groups, commissions and programs). The technical document should be based on William Wright's discussion paper as well as on Blair Trewin's (2007) paper *The role of climatological normals in a changing climate*. World Climate Data and Monitoring Program No. 61, WMO-TD No 1377. 46pp);

b- Submit the peer-reviewed document for endorsement by the Commission at its sixteenth session (CCl-XVI). The new concept should be reflected afterwards in the CCl guide to Climatological practices which will need to be updated accordingly; - After the above two steps are accomplished, The WMO technical regulations (WMO-No49, Vol I) should be amended to reflect the new definitions of WMO dual standard normals. The amendment should be formally decided by CG-XVII in 2015.

Benefit: *WMO Technical regulations are the best mechanism for providing standards and recommending practices. It is endorsed by Congress and have the status of regulations not only guidelines. Disadvantage: it is a long process for updating the Technical regulations as it should be endorsed by CCl session and CG.*

Scenario B (Provision of guidance)

10.6 MG endorsed the concept of the dual approach for computing climate Normals and decided the following:

a- Finalize William's paper and publish it as a WMO technical document as in A.1. The document will guide the members on the two models for computing the normals i.e, reflecting the need for using 10 year cycle updates of the normals (*without calling them standard normals*) which would be useful for climate applications; and the need for keeping the 30 years update cycle for the Standard Normals as a requirement long term climate variability and climate change monitoring.

b- In order to communicate formally this guidance to the Members, there should be a decision at the next EC session which will be communicated formally through WMO official channels. The new normals 1981-2010 can be computed by all members by 2013 and be effective starting January 2013.

Benefit: *Quick implementation and keep the technical regulation unchanged. Disadvantage: Not being part of the technical regulation, the guidance can be forgotten with time. Also other institutions beyond WMO might not be aware of the guidance.*

Scenario C (Hybrid)

10.7 Do B while working on A in view of amending the technical regulation through CCl-XVI and CG-XVII in 2014 and 2015 (resp.)

Comment: *This is desirable in view of fact that MG feels the urgency of providing preliminary guidance with in view to introducing the new normals 1981-2010 in January 2013 for example.*

Common decision to the three scenarios:

10.8 CCl MG decided that CCl should engage consultations with other technical commissions and programs on the implications of the new definitions in the generation, coding and dissemination of climate data in particular CLIMAT and CLIMAT SHIP reports and any other relevant products that uses the WMO definition of the Normals. This would ensure a common understanding of the new approach among the stakeholders and the Members.

ANNEX I

Discussion paper on the calculation of the Climate normals a proposal for a dual system

(William Wright)

Introduction and need for change:

The Standard Climate Normals underpin many climate services and applications, including climatologies, and also comprise the reference period for the evaluation of anomalies in climate variability and change monitoring. The current method for calculation of these Normals is to average station data over a 30 year period, and update the Normals every 30 years. This might be referred to as the "30/30 model". The current Standard Normals period is 1961-90, and under current methodology, the next update will be in 2021, when the 1991-2020 period will become the new standard.

The question arises about the representativeness of a period such as 1961-90 after 15, 20, 25 years in a non-stationary climate. Many climate applications need to base fundamental planning decisions on average and extreme climate conditions, and it is plain that, for instance, an orchardist in 2015 trying to assess whether the climatic conditions in a region suit a particular variety of fruit, is not going to be receiving optimal guidance from 1961-90 Normals. At the same time, a set of Climate Normals that is stable over a long period is still required to anchor time-series of temperature, rainfall etc for climate monitoring purposes. Recognising these differing needs, the Commission for Climatology (CCl) wishes to propose the adoption of a dual system of normals, as described below. In so doing, the CCl recognises that such a change to long-standing practice may result in considerable extra work for some NMHSs in amending products, and the possibility of other unintended consequences arising. For these reasons, we invite comment on the proposal from climate services and other Technical Commissions.

