MEETING

Meeting Date	09-10/09/2010	**Ref**	DG-H/2010/cz/kw
Meeting Place	Worcester College	**Chairman**	Claus Zehner
		Participants	Claus Zehner (**CZ**); Richard Eckman (**RE**); Carole Deniel (**CD**); Christopher Barnet (**CB**) Jay Al-Saadi (**JA**); Kevin Bowman (**KB**); Rose Munro (**RM**); Brian D. Killough (**BDK**); Hartmut Boesch (**HB**), Tony Freeman (**TF**); Tatsuya Yokota (**TY**); Gareth Thomas (**GT**); Caroline Poulson (**CP**); Thomas Piekutowski (**TP**); Albrecht von Bargen (**AB**); Brian Kerridge (**BK**); John Burrows (**JB**); Oksana Tarasova (**OT**); Karen Woudberg (**KW**)
Subject	CEOS Atmospheric Composition Constellation (ACC) Meeting (6th)	**Copy**	Mitch Goldberg (MG); Karen Rosenlof (KR); Richard McPeters (RM); Shuji Kawakami (SK); Diego Loyola (DL); Michel Van Roozendael (MR); Rainer Hollmann (RH); Thomas Holzer-Popp (THP); Gerrit de Leeuw (GL); Michael Buchwitz (MB); Tamotsu Igarashi (TI)

Welcome/Introduction – C. Zehner

See presentation (all oral presentations are available at http://www.ceos.org/index.php?option=com_content&view=article&id=297:acc6onaccmtgspage&catid=53:acc-meetings&Itemid=94)

The main objectives of ACC are to establish a framework for long-term coordination among the CEOS agencies in the field of atmospheric science and applications.
Progress to date: ACC has initiated several projects to demonstrate the constellation concept and the value adding by combining different data sets; organised workshops and produced documentation (e.g. future mission gap analyses, workshop reports with concrete recommendations to space agencies).
The purpose of the ACC-6 meeting is to get an overview of ongoing space agencies activities on atmospheric climate data generation and to evaluate if there is a need for international (ACC) cooperation on this (e.g. combined Essential Climate Variables generation?).

The Status of the ACC Web-portal (transfer to WGISS) – R. Eckman

See presentation
Within the ACC framework DLR and NASA have developed a Web-portal to support interoperability amongst the atmospheric research and applications communities. The aim is to enhance international cooperation, data sharing and services. Potential users for the AC portal include atmospheric researches and "value adding" organisations. An alpha release of the portal has now happened - http://wdc.dlr.de/acp. Given the huge IT component for the portal maintenance it is being proposed to shift this activity into CEOS-WGISS with scientific advise by ACC.

Decision: **There was general agreement that this activity will move from ACC to WGISS.** TY: asked about WMO co-operation on this issue CZ/RE: this is ongoing and will be continued.

ACC Project on Volcanic Ash Monitoring – The Eyjafjoll 2010 Eruption – C. Zehner

See presentation
Volcanic ash is a hazard for airplanes. ICAO (International Civil Aviation Organisation) reacted to these potential threat and established a worldwide warning system for aviation through 9 Volcanic Ash Advisory Centres (VAACs). ESA is running currently two projects to support the European VAACs by using GOME-2, SCIAMACHY, OMI, IASI, SEVIRI, AVHRR, AIRS data and dispersion modelling. The Eyjafjoll 2010 eruption had a big impact economic impact especially in Europe and based on this the initial guidelines to restrict European air space were relaxed (a change from zero volcanic ash tolerance to some tolerance). This changed considerably remote volcanic ash measurement requirements as there is now the need to know not only IF there is any ash but HOW MUCH (concentration) ash there is. On 26/27 May an ESA/EUMETSAT workshop on volcanic ash monitoring from space took place at ESRIN. The workshop proceedings (http://earth.eo.esa.int/workshops/Volcano/index.php?page=42&type=s) include lessons learnt and recommendations on what has to be done to establish an efficient future end-to-end system in Europe for volcanic ash warning/monitoring. The aim of the ongoing ACC volcanic ash monitoring project is to extend these European activities in order to provide a global volcanic ash alert system by cooperation with NOAA, and NASA.

NOAA Activities on volcanic ash and GHG CDRs – C. Barnet (on behalf of M. Goldberg)

See presentation
NESDIS on Volcanic Ash: During the Eyjafjol eruption the London VAAC requested NESDIS to provide GOES-R Volcanic Ash products routinely to them. SEVIRI products providing information about the ash cloud extension as well as concentration and height distribution were widely used.

