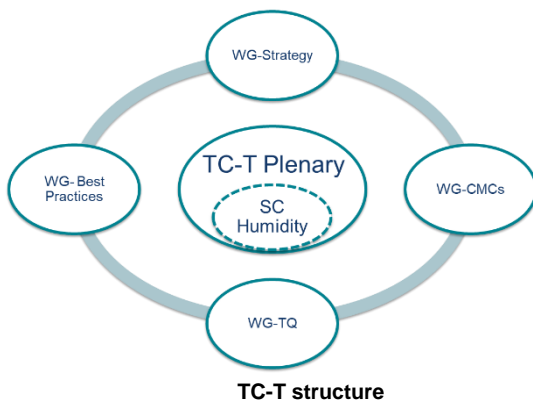


1. General Aspects

The TC-T is structured in one Sub-Committee for humidity and moisture (SC-H) and four very active working groups dealing with the TC general strategy (WG-Strategy), capacity building and knowledge transfer (WG- Best Practices), CMCs evaluation (WG-CMCs) and Thermophysical Quantities (WG-TQ). These groups develop and coordinate the most important activities of the TC between plenary meetings.



Since the last report and due to the Covid-19 situation, two on-line meetings took place the days 1st and 2nd of September 2020 and from 26th to 29th April 2021.

For this reason some activities initially planned have been postponed or modified such as the joint face-to-face meeting with COOMET or the training courses and workshops.

During the 2021 meeting the TC-T plenary supported unanimously the candidacy of Steffen Rudtsch (PTB) as next TC-T chair.

2. Projects

Currently there are 17 projects in progress, 1 agreed and 1 ongoing. In this reporting period one project was completed (118) and two concluded without report (1167 and 1193).

No news have been received since a couple of years regarding project 1294, so the EURAMET contact persons of the corresponding partners have been contacted to see if they have intention to continue with the activities or if they want to conclude the project.

Since the last GA only 2 new project started, project numbers 1516 and 1524.

3. Comparisons

There are several running comparisons at CCT and regional level that involve most of the TC-T members:

- CCT.K8: Comparison of realisations of local scales of dew-point temperature of humid gas. The measurements have finished. The instruments behaved well with good reproducibility. There was an anonymous presentation of results at the TEMPMEKO 2019 conference and the final report is in progress.
- EURAMET project 1352: Comparison of the realisations of the relative humidity (RH) in the range from 10%rh to 95%rh at temperatures from -40 °C to +1 °C. This comparison is behind schedule due to re-organisation problems of the coordinator.
- EUROMET.T-K8 (project 717): Comparison in dew-point temperature (high range). Draft A was sent to the participants in autumn 2019 for comments, the feedback from the participants is being evaluated and discussed, the finalisation of Draft B is expected before the summer 2021.



- EURAMET project 1189: Comparison of the realisations of the relative humidity in the range from 10%rh to 95%rh at temperatures from -10 °C to 70 °C. The final report has been published in the EURAMET website.
- CCT.K10: Realization of the ITS-90 between 960 °C and 3000 °C. The Draft A report has already been sent to the participants. Draft B is under finalization.
- EURAMET.T-K9 (project 1318): ITS-90 SPRT Calibration from the Ar TP to the Zn FP. The measurements have been finished long ago. As the corresponding KC comparison has circulated the Draft A, the coordinator has been able to analyse the participant results with respect to the KCRV. It is expected to circulate the Draft A within the co-pilots by 15th May 2021 and by the 7th June it will be sent to the participants for comments aiming at approving it by September 2021.
- CCT-S3: Supplementary comparison on thermal diffusivity measurements of isotropic graphite using laser flash method. First version of Draft B submitted for review to the WG-KC of CCT in November 2020.

There are other comparisons that involve a lower number of participants (there are mostly bilateral): EURAMET projects number 1145, 1149, 1167, 1357, 1358, 1401, 1403, 1434, 1442, 1446, 1447 and 1457, most of the coordinators have sent a progress report that can be consulted in the EURAMET web page.

Since the previous report the comparison corresponding to project numbers 1189 has been completed.

