EARTHCARE VALIDATION WORKSHOP

13 – 15 June 2018

University Club Bonn, Germany

ABSTRACT AND POSTER OVERVIEW

Contents

Oral Presentations

Wednesday 13 June 2018 - General Approaches and multi task country contributions

ID: 38188	TITLE: German Initiative for the Validation of EarthCARE (GIVE)
PI: Dr. Ulla Wandinger (Leibniz Institute for Tropospheric Research TROPOS,GERMANY)	
SUMMARY	

The proposal introduces the German Initiative for the Validation of EarthCARE (GIVE). The proposed activities will allow the validation of the entire chain of EarthCARE L1 and L2 products as well as the evaluation of related algorithms and instrument calibrations. The approaches include EarthCARE-to-ground, EarthCARE-to-aircraft and EarthCARE-to-satellite comparisons, supported by cloud, aerosol and radiative-transfer modelling. Validation activities will include dedicated campaigns as well as long-term support over the mission lifetime.

The Cal/Val activities make use of a number of opportunities emerging from planned campaigns, in particular airborne experiments with the German HALO during EUREC4A in the tropical North Atlantic, HALO-(AC)3 in the arctic region and CIRRUS-HL over the extra-tropical North Atlantic in 2020/21. For the first two campaigns, the HALO will be equipped with an EarthCARE-like payload (radar, lidar, radiometer and spectrometer), whereas for the third campaign, the high-spectral-resolution lidar will be flown together with extended in-situ instrumentation. Direct underpasses beneath the EarthCARE track will be performed during the campaigns. The German activities in the Arctic in the framework of the (AC)3 and MOSAIC campaigns in 2019/2020 will provide further opportunities to combine shipborne and airborne radar, lidar and in-situ observations in the vicinity of EarthCARE tracks.
Long-term support of the EarthCARE mission is planned through a number of German ground-based facilities operating Doppler cloud radars and aerosol lidars together with a variety of other remote-sensing instruments and radiation sensors. Four sites in Germany (Juelich, Leipzig, Lindenberg and Munich), the Barbados Cloud Observatory, lidar stations in Cape Verde, Cyprus, Israel and Tajikistan, the mobile aerosol and cloud observation facility LACROS and other mobile radar and lidar instruments for shipborne, airborne or land-based deployment will contribute to these activities. Cross-satellite validation activities will enable the global assessment of EarthCARE products. These experiments will make use of data from SEVIRI, MODIS, OLCI, SLSTR, AVHRR, MHS and other sensors to validate EarthCARE aerosol, cloud and radiation flux products. In-house developments of German partners, e.g., regarding ice water path retrievals or specific co-location procedures, will allow for unique validation options involving independent satellite observations.

It is envisaged to synergistically explore ground-based, airborne and satellite-based measurements in order to validate the EarthCARE product chain and the radiation closure concept as a whole. These activities will be supported by aerosol, cloud and radiation modelling aiming at the connection of observations and the investigation of spatial and temporal variances of the measured parameters. All obtained data, results and findings will be made available to ESA as soon as possible. Near-real-time data provision is planned for all continuously running facilities. Regular reporting, discussion of results with the EarthCARE Cal/Val team, active participation in Cal/Val workshops, presentations at conferences and publication of results in peer-reviewed journals are assured by the team. The team is composed of well-experienced scientists from 11 German institutions with expertise in satellite,

airborne and ground-based remote sensing as well as cloud, aerosol and radiation modelling. Several team members are involved in EarthCARE Level 2 algorithm developments.

ID: 38839	TITLE: Swedish contribution to ESA s EarthCARE Cal Val activities (SweVal)
PI: Dr. Abhay Devasthale (SMHI,SWEDEN)	
SUMMARY	

