1. Opening

The meeting of the CCI Task Team on Homogenisation (TT HOM) was formally opened at 9.30 a.m. on Monday, 20 April 2015. On behalf of the Secretary-General of the World Meteorological Organization (WMO), Mr Peiliang Shi, Director, WMO Information System Branch, addressed the meeting by highlighting the key role of high-quality data for climate variability and change analyses. He emphasised the need for guidance to enhance WMO Members’ operational capabilities for homogenising time series data and elaborated on the potentials of WIS and WIGOS to make more suitable high-quality observational data available for homogeneity treatment.

2. Organisation of the meeting

The meeting was chaired by TT HOM Chair Mr Victor Venema. The agenda for the meeting (see Annex 1) was adopted with no revisions. The meeting agreed on its hours of work and other practical arrangements. The list of participants is presented in Annex 2.

All meeting presentations listed below can be accessed here: http://www.wmo.int/pages/prog/wcp/wcdmp/Meetings.php [to be done].

3. Status of homogenisation activities

3.1 Review of relevant outcomes of WMO constituent body sessions

Mr Peer Hechler provided an overview of TT HOM-relevant outcomes and recommendations of the 16th World Meteorological Congress, the 65th Session of the Executive Council and the 16th Session of the Commission for Climatology, thereby elaborating on WMO’s role and working structure in general as well as recent WMO activities relevant to homogenisation in particular.

3.2 Brief appraisal of recent homogenisation activities worldwide

Ms Manola Brunet, Co-Chair of CCI OPACE 2 (Climate Monitoring and Assessment) provided an overview presentation, addressing the wider context of TT HOM activities, and highlighting a couple of important issues to be considered, such as the expectation for this Team to guide Members in implementing operational QC and homogenisation processes including provision of criteria regarding applicability and limitations of existing methods. Mr Blair Trewin informed of the results of a survey on national homogenised data sets, which suggests that only a minority of WMO Members generates and maintains homogenised time series data. Mr Matthew Menne discussed version 4 of the Global Historical Climatology Network monthly temperature data set and Ms Renate Auchmann briefed the Team of homogenisation work in the context of the EUSTACE (EU Surface Temperature for All
Corners of Earth) project. Ms Monika Lakatos elaborated on the Budapest homogenisation seminar series, and Ms Xiaolan Wang and Mr Jose Guijarro discussed homogenisation activities in Canada and Spain, respectively. Ms Clara Oria addressed relevant activities in Peru and RA III. Further presentations concerned homogenisation aspects of the CARPATCLIM regional project (Mr Tamas Szentimrey), the Australian Climate Observations Network (ACORN) temperature data set as well as the International Surface Temperature Initiative (ISTI) (Mr Trewin). Team members from Pakistan (Mr Ghulam Rasul) and Congo (Mr Wilfrid Louamba) informed of sporadic homogenisation activities and Mr Ardhasena Sopaheluwakan (observer from Indonesia) referred to relevant national and regional activities in Indonesia and Southeast Asia.

4. Homogenisation methods, software and guidelines

The Team addressed and discussed several aspects related or linked to the activities of TT HOM:

- Collaboration opportunities with other groups and teams including ET CCDI, ET DARE, OPACE-5 Teams etc.
- Challenges of homogenisation treatment over complex terrains, such as mountainous areas
- Opportunities of a global climate reference network, following the example in the United States of America of clusters of stations to provide in the future observational time series, which do not require subsequent homogeneity treatment. The Team acknowledged relevant ToR of the Group of Rapporteurs on Climate Observational Issues and agreed to consider providing advice from TT HOM viewpoints to this group
- Metadata requirements in support to homogenisation activities
- Homogeneity issues in transition periods from conventional to automated meteorological observations. The Team welcomed the announcements of relevant scientific papers.
- Guidance for Members regarding homogenisation
- Distinguishing operational climate data Quality Control (QC) and homogenisation testing/homogenisation, with the latter domain building on robust quality controlled data and metadata. The Team noted OPACE-1 plans to provide updated guidance on QC to Members
- Mathematical aspects of homogenisation
- Homogenisation methods including access to software and strengths and weaknesses of different methods
- Homogenisation of daily data
- Maintaining homogenised data sets by regularly re-assessing homogeneity and providing adjustments where needed
- Importance of always keeping original observational data
- Keep using Stevenson screens when automating observing station networks (Relevant studies suggest that removing Stevenson screens and using different types of sun-protection shelters introduce significant inhomogeneities to temperature time series data).

