Minutes of the
8th Atmospheric Composition Constellation Workshop (ACC-8)
Columbia, Maryland, USA
18-19 April 2012

1.0 Executive Summary

The Committee on Earth Observation Satellites (CEOS) ACC-8 was held at the Sheraton Columbia Town Center Hotel in Columbia, Maryland, USA, on 18-19 April 2012. The meeting was held in conjunction with the Stratospheric Processes and their Role in Climate (SPARC) Workshop on Past Changes in the Vertical Distribution of Ozone which was held earlier that week at the same venue. The Atmospheric Composition Constellation (ACC) is one of the six virtual constellations that support the overall goals of the Group on Earth Observations (GEO) and provide prototype systems supporting the implementation of the Global Earth Observing System of Systems (GEOSS). The meeting was attended by representatives from participating CEOS agencies, related universities, and supporting organizations, including the Belgian Institute for Space Aeronomy, CSA, DLR, Environment Canada, ESA, EUMETSAT, Finnish Meteorological Institute, Johns Hopkins University, KNMI, Korean Aerospace Research Institute (KARI), NASA, National Institution of Information and Communication Technology (NICT Japan), NOAA, Northrop-Grumman, SPARC, University of Bremen, University of Maryland, University of Saskatchewan, University of Toronto, Yonsei University, and York University. We are grateful to Kathy Thompson and Rose Kendall for meeting logistics.

The Workshop had three sections: 1) Geostationary Air Quality Constellation Coordination, (2) Near-Term Total Ozone Measurement Coordination, and (3) Limb-Scattering Ozone Profile Measurements. The workshop Agenda and participant list are attached to these minutes. The presentations can be found at
http://www.ceos.org/index.php?option=com_content&view=article&id=369:acc8meetingpresentations&catid=53&Itemid=94

2.0 Workshop Highlights and Recommendations

1. New Directions for CEOS Virtual Constellations

    a. The CEOS Executive Officer discussed new priorities for CEOS which have emerged during the last year through its Self Study activities. Particularly relevant to ACC, is the recommendation that CEOS virtual constellations align their activities to contribute to the WMO Global Climate Observing System (GCOS) Implementation Plan through the development of relevant fundamental climate records.

2. Geostationary Air Quality Constellation Coordination

    a. The position paper, "A Geostationary Satellite Constellation for Observing Global Air Quality: An International Path Forward" was endorsed by CEOS leadership at

SIT-26. It is available at
http://www.ceos.org/images/ACC/AC_Geo_Position_Paper_v4.pdf .

b. Representatives from the US GEO-CAPE, European Sentinel-4, Japanese GMAP-Asia (and Apollo), and Korean GEMS on Geo-KOMPSAT missions discussed current status and plans for their missions. The Canadian Polar Communications and Weather (PCW)/Polar Highly Elliptical Orbital Science (PHEOS) mission was also represented at the workshop. Given its geostationary-like orbit characteristics and air quality mission measurement objectives, it was recommended that it be included as one of participating satellite missions in the coordination effort. This recommendation was accepted by ACC membership.

c. Results: Progress is being made in implementing the initial near-term recommendation from the position paper. Cross-agency membership on mission science and advisory teams is being initiated. The following researchers were tentatively identified as participants on these teams:

ESA: Ben Veihelmann, Claus Zehner
DLR: Diego Loyola
NASA: Jay Al-Saadi
NOAA: Shobha Kondragunta (TBC)
NIER/ME: Youdeog Hong (TBC)
Yonsei Univ.: Jhoon Kim
NICT: Yasuko Kasai
JAXA: Shuji Kawakami

An OSSE workshop is tentatively planned for autumn 2012 to be hosted by ECMWF. Plans for methodologies to assess the societal benefits of the observations were discussed. It's expected that this activity will take place in 2014.

3. Near-Term Total Ozone Measurement Coordination

a. Following up on last year's ACC-7 workshop, modelers and instrument team representatives from the U.S. and Europe discussed the current status of their total ozone data sets with an emphasis on algorithm improvements, uncertainty quantification, validation, and intercomparison activities.

b. It was noted with regret that Envisat had ceased to operate, thus ending the valuable ozone time series from GOMOS, MIPAS, and SCIAMACHY.

c. Recommendation: A consensus emerged that ACC could facilitate a two-step process that would respond to the new emphasis for the virtual constellations to respond to GCOS actions:

1) Collaborations among the various instrument groups to make a best-effort characterization of errors of the individual data sets (i.e., SBUV/TOMS/OMI and the GOME/SCIAMACHY/GOME-2 datasets).

2) Enhance interaction between North American researchers and European ozone_cci project participants to bridge the gap between these two sets of total ozone measurements.

4. Limb-Scattering Ozone Profile Measurements

   a. Members of current and future limb scattering profile ozone measurement missions discussed results and future plans. Initial results of profile ozone from the recently launched Suomi NPP OMPS limb sensor are promising with good agreement with other measurements.

   b. It was noted that with the unexpected end of SCIAMACHY O_3 measurements, the aging of existing sensors, and uncertainty in US JPSS ozone limb measurement plans, a looming gap in ozone profile measurements exists. OSIRIS continues to provide measurements and SAGE III-ISS, with a planned 2014 launch, should also somewhat mitigate this concern.

   c. The O_3 profile limb teams collaborate closely through related international efforts such as the joint SPARC, International Ozone Commission (IOC), Integrated Global Atmospheric Chemistry Observations Programme, and Network for Detection of Atmospheric Composition Change (SI^2N) Initiative on Past Changes in the Vertical Distribution of Ozone.

   d. It was agreed that new ACC projects on co-operation on total ozone and limb scattering measurements will be established. Details will be finalized by the end of 2012 (lead: C. Zehner).

5. Other Issues

   a. Several complementary projects were discussed at the workshop. The SPARC Data Initiative and the ACCMIP project are activities that involve many ACC members.

   b. A presentation on the Multi Sensor Volcanic Eruption Alert System, a project tracked by CEOS and led by ACC, demonstrated excellent progress in the timely transmission of alerts to affected aviation interests and related agencies.

   c. A report was presented on the CEOS Carbon Task Force and its progress in composing a response to the GEO Carbon Strategy Report. One section of the report dealing with the atmosphere domain is of particular interest to ACC. It is possible that ACC will play a role in implementing some of its atmospheric relevant recommendations (e.g., on the generation of GHG essential climate variables (ECVs) as articulated in the GCOS Implementation Plan).

