**WMO recognition of centennial observing stations**

Concept paper for submission to ICG-WIGOS IV, 17-20 February 2015

**Introduction**

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5 WGI) confirms that it is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century. The evidence for this has grown, thanks to more and better observations, an improved understanding of the climate system response and climate models.

Long-term observations and in particular those from observing stations that provide continuous data for 100 years or more (centennial observing stations) are crucial for documenting and analysing long-term variations of the Earth’ climate on multi-decadal to centennial timescale, thereby providing useful input to relevant climate research and services, and beyond.

WMO and its Members have an interest in protecting well-sited long-term observing stations, including centennial observing stations, with good quality time series of meteorological parameters. It is noted, however, that some of these observing stations may be at risk due to significant changes in the surrounding environment (e.g. artificial structures) or due to enforced closure or relocation as a result of competing societal interests.

A WMO recognition mechanism is expected to raise the profile of long-term observing stations and specifically centennial observing stations, and contribute to Members’ efforts to maintain such stations under the most preferable conditions. Moreover, the recognition mechanism will greatly promote the application of the CIMO Site Classification.

**Background and references**

Sixty-five Members responded to a ***WMO survey on centennial observing stations*** in preparation for the first extraordinary World Meteorological Congress in 2012 and reported – in the absence of any criteria - 11000 observing sites that had been open for more than 100 years.

***WMO Executive Council*** at its sixty-fifth session requested the Commission for Climatology (CCl) jointly with the Global Climate Observing System (GCOS) programme and the Commission for Instruments and Methods of Observations (CIMO) to investigate site certification mechanisms, network criteria and monitoring principles and to set-up an appropriate WMO mechanism for the recognition of centennial observing stations based on a minimum set of objective assessment criteria.

***Two experts***, Dr Ingeborg Auer, ZAMG, Austria and Mr Michel Leroy, Météo-France, France ***visited the WMO Secretariat*** in November 2013 and developed draft recognition criteria from climatological and instrumentation perspectives.

***A WMO scoping meeting on a potential WMO recognition mechanism for centennial observing stations*** was organised on 11-13 June 2014 at WMO Headquarters, Geneva, Switzerland. Experts from Member countries, CCl, the Commission for Basic Systems (CBS), CIMO, GCOS, the WMO Integrated Observing System (WIGOS) and the WMO Secretariat discussed the issue, consolidated the above mentioned criteria and proposed a mechanism for the recognition of centennial observing stations (meeting report cf. http://www.wmo.int/pages/prog/wcp/wcdmp/COS.php).

CCl, CIMO and CBS subsequently agreed to further support the recognition of centennial observing stations initiative; cf. paragraph 10.2 (***CCl-XVI***); doc 7(8) with Recommendation 7(8)/1 (***CIMO-XVI***) and paragraph 3.1(1).30 ***(CBS-Ext.(2014)***.

**Test cases**

Participants in the above mentioned scoping meeting agreed to test the draft recognition criteria. Relevant exercises were performed within Aemet, Spain; DNM, Guinea; Hong Kong Observatory (HKO), Hong Kong, China; Météo-France (MF), France; National Weather Services (NWS), USA and ZAMG, Austria. A relevant template was proposed by Dr T. C. Lee, HKO, and used in most cases (cf Attachment 2 of the Annex). It can be concluded that the overall performance of the draft criteria was considered to be appropriate; further details see table below:

|  |  |  |
| --- | --- | --- |
| **NMHS** | **Key outcome** | **Remarks** |
| Aemet | Expect 9 out of Aemet’s 24 candidate stations to fulfil the criteria | More detailed report under preparation |
| DNM | 1 out of 5 candidate stations may meet the criteria |  |
| HKO | HKO Headquarters station to pass the draft criteria |  |
| MF | 136 out of 380 candidate stations for precipitation to fulfil the criteria | Sufficient metadata might not always be available; Very time-consuming to fill in the template for each station (-> countries with a large number of centennial stations); MF might not be able to maintain stations according to WMO standards, which are not owned or operated by MF.  |
| NWS | Positive feedback; criteria performed well | Difficulty to examine each potential candidate, as this is very time-consuming for countries with a large number of centennial stations |
| ZAMG | Positive feedback; criteria performed well | Sufficient metadata might not always be available |

**Additional feedback**

During a side meeting, Members at CCl-XVI requested:

1. to also consider long-term observing stations, which do not yet have a centennial record, in order to encourage continuation of respective observations ('candidate station');
2. further specification of some of the proposed criteria (e.g. 'station relocation'); and
3. consideration of introducing different categories/lists of recognised centennial stations to better reflect the site and data characteristics of the stations, such as existence or non-existence of data gaps, relocations, urbanisation effects etc.

During a Panel discussion, Members at CIMO/TECO expressed concerns over who will provide the overall management of the process, the cost, the complexity and also the benefit.