In comparison to passive sensors, the history of space-borne active lidar and radar for atmospheric sensing is relatively recent. Ever since the launch of CALIOP-CALIPSO and CPR-CloudSat in 2006, unprecedented global views of cloud and aerosols are obtained. They not only challenge our understanding of cloud and aerosol properties derived from the traditional sensors, but they also question very definitions of cloud and aerosol layers and the sensitivity of various sensor systems. A significant part of this enormous scientific progress made in the last decade in the era of CALIPSO+CloudSat can be undoubtedly attributed to numerous validation and comparison activities done by research groups across the world while focusing on different aspects of validation.
In this context, ESA s EarthCARE satellite will not only take the degree of our scientific understanding to the next higher level, but it will also pose new challenges, given the highly advanced lidar and radar onboard. Simultaneously, the demand from the user community in characterizing uncertainties, biases and differences among different observational system is also ever increasing. As the EarthCARE poses to be the next de facto reference for cloud and aerosol retrievals, validating EarthCARE retrievals is of paramount importance. Over the years, we have also learned that no single validation approach can fully characterize strengths and weaknesses of a particular observing system. It can rather be argued that the combination of various approaches, such as insitu-to-satellite, satellite-to-satellite, flight-to-satellite, are needed in this context.
Therefore, the proposed Swedish initiative will contribute to fulfil two specific objectives of the EarthCARE s Cal Val activity. 1) Comparison of cloud and aerosol properties with independent ground based observations and 2) Comparison with other space-borne sensors (at the instantaneous level and statistical). The ground based measurements from a potential cloud radar site in Sweden together with other campaigns in the Arctic will be used, thus focusing primarily on the high latitude regions. The second objective will be met in the framework of EUMETSAT s NWCSAF and CMSAF projects, thus focusing on European as well on global scales. The deliverables will include sharing and publication of validation/comparison results through report and peer-reviewed articles.
The proposed project is expected to run 3 years from 2019-2021..

ID: 39067	TITLE: Validation of EarthCARE Product in China
PI: Prof. Xiuqing Hu (National Satellite Meteorological Center,CHINA)	
SUMMARY	

The primary objectives of this proposal are to use the China ground-based or Chinese FengYun polar-orbiting satellite data to validate the corresponding EarthCare L1/L2 products. Main content includes: (1) Validation of ATLID L1 return signals and extinction coefficient vertical profiles by using ground-based lidar systems; (2) Validation of ATLID L2 integrated aerosol optical depth product using China ground-based sunphotometer network; (3) Radiometric calibration and validation of MSI visible and near infrared bands using Dunhuang China Radiometric Calibration Sites (CRCS) site; (4) Inter-comparison and mutual evaluation of EarthCARE with FY-3 satellite L1/L2 products. After this study, we hope to get some anticipated results: (1) The uncertainties of ATLID L1 products in the region of dust aerosols and polluted city aerosols in China; (2) The uncertainties of ATLID L2 aerosol products over China, which are validated using ground-based sunphotometer instruments; (3) inter-comparison results between MSI, BBR L2, and combined science products (including aerosol, cloud and radiation) and China FengYun-3 corresponding products in globe; (4) During this program, the research results of both sides will be published as papers of academic journals, abstract or papers of conference and workshop, posters of meetings, and short articles of newsletters.

The research team is composed of National Satellite Meteorological Center, China Meteorological Administration (NSMC/CMA), Beijing Research Institute of Telemetry, Italian National Research Council (CNR), and University of Naples Federico II .

ID: 39183	TITLE: Validation of EarthCARE products towards their homogenization with CALIPSO for consolidating the 3D long-term ESA-LIVAS climatology of aerosols, clouds and radiation (ACROSS)

PI: Dr. Vassilis Amiridis (National Observatory of Athens,GREECE)