3.0 Summary of Workshop Topics and Discussions

3.1 Introduction

Tim Stryker (CEOS Executive Officer/USGS) discussed the emerging new directions for CEOS working groups and virtual constellations in support of the new GEO work plan and results of the CEOS Self Study particularly with respect to CEOS future activities. Key points relevant to the ACC include the improved coordination of space agency activities related to climate, particularly through an increased emphasis on the development of fundamental climate data records in collaboration with the CEOS Working Group on Climate. In addition, an increased alignment of the virtual constellations towards contributing to the WMO Global Climate Observing System (GCOS) Implementation Plan is foreseen.

The Self Study considered both internal and external CEOS coordination issues. The working groups and virtual constellations will have increased visibility with the CEOS Strategic Implementation Team (SIT), both through bi-monthly telecons with SIT leadership and enhanced opportunities for discussion at SIT meetings. The provision of adequate resources and personnel is a key area that SIT leadership is committed to address by working with member agencies and the working groups and virtual constellations. The Self Study recommended an increased focus on the physical delivery of new and unique information products and services through improved internal ("horizontal") coordination between working groups and constellations to better synchronize their work.

Claus Zehner (ACC Co-Lead, ESA) discussed the scope of the meeting. As articulated at last year's ACC-7 meeting (see http://www.ceos.org/images/ACC/acc7/ACC-7%20Minutes%20v1.6.pdf for further information), the ACC's key objectives are to collect and deliver data to improve predictive capabilities for coupled changes in the ozone layer, air quality, and climate forecasting and to meet participating agency priorities that are aligned to the GEO societal benefit areas (e.g., health, climate, energy, ecosystems). ACC works to facilitate international collaboration among space agencies and establish a framework for long term coordination of CEOS's goals. The goals of the present meeting are to:

- Consider mission status and near-term actions for the Air Quality constellation effort. The coordination paper, which articulated both near- and long-term actions, was endorsed at SIT-26 held in May 2011.
- Follow-up on last year's discussion of total ozone data set generations and consider how ACC can facilitate future cross-agency activities. Assess ongoing activities of European and North American space-based and ground-based observations. Also, consider input from atmospheric modelers and their needs for harmonized data sets and/or high quality time series from individual instruments.
- Discuss current status of limb-scattering ozone profile measurement missions, assess upcoming mission prospects, and consider coordination needs.

3.2 Geostationary Air Quality Constellation Coordination

3.2.1 GEO-CAPE and near-term AQ Constellation activities (Jay Al-Saadi, NASA Headquarters and Langley)

AQ Constellation

Several countries and space agencies are planning to launch geostationary satellites in the 2017-2022 timeframe to obtain air quality measurements. A geostationary orbit provides near continuous observations (many times per day), but a single geostationary satellite can view only a portion of the globe.

Since these missions share fundamental common objectives yet individually are restricted to regional relevance, harmonization through a constellation framework will provide a global perspective otherwise impossible to achieve. Such an integrated global observing system for atmospheric composition is key to abatement strategies for air quality as laid down in various international protocols and conventions (IGACO, GEO, WMO GAW).

The scope of the air quality constellation activity will be to

- Conduct international collaborative activities to improve preparation for, and capabilities of, these air quality missions;
- Identify policy-relevant science and environmental services that would be enabled by common observations from each mission; e.g., by improvements in regional emissions to common confidence levels over the entire industrialized Northern Hemisphere, improvements to air quality forecasts and assimilation systems, and improved assessment capabilities;
- Include those climate aspects that are interrelated with AQ; e.g., short-lived climate forcers (O_3, aerosols), AQ/climate co-benefits; LEO missions over oceans and intermediate regions not covered by the planned geostationary observations.

GEO-CAPE Status

NASA's GEO-CAPE mission, originally proposed in the US National Research Council's 2007 Earth Science Decadal Survey, has as its principal objectives to track air pollution transport, identify natural and anthropogenic sources of aerosol and ozone precursors, and understand response of coastal ecosystems to atmospheric and riverine input, human activity and climate change. Its continuous high temporal observations will allow pollutant concentrations to be related to their sources and transport, as well as provide data to improve air quality forecasts and coastal zone management.

As a result of budget challenges, GEO-CAPE is not presently scheduled for launch before 2022. NASA is considering a distributed mission implementation concept featuring earlier launches of individual instruments on commercial communications satellites. It's possible that the AQ component could launch at a similar date as the European and Asian missions.

NASA is funding an Earth Venture-1 project called DISCOVER-AQ which is a 5-year series of airborne campaigns that is demonstrating how multiple remote sensing observations per day will be combined with ground based measurements in integrated observing systems for air quality.

3.2.2 Sentinel-4, -5 and -5P (Claus Zehner, ESA)

The Sentinel missions will utilize a constellation approach with platforms in both Geostationary (Sentinel-4) and low Earth orbits (Sentinel-5 and Sentinel-5P) to address multiple policy drivers (e.g., ozone, air quality, and greenhouse gas monitoring). Sentinel-4 will be a UV, visible, and near-IR (UVN) instrument aboard the EUMETSAT MTG-S satellite, while Sentinel-5 is planned as a UVN plus shortwave IR (UVNS) instrument on EUMETSAT's EPS-SG platform. To provide continuity between SCIAMACHY on Envisat, OMI on AURI, and the future Sentinel-5 launch, a precursor LEO mission, Sentinel-5P, will feature a UVNS spectrometer on a dedicated platform.

The Sentinel-4 mission will concentrate on Europe and part of North Africa with a spatial coverage of 8 km at 45°N. Anticipated measurements include total and profile O_3, NO_2, SO_2, aerosols, clouds, and surface reflectance. A preliminary design review will take place during summer 2012 with an anticipated launch in 2019. The mission will be operated by EUMETSAT with European Commission Global Monitoring for Environment and Security (GMES) services and future downstream services provided at the national level.

The Netherlands will provide TROPOMI for Sentinel-5P with an anticipated 2015 launch. Atmospheric composition measurements will include profile and total O_3, NO_2, SO_2, CO, CH_4, aerosols, and possibly total column CO_2. It is anticipated that the mission will fly in a loose formation with Suomi NPP which will yield additional synergistic benefits.

3.2.3 MTG-IRS (Rose Munro, EUMETSAT, on behalf of Cathy Clerbaux, LATMOS)

Infrared sounding (IRS) aboard MTG will have high spectral and spatial sampling from a geostationary orbit, delivering information on horizontal and vertical gradients of moisture, wind and temperature. These measurements will provide a unique perspective between the individual radiosonde measurements and those from polar orbiting satellites. For atmospheric composition, MTG-IRS will provide measurements of CO and ozone, in synergy with the UVN measurements on the same platform (Sentinel-4). While not optimized for atmospheric composition, measurements will yield tropospheric columns of CO and ozone, which will be particularly useful at high pollution levels. Ash detection may also be possible.