The proposal:

The CCl proposes that the standard period of climatological normals be redefined as a dual standard:

1. Retain the 30/30 model, i.e., a base period of 30 year normals, updated every 30 years, i.e retain 1961-90 as the base period until 2021, when 1991-2020 will become the new base period; AND

2. Define a "rolling" set of 30 year Normals updated every 10 years (hereafter the 30/10 model), such that 1981-2010 becomes the current base-period, until 2021, when 1991-2020 will become the new base period, and in 2031, that 2001-2030 become the base period.

Other considerations:

Trewin (2007)[1] conducted an in-depth analysis of the representativeness of climate Normals, and concluded among other things that for many purposes and variables shorter periods, based on as few as 10-15 years of data, could be used. This might enable Normals to be calculated for more stations than would be the case with a 30 year Normal. However it was felt that a

[1] Trewin, B (2007): The role of climatological normals in a changing climate. World Climate Data and Monitoring Program No 61, WMO-TD No 1377. 46pp

consistent standard should apply for all variables, and that rainfall, at least, required at least 30 years of data to establish a reasonably stable average.

Arguments for the dual 30/10 and 30/30 models:

Considerations for and against the above proposal are summarised in Attachment 1.

The process:

1. Consent for, and comment on, the above proposal is to be sought from all Technical Commission (and… representative user Groups? Regional Associations?)

2. Should there be general agreement for the proposal, the CCl would draft a proposed revision of the calculation method for approval at the next WMO Executive Council?

The Case for changing the methodology:

1. The use of more up-to-date Normals under the 30/10 model provides a more realistic base period for climate services. For instance, design standards and climatologies would be based on a more representative standard that better reflects possible changes in climate. By contrast, basing design standards etc on climate Normals that are up to 30 years out of date might raise significant credibility problems with the users of services and products ("can't we get more recent data than this?")

2. The latter point is accentuated if we consider the possibility that, under a changing climate, some kind of tipping point could be passed, leading to a large and sudden change in one or more fundamental climate variables. Such tipping point changes have arguably already occurred (e.g., sudden rainfall drops in Southwestern Australia and more recently, in Southeastern Australia).

3. Some NMHSs already employ a 30/10 model, for instance NCDC in the United States. Australia is likely soon to adopt this model.

4. More common updates mitigate the effects of technological change. For instance, the period 1961-90 averages were based largely on conventional observations, whereas by 1981-2010 (or 1991-2020), many observational systems were largely automated, and the former period corresponds roughly with the widespread adoption of satellite products. Thus comparisons of averages between periods (useful for some purposes) might reflect at least partially technological change as well as actual climatic differences.

5. Similarly, a number of new products, including satellite products, have been introduced since 1981, hence the 1981-2010 period is the first opportunity to present normals for these products.

6. Adopting the dual standard, so that one version of the Normals is kept constant for a lengthy period (the 30/30 model), provides the stability needed for referencing climate variability and change. To do otherwise would make the problem of communicating climate variability and change to the public harder. If we replaced the 1961-90 base period for climate anomalies with the warmer 1981-2010 standard, and continued to do this every ten years, the appearance of time-series would keep fluctuating, making it harder to demonstrate, for instance, a warming trend. In particular, at the current time global debate and negotiations on climate change mitigation and adaptation are at a sensitive stage: many climate change scientists believe that failure to take immediate action could lead to irreversible, dangerous climate change. If only the 1981-2010 standard were adopted, time-series would suddenly start to show negative anomalies in some years, whereas previously anomalies were nearly all positive. This would make it

harder to demonstrate a warming trend. Although an illusion, countering this illusion in the face of organised climate change scepticism would be a major communication challenge for NMHSs the world over, as well as for the IPCC and related bodies.

7. Modern technologies such as enhanced computing capability and increasingly, modernised database systems (e.g., CCl's initiative of implementing Climate Database Management Systems) make it much easier to update Normals than previously.