SUMMARY

The overarching objective of ACROSS is to perform thorough cal/val investigations on EarthCARE products over Greece, a region well-known for its complex atmospheric environment. The experiments will be designed such as to achieve the following core objectives: (1) to perform a thorough validation of the EarthCARE stand-alone aerosol and cloud products employing sophisticated ground-based remote sensors and spaceborne observations derived from passive and active satellite instruments; (2) to utilize the validated aerosol and cloud products in Radiative Transfer Model (RTM) simulations for depicting radiation and further intercompare with high-quality solar irradiance measurements at surface (ground-based actinometry) and at TOA (space-borne radiometers, including BBR); (3) to expand ESA-LIVAS for including EarthCARE aerosol, cloud and radiation products, and to utilize the RTM developed in step 2 in order to include CALIPSO-based radiation estimations in the existing ESA-LIVAS aerosol and cloud climatic dataset. LIVAS will contribute on the evaluation of the EarthCARE performance in terms of reproducing well-known climatological patterns at global scale. The validation activities will involve: • a continuous cal/val activity at three monitoring sites in Greece (Thessaloniki, Athens, Finokalia) • 3 Intensive Observational Periods (IOPs) of 3-month each, including targeted large-scale field experiments in Greece • on-demand operation of mobile facilities that will be deployed at EarthCARE orbital crossing points in Greece The project consortium will use quality-assured instrumentation including multi-wavelength lidar systems, sun-photometers, broadband radiometers and in situ surface and airborne (UAV) sensors (part of the ACTRIS RI). Future upgrades of the ground-based instrumentation are anticipated, including a cloud-radar and a microwave radiometer. These instruments will be included in the cal/val effort. For the TOA EarthCARE product validation, satellite multi-sensor synergies will be utilized, using aerosol and cloud retrievals from passive sensors in polar (e.g. MODIS, VIIRS) and geostationary (e.g. SEVIRI) orbits but also solar radiation retrievals acquired by CERES and TOA Radiation GERB/SEVIRI product. In terms of scientific requirements, the project will be realized by an interdisciplinary group of academic experts on: (a) ground-based remote sensing, (b) surface/airborne in situ measurements, (c) satellite observations, (d) radiative transfer modeling, (e) solar radiation measurements at surface and (f) earth system modeling.

Thursday 14 June 2018 - Specific instrument product and algorithm validation

ID: 37730	TITLE: EarthCARE BBR L1 and L2 Products Assessment
PI: Dr. Nicolas Clerbaux (Royal Meteorological Institute of Belgium,BELGIUM)	
SUMMARY	

BRR instrument performance and product quality will be thoroughly assessed by a series of validation activities. These will establish the quality of the level 1 instrument radiances at both the nominal 10x10km2áspatially integrated scale (B-NOM) and at detector level (B-SNG). Assessment will address spatial and radiometric accuracy, consistency, stability, noise and anomalous behaviour. Both level 1 and level 2 product assessment will use Earth reference targets including deep convective clouds and coastlines and co-incident MSI observations to inform the analysis. The evaluation of the level 2 products (BM-RAD and BMA-FLX) will also involve comparisons against independent broadband measurements from CERES, GERB or ScaRaB. Level 2 evaluation will provide assessment of both the level 2 processing and the quality of the underlying level 1 data.

The 18-month pre-launch period will be used to develop tools and techniques and to plan data acquisition.áThis will buildáon the expertise of the partners in calibration /validation of the GERB, CERES and ScaRaB instruments, adapting existing tools and techniques and developing new ones where needed. An EarthCARE Validation Plan detailing the proposed validation studies will be delivered 4 months before launch at the Cal/Val Readiness Review.

Assessment during the 6 months commissioning phase will put primary focus on the level 1 data to establish basic data integrity, noise characteristics, gain stability and the effect of chopper drum speed on the science products. Results will inform discussions onátheáoptimum operating configuration and provide recommendations for the lifetime of the mission. A preliminary BBR validation report will document the results for the Commissioning Phase review.

Over the 3 year mission, products will be further evaluated and monitored, with changes to instrument response regularly assessed. áDedicated analysis of level 2 products may result in recommendations for updates to the level 2 processing (e.g. BBR radiance unfiltering or radiance to flux conversions). All findings will be consolidated in a BBR validation report provided to ESA at end of the project, 3 years after commissioning.

The team has extensive expertise in calibration/validation and operation of broadband radiometer instruments and access to existing tools which will support the planned validation studies.

ID: 38623	TITLE: SPACECARE (Study of Precipitation in the AntarctiC with EarthCARE)
PI: Dr. Christophe Genthon (CNRS,FRANCE)	
SUMMARY	

