2011 Update on IGACO-Ozone/UV
The IGACO report

IGOS
Integrated Global Observing Strategy

For the Monitoring of our Environment from Space and from Earth

January 2002
An international partnership for cooperation in Earth observations

IGACO
THE INTEGRATED GLOBAL ATMOSPHERIC CHEMISTRY OBSERVATIONS THEME

For the Monitoring of our Environment from Space and from Earth

September 2004
An international partnership for cooperation in Earth observations
The IGACO structure

Implementation
WMO-CAS (EPAC)

Other WMO Prog.
WWW, Space, GCOS, WCRP

Thematic Foci
IGACO-Ozone/UV
UTLS Chem.
Lead: FMI
GAW SAG Ozone
GAW SAG UV

IGACO-GHG
Climate forcing
GAW SAG GHG

IGACO-Aerosols
Climate-chemistry interactions
GAW SAG Aerosols

IGACO-LRTAP-AQ
GAW SAG Aerosols
GAW SAG React. Gas

Cross cutting
Observational Systems
Assimilation & Modelling
Product Delivery and Databases
Quality Assurance and Validation
IGACO - Ozone and UV radiation

IGACO (International Global Atmospheric Chemistry Observations) is a strategy for bringing together ground-based, aircraft and satellite observations of 13 chemical species in the atmosphere. IGACO will be implemented as a strategic element of the Global Atmospheric Watch (GAW) programme of the World Meteorological Organization (WMO).

The implementation will be organised in four focus areas: Ozone, Aerosols, Greenhouse gases and Air Quality / Long-range transport. Activities in each focus area will be coordinated by a WMO, jointly with a IGACO Theme Office hosted by a research institution in the field. The IGACO-Ozone and UV Office is hosted by the Finnish Meteorological Institute.

Latest News:
On 12-14 March 2007, IGACO-O3/UV organised a workshop discussing different aspects of Data Management. The meeting was hosted by EMPA in Duebendorf, Switzerland. Among the topics were improved access to data, submission procedures, protocols and data homogeneity and quality.

Read more »
IGACO-O₃/UV is implemented through Global Atmosphere Watch

The Implementation Plan for IGACO-O₃/UV was published as GAW report # 182 in April 2009.

The Implementation Plan is divided into 4 sections:
- Observations of ozone
- Observations of UV radiation
- Modelling and data assimilation
- Data archiving and data dissemination

Activities that were discussed and recommended at the Anavyssos workshop in 2006 constitute a large part of the Implementation Plan.
IGACO-\( \text{O}_3/\text{UV} \) events

- MoU between FMI and WMO: Autumn 2005
- IGACO-Ozone/UV workshop in Anavyssos, GR: May 2006
- IGACO-Ozone/UV workshop in Dübendorf, CH: March 2007
- IGACO-Ozone/UV workshop on difficult ozone time series: Tenerife, April 2007

♦ This workshop, together with 7th ORM recommendation, led to the Dobson Data Quality workshop in Hradec Králové in February 2011
IGACO-O$_3$/UV events

1st GAW - IGACO - NDACC workshop (Ozone Theme Meeting) on ozone measurement techniques: April 2008, Geneva

2nd GAW - IGACO - NDACC Ozone Theme Meeting, 11-13 May 2009, WMO, Geneva

GAW - IGACO - NDACC Workshop for comparison of DOAS/SAOZ total ozone measurements with satellite measurements, 29-30 June 2009, FMI, Helsinki

3rd GAW - IGACO - NDACC Ozone Theme Meeting on Ozone Absorption Cross Sections, 23-25 March 2010, WMO, Geneva
IGACO-\(\text{O}_3\)/UV events

4th GAW - NDACC - IGACO - SPARC Ozone Theme Meeting on past trends in the vertical distribution of ozone

Presented by Johannes Staehelin tomorrow morning
Workshops until 2008 were reported on at the 7th ORM in 2008.

Will now focus on the outcome of the ozone absorption cross section workshops and study.

Absorption Cross Sections of Ozone (ACSO)

ACSO ("Absorption Cross Sections of Ozone"), established in spring 2009, is a joint ad hoc committee of WMO-GAW (SAG-ozone + IGACO-O$_3$/UV) and the International Ozone Commission (IO$_3$C, IAMAS).
Problem: Presently used ozone absorption coefficients are the Bass and Paur (B&B) from 1985. These cross sections are not fulfilling demands of the satellite community.

New ozone absorption cross sections were measured in the early to mid 1990s by Brion, Daumont and Malicet and co-workers. These X-sections have been given the name BDM.