The case against changing the methodology:

1. Some NMHSs would face large increases in workload to revise products and services currently based on the 1961-90 period. Knowing that the base period will need to be updated in 2020 is a very different proposition to having to update within perhaps the next two to three years, and then (depending on what base period model is selected) having to face regular updates thereafter. This problem might be mitigated if, for instance, WMO provided software to regularly update normals (based on agreed common standards with regard to, e.g., missing data), which may be possible with CDMS. Alternatively, the normals could be calculated centrally by global agencies such as NCDC.

2. There is a risk that more frequent changes of normals could lead to instability, with climate-linked design standards, for instance, varying too much between update periods.

3. The use of two standards raises the prospect of confusion and perhaps the inappropriate use of Normals for specific purposes. A communication strategy for NMHSs would be needed.

ANNEX II

WMO technical regulations and recommended practices relevant to computing, coding and disseminating Normals

Compiled by the secretariat

Definitions (WMO, Technical Regulations WMO No 49 Vol. I)

Period averages. Averages of climatological data computed for any period of at least ten years starting on 1 January of a year ending with the digit 1.

Normals: Period averages computed for a uniform and relatively long period comprising at least three consecutive ten-year periods.

Climatological standard normals. Averages of climatological data computed for the following consecutive periods of 30 years: 1 January 1901 to 31 December 1930, 1 January 1931 to 31 December 1960, etc.
N O T E: When data are not continuous, adjusted normals may be computed.

Distribution of Climate data (CLIMAT reports) (WMO, Technical Regulations WMO No 49 Vol. I

Each Member **shall** arrange for the distribution of the climatological data for a selection of its stations, in accordance with the provisions of Annex II *(Manual on Codes* (Publication No. 306)) and Annex III (Manual on the Global Telecommunication System (Publication No. 386)). The data shall be available as soon as possible after the end of the month.

Normals in the WMO Manual on Code (WMO No306)

FM 71–XII CLIMAT Report of monthly values from a land station

The CLIMAT code form consists of five sections:

0 — Code name and groups MMJJJ IIiii

1 111 Monthly data of the month referred to in MMJJJ including number of days missing from the records. This section is mandatory

2 222 Monthly normals corresponding to the month referred to in MMJJJ including number of years missing from the calculation

3 333 Number of days in the month with parameters beyond certain thresholds during the month referred to in MMJJJ

4 444 Extreme values during the month referred to in MMJJJ and occurrence of thunderstorms and hail

71.4.1 Meteorological Services **shall submit** to the Secretariat, for distribution to the Members, **complete normal data** of the elements for stations to be included in CLIMAT bulletins. CLIMAT reports for the two months following the submission of such complete normal data to the Secretariat shall include the normals for the months in question, in the form given in Section 2.

The same procedure shall be followed when Services consider it necessary to make amendments to previously published normal values.

Note: When normal data are included in the bulletins, the number of stations per bulletin may be reduced if necessary.

71.4.2 The normal data reported shall be deduced from observations made over a specific period defined by *Technical Regulations*.

Note: Section 2 of the code supplies the means to specify the start and finish years, and those years missing from the calculations where it is not possible to supply data for the full recommended period.

Recommended practices Guide to climatological practices (WMO No 100, 2011 edition

Where climatological standard normals are used as a reference, there are no clear advantages to updating the normals frequently unless an update provides normals for a significantly greater number of stations. Frequent updating carries the disadvantage that it requires recalculation not only of the normals themselves, but also numerous datasets that use the normals as a reference.

Secular trends reduce the representativeness of historical data as a descriptor of the current or likely future, climate at a given location. Furthermore, the existence of multidecadal variability in the climate system causes differences in climate normals from one reference period to the next such that the representativeness of any given normal for the present climate is reduced.

For predictive uses, NMHSs are encouraged to prepare averages and period averages. The optimal length of record for predictive use of normals varies with element, geography and secular trend. In general, the most recent 5- to 10-year period of record has as much predictive value as a 30-year record. Shorter reference periods allow normals to be calculated for a much wider range of stations than is usually possible for a standard normals reference period. For elements that show a substantial underlying trend (such as mean temperature), predictive accuracy is improved by updating the averages and period averages frequently.