3.2.4 GMAP-Asia and APOLLO (Yasuko Kasai, NICT)

Both the Geostationary Satellite for Asian Air Pollution (GMAP-Asia) and Air Pollution Observation Mission (APOLLO) are motivated by increasing anthropogenic emissions of NOx in Asia. These anthropogenic emissions now exceed levels in North America. Both planned missions have multiple scientific and societal goals, which include to monitor emission inventories at human activity scales, measure atmospheric chemistry species, improve models and assimilations, monitor climate impacts, track the intercontinental transport of air pollution, and provide weather/health advisories at small city scales.

GMAP-Asia will comprise both a UV/Visible and thermal IR (imaging FTS) sensors. At present, technology development is ongoing with two papers recently published in *Advances in Space Research*.

APOLLO, which will fly aboard the International Space Station, will demonstrate 3-D field observations of tropospheric ozone and its precursors with 3 x 3 x 3 km resolution with same point observations from multiple instruments. Three candidate instrument concepts are being considered: a UV/Visible instrument (Scia-ISS) in collaboration with the University of Bremen and JAXA, an IR instrument from JPL, and a microwave concept based on MLS and SMILES in collaboration with JAXA, NICT, and JPL. A mission design review will take place this summer with planned launch in 2017. APOLLO could potentially connect the observations from multiple, dispersed geostationary AQ observations, given its LEO orbit.

3.2.5 GEMS Mission Onboard Geo-KOMPSAT (Jhoon Kim, Yonsei Univ.; C. K. Song, National Institute of Environmental Research (NIER) & Ministry of Environment; D. H. Ko, KARI)

The Geostationary Environment Monitoring Spectrometer (GEMS) will fly onboard the Geo-KOMPSAT satellite with a planned 2018 launch. This mission involves four ministries and responds to the National Aerospace Promotion Act and the National Climate Adaption Plan. GEMS is a UV/Visible spectrometer that will cover the Asia-Pacific domain (target center 120°E, 17°N), measuring O_3 (with ~2% accuracy), NO_2, HCHO, SO_2, and AOD. Two other instruments, GOCI-2 and a meteorological imager will also fly on the mission. Lifetime is expected to be greater than 7 years. Funding has been initiated in 2012 with the selection of a main contractor anticipated by late this year.

GEMS is expected to provide measurements of air quality and short-lived climate-change drivers (SLCD) with high temporal and spatial resolution. GEMS will contribute to the understanding of the global extent of pollution events, source/sink identification, and long-range transport of pollutants and SLCD.

3.2.6 PCW/PHEOS (Jack McConnell, York University)

The Canadian Polar Communications and Weather (PCW) mission will consist of two satellites in highly elliptical orbits providing a quasi-geostationary orbit with a focus on the Arctic region. Objectives include reliable communication services at high northern latitudes, high temporal/spatial resolution meteorological measurements above 50°N in support of numerical weather prediction, environmental monitoring, and climate change monitoring. The Polar Highly Elliptical Orbital Science (PHEOS) instrument will fly onboard PCW with FTS and UV/Visible (UVS) instruments to measure multiple species relevant to atmospheric composition including O_3, NO_2, CO, CH_4, CO_2, and a number of air-quality relevant consituents. Multiple academic, government, and private institutions are collaborating in mission planning.

The primary PHEOS Mission objectives are:

- Improve weather forecasting and climate modeling in the Arctic
- Better understand the impact of industrial and agricultural pollution and Boreal forest burning on the Arctic
- Assess emissions of GHGs in Arctic environs

Phase A studies revealed that a larger platform would be necessary to fit the UVS sensor. Nonetheless, a reasonable amount of science return could be expected in the absence of the UVS sensor.

Within the context of a planned AQ constellation, the PHEOS orbit is particularly interesting since it would spend consider time over North America, Europe, and Eastern Asia. PHEOS could act as a transfer calibration standard between the various missions. This would mirror the potential use of the LEO-orbiting APOLLO to connect these AQ measurements across the globe.

3.2.7 Path Forward to Implement Short-Term AQ Constellation Actions (All; Jay Al-Saadi, discussion lead)

This activity has focused on harmonizing the planned geostationary AQ missions. The "baseline" constellation data products are those common to all missions. The coordination effort also provides a framework for implementing the overall space component of an integrated observing system for AQ. For example, defining "goal" constellation data products provides a basis for assessing candidate measurement requirements for missions with payload details still to be determined and evaluating new mission concepts (e.g., ESA EE MAGEAQ to complement MTG/Sentinel-4 and possible NASA Earth Venture concepts).

It's recognized that extending coverage to the Southern hemisphere is desirable. Copies of instrument designs could be utilized to lower per-instrument cost and launching on commercially hosted payloads would reduce cost. The AQ constellation framework is flexible so that other missions can be added as they gain approval. The Canadian PCW/PHEOS mission should be embraced.

Common air quality products can be produced from these missions combined with operational geostationary meteorological missions. UV-Vis observations will allow a common set of tropospheric column products to be produced over the industrialized Northern Hemisphere at ~8 km spatial resolution and 1 hour refresh

- O_3
- NO_2
- HCHO
- SO_2
- AOD

Aerosol detection in the UV will allow absorbing aerosol to be distinguished from total AOD, providing information on aerosol speciation and important to the air quality/climate interface. The combination of FCI on MTG and ABI on GOES-R and GEO-KOMPSAT will allow continuation and improvement of several currently produced aerosol and fire products.

The near-term recommendations as articulated in the position paper are:

1. CEOS agencies to coordinate one or two key people to be part of mission science or advisory teams with a focus on common science and collaborative data products.

    Status: Should complete this year; need to identify people and resolve details. Those tentatively identified at the meeting included Ben Veihelmann (ESA), Claus Zehner (ESA), Diego Loyola (DLR), Jay Al-Saadi (NASA), Shobha Kondragunta (NOAA, tbc), NIER/ME: Youdeog Hong (NIER/ME, tbc), Jhoon Kim (Yonsei, University), Yasuko Kasai (NICT), Shuji Kawakami (JAXA).

2. ACC to organize a workshop focused on air quality Observing System Simulation Experiments (OSSE) activities. CEOS to encourage and enable participation from relevant member agencies.

    - Status: Planning has started thanks to David Edwards (NCAR) and Vincent-Henri Peuch (ECMWF). Points of contact from each country need to be identified. A tentative date for the workshop is October 2012 at ECMWF. Each country will identify participants and provide their travel support.

3. ACC to coordinate societal benefit assessment of satellite air quality observations, leveraging recent GCOS and GEO UIC efforts.