4. CMCs

The CMCs are reviewed by the members of the WG-CMCs that is currently chaired by D. del Campo. The members are appointed by the TC-T plenary based on their different expertise. Currently there are 3 members (1 MIRS/UL-FE/LMK and 2 NPL) to review the CMCs for SPRTs and fixed points, 2 (PTB and RISE) to review the CMCs for industrial thermometers, 1 (CEM) to review the CMCs for thermocouples, 2 (PTB and LNE-CNAM) to review the CMCs in radiation thermometry and 2 (INRiM and MIRS/UL-FE/LMK) to review the CMCs in humidity.

In April 2020 the first submission through the new KCDB 2.0 was sent for Inter-RMO review with a total number of 79 CMCs from 7 countries, most of the CMCs have been published after the summer what significantly improves the timing of precedent submissions.

In February 2021 a new batch of 28 CMCs from 10 countries is currently under EURAMET revision which will be concluded by the end of May 2021.

A new batch of CMCs from other RMOS (3 COOMET, 6 AFRIMETS and 26 APMP) is currently under revision.

The problems encountered performing inter-RMO reviews have started to be solved. During the last part of 2021 a couple of meetings of the CCT-WG-CMCs took place in which EURAMET has proposed to start the transition from instrument-based CMCs to quantity-based CMCs. In the meantime the CCT has agreed to modify the name of service category 2.2. from “industrial platinum resistance thermometers” to “platinum resistance thermometers” what partially solves some of the problems encountered such as the duplication of this CMC entry for IPRTs and SPRTs. In addition it has been suggested to reduce the number of service categories for thermocouples and temperature sensors with display unit.

5. Activities of the Subcommittees

The TC-T has only one sub-committee regarding Humidity and Moisture. The Sub-Committee Humidity (SC-H) is concerned with all issues of measurement of humidity and moisture, as well as with standards and references necessary for developing the metrology in the field.

The SC-H is coordinated by Vito Farnicola (INRIM) with Domen Hudoklin (MIRS/UL-FE/LMK) as co-chair. The SC-H met the 28th April 2020 where a new convenor Domen Hudoklin (MIRS/UL-FE/LMK) was supported unanimously by the subcommittee members which warmly thanked the outgoing convenor Vito Farnicola for his years dedicated to the community.

6. Participation in EMRP/ EMPIR

Due to the Covid-2019 situation, all the projects in which the thermometry community is involved were delayed for 6 months.

In 2020 there were several proposals lead by the thermometry community in both Fundamental and Industry calls, being three of them (two in industry and one in fundamental) follow-up projects of EMPRESS, DynPT and PhotoQuant. The other two are proposals which did not succeed in previous calls or that were not finally submitted, but whose objectives are very relevant and which have a high potential impact in industry and in the future of primary thermometry. Unfortunately there was almost a complete failure in the call having finally just one of the projects PROMETH2O which was selected for funding. This project is focused on solving one of the most important problem in the production of ultra-pure process gases: the humidity content. The project intends to fill the gap between the demand of traceable measurement and the currently available humidity standards and to develop traceable and improved methods for trace water measurement relevant to the production and use of UHP gases. Despite the success of this interesting proposal the TC-T plenary showed its concern regarding the lack of success of the three follow-up projects.

The TC-T has also participated in the first stage of the European Metrology Partnership first call which has as main topic the European Green Deal. The community have participated in many proposals, some of them agreed within the EMNs Energy Gases and Climate and Ocean Observation. The formal list of SRTs is to be approved, however it seems that no climate monitoring proposals will be successful. This is not the first time that something similar happens (i.e. last Environment EMPIR call). It was supposed that the establishment of the EMN on Climate and Ocean Observation and the publication of the Stakeholders Report would contribute to increase the success of these type of proposals, but this was not the case.

7. Capacity Building: Activities of the last year and future needs

The TC-T is really engaged with all the capacity building activities organized by EURAMET and in fact it is one of the main objectives of the WG-BP, discussed within the Strategy Group and there is always a slot on the TC-T agenda for the Euramet CB Officer to give a presentation.

During the 2019 meeting a course was proposed on the organization and data treatment of comparisons. The reason was that most of the delays in the completion of inter-laboratory comparisons was the complexity of the data treatment, so if there were more people able to do it maybe the issues with the delays could be partially solved. This course was discussed and agreed with the CB officer and the WG-Strategy. In principle the targeted audience was just COOMET and EURAMET TC-T members, however as the training was organized by video conference, the target audience was widened to include TC-T members of all RMOS.