**Discussion**

The test cases indicate the appropriateness of the draft recognition criteria as well as of the proposed template. The resource implications for Member countries with a rather large number of potential centennial stations are acknowledged (it may be suggested to prioritise the work by starting with stations with the longest and/or most important records). It is, however, hoped that the process of identifying WMO Centennial Observing Stations (as stations meeting the recognition criteria will be known) provides valuable information to the respective NMHSs themselves. The majority of Members are expected to have a rather small number of potential WMO centennial stations.

For observing stations not owned and/or run by a NMHS it is considered to be a motivation to operate the station in accordance to WMO standards in order to keep the WMO recognition status. It is understood, however, that there is no way for the NMHS to guarantee such performance. (*Note: Consider the outcome of a current WIGOS initiative on non-NMHS stations)*

It is believed that the suggested recognition mechanism as proposed by the above mentioned WMO scoping meeting can be expanded, if Members wish so, to capture the idea of ‘candidate stations’, respectively long-term observing stations with observational records of e.g. 60 years or more. For the moment, however, it is recommended to focus on centennial stations only and consider the concept of ‘candidate stations’ in a later stage. It is felt to be important to gain enough operational experience with the mechanism before considering handling the much larger number of potential ‘candidate stations’.

The implementation of the WMO recognition mechanism should be accompanied by a strong WMO campaign in support of high-quality observations.

It is felt that further specification of the draft criteria, e.g. regarding ‘relocation’ can be counter-productive as there is a risk of ending up with too rigid criteria, which does not anymore capture individual settings. It is rather encouraged to apply climatological expertise in assessing individual cases, and document facts, which will be subject to review by a WMO expert team.

**Conclusion and way forward**

Based on the discussion above it is proposed to consider implementation of a WMO recognition mechanism for centennial stations as described in the Annex.

The proposal is expected to be introduced and discussed during ICG-WIGOS IV, 17-20 February 2015, where ICG-WIGOS will be invited to consider establishing a small task team with participation from CBS, CCl, CIMO and GCOS with Terms of Reference as provided in the Annex.

It is planned to submit a draft resolution to the 17th session of the World Meteorological Congress in order to pave the way for the implementation of the recognition mechanism.

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ANNEX

**Proposed WMO mechanism for the recognition of centennial observing stations**

**Aims:**

* To raise awareness of existing long-term observations and their importance across WMO programmes, to international mechanisms (such as GFCS), and the public;
* To help maintaining, and facilitate planning for, long-term observing sites;
* To promote high quality long-term observations in the future;
* To encourage sharing of long-term time series data including its use for climate variability and change analyses;
* To facilitate the WIGOS ambition and to promote the effective and efficient use of resources, including resource mobilization, to ensure sustainable meteorological observations.

**Proposed mechanism:**

* **Send out to Members, on a regular basis (e.g. every second year, tbd), a permanent invitation to apply for WMO recognition of centennial observing stations as per criteria defined in attachment 1:**

*Note: The invitation will include the list of recognition criteria to be ticked off and commented on by Members for each nominated observing stations (template cf. attachment 2). Further, it will include information on the review cycle (e.g. once a year), and it will request nomination of a national focal point including information of his/her official position in the respective organization. Members will be encouraged to include into their applications nominations from observing station operators outside the NMHS.*

* **Review of nominations received from NMHSs by the Task Team on Long-term Observing Stations (proposed to be established under WIGOS; see proposed Terms of Reference below)**
* **Recommendations for formal recognition to be tabled at Executive Council sessions;**
* **Stations to be listed in the WIGOS Information Resource (WIR);**
* **WMO to run, and to keep up-to-date, a special Website and a brochure on centennial observing stations indicating their particular importance, with reference to the above mentioned station list;**
* **Nominations to be renewed every ten years.**

**Draft Terms of Reference of an WIGOS Task Team on Long-term Observing Stations** (Task Team proposed to be established for an initial two years period December 2015 to December 2017):

* Consolidate the work done on the WMO recognition mechanism for centennial observing stations with the aim of its operational implementation
* Investigate options for broadening the recognition mechanism to include long-term observing stations with less than 100 years of observations (‘candidate stations’)
* Guide the drafting of an invitation letter to WMO Members to apply for WMO recognition of centennial observing stations (to be sent out by WMO Secretariat), analyse the responses and propose a list of recognised centennial observing stations through ICG-WIGOS to WMO Executive Council
* Guide the development of a specific WMO WebSite and a WMO brochure to promote long-term observations and the WMO recognition mechanism for centennial observing stations
* Provide guidance on (i) maintaining long-term observing stations and (ii) generating long and homogeneous station time series of GCOS Essential Variables
* Advise on how to implement the recognition mechanism
* Report half-yearly to ICG-WIGOS

***Proposed membership:***  one representative from CBS, CCl, CIMO and GCOS

2 Attachments