    - Status: Complete during 2014? The PHEOS team has looked at societal benefits from a user requirements perspective involving benefits to communications, atmospheric composition, weather, mining and other resource extraction in Canada. The SBA relevance is a critical factor in justifying the mission. It was suggested that as each agency does its societal benefit assessments that they could be shared with the other groups. Health benefits are clearly one major area relevant to air quality forecasting.

3.3 Near-Term Total Ozone Measurement Coordination

3.3.1 Current Scientific Issues Involving Atmospheric Ozone: Implications For Future Space-borne Observations (Ross Salawitch, University of Maryland)

Ross discussed a number of science issues relevant to space-based total and profile ozone observations. In the stratosphere, the strength of the Brewer-Dobson circulation has increased due to rising GHG concentrations, leading to a super recovery of mid-latitude ozone and a depletion of tropical ozone. Accurate stratospheric ozone profiles are essential to improve our understanding of this issue. The interpretation of mid-latitude ozone loss due to volcanic eruptions is strongly dependent on the choice of the long-term total ozone dataset used in the analysis, which points to a serious need for better understanding the differences among these data. This uncertainty has serious implications in our ability to understanding the impacts of geoengineering of the climate. The Arctic ozone hole of 2011 may not be a unique event since there is evidence that the depth of the coldest winters is increasing. We need both space- and ground-based Arctic measurements to elucidate this issue.

Methodologies for inferring surface ozone based on space-based observations point to both the utility and limitations of the techniques, particularly when applied to air quality exceedance issues. There is a need for a revolution on the technologies needed to measure surface ozone levels from and/or evolution from space on a 6-hr time scale for these measurements to be useful to the AQ forecasting community.

In the upper troposphere (UT), there is a major gap in our understanding of photochemistry, compounded by the fact that tropospheric O_3 is an important anthropogenic GHG. Photochemical control of UT O_3 is not well established leading to the concern that we don't know what effect, if any, legislation in place to reduce surface O_3 will have on UT O_3. FTIR measurements from a non-polar orbit could constrain UT HO_2, NO, NO_2 and source species.

3.3.2 The NASA MEaSUREs GOZCARDS project (Lucien Froidevaux, JPL)

The Global OZone Chemistry And Related trace gas Data records for the Stratosphere (GOZCARDS) project's goal is to produce long-term global time series of Earth System Data Records (ESDRs) for ozone and other gas profiles by joining/merging various satellite data with a strong emphasis on validation. Ozone is a key data set considered with numerous data sources used (SAGE I, SAGE II, SAGE III, HALOE, UARS MLS, ACE-FTS, Aura MLS + POAM as a check). For zone mean ozone, GOZCARDS results show better profile resolution in the lower stratosphere. The project has found that careful analyses can help detect small changes/drifts between various time series, which would be beneficial to other harmonization efforts.

Datasets, using common formats and with an emphasis on ease of accessibility, will be delivered for public access to sites at JPL and Goddard. Datasets will contain appropriate metadata. Papers for submittal to peer-reviewed journals are currently being prepared.

3.3.3 SBUV/TOMS Total Ozone Record (P. K. Bhartia, NASA Goddard)

The space-based total ozone record has a long heritage. There are three principal algorithms employed: the "TOMS" algorithm based on the 1967 *Journal of Atmospheric Sciences* paper, the "DOAS" algorithm, which cannot be applied to SBUV or TOMS measurements since the wavelength information is unavailable, and the "SBUV" algorithm from Rich McPeters that calculates the total ozone from integrating the retrieved profile.

Only small gaps exist in the 40+ year record initiated by Nimbus 4. With four operating NOAA satellites, the record should continue for at least 5-10 years. Comparisons with the ground-based Dobson record reveal only ~0.5% differences. It's unclear which measurement is "correct", so there are no plans to make corrections to the SBUV record. Data are available by many means, including through anonymous FTP from Goddard.

The current TOMS algorithm is around 10 years old and a new version is under development (v9) which will be cross-calibrated with SBUV and use the Brion et al. O_3 cross sections, among other improvements. In general SBUV data are better used for trend studies because of the longer record with fewer gaps. TOMS data are better suited for mapping, but it's important to recognize that they are not independent of SBUV.

The Chinese FY-3A and FY-3B TOU O_3 data are performing well. The SBUV-derived instrument is only working well on FY-3B. The v8 TOMS algorithm is being used to produce the FY-3 O_3 data.

3.3.4 OMI, TROPOMI and more... (Pepijn Veefkind, KNMI)

The Ozone Monitoring Instrument (OMI) on EOS Aura was launched in 2004. Performance has been radiometrically very stable. If the row anomaly remains as is, it can run for many years. It is expected that there will be overlap with the Sentinel-5P launch in 2015. Sentinel-5P will fly the Tropospheric Monitoring Instrument (TROPOMI).

The DOAS algorithm used on OMI is being updated. Changes include the use of Brion O_3 cross sections, improved fitting function, and an updated treatment of snow/ice covered pixels.

A multi-sensor reanalysis of total ozone data has been conducted at KNMI. These data are corrected using Brewer and Dobson data as reference and then assimilated. Data are available at http://www.temis.nl/macc .

The ozone profile is retrieved from OMI in 18 layers with work on enhancements to the algorithm ongoing. In addition, GOME-2 is yielding tropospheric column estimates.

3.3.5 Status Report for OMPS: Preliminary Findings (Larry Flynn, NOAA)

The Ozone Mapping and Profile Suite (OMPS) onboard Suomi NPP was launched on 28 October 2011. The Nadir Mapper and Nadir Profiler instruments electronics, detectors, optics, and onboard calibration systems are performing well and giving consistent results relative to laboratory measurements and predictions. In particular, analysis of dark current, hot pixels, and signal to noise ratio are yielding consistent results.

The irradiance and radiance measurements have been found to have appropriate ranges and variations. They are responding to real solar and atmospheric signals, and have good information content on ozone and UV reflectivity. Relative levels of instrument noise, stray light, non-linearity, and dark current are small and preliminary evaluations find they are close to the design requirements.

The OMPS Nadir Mapper and Nadir Profiler Earth-View SDR products have advanced to beta maturity.

3.3.6 GOME-2 Reprocessing & Metop-A and Metop-B Tandem Operations (Rose Munro, EUMETSAT)

The second reprocessing campaign of GOME-2 level 1 data (G2RP-R2), comprising data from the time period from January 2007 to January 2012 is currently being finalised. The reprocessing is carried out with EUMETSAT's latest processor version 5.3.0 installed in the operational ground segment. The main changes with respect to R1 (Processor version 4.0 from January 2007 to December 2009) are improved polarisation correction for the full mission, improved geo-referencing including geo-location, random noise contribution instead of absolute errors reported in the product, product format 12.0, homogenous data-set (removing the impact of previous processor changes). The complete data set will be available to all interested users during the course of the 2nd and 3rd quarter of 2012.