The training on comparisons was finally organized in collaboration with BIPM and counted on speakers not only from EURAMET but from BIPM and other RMOS (COOMET, APMP and SIM). It was organized in (2+2) hours sessions the 26th and 27th April (from 13:00 to 15:00 CEST) and counted with around more than 80 attendees. The number of attendees was increased from the initial 70 foreseen due to the strong interest caused. The training was not only useful to improve the competences of the attendees but to strengthen the links among the RMOs.

For 2022 a training on CMCs has been agreed by the TC-T plenary, it will take place jointly with the annual meeting, a similar experience as the one with the training in comparison is foreseen with the final goal of improving the CMCs review process among the RMOs. It was also agreed to launch the 2nd Summer School on Thermometry hosted by MIRS/UL-FE/LMK, but the date is not fixed yet (September 2022 or 2023) as it will depend on the evolution of the pandemic.

In addition a 1-day workshop coordinated by Graham Machin and Anatolii Pokhodun on the new kelvin challenges and opportunities will also take place together with the 2022 TC-T meeting.

8. Meetings

The TC-T 2019 on-line meeting took place the 1st and 2nd September. On the first day the different WGs met, on the second day they were the meetings of the SC-H and the TC-T plenary. The meetings of the working groups Best Practice and Thermophysical Quantities, together with the TC-T plenary were open to COOMET attendees, however not many took part, probably due to the language problems. There were 23 attendees in the WG meetings, 69 in the SC-Humidity and 74 in the TC-T plenary as average.

The 2021 meeting was also organized online jointly with COOMET. In order to facilitate the participation of the COOMET attendees in the discussion, the meetings of the WG Best practice and Thermophysical Quantities as well as the meeting of the project Air Temperature metrology (1459) and the TC-T+SC-H meeting was organized using the COOMET Zoom facilities which allows different channels to allow direct translation Russian/English. The meeting were really successful and it allowed the engagement of COOMET members in different TC-T activities. There were a total of 90 participants from EURAMET in the different meetings and 13 representatives from COOMET.

It is expected that in 2022 it will be possible to have a face-to-face meeting hosted by SMU, however the dates should still be fixed.

9. Issues

In the 2018-2019 report it was pointed out the concern of the TC-T members by the uptake of the EURAMET calibration guides by the accredited laboratories in some countries. During the 2020 the EA chair was contacted by the TC-T chair and the EURAMET General Secretary and it was made evident that a link to the EURAMET guidelines appears in the EA website (<https://european-accreditation.org/about-ea/who-are-we/>), however a more clear support would be desirable. in metrological traceability of measurement results and is concerned about how the different European Accreditation Bodies will establish their own policies.”

The TC-T is improving the interaction with the recently created EMNs. A plan for maintaining interactions is coordinated by the WG-Strategy and a set of presentations of the EMNs of interest for the TC-T were scheduled during the 2020 and 2021 meetings. As a result of this the TC-T was invited to participate in the elaboration of the roadmaps of the QT EMN and has collaborated in the

proposal of AdvManu. In addition, the TC-T has been invited to present its activities in the Energy Gases annual meeting.

10. Strategic Planning

The TC-T Strategic Planning falls within the responsibility of the WG-S currently chaired by Steffen Rudtsch (PTB).

In 2021 two orientation papers one in thermometry and a second one in thermophysical quantities were prepared. The aim of these papers was to help the TC-T community with the formulation of proposals in the 2021 Green Deal call.

With respect to the roadmaps, the CCT Strategy plan is currently under revision and subsequently the update of the TC-T roadmaps will start in autumn 2021.

11. Outlook for 2021/2022

In 2021-2022 TC-T activities will include, apart from the routine activities like CMC review:

- Organisation of the face-to-face joint EURAMET/COOMET meeting, which due to the complexity of the meeting will require additional logistic efforts.
- Organization of the Training Course on CMCs.
- Organisation of the workshop on the new kelvin challenges and opportunities.
- Update of TCT roadmaps in preparation for the new metrology research program