Eventually, the Team envisioned its activities as a contribution to the overall goal of each Member having (at least a set of) homogeneous time series data sets.

5. Key activities and work plan

The Team’s discussions resulted in a number of actions, conclusions and recommendations, which are captured in the Team’s ‘Recommendations, conclusions and work plan’ (Annex 3).

6. Joint session with the Task Team on the Definition of Extreme Weather and Climate Events (TT DEWCE)

The agenda of the joint session is presented in Annex 4. Relevant conclusions and recommendations have been integrated in the Team’s ‘Recommendations, conclusions and work plan’ (Annex 3).

7. Any other business

No further items were raised by the participants.

8. Conclusions and recommendations

[Cf. Annex 3]

9. Closing

The meeting was closed by its chairperson on Wednesday, 22 April at 6 p.m.
MEETING OF THE CCI TASK TEAM ON HOMOGENISATION (TT HOM)
Geneva, Switzerland, 20–22 April 2015

Agenda

1. OPENING

2. ORGANIZATION OF THE MEETING
   2.1 Adoption of agenda
   2.2 Working arrangements

3. STATUS OF HOMOGENISATION ACTIVITIES
   3.1 Review of relevant outcomes of WMO constituent body sessions
   3.2 Brief appraisal of recent homogenization activities worldwide

4. HOMOGENISATION METHODS, SOFTWARE AND GUIDELINES

5. KEY ACTIVITIES AND WORKPLAN

6. JOINT SESSION WITH THE TASK TEAM ON THE DEFINITION OF EXTREME WEATHER AND CLIMATE EVENTS (TT DEWCE)

7. ANY OTHER BUSINESS

8. CONCLUSIONS AND RECOMMENDATIONS

9. CLOSING
### LIST OF PARTICIPANTS

**AUSTRALIA**  
Mr Blair TREWIN  
Bureau of Meteorology  
Mob: +61 413 849 309  
E-mail: b.trewin@bom.gov.au

**CANADA**  
Ms Xiaolan WANG  
Environment Canada  
Mob: +1647 4480783  
E-mail: xiaolan.wang@ec.gc.ca

**CONGO**  
Mr Wilfrid S.R.L. LOUAMBA  
Direction de la Météorologie  
Mob: +242 66193292  
E-mail: sergelkb@yahoo.fr

**GERMANY**  
Mr Victor VENEMA  
Leader of TT-HOM  
Meteorologisches Institut, Universität Bonn  
Office Tel: +49 228 73 51 85  
E-mail: Victor.Venema@uni-bonn.de

**HUNGARY**  
Ms Monika LAKATOS  
Hungarian Meteorological Service  
Mob: +36 20 965 8759  
E-mail: lakatos.m@met.hu

Mr Tamas Bela SZENTIMREY  
Hungarian Meteorological Service  
Mob: +36 30 5055257  
E-mail: szentimrey.t@met.hu

**PAKISTAN**  
Mr Ghulam RASUL  
Pakistan Meteorological Department  
Mob: +92 301 5577145  
E-mail: rasulpmd@gmail.com

**PERU**  
Ms Clara ORIA  
SENAMHI  
Mob: +971 424413  
E-mail: clara@senamhi.gob.pe
Mr Jose Antonio GUIJARRO
AEMET
E-mail: jguijarrop@aemet.es

Ms Manuela BRUNET
Co-Chair of CCI OPACE 2 Climate Monitoring and Assessment
University Rovira i Virgili
Office Tel: +34977559583
E-mail: manola.brunet@urv.cat