Metop-B is to be launched in June 2012, following a short delay. The orbits for all Metop satellites are essentially the same. During tandem operations, one option is to operate both GOME-2 instruments with 960km swath to reduce the ground pixel size by a factor of two whilst retaining effectively the same coverage. Data would be temporally separated by 49 minutes (approximately half an orbit). The data from both satellite instruments would be interleaved.

Initial operations following launch will be at the original swath size (1920 km). Early Level 1b data availability is expected a few months following launch. Evaluation of the swath size will take place and community input is solicited (direct e-mail to Rose is desirable). A decision point for operation of one or both of Metop-A and Metop-B with 960km swath will take in early 2013.

3.3.7 Monitoring of ozone using IASI/Metop (Rose Munro, EUMETSAT, on behalf of Cathy Clerbaux, LATMOS)

The measured Arctic total column ozone values in 2009 and 2009 exhibit large differences, as expected. Agreement between IASI and GOME-2 Antarctic ozone evolution agrees reasonably well. The Concordiasi campaign which took place in Antarctic during August-November 2010 measured ozone profiles. Compared with IASI ozone, the sondes were in good agreement in the

0-10 km region, but exhibited a positive bias in the UT/LS (~20% at 18 km), while above 30 km, a small negative bias was seen.

Five years of tropospheric ozone column at the global scale from IASI is now available. At the continental scale in Northern Europe, comparison of the annual variability to MACC reanalysis simulations is reasonably good. At the city scale, tropospheric ozone exhibits similar seasonal variation compared with ground based results at Paris and Rome.

3.3.8 <u>GOME-type Total Ozone Data Record</u> (Diego Loyola, DLR)

A GOME-type total ozone data record has been constructed using multiple datasets: GOME (1995-2011), SCIAMACHY (2002-present), and GOME-2 (2007-present). The GDP 4.x algorithm is based on the GDOAS approach which fits ozone slant column and effective temperature. An external temperature is not needed for this approach. GOME-2 and SCIAMACHY and adjusted to GOME since a self-consistent, independent long-term dataset was the desired outcome. No ground-based data were used in the process, but they can be used for validation. One concern with the approach is the possibility of possible drift on absolute accuracy. An artificial neural network approach is employed for multi-sensor data merging. Results of intercomparisons with chemistry-climate models reveal that features look reasonable, but there are some offsets in absolute values. Decadal variation was addressed in a recent paper by Dameris and Loyola.

The new GDP 5 algorithm directly fits GOME reflectivity using on-the-fly MS radiative transport calculations. This new approach works better than GDP 4 at high solar zenith angles. The complete data set has been reprocessed with this new algorithm and a recent paper by van Roozendael in *Journal of Geophysical Research* describes the algorithm in detail.

3.3.9 <u>GOMOS Error Estimation</u> (Johanna Tamminen, FMI)

Envisat/GOMOS is a stellar occultation instrument measuring, in the UV-VIS region, O_3, NO_2, NO_3, aerosols, and science products like OClO, Na, Polar Mesospheric Clouds and auroral parameters and, in the NIR region, O_2 and H_2O. Vertical resolution is 2-4 km over an altitude range of 10 – 100 km. Data is available from 2002-2012 from pole to pole during night, which means that the summer pole is not measured. There are a few gaps in data and since 2011 there have only been a few measurements due to instrument problems.

There is a two-step retrieval process involving spectral inversion followed by vertical inversion. Random errors dominate in the stratosphere, with sources that include measurement noise and scintillations. Systematic errors and model uncertainties include the aerosol model (which is the main source of such errors below 25 km), ozone cross sections (BDM vs. Bogumil), and temperature profiles. The uncertainty in the wavelength dependence of the aerosol model causes a ~10-20 % uncertainty in O_3 below 20 km. The impacts of instrument aging are also a concern, particularly increasing the impact of the “cool star” problem.

Version 6 data, with improved error characterization, is expected in summer/autumn 2012. On average, there is good agreement with ground-based and other satellite measurements.

3.3.10 Smoothing and Sampling Issues Affecting Data Comparisons (Jean-Christopher Lambert, BIRA-IASB)

Bias and noise introduced by differences in smoothing and sampling can spoil the value of a data comparison. The problem is a combined effect of measurement properties (measurement + retrieval) and of atmospheric properties. It can be multi-dimensional. Observation operators that reproduce perfectly smoothing and sampling characteristics of the observation have been/are being published for major remote sensing techniques and a few key molecules.

Consideration of smoothing/sampling issues enables the optimization of co-location criteria, the assessment of smoothing errors of individual observation systems, as well as the assessment of discrepancies due to differences in smoothing and sampling of atmospheric field. As a result, more compact tracer-tracer correlations may be obtained.

Propagation of smoothing/sampling properties through the various data set levels (e.g., L3, L4) and the impact on merged data sets is an important issue to address.

3.3.11 Total ozone algorithms developments for GOME, SCIAMACHY and GOME-2 as part of the ESA Ozone_cci project (Michel van Roozendael, BIRA-IASB)

The ESA Climate Change Initiative (cci) Programme is currently in its first phase (2010-2013), focusing on 11 ECVs (Atmosphere, Land, Ocean). The goal is to make best use of ESA and ESA third-part mission (TPM) sensors. With respect to the ozone_cci, total ozone, nadir and limb profile measurements are being considered. Thirteen agencies are participating in the project.

For total ozone, the developments focus is on demonstrating improved retrieval approaches to generate more consistent L2 and L3 data products from GOME, SCIAMACHY and GOME-2. Prototype data sets will be generated by the end of 2012 with reprocessing covering the 1996-2011 period. As for other CCI data products, total ozone series will be evaluated by independent validation teams, and used as an input for intercomparisons to other existing data sets (including model data). Once evaluated, CCI data sets will be freely available for the user community

An additional activity on OMI total ozone retrieval will be started in early 2013, with the aim to better link European and NASA/NOAA data sets (in particular, to better understand and characterize systematic differences).

3.3.12 A European modelling view on (total) ozone data set usage within climate models (Michel van Roozendael, BIRA-IASB on behalf of Peter Braesicke, University of Cambridge)

The interaction of ozone and climate change is a key motivating factor for studying total ozone trends. We need continuous, precise, drift free observations of (total) ozone, with good temporal and spatial coverage, to quantify natural variability, attribute ozone changes (e.g., Mt. Pinatubo impacts), and assess trends (dynamical versus chemical).

The current efforts in merging data sets across sensors are extremely important. Looking into the future, it would be desirable to minimize discrepancies between future sensors (admittedly, this is very hard to do).

