

Minutes from the Meeting of the WMO Scientific Advisory Group for Greenhouse Gas Measurements, Friday, September 11, 2009, MPI, Jena, Germany

Present: *Ed Dlugokencky (Chair), Paul Krummel (Rapporteur), Len Barrie, Hans-Eckhart Scheel, Jim Butler, Ernst Brunke, Martin Heiman, Doug Worthy, Oksana Tarasova, Kazuto Suda, Toshinobu Machida (G), Gordan Brailsford (G), Chip Miller (G), Brad Hall (G), Dave Griffith (G), Armin Jordan (G)*

A. Opening:

Len Barrie and Ed Dlugokencky opened the meeting and welcomed members, new members and guests. An agenda for the day's discussion was distributed by the chair.

Eckhart suggested quicker turn around of the minutes and finish them before Christmas 2009.

Item 1. Review action items (in blue) from SAG meeting in Helsinki, Finland, (September, 2007):

SAG Action: Eckhart Scheel to remove line 880 completely. Remove 'future' from line 877.

Done

SAG Action: Yukitomo Tsutsumi to supply Eckhart Scheel with a sentence describing time stamp definition for the measurement guide.

Done, information received by ES and inserted into the MG.

SAG Action: Eckhart Scheel to include text in the SOP and/or questionnaire for site audits stating that metadata archived at the WDCGG for a station is reviewed as part of WMO audit process.

Done

SAG Action: Ed Dlugokencky to talk to Brad Hall who will talk to Andreas Engel (IHALACE referee) about possibility of making IHALACE results publicly available on the web.

Results have been distributed anonymously; there are currently no plans for web page.

Brad Hall gave an update on this – they are working on way to write-up the results.

Andreas Engel has asked Hall to write up results, this will need endorsement from all IHALACE participants, and the plan is for a Journal article style format for the results. Len suggested that the SAG to recommend this to the IHALACE group.

Action: Oksana to draft a letter/e-mail to IHALACE group recommending Brad Hall to write up IHALACE results for a journal article, but to inform Andreas Engel first.

Paul Krummel then asked about scale differences at the time of the IHALACE measurements between different labs in same program (ie AGAGE) and is there a plan to get updated data. Brad said that if this is the case then they would only want an update of the scale factors (between old and new), and not a full data update.

SAG Action: Jim Butler to prepare draft document for N₂O, CFC-11 and CFC-12 to be submitted to GCOS as comprehensive networks, based on CO₂ & CH₄ document that was submitted to GCOS. **See agenda item 11.**

SAG Action: Jim Butler and Brad Hall to talk to Ray Weiss about CCL for CFC-11 and CFC-12 (they will talk to him about SF₆ anyway). **See agenda item 10.**
In short, this will not happen.

SAG Action: The group is encouraged to look at the new WDCGG website and send feedback to Yukitomo Tsutsumi (now Kazuto Suda san).

Very little feedback received from SAG members. New website is already live, however feedback is still welcome. Ed suggested that plotting of time-series data on WDCGG should not include hard flagged data, which was supported by the SAG group.

Action: SAG to provide feedback to Kazuto Suda on the new WDCGG website.

Action: Kazuto Suda to look into not plotting hard flagged data in time-series figures on WDCGG webpages and to make the link to GAWSIS more visible on the WDCGG webpage ie place the link on the main WDCGG homepage.

SAG Action: Len Barrie to talk to Armin Jordan about organizing a SAG sub-group for H₂ and CCL for H₂ under the umbrella of reactive gases SAG.

During the experts meeting a successful vote was taken to recommend/endorse MPI as the H₂ CCL. Ed asked Armin if he preferred this activity to fall under the Reactive Gases SAG or the GHG SAG. Armin said he preferred it to fall under the GHG SAG as he has closer ties with it. The group discussed this topic and agreed that H₂ should be under the umbrella of the GHG SAG as this is an active group and is appropriate especially if/when there is a move to H₂ economy and resulting emissions. There is no need for a sub-group - obsolete. The H₂ CCL was endorsed by GHG SAG.

Action: **Oksana?** There needs to be an exchange of letters from WMO to MPI to formalize this (MOU).

Action: Also need a MOU from WMO to NOAA for the SF₆ CCL as this has not yet been done.

SAG Action: Len Barrie to distribute hard and electronic copies of the WMO GAW report number 134 (CO₂ MGs) ASAP. SAG GHG then to review the document. Len Barrie and Ed Dlugokencky to recommend a team to update the document and to identify a person to take the lead. We should follow Eckhart Scheel's N₂O & CH₄ measurement guidelines as a template; i.e., use the structure of the document, but add measurement principles for different instruments used by GAW partners and add information on calibration scales. Eckhart Scheel will produce an outline (template) of the document and will give advice on the format, then need input from CO₂ measurement experts will be requested (the above mentioned team). **See agenda item 8.**

SAG Action: Len Barrie to organize a webpage area on the WMO GAW website for reports on user experiences with new laser-based optical systems for measurements of

GHGs. It will include an area/section for manufacturers input and feedback by GAW members.