Mr Matthew J. MENNE
Co-Leader of TT-HOM
NOAA
Mob: +1 828 423 96 89
E-mail: matthew.menne@noaa.gov

Mr Peer Hechler
Scientific Officer, Data Management Applications Division
DMA/WIS/OBS
Tel: +41 22 730 8224
E-mail: phechler@wmo.int

Mr Steve Foreman
Chief, Data Representation, Metadata and Monitoring Division
DRMM/WIS/OBS
Tel: +41 22 730 8171
E-mail: sforeman@wmo.int

Note:
Ms Renate Auchmann, Institute of Geography,
University of Bern, Switzerland participated on the first day on own behalf (renate.auchmann@giub.unibe.ch)

Mr Omar Baddour
Chief, Data Management Applications Division
DMA/WIS/OBS
Tel: +41 22 730 8268
E-mail: obaddour@wmo.int

Mr Peiliang SHI
Director, WMO Information System Branch
WIS/OBS
Tel: +41 22 730 8219
E-mail: pshi@wmo.int

Mr Ardhasena SOPAHELUWAKAN
Observer – TT-DEWCE Member
BMKG
Mob: +62 811 218 563
E-mail: ardhasena@gmail.com

Mr Peer Hechler
Scientific Officer, Data Management Applications Division
DMA/WIS/OBS
Tel: +41 22 730 8224
E-mail: phechler@wmo.int

Mr Steve Foreman
Chief, Data Representation, Metadata and Monitoring Division
DRMM/WIS/OBS
Tel: +41 22 730 8171
E-mail: sforeman@wmo.int

Note:
Ms Renate Auchmann, Institute of Geography,
University of Bern, Switzerland participated on the first day on own behalf (renate.auchmann@giub.unibe.ch)
# Recommendations, conclusions and TT HOM Draft Workplan

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible person(s)</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Publish Guidelines on Homogenisation</td>
<td>(See Chapter leads below)</td>
<td>Final draft: Spring 2017</td>
</tr>
</tbody>
</table>