SPACECARE (Study of Precipitation in the AntarctiC with EarthCARE) will evaluate EathCARE's level 2 precipitation products in Antarctica. There are very few places in Antarctica where precipitation is continuously measured. This is because Antarctica is a very sparsely populated continent and because difficult logistics and extreme conditions strongly limit the operation of any instrument. On the top of that, the classic instruments (capture gauges) fail in the interior of the continent because the precipitation rates are extremely small and at the periphery because of very strong winds and blowing snow. Alternate less traditional methods must be used. To our knowledge, the longest continuous consistent series of snowfall observation in Antarctica is obtained at Dumont dUrville (DDU) station in coastal Adelie Land. This is obtained with a K-band vertically profiling radar which was scaled and calibrated during an intensive observation campaign in the austral summer 2015-16 using a combination of other instruments including a X-band dual polarization scanning radar, The K-band radar has been continuously operated since and is expected to continue operation after EarthCARE is launched and begins producing data. As precipitation is stratiform rather than convective, observation at DDU has large spatial significance. The 1st order comparison between the surface and space observations when the satellite overflies close enough to DDU will be straightforward, as both surface and space radars provide post-processed data of direct estimates of precipitation rates: the priority request to ESA for this project is the CPL2a precipitation rates (C-TC, C-CLD, ACM-CAP) estimates over Antarctica. Further, more detailed comparison will address vertical profiles of reflectivity and estimates of aerometeors characteristics as the surface radar profiles to 3000 m, expecting a fair intersection with the surface part of EarthCARE CPR soundings high enough to be unaffected by ground clutter. France (Institut des GΘosciences de l'Environnnement, Grenoble) and Switzerland (Laboratoire de TΘlΘdΘtection Environnementale, Lausanne) are already collaborating within the APRES3 project and have provided the 1st evidence that precipitation in Antarctica is even more complex than initially thought because a significant part re-evaporates in a dry surface air layer before reaching the ground. As a major issue with antarctic precipitation is that it feeds the ice sheet and any change in the future will affect the ice mass stored and thus global sea-level, accurately assessing and monitoring Antarctic precipitation down to the surface is a crucial issue. As other satellites do not have the right sensors or do not overfly Antarctica, CloudSat with the CPR has provided the 1st model independent climatology of Antarctic precipitation over he largest part of the ice sheet (to 82°S), with the limit that ground clutter (the blind zone) prevents seeing the evaporation layer. As CloudSat is failing, it is essential that EarthCARE's CPR takes over and is thus quickly evaluated over Antarctica, and in particular the evaporation layer assessed, using in situ observations. This is the main objective of the program. In order to evaluate the full chain of events leading to precipitation, it is also planned to use synergetic A-TRAIN DARDAR products (developed at LATMOS, Paris, France) to evaluate cloud properties from AC-TC product.

ID: 38709	TITLE: Evaluation of EarthCARE Radiances and Fluxes with CERES Data Products

PI: Dr. Norman Loeb (NASA Langley Research Center,USA)

SUMMARY

The work proposed here is based upon the assumption that when EarthCARE instruments start taking measurements, at least one of the Clouds and the Earth s Radiant Energy System (CERES) instruments on Aqua, S-NPP and JPSS-1 is operational.

The proposed work consists of four parts, 1) evaluation of broadband radiances observed by the BBR instrument with co-located broadband radiances observed by CERES instruments, 2) evaluation of broadband top-of-atmosphere (TOA) fluxes derived from BBR radiance observations with co-located CERES- and geostationary-derived TOA fluxes, 3) evaluation of EarthCARE computed TOA and surface fluxes with fluxes derived from CERES algorithms and surface observations, and 4) evaluation of EarthCARE cloud properties with cloud properties derived from Moderate Resolution Imaging Spectroradiometer (MODIS) and geostationary satellites with the CERES cloud algorithm, and evaluation of other input variables such as surface albedos and temperature and humidity profiles used in flux computations.

The first part directly addresses the calibration of the BBR instrument relative to calibration of CERES instruments.

The second part of the proposal examines how angular distribution model differences lead to TOA flux differences. Because EarthCARE uses shortwave and longwave angular distribution models that differ from those used by CERES, TOA flux differences will likely significantly exceed instrument calibration differences.

The third part compares computed TOA fluxes derived from the EarthCARE and CERES algorithms. In addition, downward shortwave and longwave surface fluxes derived from the EarthCARE algorithm will be compared with surface observations. Currently, forty-six buoys and thirty-six land observation sites are used for evaluation of CERES surface fluxes.

In part four, the computed TOA and surface flux differences between EarthCARE and CERES will be evaluated in the context of how the inputs used by both groups compare with one another. These include: cloud properties, surface albedos, surface emissivities, and temperature and specific humidity profiles. Input comparisons are needed in order to understand the causes of TOA and surface flux differences.

The above four proposed activities also provide an opportunity to evaluate the CERES radiance and flux products. The radiance comparisons provide an independent check on CERES calibration. Because BBR provides broadband radiances at three different angles from the same geolocation over its ground track, BBR observations are unique and provide an ideal dataset to test CERES angular distribution models.