Not done. Benoit Wastine to organize a webpage for these types of systems (outcome from experts meeting), can it be expanded to include other techniques eg PID or another way to host? Some discussion on new measurement techniques ensued and whether they are endorsed or not, the measurement guidelines will need to be updated.

Action: WMO to liaise with Benoit on this topic and webpage development.

SAG Action: Eckhart Scheel suggested the need for a table for CH₄ & N₂O on how to convert between scales. Ed Dlugokencky and Brad Hall to put the table together for possible inclusion on WDCGG web page.

ES: I refer to the e-mail of Kazuto Suda of 30 July 2009: I appreciate the comprehensive information provided in Summary No. 33. However, on the WDCGG homepage it is a bit hidden. Access via "Update Note" / Summary 33. Suggestion to show the same information under Data or some other more evident page.

Eckhart asked Kazuto again and he said the he will fix this.

Kazuto mentioned that the CO₂ data in the WDCGG are on many different scales and what to do about converting between them? Ed suggested that we (the SAG) ask data the contributors to submit their data in the latest CO₂ scale. Armin supported this but also mentioned that this may be difficult, especially for old data.

Action: Update recommendations to be specific about submitting CO₂ data to WDCGG on the WMOX2007 scale (or whatever the latest scale is).

Action: Ed and Armin to write an appeal to the community to report their data in the most recent scale, then Liaise with Oksana for distribution.

Action: WDCGG will encourage contributors to submit data in latest WMO scales.

The group then discussed ways to convert between the different CO₂ scales and that we (GHG SAG) should provide guidelines on ways to transfer data from previous old scales to the current WMO CO₂ scale.

Action: Gordon Brailsford to work with Pieter Tans to do a test case to convert old Baring Head CO₂ data into the current scale. Then place summary/guidelines of how to convert between the CO₂ scales on the calibration pages at NOAA, including uncertainties. These will be 'best practice guidelines'.

Discussion followed about tank identification problems (duplicate IDs) when tank IDs entered on NOAA CO₂ calibration webpage.

Action: Ed to recommend that if a new tank with a duplicate tank ID exists then add extra ID stamp.

SAG Action: Len Barrie to approach members of our community about joining the GHG SAG.

Doug Worthy has agreed to join GHG SAG. Other potential changes in store.

Len spoke about healthy turn over of SAG members, with adding new members as necessary. SAG needs to take integrated approach, not just ground based observations, but with links to satellite observations, total column measurements, and to modellers etc.

See also agenda item 14 (f).

Item 2. WMO plans to sign a Mutual Recognition Agreement (MRA) with the International Committee of Weights and Measures (CIPM). (Ed will discuss implications for GHG CCLs and our community.)

This action will help make atmospheric measurements used to verify GHG emissions legally defensible. In general, the MRA assures equivalency among standards among its signatories through “key comparisons”. WMO GAW will still recommend that GAW participants maintain a direct link to the CCLs for GHG standards. Once signed, CCLs will need ISO certification. They will need to prepare quality systems (QS) that meet requirements of ISO guidelines 17025 and 34. Preparation of the QS will require about a person-year of effort. NIST will help NOAA with this process; the QS must then be approved by the SIM (Inter-American Metrology System), and it must demonstrate traceability to SI standards. There is now starting to be an exchange of information between NOAA and NIST, which will ultimately benefit our community, including how to treat statistics better and by decreasing uncertainty on measurements of temperature and pressure used during manometric CO₂ scale propagation.

There will be a meeting on this issue between WMO and BIPM in Geneva, 30 March – 1 April 2010 (50-60 people). Ed, Len & Oksana to attend from GHG SAG.

Item 3. Do we need a strong statement from the GHG SAG that measurements should be traceable to the WMO mole fraction scales, and they should not be corrected based on ICPs? (Ed)

The group discussed this.

*Recommendation: If possible scales should be compared directly, else use ICP information for adjustments for interpretative studies only. **Measurements should not be corrected based on ICPs.***

Item 4. EMPA will perform audits of CO₂ measurements at GAW stations. (Ed)

Group discussed this: Maybe not as useful for an established site, but for a new site could be extremely useful. They might use results from cucumber/sausage comparisons to identify sites that may benefit most from an audit. WMO GAW audit reports add some credibility that is useful for some stations. Audit may now also include travelling CRDS system. May take sometime for Empa to gain experience in this, so some caution in results should initially be taken.

This activity has already been endorsed by GHG SAG.