NESDIS on GHGs: AIRS/IASI/CrIS thermal infrared measurements complement solar/passive measurements by providing an independent upper boundary condition that can be used to constrain GHG sources and sinks derivation from e.g. GOSAT or SCIAMACHY measurements. AIRS retrieval algorithms have been successfully applied to IASI measurements allowing time continuity and efficient combination of different sensor measurements.

International Cooperation: NOAA's CDR programme can offer to support the climate goals of other agencies. NOAA would welcome co-operation with other space agencies for climate studies. Specific challenges are in the combination of different satellite instruments data, separation of geophysical signals and measurements versus modelling uncertainty and clear error characterisation of the provided products.

Status of the Position Paper on an Air Quality Constellation – J. Al-Saadi

See presentation
A **Position Paper** is under preparation proposing the establishment of a **real ACC Constellation** for air quality through international cooperation based on following future geostationary missions: ESA Sentinel 4, **2017**, JAXA GMAP-ASIA, **2017**, Korea MP-GeoSat, **2018** and NASA Geo-CAPE, **2020.** This constellation will **include** as well planned complementary LEO missions (e.g. precursor of Sentinel 5). CEOS should define the implementation strategy of such a constellation, which will rely then on bilateral agreements and dedicated space agency funding.

Next Steps:
- Perform another document review and finalise it by Christmas 2010.
- Present this paper to CEO SIT early next year with clear recommendations on what should be done in order to set up a real Air Quality Constellation.

Status of ACC Contributions to the CEOS Response to the GCOS Implementation Plan (IP) – R. Eckman

See Presentation
CEOS has a significant task to respond to the latest GCOS IP by Jan. 2011. In this context ACC should especially review atmospheric tasks/Action Items (AIs), which include e.g. continuation of atmospheric satellite data (limb missions in particular) and ground stations networks for validation, and generation of GHG and ozone climate data sets.

Next Steps:
RE has already collected input from ACC members on above mentioned GCOS AIs. Action on **RE** to send out the current document to all by Sep. 20. ACC members will provide feedback and will make a more concise GCOS IP review by mid Dec. 2010.

Ongoing Projects on Essential Climate Variables – ECV's

The O3_cci Project – C. Zehner (on behalf of M. Van Roozendaehl)

See presentation
ESA Climate Change Initiative: 12 projects have started mid 2010 to develop prototype processors and ECV data sets within a first project phase by 2013 (based on GCOS requirements for ECVs derived from satellite measurements and using mainly ESA (including Third Party Mission), and EUMETSAT data).11 ECVs will be generated by mid 2013, which include on atmosphere the parameters Ozone, GreenHouse-Gases, Aerosol and Cloud information.

Ozone: Activities will concentrate on three types of Ozone data products:
- **Total ozone:** The L2 retrieval algorithm baseline is the GOME DATA PROCESSOR (GDP) 5, which will also be applied to SCIAMACHY and GOME-2 data. OMI data will be included in the merged data set (using the NASA OMTO3product). This data set will cover the period 1995 until now.
- **Low resolution ozone profiles from nadir sounders:** A Round-Robin exercise will be performed to select/combine the better of the two existing KNMI (OPERA-OMI) and the RAL retrieval algorithms. The GOME, SCIAMACHY, GOME-2, and OMI sensors will be included in the prototype ECV parameter generation. The first prototype data set will consist of a minimum of two contiguous years.
- **Higher resolution ozone concentration profiles derived in the upper troposphere and in the stratosphere using limb and occultation types of instruments:** The limb profile data product will be generated by merging data from three different sensors: MIPAS, GOMOS, and SCIAMACHY. For GOMOS, this will rely on the ESA operational data product. For SCIAMACHY it will be based an advanced (IUP) scientific product which provides a better altitude coverage than the operational product. For MIPAS several competing algorithms will be inter-compared. Detailed error characterization will be performed for all three sensors. The Envisat data will be extended by TPM missions (Odin, ACE). The first prototype data set will cover at least two contiguous years. Non-European (e.g. TOMS, SBUV, HALOE, MLS) data sets are only being used for validation/intercomparison.

International Cooperation: Exchange of expertise with non-European scientists on e.g. level 2 retrieval algorithms, on ancillary data sets, on data characterization and error analysis, on data merging approaches, and on specification of user requirements for climate-relevant ozone data products. Consultation on use of non-ESA data sets for validation purposes. Combine efforts on creation of joint (merged) ozone data products, feeding in appropriate error values, averaging kernels, etc.