- BDM has much better resolution than B&P: 0.01 nm vs 0.1 nm
- Extended wavelength range: 195-345 nm vs 245-340 nm
- BDM has more precise data for temperature dependence of the X-sections
WMO and IO\textsubscript{3}C established in spring 2009 a joint ad hoc commission with the mandate:

- Review of literature of ozone absorption cross sections (temperature dependencies); first priority: wavelength range of 300-350 nm (extension ?)
- Impact of changing ozone absorption cross sections for all commonly used (both ground-based and satellite) ozone instruments (consistency of records; impact of implementation).
- Recommend whether a change should be made to presently used WMO/IO\textsubscript{3}C standard ozone absorption cross section data (Bass and Paur, 1985).
- If a change is recommended, provide guidelines and time-line for implementing new absorption cross sections, for each instrument type.
- Findings to be documented in a report.
- The recommendations to be discussed with the community.
- The formal mandate ends two years after the first meeting in 2009 (2011).
Small effect on Dobson measurements

- Little effect when using the operational retrieval algorithm (AD observations)
- Sensitivity of total ozone observations on atmospheric temperature smaller when using BDM instead of B&P
- Discrepancy between AD and CD observations not smaller when using BDM instead of B&P: probably because of another problem in Dobson spectrophotometry (stray light problem?)
- Consider improvement of retrieval algorithm: Atmospheric temperature profile dependency strongly determines accuracy of total ozone measurements of Dobson instruments when using present retrieval algorithm
**Significant effect on Brewer measurements**

- Better quality of ozone absorption cross sections BDM over B&P: Better accuracy and precision of Brewer total ozone measurements expected
- When using BDM instead of B&P: lower column ozone results are expected (3% lower ozone in average)

**For Umkehr retrievals the effects are similar for Dobson and Brewer:**

- Stray light effects have a substantial effect to falsify Umkehr ozone profile data in the current algorithm
- Effects of temperature dependence affects Umkehr profile measurements much less than stray light effects
- Effects of replacement of B&P by BDM are similar in magnitude to the temperature dependence (with opposite sign)
Differential Absorption Lidar (DIAL)

- Effects for mean profiles are small
- Largest effects for ozone in the upper stratosphere (ca. 1.5%) and the lower stratosphere (15 km) in the tropics (-1.5 %)

Satellite measurements

- TOMS, OMI, GOME, GOMOS, SBUV, SAGE II & III, OSIRIS
- The effect of changing from B&P to BDM depends on the instrument in question. Typically, a change from B&P to BDM will lead to an increase in total ozone of about 1-3%.
More info

- [http://www.wmo.int](http://www.wmo.int)
- [http://www.igospartners.org/Atmosphere.htm](http://www.igospartners.org/Atmosphere.htm)
- [http://www.igaco-o3.fi](http://www.igaco-o3.fi)
Data exchange
Multitude of data bases

A new data base is created every time there is a need for new functionality

- World ozone and UV data centre (Woudc, Toronto) has existed since the 1960s
- In early 1990s the need arose for access to data in near-real time, which led to the creation of NILU’s NADIR data base and FMI’s UV data base

Time consuming to submit data to many data bases

Difficult to find data since they are stored in many different places
data providers
(e.g. ESA, NASA, NASDA, ECMWF, NCEP, station networks, individual stations, field campaign data centers, ...)

bureaucratic procedure, i.e., submission of proposal, annual reports, final report, etc.

simple registration or free access

data users
individual research groups
Ideal situation

Data providers

Data protocol

GTS/WIS

Data centres

Data users
Data formats

Many formats
- HDF, NetCDF, NASA Ames, ISO, CSV, GRIB, CREX, BUFR, XML...

Difficult to persuade everybody to use one format
- Converters can translate between the various formats
One-stop shops and data mining

http://wdc.dlr.de/
http://ozonewatch.gsfc.nasa.gov
WMO Information System (WIS)

- World Radiation Centre
  Regional Instrument Centres

- Climate research institutes
  Universities
  Regional Climate Centres

- International organizations

- 6 GAW World Data Centres
  GCOS Data Centres
  Global Runoff Data Centre

- Managed, regional and Internet communications networks

- Commercial service providers

- WMO World Data Centres

- Real-time “push”
  On-demand “pull”

GAW: Global Atmosphere Watch
GCOS: Global Climate Observing System
NMC: National Meteorological Centre
DCPC: Data Collection or Product Centre
GISC: Global Information System Centre

8th ORM, 2-4 May 2011