Item 5. WDCGG has updated the Data Submission and Dissemination Guide. Please review the guide and WDCGG web site, and report your concerns at the meeting. (Suda)
WMO GAW report number 188 now published on web.

Item 6. NOAA ESRL proposes a web page to collect results from the international GHG comparison experiment and track its progress. (Ed)

WMO round robin results – how to make them more useful? Proposal is for participants to report results through a web page interface. It will include tracking of cylinders and allow for update of results etc. To some degree this cuts out the referee and should expedite submission of results and improve analysis. Discussion on this topic ensued ...

Action: SAG to provide statement that the webpage hosted by NOAA for WMO round robins is to support the facilitator.

Item 7. Status of measurement guidelines for CH₄ and N₂O. (Eckhart)

WMO report 185, now available on WMO GAW webpage! The group thanked Eckhart for a job well done for his efforts in preparing the report and seeing it through to fruition.

Item 8. Status of measurement guidelines for CO₂. (Ed)

These guidelines need to be updated. Ed approached Andy Crotwell and Andrew Manning to be involved, draft was promised by Sep 2009. Ed contacted Atmospheric Measurement Techniques journal (EGU) to see if they would accept this as a journal article and the response was positive. Len requested that a GAW technical report number also be associated with the article. A draft has been promised by the end of the year (2009) for comment by the SAG, and then for comment by the measurement community.

Action: WMO (Oksana) to try to expedite the completion of the report/journal article.

Action: Ed to convey the above process to Andy Crotwell and Andrew Manning and cc to Oksana.

Item 9. GAW's role in the Greenhouse Gas Information System. (Butler).

Jim Butler summarized this. Observation based analysis system using models (eg CarbonTracker) to help convey information, on regional scales, about how effective mitigation strategies have been. Atmospheric measurements will be central to this system. Originating out of USA, how will it fit in globally or with GAW? Might be a change in the way we do some things eg improving quality control and uncertainty estimates. Take on more responsibility and tasks, more measurements including in situ. Our role is critical in this. **Jim to help summarize this.**

GAWs role: recommendation that we have more *in situ* measurement sites to fill in the gaps in current measurement networks. Also a quicker turn-around time for submission of data to be used in these inversion modeling activities. Will need to be able to merge data from many different labs/networks to do this, and hence, need to improve our comparison activities/techniques.

Item 10. Common, SI-traceable standard is still needed for halocompounds. (Ed)

There was a proposal that the Scripps Institution of Oceanography (SIO) lab of Ray Weiss would be CCL for halocarbons, but for various reasons, this will not happen. For a CCL need long-term stable base funding, this is not necessarily the case for SIO. Ray is not interested in providing standards for GAW, only for AGAGE and related programs. We could make NOAA the CCL for CFC-11 & CFC-12. Future needs for many other compounds may be more problematic. Do we need a CCL? There are currently two main labs with standards for CFCs, namely NOAA and SIO, and relationship between these scales are well known. The group decided that there is probably no need for a CCL for CFC-11 & CFC-12.

Recommendation: NOAA will not take on the CCL for CFC-11 & CFC-12 unless needed (eg for adoption by GCOS, see item 11).

The need for calibration of emerging GHGs is still unresolved.

Item 11. Addition of N₂O to GCOS GHG measurement network: CO₂ and CH₄ networks have been accepted; next species to pursue is N₂O. More generally, how should GHG measurement community integrate with GCOS? (Butler)

N₂O will be brought up in the April 2010 meeting. CH₄ and CO₂ adopted. The CO₂/CH₄ document will be adapted for N₂O. CFC-11 & CFC-12 should also be included.

Action: Jim Butler to put forward CFC-11 & CFC-12 along with N₂O to GCOS.

Item 12. Will the WDCGG make available simulated time series of GHGs produced by TransCom-CH₄ (for general information about Transcom experiments, see: <http://www.purdue.edu/transcom/>) to compare with observations? (Oksana)

TransCom have agreed to make available time-series (1990-2007) of CH₄ simulation data for all well defined CH₄ measurement sites. Output from six models all using same emission estimates and OH. Are we interested in these and how to make the data available? Place them on WDCGG or just a link to a TransCom website? What data format to use, netCDF or ASCII format same as data on WDCGG?

The group are in favour of a link to the data from the WDCGG webpage to the TransCom website, and an ASCII data format.

Recommendation: SAG recommends that what would be best for experimentalists is for TransCom modelers to provide their best estimates of CH₄ at each observational site and make the data available.

What does the TransCom community plan to do with their results?

Action: Oksana to convey the above to the TransCom community before the TransCom meeting, 19-20 September, 2009.

Item 13. Tasks from GAW Strategic Plan:

(a) Make recommendations for expansion of the GHG measurement network that will improve attribution of fluxes in inverse model studies.