In addition, BBR-derived TOA fluxes provide an evaluation of TOA fluxes inferred from geostationary satellite imagers using narrowband to broadband conversions. Comparisons of surface fluxes and inputs used for flux computations also enable evaluation of CERES surface fluxes and inputs.

Because the EarthCARE overpass time (2 pm daytime) is different from the Aqua and S-NPP overpass times, the comparisons enable evaluation of cloud properties and surface fluxes derived from geostationary satellite imagers as well as MODIS and VIIRS. Furthermore, the computed surface flux comparisons provide the evaluation of surface fluxes over polar regions where surface observations are scarce.

ID: 38816	TITLE: Validation of EarthCARE Aerosol products over key REgions with a focus on high latitudes (VECARE)

PI: Dr. Gerard Ancellet (CNRS-LATMOS,FRANCE)

SUMMARY

The main goal of this proposal is a validation of the Atmospheric Lidar (ATLID) A-ALD data products and of synergistic aerosol data product derived from the combined use of ATLID with the Multi-Spectral Imager (MSI) at high latitudes and to propose a specific analysis to characterize and validate aerosol properties above low dense water clouds at the global scale. It includes 3 contributions: 1) analysis of climatology from CALIPSO over dedicated regions using research products (SODA and derived products) for the characterization of aerosol properties (AOTs, Angström coefficient, lidar ratios, depolarization…) over clouds and ocean (possibly over land), and exploitation of new retrieval algorithm developed at LATMOS to characterize aerosol properties for layers transported in the free troposphere from CALIPSO. This task will be done in collaboration with US teams (see D. Josset proposal) 2) comparison of EarthCARE observations to ground-based (and possibly airborne) lidar observations at high latitudes focusing on the aerosol layer geometrical and optical characteristics at 355 nm, namely the layer aerosol optical thickness (ALOT) and total aerosol thickness (AOT), lidar ratio and particle linear depolarization ratio. 3) comparison of EarthCare observations to CALIPSO/SODA observations if simultaneous observations are still possible in 2020 and/or comparison to CALIPSO/SODA database, (see task 1) In task 2, various lidar observations used for polar research will be considered: Tomsk, Siberia (808 and 532 nm), drifting buoys in the Arctic (IAOOS project) equipped with autonomous lidars (800 nm), stratospheric observations by the Arctic Lidar Observatory for Middle Atmosphere Research (ALOMAR) lidar (355 nm) and Dumont D'Urville French Antarctica station (532 nm). Except for the ALOMAR station where direct comparison at 355 nm can be performed, aerosol type information is needed and proposed for the other lidar observations. The deliverables will include: - direct comparison of the ATLID 355 nm aerosol ALOT, lidar ratio and layer depolarization ratio with ground based lidar observations in Siberia, Scandinavia (ALOMAR), in the Arctic lower troposphere (IAOOS) and in Antarctica (DDU) - 1-year distribution of ATLID aerosol layer geometrical and optical characteristics will be compared with the CALIOP 11-yr distribution of aerosol layer in Siberia and Eastern Arctic, and Antarctica as well as other regions in the frame of the collaboration with US teams (see D. Josset's proposal): layer frequency for different altitude and latitude range, and different season. - 1-year distribution of aerosol types (smoke, polluted continental, dust) derived from the analysis of ATLID lidar and depolarization ratio (Gross et al. 2015), together with the data of the Multi-Spectral Imager (MSI) on-board the EarthCARE platform will be compared with the statistical analysis of the aerosol type conducted using CALIPSO

ID: 38935	TITLE: Innovative retrieval methods of aerosol and cirrus cloud optical depth above water clouds and ocean surface, and its application in ATLID cal/val studies.