The interpretation of measurements requires high quality meteorological data and long climate model integrations. Close links to the operational weather centres and climate research institutions are important.

3.3.13 Discussion / Next Steps for ACC projects responding to new CEOS directions (All; Claus Zehner, discussion lead)

It was noted that modelers are often interested in using a harmonized ozone dataset with known characteristics, rather than individual instrument datasets, particularly for model assessment. Greg Boedeker gets many requests for his unified datasets. But, there is concern that Boedeker's statistical techniques may not be the best approach.

Discussion centered on several issues:

- Define harmonization and why we are doing it. An overarching answer to the question of "why" is the desirability of the community to respond to the GCOS Implementation Plan actions.
- Understanding data set characteristics as well as possible (which was discussed in many of the presentations); the need for instrument experts to be involved in a substantive manner
- How to merge data sets: potential role of data assimilation which adds considerable complexity. Merging with a science question in mind should guide the methodology.
- Merging should add value to existing data sets: e.g., filling in spatial gaps for improved resolution

Moving forward, ACC could facilitate a two-step process that would be valuable to the community:

1. Working among the various instrument groups to make a best-effort characterization of errors of the individual data sets (i.e., SBUV/TOMS/OMI and the GOME/SCIAMACHY/GOME-2 datasets).
2. Interaction between North American researchers and European ozone_cci project participants to bridge the gap between the two sets of measurements.

The question of resources was addressed. In the US, the NASA MEaSUREs program currently is evaluating proposals, including some from ACC participants. If these proposals are successful, then resources will be available to move forward with the first step. In Europe, the first phase of the ozone_cci effort is providing adequate resources.

3.4 Limb-Scattering Ozone Profile Measurements

3.4.1 SCIAMACHY Limb Ozone Status (Mark Weber University of Bremen)

The Scanning Imaging Absorption Spectrometer for Atmospheric Chartograpy (SCIAMACHY) was launched on February 28, 2002 into a polar, sun-synchronous orbit with descending node at 10:00 LST and an altitude of 800 km. Three measurement geometries are possible: nadir, occultation, and limb. While SCIAMACHY had been fairly healthy, the unfortunate loss of communications with ENVISAT just prior to the workshop means the instrument lifetime will likely be just over 10 years.

Limb measurements relevant to ozone chemistry are NO_2, O_3, OClO, BrO, H_2O, and aerosol. Recently, limb water vapor retrievals have been made with an altitude range of 10-25 km. The time series exhibits a high bias in the tropics (partially due to multiple scattered tropospheric water vapor contribution), but the interannual variability is well captured. Ozone limb profiles from 10-65 km are being retrieved with vertical resolution of 4 km. The observations are optimized for limb-nadir matching, emphasizing tropospheric ozone. A recent error analysis of ozone limb measurements (Rahpoe et al., to be submitted) shows that systematic errors are 5% above 20 km and10% below 20 km, while the random error is 15% for a single profile. Validation against MLS, SAGE, and ACE-FTS are good. A number of ozone science papers derived from SCIAMACHY results have been published in recent years: including investigations of the 27-day solar signature, Antarctic and Arctic chemical ozone losses, solar proton event related ozone losses, and long-term trends.

The SCIAMACHY team is involved with consolidation of ozone measurements for use as a climate data record and merging with other ESA sensor data (GOMOS/MIPAS/ESA-TPM) and historical data (SAGEs/HALOE) through the ozone_cci project. With the likely loss of ENVISAT and aging of other mission platforms, there is a danger of looming gaps in high vertical resolution ozone profile data.

3.4.2 OMPS Limb Profiler Initial results (P. K. Bhartia, NASA Goddard)

The retrievals are still in a testing phase with not a lot of data collected. Initial comparisons of OMPS limb profile ozone with Aura MLS reveal very good agreement with bias of ~3% from 100-1 hPa. Comparisons of stratospheric aerosol from OMPS and 2-week zonal mean Calipso data are also encouraging. Polar Mesospheric Clouds are also detected.

There will be a high synergy between the nadir and limb sensors. It's anticipated that these measurements will studies of tropospheric O_3 and volcanic aerosols. Climate-relevant data products, including daily global stratospheric aerosol profiles, cirrus frequency, and PMCs & PSCs are anticipated.

With respect to CEOS ACC, several issues should be considered. The OMPS Limb sensor is not manifested on JPSS-1 and NOAA is discussing possible removal of OMPS-LP from JPSS-2. There may not be Aura/MLS-like O_3 profiles from a US sensor after Suomi NPP.

3.4.3 OSIRIS on Odin over a decade of ozone from limb-scattered sunlight measurements (Doug Degenstein, University of Saskatchewan)

OSIRIS is a 280 to 810 nm spectrograph with approximately 1 nm resolution. Ozone retrievals are made at optical wavelengths with the use of normalized wavelength pairs and triplets making the process self calibrating so instrument stability is less of an issue. The sulphate aerosol retrievals are critical for understanding the ozone through its importance in the forward radiative transfer modeling to capture sub-visual cirrus properly. Comparisons with SAGE III reveal good agreement in magnitude and vertical features. OSIRIS aerosol time series show that volcanic aerosol is contributing to the recent build-up in atmospheric burden.

Environment Canada are using the OSIRIS ozone data product (2001-2009) to extend the SAGE I and II time series. Together with SBUV and the various SBUV2 instruments, a 1979-2009 homogeneous monthly, zonal-mean data set is being constructed that may be suitable for use in trend studies. The precision and stability of the OSIRIS data make it a useful resource for extending the data record from 2005 to the present.

3.4.4 Stratospheric Aerosol and Gas Experiment III: SAGE III/ISS (Joe Zawodny, NASA Langley)

SAGE produces vertical profiles of aerosols and gases in the stratosphere and upper troposphere. The multi-decadal SAGE ozone and aerosol data sets have undergone intense scrutiny and have become the international standard for accuracy and stability. SAGE ozone data have been used to monitor the effectiveness of the Montreal Protocol. The high precision, accuracy, and resolution of the SAGE ozone profile measurements is unique. Difference between SAGE III and SAGE II is virtually a constant, independent of altitude. This demonstrated measurement fidelity allows the past ozone record to be linked with the future (SAGE III/ISS) with little loss in trend quality.

The International Space Station (ISS) inclined orbit provides excellent measurement coverage for middle and low latitude sampling. SAGE III/ISS will launch in 2014 aboard a SpaceX Falcon-9. The limb signal level similar to the lunar signal. Channel locations were selected to measure O_3, O_2, NO_2, H_2O, and aerosols. The feasibility of this measurement has been demonstrated. While the measurement will be in an “experimental mode”, the data will be used to assist in the development of the OMPS algorithms with the potential to provide daily global maps.