Ozone and Water Vapour ECV Parameters as Derived from Multiple Sensors – given by R. Eckman, on behalf of L. Flynn, R. Mc Peters, and K. Roselof

See presentations
NASA Ozone: Long term ozone data sets (total columns and profiles) have been established based on 40 years of BUV, SBUV and TOMS observations. Critical issues in establishing such a data set are relative calibration when there is no overlap of instruments. This data set will be extended in the near future by including OMI and OMPS data.

NOAA ESRL Ozone: Zonally averaged global gridded 3-dim. ozone time series based on SAGE-2, HALOE, SBUV (version 8), MLS (UARS), Aura MLS and TOMS (including SME, UGAMP, and KNM O3 climatologies) have been generated. Main users of these data are modelers (Readings, SPARC CCMVAL). HALOE, which had the best overlap with other datasets, has been used to scale other datasets, profiles were scaled to match TOMS total columns, and SME climatology (from the 1981-1991) is used for the mesosphere. Possible improvements include a better ozone representation in polar regions and in the troposphere.

NOAA ESRL Water Vapour: It is planned to put together a satellite based series of monthly global averages. So far Aura MLS and HALOE water vapour data have been matched up in the tropics and SAGE II, HALOE retrieval (V20) and AIRS data are being added. HALOE/MLS data set will be used in radiative transfer modeling. No estimates of uncertainties have been made for these combined zonally averaged time series of water or ozone.

International Cooperation: Comparisons with additional international data sets and inclusion of other satellite/sonde data is desired.

NOAA Ozone CDRs: Already existing ozone time series (total columns and profiles) will be extended by the future Ozone Mapping and Profiler Suite (OMPS) data.

International Cooperation: Comparisons/homogenization of DOAS and TOMS-like total column ozone retrieval products and the identification of diurnal variations for profiles.

Observational constraints on the vertical distribution of instantaneous ozone radiative forcing in chemistry climate models- climate models – K. Bowman

See presentation
Ozone radiative forcing in the troposphere has a warming impact on climate. It has been demonstrated (by using different chemistry climate models (e.g. AM2_Chem, CAM_CHEM)) that the evaluation of this effect can be done by using instantaneous radiative forcing kernels (IRFK). TES data showed that the uncertainty in the radiative forcing of tropospheric ozone is largest in the tropical and extra-tropical middle-to-upper troposphere.

EUMETSAT – R. Munro, J. Schulz

See presentation
EUMETSAT CDR Overview: The aim is to generate combined FCDRs for the Meteosat, METOP and for all NOAA heritage instruments. Partnerships involve ISCCP, GPCP, WMO, GSICS, WMO, Scope, ECMWF, and the ESA Climate Change Initiative. Main target parameters include: Precipitation, Surface Radiation Budget *(including Solar Radiation)*, Wind Speed and Direction, Cloud properties, Earth Radiation Budget, Upper-Air Temperature, Water Vapour, Wind Speed and Direction, Sea Ice, Sea Level, Sea State, and Albedo.

Possible International Cooperation: EUMETSAT has a clear focus on meteorological parameters but will contribute and is open for cooperation on composition parameters.

CEOS CO2 and CH4 Gap Analysis Report – B. Killough

See presentation
SEO Gap Analysis: Based on existing and planned GHG missions a gap and requirements analysis for a future GHG constellation has been performed**.** A future GHG Constellation might consist of 3 satellites with short-wavelength absorption (near surface, lower troposphere) instruments [>500-km swath, 2-km spatial sampling<1-day combined revisit, <4-ppm (1%) accuracy], 1 satellite with a laser absorption instrument (vertical profiling, day+night) [>1 satellite, <10-km spatial sampling, <1-ppm (0.25%) accuracy], and 2 satellites with emission instruments (middle to upper troposphere) [>2 satellites, >2000-km wide swath, 10-km spatial sampling<6 hours combined revisit, <4-ppm (1%) accuracy].

Next Steps:
More work has still be performed – especially on giving a rational (what applications needs it) for each derived requirement. BK will update the current documentation and will present those findings at the next ACC meeting in 2011.

The GHG_cci Project – Hartmut Boesch

See presentation
The main GHG_cci project activities by mid 2013 are: Two existing satellite sensors will be used as the main data sources: SCIAMACHY on ENVISAT and TANSO on GOSAT. Both instruments measure NIR/SWIR spectra of reflected solar radiation and are sensitive to CO2 and CH4 concentration changes close to the Earth's surface.

