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| WORLD METEOROLOGICAL ORGANIZATIONCOMMISSION FOR BASIC SYSTEMS-----------------------------FIRST MEETING OF INTER-PROGRAMME EXPERT TEAM ONDATA REPRESENTATION MAINTENANCE AND MONITORINGTOKYO, JAPAN, 1 - 5 JULY 2013 |  | IPET-DRMM-I / Doc. 3.2 (5)(14.VI.2013)-------------------------ITEM 3.2ENGLISH ONLY |

**Daily Climate Observations via Monthly CLIMAT Messages**

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**Summary and Purpose of Document**

For many measures of climate extremes, monthly CLIMAT data are insufficient and daily summaries provided via SYNOP messages are also insufficient. There is a need for a Daily CLIMAT message; not just for timeliness, but principally for data that is compatible with long historic daily series developed and made available by NMSs. ICT-IOS recommended in 2012 that daily climate observations be included in monthly CLIMAT messages as a means of addressing the gap in climate quality daily observations. The purpose of this document is to provide an update of this issue and progress with future plans. Input from IPET-DRMM on this activity and issues associated with implementation and reporting requirements would be very valuable. NOAA/NCDC in cooperation with IPET-DRMM members and NOAA/NCEP are working on developing an implementation of this via BUFR formatted messages. Software development is expected to be completed in June 2013 to be followed by a period of validation.

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**ACTION PROPOSED**

The meeting is invited to take note of this activity and provide any suggestions for improvement or collaboration with other organizations.

##### DISCUSSION

##### Daily Climate Observation Problem:Development of the principal measure of the state of the climate – the global temperature record - has extensively depended on monthly CLIMAT data provided by NMSs. Over the last 20 years there has been a growing demand for indices and measures of the climate that also consider extremes (Jones et al. 2012). For many extreme measures, monthly CLIMAT data are insufficient and there is a need for a Daily CLIMAT message. This need is not just for timeliness, but principally for data that is compatible with long historic daily series developed and made available by NMSs.

##### Attempts have been made to use SYNOP data for this purpose (e.g. by the European Climate Assessment and Dataset, ECA&D) but there are serious issues of incompatibility of SYNOP data with traditional methods of climate measurement within NMSs (see van den Besselaar et al., 2012). The most notable issue of incompatibility is associated with the way that daily maximum and minimum temperature are measured. Principally this is due to the fact that climate observations reflect the maximum and minimum temperatures measured over the previous 24-hour period, while daily summaries provided via SYNOP messages do not.

##### Daily summaries in SYNOP messages are based on measurements that occur between synoptic reporting times and often over a period less than 24-hours. For instance in Europe minimum temperatures are recorded over the first 12-hour period and maximum temperatures during the next 12-hour period. Measured in this way, the true daily minimum and maximum temperatures are often not reported because they occur outside those 12-hour periods. As a result SYNOP reports have been shown to significantly underestimate extremes. Minimum temperatures measured in this way are often higher than the true daily minimum temperature. Similarly, maximum temperatures reported via SYNOP messages are often lower than the true daily maximum temperature reported as 24-hour climate observation. Similar problems occur for precipitation. As a result, when SYNOP data are used to extend climate series, spurious trends can result. In other regions of the world SYNOP reporting practices can differ but problems remain. In the U.S., for example, the daily maximum and minimum temperature are reported during the 24-hour period ending at 00 UTC while a true climate observation is reported as a midnight-to-midnight local observation.

##### Solution: While retaining SYNOP reporting (or its equivalent) for users who will continue to require max/min temps and total precipitation summarized according to the synoptic hours, proceed with the development of daily climate observations that are consistent with national climate databases for daily maximum temperature, daily minimum temperature, precipitation, total snowfall, and daily snow depth. Each of these observations should be taken at the observing time consistent with the climate reporting practices of the NMS and reflect conditions over the previous 24 hour period. The climate convention varies from country to country so the desire would be for each country to retain its traditional observing practice in reporting daily climate summaries. For example, while the U.S. is local midnight, Australia is 9 am local, Canada is 06 UTC. These observations can be efficiently provided via daily CLIMAT messages or other methods specifically designed for climate purposes.

**Path Forward:** NOAA/NCDC in cooperation with IPET-DRMM and NOAA/NCEP has begun developing an implementation to address this need via BUFR formatted messages. A draft of a BUFR template incorporating the new daily climate elements has been created. This template will provide the ability for NMHCs to provide up to 31 daily observations for the following elements.

* Time of Observation for Temperature
* Daily Maximum Temperature
* Daily Minimum Temperature
* Daily Mean Temperature (if it differs from max+min/2)
* Time of Observation for Precipitation
* Total Daily Precipitation
* Depth of New Snowfall
* Depth of Total Snow on the Ground

The proposed template is as follows. The first descriptor is taken from document B/C 30 on the WMO MTDCF web site. The remaining descriptors were then added to provide reporting capability for the (up to) 31 daily observations as noted above.

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| 3-07-073 | Sequence for representation of monthly values suitable for CLIMAT data |
| 1-17-000 | Delayed replication of 17 descriptors |
| 0-31-001 | Number of replications - set to a value corresponding to the number of days in the month for which data are being reported |
| 0-04-001 | Year |
| 0-04-002 | Month |
| 0-04-003 | Day |
| 0-04-004 | Hour |
| 0-04-024 | Time period - set to a value of 24 to indicate the period beginning at the specified time and ending 24 hours later |
| 0-07-032 | Height of sensor (thermometer) above local ground |
| 0-08-023 | First-order statistics - set to a value of 2 to indicate maximum value |
| 0-12-101 | Temperature (maximum) |
| 0-08-023 | First-order statistics - set to a value of 3 to indicate minimum value |
| 0-12-101 | Temperature (minimum) |
| 0-08-023 | First-order statistics - set to a value of 4 to indicate mean value |
| 0-12-101 | Temperature (mean) |
| 0-08-023 | First-order statistics - set to “missing” to cancel |
| 0-07-032 | Height of sensor (rain gauge) above local ground |
| 0-13-060 | Total accumulated precipitation |
| 0-13-012 | Depth of fresh snow |
| 0-13-013 | Total snow depth |

By the nature of the BUFR format and the large number of observations that will be reported each month, the level of complexity and technical sophistication needed by each NMHS will be high. Initially the quality of observations may suffer due to the complexity. A program of training will be required if this is to be successful. Consideration also needs to be given to whether a requirement should be developed for compulsory reporting of daily climate observations while asking that each host country use methods consistent with their country’s climatological practices.

Software development is expected to be completed in June 2013 to be followed by a period of validation. Subsequent validation will be conducted by NCDC, NCEP, and others who may potentially be interested.

##### References

##### Jones, P.D., Lister, D.H., Osborn, T.J., Harpham, C., Salmon, M., Morice, C.P. 2012: Hemispheric and large-scale land surface air temperature variations: An extensive revision and an update to 2010. J. Geophys. Res. 117, D05127, doi:10.1029/2011JD017139.

##### van den Besselaar, E.J.M. Klein Tank, A.M.G, van der Schrier, G. and Jones, P.D., 2012: Synoptic messages to extend climate data records. Journal of Geophysical Research, 117, D07101, doi:10.1029/2011JD1688.