3.4.5 The Atmospheric Chemistry Experiment (ACE) (Kaley Walker, University of Toronto)

The Atmospheric Chemistry Experiment (ACE) Satellite Mission aboard SCISAT-1 was launched on August 12, 2003 into a 74° inclination orbit at 650 km. Measurement mode is by occultation. This objective is to measure atmospheric composition: profiles of numerous trace gas species including tracers, halogens, and carbon-containing gases; cloud and aerosol extinction; and temperature/pressure. Both the ACE and MAESTRO instruments continue to age gracefully.

ACE-FTS ozone is using a new v3.0 retrieval algorithm. Early versions were well validated with several published papers. ACE is involved in a number of international collaborations including the SPARC Data Initiative, SI2N, GOZCARDS, CCMVal2, and ozone_cci. Beyond its projected lifetime, other mission concepts are being explored including a next generation FTS instrument (SOAR) and next generation OSIRIS (CATS).

An International ACE/SAGE III workshop planned for fall 2012 at Old Dominion University, in Norfolk, Virginia during the week of October 15. Peter Bernath (pbernath@odu.edu) is the organizer.

3.5 Other Topical Projects: Status of Current Projects, Future Projects, Agency Activities, Carbon Task Force

3.5.1 SPARC Data Initiative (Lucien Froidevaux, JPL, on behalf of Michaela Hegglin, hegglin scientific, Switzerland)

The Stratospheric Processes and their Role in Climate (SPARC) is a core project of the World Climate Research Programme (WCRP) with the objective to engage and facilitate the stratospheric research community to focus on gaps in knowledge of particular relevance for climate, in coordination with relevant partners.

The knowledge of quality of different satellite data sets needs to be improved for different applications so that comparisons can be more meaningful. A recommendation from CCMVal-2 noted that long-term, vertically resolved data sets of constituent observations in the stratosphere are required to assess model behavior and test model predictions. The SPARC Data Initiative (SDI) will assess the state of data availability from the multi-national suite of space-based instruments, compile climatologies of chemical trace gases in collaboration with instrument PIs with the main objective to facilitate detailed inter-comparison of climatologies.

The scope of the activity is on vertically resolved measurements of atmospheric constituents from the upper troposphere to the lower mesosphere (approximately 5-65 km) with a main focus on satellite measurements. The report is targeting 25 different long-lived and short-lived trace gas species and aerosol. The SDI report, to be completed by autumn 2012, will serve as direct input for data merging exercises and trend evaluations (SI2N, WAVAS II, CCI) and for CCM-measurement comparisons (CCMVal).

3.5.2 The Atmospheric Chemistry and Climate Model Intercomparison Project (ACCMIP): Overview and the Role of Satellite Data in Model Evaluation (Jessica Neu, JPL)

ACCMIP is an IGAC/SPARC Atmospheric Chemistry and Climate project with an impetus from the realization that CMIP3 models had substantial differences in climate projections that could be attributed to short-lived species. Differences are due to the inclusion of species and processes (e.g., aerosol indirect affect, tropospheric O_3 chemistry), stratosphere-troposphere exchange of O_3, and emissions projections. ACCMIP interactive chemistry simulations are designed to characterize forcings imposed in CMIP5 historical and future simulations, provide diagnostics to understand cause of differences in model forcing, provide constraints on uncertainties due to natural emissions and anthropogenic emission projections, and yield observation-based evaluation of our understanding of chemistry-climate interactions.

Future ACCMIP activities will be greatly strengthened by a systematic collaboration between the satellite and climate model communities. There is a need for infrastructure for providing satellite data for model comparison; obs4MIPs provides a template. ACCMIP should be expanded to an international effort with additional satellites, trace gases, aerosols. The SDI has demonstrated the importance of multiple data sets. Also, there is a need for mechanisms to develop comparable data sets, observation simulators, and perform comparisons. How might ACC be involved in this process?

3.5.3 CEOS Atmospheric Composition Portal (ACP) (Chris Lynnes, NASA Goddard)

The ACP provides access, tools, and contextual guidance to scientists and value-adding organizations in using remotely sensed atmospheric composition data, information, and services. Its mission is to help foster interoperability and application of atmospheric composition data, information and services worldwide, to identify the unique requirements and common features of the ACC and GEOSS users to provide a value-added and complementary capability, and to work with partners in CEOS and the broader AC community in advancing the ACP.

ACP is at the intersection of the atmospheric and information sciences communities. The beta site is available at http://wdc.dlr.de/acp . Current efforts are focused on a new simple subset wizard and a planned multi-sensor data synergy advisor. ACP collaborates with a number of ongoing activities including the GEO QA4EO project, atmospheric emissions projects, the GEOSS Air Quality community of practice, and the ESIP Federation. The ACP project is eager to engage ACC in better populating the Data Table and populating the Ozone Comparison Knowledge Base for further evaluation.

3.5.4 CSA activities of relevance to the CEOS virtual Atmospheric Composition Constellation (Thomas Piekutowski, CSA)

Current missions of interest include MOPITT on Terra (1999-present), OSIRIS on ODIN (2001-present), SCISAT/ACE (2003-present). A number of future mission concepts are being evaluated, including Chemical and Aerosol Sounding Satellite (a follow-on to SCISAT/ACE and OSIRIS) and an instrument study for an FTS on highly elliptical orbit for high-latitude observations of atmospheric chemistry.

Examples of validation, modeling, and data use include ground-based observations at PEARL (80N – supporting NDACC and TCCON), ongoing validation of SCISAT/ACE through Arctic sunrise campaigns at PEARL, validation of GOSAT products, the CMAM-20 (Canadian Middle Atmosphere Model) reanalyses, support for SPARC and related activities (e.g. SPARC Data Initiative, assessment reports), support to Environment Canada in developing the EC-Carbon Assimilation System, and grants for research at Canadian universities to facilitate data exploitation, FTIR techniques, and balloon-borne experiments.

3.5.5 Multi Sensor Volcanic Eruption Alert System (Claus Zehner, ESA)

A web-based alert service has recently been initiated and is operated by BIRA/IASB with over 100 subscribers, including many of the Volcanic Ash Advisory Centers, observatories, aviation companies, and regional and local governments. The alert system relies on the combined use of UV-visible and infrared satellite instruments and sends simple e-mail messages at 12-hour intervals. A critical goal is to avoid false notifications. SO_2 is derived from five instruments (SCIAMACHY, GOME-2, OMI, IASI, and AIRS).

On its first day of operations, the Support to Aviation Control Service (SACS) provided correct alerts based on GOME-2 and IASI measurements on an Etna eruption with peak on April 12, 2012 at 17.00 LT. The alerts and further information are available from http://sacs.aeronomie.be).