A two-year, round-robin exercise will be conducted for ten different CO2 and CH4 retrieval algorithms, as developed by IUP, SRON, and ULE for SCIAMACHY and GOSAT. GHG data products (columns and profiles) derived from AIRS, IASI, MIPAS and ACE-FTS measurements will also be used in scientific studies to assess the extent to which they can constrain surface fluxes. The best algorithms will be applied to the most complete satellite observations record available. A fast processing scheme, combining SCIAMACHY and GOSAT measurements, will be used to cover the time period 2002 until present. This can potentially deliver a consistent ten-year record of total columns for both species. A more accurate, but highly computationally intensive, 'full physics' processing scheme will also be applied to a single year of data.

International Cooperation: Close collaboration is needed with other projects generating climate variables (NOAA, NASA, NIES ...). Cooperation on future GHG missions should enable to develop a strategy for long-term, continuous, cross-calibrated data records, to move towards consistent data formats and documentation, to achieve a consistent way of documenting and assessing data quality, to facilitate constellations of satellites or joint missions to increase the science return. A. one-stop-shop for GHG satellite datasets and relevant sub-orbital data (ground-based, aircraft) should be established. International cooperation should guarantee the continued support for ground-based networks and to influence future site selection to increase the benefit for satellite validation

GHG ECV Parameters Generated at JPL – T. Freeman

See presentation
GHG ECV Parameters at JPL: JPL is currently generating ECVs for CO2 from AIRS, TES and GOSAT. AIRS measurements are also being used to derive CH4 products for the mid-troposphere. Exploratory products are also being generated: N2O from TES, Tropospheric O3 from TES, Stratospheric and Lower Troposphere CO2 from AIRS, and CH4 from GOSAT. Furthermore JPL is heavily involved in GOSAT calibration and validation activities, with the specific goal to prepare for the upcoming future OCO-2 mission.

GOSAT level 3 and 4 products – T. Yokota

See presentation
GOSAT Higher Level products at NIES: The GOSAT level 2 data include total columns of CO2 and CH4 (SWIR) and profile of CO2 and CH4 (TIR). Level 3 data are global maps based on the Level 2 data showing the GHG distribution. Level 4 data will indicate CO2 fluxes and the CO2 3-dim fields. GOSAT Level 2 data are already available and the Level 3 data will be distributed soon. The 3rd GOSAT Research Announcement has been issued during August 2010.

The Aerosol_cci Project – G. Thomas

See presentation
The project will **produce the following sets** of global aerosol products covering either the year 2008 or 1997, depending on the input data availability **by mid 2013**:
Tropospheric level 2 products (10 km horizontal resolution): multi-spectral aerosol optical depth and aerosol type probability (AATSR/ATSR 2, MERIS, and PARASOL)
Tropospheric level 2 products (50 km horizontal resolution):
- synergetic multi-spectral aerosol optical depth and aerosol type probability (SCIAMACHY + AATSR, GOME-2 + AVHRR/3, GOME + ATSR-2)
- UV absorbing aerosol index with averaging kernels (OMI, SCIAMACHY, GOME)

Stratospheric level 3 product (2.5° gridded): extinction profile GOMOS (SCIAMACHY)
Tropospheric level 3 products: merged multi-spectral aerosol optical depth and aerosol type product(s) global "climatology" (for the reference year) of aerosol type probability

AERONET is the primary validation tool, and there is ongoing close co-operation with AEROCOM and WMO-GAW.

International Cooperation: Development of "community modules" (in particular the harmonisation of aerosol models between aerosol_cci and NASA products (work underway in cooperation with Ralph Kahn from the MODIS and MISR aerosol teams). Extension of round-robin algorithm intercomparison work to fully include MODIS and MISR products (MODIS already to be used as an external comparison dataset). Potential to link aerosol_cci with the ongoing WMO Sustained, Co-Ordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM) project. Strengthen links to the international modelling community by engaging in further data utilisation and model intercomparison studies.

The Cloud_cci Project – C. Poulson

See presentation
Main activities of the Cloud_cci project will be by mid 2013:
- Develop a inter calibrated radiance data sets for ESA and non ESA instruments in an international collaboration (FCDRs)
- Develop a coherent physical retrieval framework for the GCOS cloud property ECVs cloud cover, cloud top height and temperature, liquid and ice water path that can be considered as an open community retrieval framework that will be publicly available and usable by all scientists.
- Develop and process two multi-annual validated global data sets for the GCOS cloud property ECVs including uncertainty estimates.
    - (A)ATSR – AVHRR – MODIS –MERIS (lowest common den. approach)
    - (A)ATSR and MERIS. (synergy retrieval)

International Cooperation: Within the project cooperation is ongoing (e.g. GEWEX, SCOPE, EUMETSAT) but more is always welcome (e.g. interact more with US experts).