This requires network design modeling studies and is different for each trace gas species and/or science questions being asked. Could this activity be picked up by the TransCom community? It is clear (& stated) that we need more measurement stations, but do we need to put more effort into merging of data sets to expand the network?

(b) Review the internal consistency of CO₂ observations archived at the WDCGG. Data should be available in “versions” (similar to NOAA’s GLOBALVIEW-CO₂ product) with consistent quality control flags. Develop methods to archive quality-assured retrievals of CO₂ column abundance. Develop guidelines for internally-consistent data set that includes in situ and remotely-sensed retrievals of column averages of long-lived GHGs. (WDCGG with guidance from SAG – 2010)

ICP participants should make more use of the results as one aspect to improve the consistency of their data, and to help assign uncertainties to their data.

Recommendation: SAG recommends that there is an urgent need for guidelines for data producers on how to assign uncertainties on their data for ultimate submission to WDCGG. Guidelines to be drafted by next experts meeting.

Action: Within next six months to one year, NOAA/ESRL (Ed) to produce an initial framework for estimating uncertainty on *in situ* trace gas measurements (sources of

uncertainty, how to quantify them and ultimately combine them) and circulate to SAG and Jörg Klausen for comment.

Discussion ensued about what is involved: Need to engage NMIs; our results have to be able to withstand scrutiny; need to consider all errors/uncertainties and combine them in a sensible way; sources of errors – errors in transfer of scales, measurement error, repeatability, scatter in results from comparison exercises (ICPs) etc.

Jörg Klausen may have an initial start on some guidelines, but we need to include uncertainty from comparison activities.

(c) Appoint a scientific advisory panel charged with developing an implementation strategy for IGACO-GHG. A major component of this task will be to produce guidelines for a comprehensive, internally-consistent data set that includes *in situ* measurements and remotely-sensed retrievals of CO₂.

One representative from each community to form a panel or membership in the GHG SAG? Chip Miller said that it is essential to have satellite measurements on the same scales as the direct atmospheric measurements. He prefers that a member from the satellite community to be on the GHG SAG.

How do we envision the internally-consistent datasets will look like? Where will they be housed? Satellite data are available from NASA via Distributed Active Archive Centres (DAACs): several gigabytes per day, and for higher level data ~75 terabytes per year! Each community has their own system and clearing house for the data, and could just link to each other. This lets each clearing house do what they do best. Machida said that his aircraft data will be distributed from the NIES Centre for Global Environmental Research webpage on the NIES CO₂ scale. TCCON have their own website which is hosted by the California Institute of Technology (CalTech, USA) where their data are available.

Should a comprehensive survey of existing datasets be contained in IGACO-GHG?

Recommendation: IGACO-GHG “data centre” (hosted by WDCGG) would be a one stop shop for what is going on with greenhouse gas measurements in the atmosphere. Provides information on, and links to, each of the other data centres (distributed data centres).

Action: Chip to draft appropriate language/text on the principles for IGACO-GHG. These to be circulated to Len, Ed, Dave, Machida, Suda, Jim & Oksana for comments. Principles should include that data need be traceable to WMO scales and that the distributed data archive policy is centered on the WDCGG as mature surface global data centre.

Item 14. Other issues not addressed above.

a) Should new measurement techniques (instruments) get something like a "stamp of recommendation (or approval)" by GAW to indicate that they are suitable for the GAW network?

No. If they meet Data Quality Objectives (DQOs) then it is OK. Also, there is a process in that every two years the experts group meets, results are presented and scrutinized by the experts community.

b) Uncertainty calculations

See Item 13(b) above.

c) GAW webpage – Eckhart wants easy access to new GAW global map. Oksana to update website.

d) Should the SAG have an endorsement of the update of the glossary of QA/QC.
This was endorsed by the SAG.

e) GHG bulletin

This is being produced currently. CO₂ is to be highlighted in this bulletin. It would also be good to highlight the TCCON network in the bulletin.

Action: Dave Griffith to send a TCCON site map and picture of a TCCON site to Len Barrie and Geir Braathen for inclusion in the upcoming GHG bulletin.

f) GHG SAG membership

Len suggested we add members from the aircraft (Toshinobu Machida), TCCON (Dave Griffith/Justus Notholt), and satellite (to be decided) communities. These people have been invited to join the GHG SAG. Brad Hall to be invited to replace Jim Butler. Martin Heiman has announced that he is to step down from GHG SAG. Martin Heiman was thanked by the group for his contributions to the GHG SAG. Armin Jordan to be invited to replace him.

Action: A letter of exchange between GAW and TCCON to be written.

A letter from Paul Wennberg to Len Barrie stating the intent of TCCON to cooperate with WMO GAW and participate in the GHG SAG was signed on 15 October 2009.

Meeting adjourned at 15:30.