3.5.6 The CEOS Strategy for Carbon Observations from Space (Diane Wickland, NASA Headquarters)

CEOS established the Carbon Task Force (CTF) to coordinate the response from space agencies to the GEO Carbon Strategy, released in June 2010. The purpose of the CEOS CTF response is to provide a strategy for the planning and provision of space-based observations of the carbon cycle and its components in support of various societal needs anticipated for carbon-related information. The Atmospheric Domain is one of six sections in the CEOS report and its coordinating author is Berrien Moore (University of Oklahoma). A key activity being conducted to support this effort is a gap analysis led by the CEOS Systems Engineering Office.

Some of the conclusions of the atmosphere domain section are:

- Space-based remote sensing observations hold substantial promise for future long-term monitoring of CO2 and other greenhouse gases

- The principal advantages of space based measurements include:
    - Spatial coverage (especially over oceans and tropical land)
    - Sampling density (needed to resolve CO2 weather)

- The principal challenge is the need for high precision

- To reach their full potential, space based CO2 measurements must be validated against surface measurements to ensure their accuracy.
    - The TCCON network is providing the transfer standard

- Just as for weather forecasting, a coordinated global network of surface and space-based CO_2 monitoring systems as well as sophisticated models that can assimilate these data are needed to provide insight into the processes controlling atmospheric CO2

The draft report is available for comment. Please contact Diane or Richard Eckman for a copy of the atmosphere domain section. Diane welcomes feedback from ACC membership. We have the opportunity to have a substantive influence on the report's structure, content, and direction.

It is anticipated that the CTF will disband following the release of the report. But its implementation is likely to be led by the CEOS Working Groups and Virtual Constellations. ACC, which has significant expertise in GHG measurements from space, could be a valuable contributor to this future effort.

Atmospheric Composition Constellation Meeting (ACC-8) - 18-19 April 2012, Columbia, Maryland

Agenda

April 18	**Scope / CEOS Executive Officier Report**	
13.30 – 13.40	Welcome/Logistics	R. Eckman/NASA
13.40 – 13.50	Scope of this Meeting	C. Zehner/ESA
13.50 – 14.10	New Directions for Working Groups and Virtual Constellations based on the CEOS Self-Study	T. Stryker/USGS/CEOS Executive Officer
14.10 – 14.20	Questions / Discussion	All
14.20 – 14.40	**Coffee Break**	
	Geostationary Air Quality Constellation Coordination	
14.40 – 15.00	GEO-CAPE and near-term AQ constellation activities	J. Al-Saadi/NASA
15.00 – 15.20	Sentinel-4	C. Zehner/ESA
15:20 – 15:30	MTG-IRS	R. Munro/EUMETSAT
15.30 – 15.50	GMAP-Asia	Y. Kasai/NICT
15.50 – 16.10	GeoKOMPSAT	J. Kim/Yonsei U and C.K.Song/NIER, ME
16.10 – 16.30	PHEOS	J. McConnell/York Univ.
16.30 – 17.00	Path forward to implement short-term AQ constellation actions: Discussion	All
	Near-Term Total Ozone Measurement Coordination: Algorithms, Uncertainty Quantification, Modelling Needs, Data Fusion	
17:00 – 17:20	Current scientific issues involving atmospheric ozone: Implications for future space-borne observations	R. Salawitch/Univ. of Maryland
	Status of Ongoing Projects	
17:20 – 17:40	SPARC Data Initiative	L. Froidevaux/JPL
19.30	**No-Host Dinner (Near Hotel)**	

April 19	**Near-Term Total Ozone Measurement Coordination: Algorithms, Uncertainty Quantification, Modelling Needs, Data Fusion**	
09.00 – 09:15	NASA MEaSUREs Global OZone Chemistry And Related trace gas Data records for the Stratosphere (GOZCARDS) project	L. Froidevaux/JPL
09.15 – 09:30	SBUV/TOMS total ozone	P.K. Bhartia/NASA
09:30 – 09.45	OMI/TROPOMI	P. Veefkind/KNMI
09.45 – 10.00	OMPS	L. Flynn/NOAA
10.00 – 10.15	GOME-2 and Metop-A and Metop-B tandem operations	R. Munro/EUMETSAT
10:15 – 10:25	Metop IASi total ozone	R. Munro/EUMETSAT (for C.Clerbaux/CNES)
10.25 – 10.40	GOME/Sentinel 5P	D. Loyola/DLR
10.40 – 11.00	**Coffee Break**	
11.00 – 11.15	GOMOS error estimation	J. Tamminen/FMI
11.15 – 11.30	Smoothing and sampling issues affecting data comparisons, with quantitative illustrations in satellite validation and data assimilation	J.C. Lambert/BIRA-IASB
11.30 – 11.45	Total ozone algorithm developments for GOME, SCIAMACHY and GOME-2 as part of the ESA Ozone_cci project	M. van Roozendael/BIRA-IASB
11.45 – 12.00	A European modelling view on total ozone data set usage within climate models	M. van Roozendael (for P. Braesicke/Univ. Cambridge)
12.00 – 12.45	Discussion/Next Steps for ACC projects responding to new CEOS directions	All
12.45 – 13.45	**Lunch Break**	
	Limb-Scattering Ozone Profile Measurements: Current Status and Near-Term Prospects, Coordination Needs	
13.45 – 14.00	OMPS-Limb initial results	P.K. Bhartia/NASA
14.00 – 14.15	SCIAMACHY	M. Weber/Univ. of Bremen
14.15 – 14.30	ODIN/OSIRIS	D. Degenstein/Univ. of Saskatchewan
14.30 – 14.45	SAGE III-ISS limb scattering measurement plans and prospects	J. Zawodny/NASA
14.45 – 14.55	ACE-FTS and ACE-MAESTRO measurements	K. Walker/U. Toronto
14.55 – 15.15	Discussion/Next Steps	All
15.15 – 15.35	**Coffee Break**	

Agency Reports, Status of Ongoing Projects, New Project Concepts

15.35 – 15.50	Atmospheric Chemistry and Climate Model Intercomparison Project (ACCMIP) project	J. Neu/JPL
15.50 – 16.05	AC Portal: Potential to contribute to multi-instrument error/uncertainty quantification activities	S. Falke/Northrop/Grumman
16.05 – 16.20	CSA activities	T. Piekutowski/CSA
16.20 – 16.35	A volcanic ash warning (alert) system based on space measurements	C. Zehner/ESA

CEOS Carbon Task Force Update

16.35 – 17.05	Carbon Task Force – atmospheric segment activities	D. Wickland/NASA

8th Atmospheric Composition Constellation Meeting (ACC-8) – 18-19 April 2012
Columbia, MD

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