Discussion on potential new ACC projects on ECVs (activities that would not happen without ACC!)

Conclusions on possible ECVs ACC projects: Already ongoing collaboration between agencies is quite good and impressive but could certainly be improved. Combined climate data sets would certainly be useful. CEOS plenary is going to set up a new working group to review (including the John Bates Index) the multitude of work going on between ECV communities and trying to coordinate among them. It is a good idea for ACC to take control of atmospheric composition ECVs. Aerosol and cloud information should be included as well but taking into account activities performed by AERCOM or GEWEX and the meteorological community in general. Such concrete coordination projects (e.g. generation of a combined American, European, Japanese GHG ECV) can certainly not only be performed on best effort basis but will need dedicated space agencies funding. Therefore future ACC meetings will review in detail single ECV parameters (e.g. ozone) to define clear work-plans and budget needs for such projects.

10 Sept 2010

JAXA activities on Climate Observations and ECV derivation presented by C. Zehner on behalf of S. Kawakami

See presentation
JAXA will provide 17 operationally and 12 experimentally out of 45 ECVs, saving 16 for future possibilities. Data production will be based on the main current and planned EO missions that are ALOS/GOSAT/GCOM/GPM/EARTHCARE. JAXA offers to support ACC especially with Geostationary Atmospheric and Meteorological Satellite measurement data. JAXA would appreciate cooperative activities for the science communities of CloudSAT, CALIPSO and EarthCARE.

CSA activities on Climate Observations and ECV derivation – T. Pietukowksi
No slides given – oral presentation

CSA will support ongoing international ECV activities through the provision of data measured by its ongoing and planned missions (e.g. SciSat, Odin, APOC).

The Exploitation of Existing US and European Data sets for the Generation of a Potential ECV water vapour profile parameter spanning troposphere and stratosphere – B. Kerridge

See presentation
• As a GCOS designated ECV, water vapour merits attention
• To generate self-consistent height-resolved data spanning stratosphere and troposphere, several satellite components would be required.
• Individual components have reached different levels of maturity and for some, further R&D required and foreseen
• To combine these into a self-consistent ECV data-set would be a challenge.
• For tropospheric water vapour, there are issues additional to attributes & quality of existing data sets from individual sensors e.g.: – Relationship with other met observables e.g. GCOS ECVs cloud, T & SST
→ *Assimilation* into GCM to combine info of diverse types (FCDR & TCDR) e.g. ERA-CLIM?
• The ESA GlobVapour project is underway; Eumetsat might lead a (tropospheric) water vapour ECV
• CEOS-ACC an appropriate forum, in view of responsibilities of operational agencies (e.g. Eumetsat and NOAA) for met. variables and other agencies (e.g. ESA, NASA & CSA) for stratospheric data
• Timely to: – stimulate progress on stratospheric water vapour profiles from limb-sounding
– consult user community, e.g. ESA CCI climate modelling group, to consider requirements for future water vapour ECV

Observational constraints on ensemble climate models for the IPCC AR5: a potential new ACC project. – K. Bowman

See presentation

Satellites Measurements to be used in IPCC Assessments:

Taylor et al (2008) have defined the protocol for the IPCC AR5 CMIP5 simulations. The protocol defines the model diagnostic output variables and their spatio-temporal scales. Observational datasets must be gridded to those outputs. The satellite datasets are still under discussion. NASA is actively involved in these discussions proposing the usage of AIRS, MLS, TES, QuikSCAT, CloudSat, Topex/Poseidon, CERES, TRMM, and AMSR-E data. KB is willing to propose within a dedicated new ACC project other data sets (e.g. Canadian, European, Japanese) as well in order to support to bring as much observational scrutiny as possible into the IPCC process.

Discussion on Potential new ACC Projects - All

All agree that this would be a good new ACC project and that KB takes the lead on this and will present a project plan/update of ongoing activities at the next ACC progress meeting.

Next Meeting:

April/May 2011 Washington USA – dates to be confirmed.

List of Actions:

Description	Action	Due Date
On ACC/GCOS IP review: Richard to send out the current document to all by Sep. 20 and to collect all ACC members' review by mid Dec. 2010 into a new document.	Richard Eckman/All	Mid Dec. 2010
On the AQ Constellation position paper: Perform another document review and finalise it by mid Dec. 2010.	Jay Al-Saadi	Mid Dec. 2010
New ACC project on IPCC: Kevin to take the lead of the new ACC project on getting more satellite measurements included into IPCC assessments.	Kevin Bowman	Spring 2011