

Report of the status IGACO-Ozone and UV

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Introduction

Integrated Global Atmospheric Observations (IGACO) report in 2004 summarized the expert opinion of an international panel of scientists and reviewers on global atmospheric chemistry observations and models and how to make the full use of them, ensure continuity, reliability and easy access to data and how to combine them. The approach for implementing the topics of the IGACO report within the WMO's GAW programme is organised with thematic foci and cross cutting initiatives. One of the themes is ozone and UV and Finnish Meteorological Institute (FMI) has agreed to host the IGACO-O3/UV secretariat. We summarize here the present status and recent activities of the IGACO-O3/UV:

- Implementation Plan and IGACO-O3/UV activities
- ACSO: IO3C & WMO GAW Ad Hoc Expert team on Absorption Cross Sections of Ozone
- Ozone theme meeting in May 2009
- Future plans

Implementation plan and IGACO-O3/UV activities

The IGACO-Ozone and UV Radiation Implementation Plan has been published as GAW report No. 182, 2009. It is based on output of several workshops co-sponsored by WMO and the International Ozone Commission of ICSU. All together 18 reviewers contributed to the final form of the Implementation Plan.

The scope of the first phase of the implementation plan is five years and 29 initial activities have been identified. These activities are divided into four groups:

- **Stratospheric ozone**
 - Column ozone measurements (Activities: A1-A6)
 - Stratospheric ozone profiles (A7-A8)
- **Ozone in UT/LS** (B1-B3)
- **UV-radiation** (C1-C6)
- **Services** (D1-D12)

The Implementation Plan can be downloaded from the WMO web site:

www.wmo.ch/pages/prog/arep/gaw/documents/TD_No1465_GAW182_web.pdf

or from the IGACO-O3/UV web-site: www.igaco-o3.fi/programme/programme_2.html

ACSO: IO3C & WMO GAW Ad Hoc Expert team on Absorption cross sections of ozone

The IO3C and the WMO recommend that an ad hoc expert team on "**Absorption Cross Sections Of Ozone (ACSO): An Activity on IGACO-Ozone**" be established with the following tasks:

- **Review** presently available literature of ozone absorption cross sections and their temperature dependencies covering all relevant temperatures; first priority is the wavelength range of 300-350 nm with possible extension to visible and IR wavelengths.
- Determine the **impact of changing** ozone absorption cross sections for all of the

commonly used (both ground-based and satellite atmospheric ozone instruments. This part of the study should include the impact on the consistency of the ozone records from instruments in the world-wide monitoring of ozone and the impact of the implementation on the groups responsible for the instruments.

- **Recommend** whether a change should be made to the presently used WMO/IO3C standard ozone absorption cross section data.
- **If** a change is recommended, then **provide guidelines** and time-line for implementing new absorption cross sections, separately for each instrument type.

The findings, including recommendations, of the Expert Team are written in a report. The recommendations are discussed with the community of the involved experts. The work will be finished in two years after the first meeting in 2009.

The ACSO Expert Team, which is led by Prof. Dr. Johannes Orphal, was established in 2009 with 27 members. Representatives from NASA, ESA, SAG-ozone, WMO, IO3C and IGACO-O3/UV are among the participants as well as laboratory experts and algorithm specialists of several ground based and satellite instruments that use the Huggins band. The kick-off was arranged in combination with the Ozone Theme Meeting in May 11, 2009 at WMO, Geneva.

This work is now defined also as IGACO-O3/UV Activity A9: Absorption Cross sections of ozone.

Ozone Theme Meeting: Absorption cross sections of ozone

The second Ozone Theme Meeting was hosted by WMO, Geneva, 11-13 May, 2009. The topic was very focused: ozone absorption cross sections. The purpose of this meeting was thus to support the work of the ACSO and it also concentrated mainly on Huggins band. The meeting consisted of four sessions: (1) general, (2) laboratory measurements of cross sections, impact of changing ozone cross sections in (3) ground-based and (4) satellite instruments.

The meeting was very successful and the discussion was active. All together 19 talks on cross sections were presented and they can be found in the web page: igaco-o3.fmi.fi/acso.

Several observations were made during the meeting:

- It is not clear which cross section and what type of temperature dependence are used by different teams/instruments. Several data sets exist of even Bass and Paur (BP) cross sections (with differences in shift, squeeze, resolution, etc). General feeling was that it would be good if the same cross sections were used by all.
- Changing from Bass and Paur (BP) cross sections to Daumont-Brion-Malicet (DBM) cross sections have rather different impact depending on instruments:
 - Brewers show strong dependence. Slightly mixed results by various teams.
 - Dobsons show only minor dependence. Temperature dependence has stronger impact.
 - OMI DOAS retrieval shows only small impact, ~1-2 DU difference.
 - OMI TOMS algorithm shows larger, 1-1.5% difference.
 - OMI profile algorithm: strong impact, differences up to 10-15% at low altitudes.
 - Lidars – dominant error originates from the temperature dependence
 - Temperature dependence is considered to be more reliable in DBM than in BP.

- Residual analysis:
 - Which cross sections are 'better' can be answered by performing residual analysis.
 - Residual analysis for TOMS retrievals showed better agreement with DBM than BP.
 - OMI DOAS residual analysis was slightly better with BP.
 - Residual analysis of US OMI profile retrieval showed better agreement with DBM than with BP. Dutch retrieval showed mixed results (limited data set: DBM better at tropics and high lat, BP better at 30N)
 - Residual analysis of comparing BP, DBM and GOME FM in SCIAMACHY retrievals showed better agreement with DBM than with BP. GOME FM was close to DBM but slightly worse. Results were consistent at all solar zenith angles.
 - Residual analysis has been done for several satellite instruments but it is also needed for ground based instruments.
- NASA and ESA (GOME, SCIAMACHY, GOME-2) are most probably going to change from BP to DBM.
- It was noted that it is very important to have consistent cross sections with large wavelength range, sufficient resolution and good slit function characterisation in several temperatures (include also lower T than presently available).

Future plans for IGACO-Ozone/UV during 2009-10

Related to Activity A5 systematic comparison of total ozone measurements from ground and space that was already performed for Brewers/Dobsons is now done also for DOAS and SAOZ type of instruments in order to detect suspicious ground-based measurements and to improve ground based data quality. Vitali Fioletov leads this comparison. The results will be discussed in a workshop that is hosted by FMI/ Helsinki in 29.6 – 1.7. 2009

The work related to ACSO will continue also during next year. IGACO-O3/UV will host the web page for the expert team and to distribute information. Yearly meetings are planned for ACSO and IGACO-O3/UV will help in arranging them.

After defining the initial set of IGACO-O3/UV activities that are described in the Implementation Plan also other related topics have risen in various discussions. One of them was the ozone absorption cross sections discussed above. Others include:

- Data portals. There are several developments going on in different parts of the world. IGACO-O3/UV could play a role in organizing a workshop to see what is the status of different developments and to improve co-operation.
- Homogenization of total ozone data set.
- Homogenization of ozone profile data set. (Related to activity A8)

As the resources for the IGACO-Ozone/UV work are limited it has been considered that organising workshops on important topics related to the IGACO-Ozone/UV is an efficient way to take steps towards the goals of IGACO. The ideas above and other future activities will be discussed during the SAG-ozone meeting in 1-3.7. 2009 hosted by FMI in Helsinki.

The key point for reaching the goals of IGACO and making the work successful is a good and active **co-operation** between all players: ozone and UV scientists, data providers, data centres, space agencies, as well as working groups, strategies and projects that are aiming for similar goals as IGACO.