**Notes:** The new Guidelines will consider content of WCDMP-53 where appropriate. The new Guidelines will basically focus on homogenisation of monthly data but will provide also some discussion about homogenisation of daily data. The new Guidelines, written in plain language, will be complemented by Web-based FAQs as well as a specific WebSite with access to homogenisation packages. Eventually, a glossary will be added to the Guidelines.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsible person(s)</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Chapter 1 Introduction</td>
<td>M. Menne</td>
<td>First outline: Sept15; first draft: Dec15</td>
</tr>
<tr>
<td>1.2 Chapter 2 Background and Prerequisites</td>
<td>M. Lakatos and M. Menne</td>
<td>First outline: Dec15; first draft: Dec15</td>
</tr>
<tr>
<td><strong>Note:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chapter to highlight QC aspects too</td>
<td></td>
</tr>
<tr>
<td>1.3 Chapter 3 Practice</td>
<td>X. Wang and B. Trewin</td>
<td>First outline: Nov15; first draft: Dec15</td>
</tr>
<tr>
<td>1.4 Chapter 4 Methods</td>
<td>V. Venema</td>
<td>First outline: Sept15; first draft: Dec15</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The chapter is expected to focus on homogenisation of monthly data and is expected to provide information re strengths and weaknesses of different methods, aspects of applicability, mathematical background etc. Developers of methods will be requested to provide relevant input information.</td>
<td></td>
</tr>
<tr>
<td>1.5 Chapter 5 Research aspects</td>
<td>V. Venema, X. Wang, T. Szentimrey, C. Oria</td>
<td>First outline: Sept15; first draft: Dec15</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Chapter is expected to address aspects of homogenisation of daily data, mathematical challenges, aspects of homogenisation of data from complex terrains (Clara) etc. The Chapter is intended for advanced readers; it will provide links to further readings (scientific papers).</td>
<td></td>
</tr>
<tr>
<td>2. Establish a complementary WebSite with FAQs</td>
<td>X. Wang</td>
<td>Compilation of relevant questions: Nov15; provision of answers: spring 2016 (tbc)</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The WebSite is expected to be updated twice a year based on TT HOM consensus. Relevant communication among TT HOM members will be facilitated by e-mail and Etherpad (Victor)</td>
<td></td>
</tr>
<tr>
<td>3. Develop –based on relevant information already given on <a href="http://www.climatol.eu/DARE">http://www.climatol.eu/DARE</a> - a WebSite to serve as WMO TT HOM pool of homogenisation packages complementary to the above Guidelines</td>
<td>J. Guijarro</td>
<td>Dec15</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Website consolidation will comprise re-ordering its content including moving homogenisation to the top of the site. Further guidance on homogenising daily data will be added based on TT HOM members input.</td>
<td></td>
</tr>
<tr>
<td>4. Document on homogenisation challenges in transition periods from conventional to automated observations</td>
<td>B. Trewin</td>
<td>Dec15</td>
</tr>
<tr>
<td>5. Liaison with CCI ET ETR on training aspects re homogenisation</td>
<td>X. Wang</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X. Wang is nominated as TT HOMs contact point for CCI ET ETR. Face-to-face training as well as e-learning are expected to be addressed. TT HOM noted the need for translation of training material in all UN languages. TT HOM is also expected to recommend on resource persons for training activities re homogenisation.</td>
<td></td>
</tr>
<tr>
<td>6. Advice on Metadata aspects in support to homogenisation activities</td>
<td>V. Venema, M. Menne, X. Wang, M. Lakatos</td>
<td>Dec15</td>
</tr>
<tr>
<td><strong>Note:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The activity is meant to facilitate homogenisation activities based on good practices in some Member countries. TT HOM’s advice need to be consistent with the WIGOS Metadata standard and implementation and will address Metadata priorities for homogenisation activities.</td>
<td></td>
</tr>
<tr>
<td>7. Next Online meetings</td>
<td>P. Hechler to organise TT HOM WebEx meetings</td>
<td>late Sept15, Nov15 (when B. Trewin will be in Geneva) and January16</td>
</tr>
</tbody>
</table>
**Draft Recommendations**

R1  TT HOM strongly promotes the free and unrestricted exchange of data to facilitate worldwide homogenisation of time series at national, regional and global scales.

R2  TT HOM welcomes considerations to establish a Global Reference Network with the aim of producing observational time series, which would not need homogenisation treatment.

**Draft Conclusions**

C1  The Team agreed to endorse the study of parallel observations in POST. The Team expects to be informed of the outcomes of POST.

C2  The Team was informed of OPACE 1 activities regarding plans to provide Guidelines on QC. The Team concluded to liaise with OPACE 1 upon a first draft of such Guidelines.

C3  Based on joint discussions with TT DEWCE, the Team noted the importance for the definition of extreme weather and climate events of (i) properly quality-controlled and homogeneous daily and sub-daily datasets, (ii) homogeneous indices time series (such as drought-relevant indices) and (iii) homogeneous time series of other than temperature and precipitation variables, including wind.
Agenda of the joint TT-HOM / TT-DEWCE session

Wednesday, 22 April 2015, 14:00 – 16:30, Press Room

Chair: Manola Brunet, Co-chair of CCI-OPACE-2

1. Opening and introduction of participants
   - Welcome remarks and a brief summary of both Teams’ ToR, Manola Brunet
   - Round table introduction of participants, all

2. Presentations
   - Using climate data for weather and climate extremes in China, Zhai Panmao
   - EUSTACE initiative, Renate Auchmann
   - WCRP Grand Challenge on Extremes, Boram Lee
   - Overview of current work and plans on data sets at NCEI, Matthew Menne
   - NCEI’s extremes monitoring, Ahira Sanchez
   - Inhomogeneities in daily data and their removal, Victor Venema

3. Discussion on linkages and collaboration

4. Closure