PI: Dr. Damien Josset (NRL,USA)

SUMMARY

The investigators developed two innovative concepts of deriving aerosol and cirrus cloud optical depths from lidar measurements of ocean surface and water clouds, and validated the techniques against airborne HSRL measurements and CALIPSO clear air measurements. This international team of investigators, supported by NASA, would like to propose applying these techniques to validate ATLID Level 2 aerosol and cirrus cloud optical depth product. Specifically, we propose to: • Improving the CALIPSO based technique so that it can be applied to ATLID; • Validate ATLID L2 aerosol and cirrus cloud optical depth data product using column integrated atmospheric optical depths derived from ATLID ocean surface backscatter measurements together with collocated cloud radar ocean surface backscatter cross section and/or wind speed measurements; • Validate ATLID L2 aerosol and cirrus cloud optical depth data product using above cloud optical depths derived from layer integrated water cloud ATLID lidar backscatter measurements; • Validate ATLID L1 data product using lidar backscatter measurements of ocean surface and water clouds when there are no aerosol and cirrus clouds. • Compare with the database elaborated using CALIPSO based technique These different activities will provide a quantification of the accuracy of L1 and L2 data that ESA will be able to use in future quality assessments. This work will rely on current NASA funding of the investigators (see attached letter of support) and on a future submission to the NASA call “U.S. participating investigator”. An internal NRL proposal has been submitted which proposes to use Earthcare data. The details are not publicly available at the moment but this research effort would help ATLID cal/val activities. As the only team with expertise using data from both the LATMOS Leandre Nouvelle Generation (Josset 2009, Mioche et al. 2010) and the NASA LaRC High Spectral Resolution Lidar (Josset et al. 2011) for CALIPSO cal/val activity, we will also actively pursue collaboration to use data of these two airborne instruments in the frame of the EARTHCARE validation activities. This will allow us to establish an independent supplemental validation of the Rayleigh and Mie channel.

ID: 39147	TITLE: Calibration and Validation for EarthCARE Cloud Profiling Radar (CPR) using Ground Based and Satellite Weather Radar Observations

PI: Prof. V. Chandrasekar (Finnish Meteorological Institute,USA)

SUMMARY

The objective of this proposal is to provide Cal/Val activities for EarthCare mission. We have more than 20 years of Cal/Val experience in GPM and CLOUDSATE missions. In calibration and validation activities with EarthCare, we propose to use GPM DPR radar observations, dual-polarization radar network at Finland, NEXRAD radar, CSU-CHILL radar as well as NPOL radar. These activities include but not limited to radar measurements calibration, error specifications, hydrometeor identification cross-validation, and Doppler velocity calibration etc.

Since the CPR is the main EarthCARE sensor capable of providing range-resolved Doppler radar observations. The observations of the CPR can be used to derive hydrometeor locations (C-FMR), Doppler velocities (C-CD), target classifications (C- TC) and microphysical retrievals (C-CLD). To be more specific, the objective of this proposal is to provide calibration and validations of the CPR L2a products in the above 4 areas.

We will apply space re-mapping technique to perform coordinate physical validation of vertical structures from different radar systems. We will perform hydrometeor classification algorithms to both space and ground radars and validate hydrometeor types. We will identify snowfall and cross compare between space and ground radars. We will calibrate Doppler velocity properties available from CPR radar on board the EarthCare satellite.

The plan for deliverables of the project:

1) We will submit quarterly progress reports describing the status of our cal/val activities after the proposal approval.

2) We will prepare a final report at the end of the project period, in accordance with a given format to be defined by the Agency.

3) We will involve in documentation and produce scientific papers.

ID: 39184	TITLE: Statistically based calibration/validation control of ATLID L1 data

PI: Prof. helene chepfer (UPMC,FRANCE)

SUMMARY

We propose a set of parameters, which would characterize the behavior of the ATLID lidar system on a day-to-day basis using the L1 data as an input. With the help of this set we will trace:
(a) the stability of the detection chain for ATLID channels (Rayleigh, Mie, and the cross-polarized one);
(b) the accuracy of cross-talk coefficients;
(c) the stability of day- and nighttime noise;
(d) the stability of the radiation detection for all atmospheric scenarios and over the whole globe using a clustering algorithm applied to the scattering ratio (SR) histograms.
We define 11 parameters: 3 related to surface reflection, 6 related to stratospheric day- and nighttime noise for 3 channels, and 2 related to the SR histogram analysis. We demonstrate the feasibility of the approach using CALIOP L1 data for polarized and cross-polarized attenuated backscatter (ATB) components in 2008-2015.
(i) The stability control using surface backscatter takes advantage of a stable scattering scene providing thousands measurements per day, namely, a clear sky ocean surface at fixed surface temperature (300±1 K). Using CALIOP data, we show that the ATB histograms built over this subset demonstrate a clear maximum, the behavior of which over the years is coherent with laser power degradation. Applied to the ATLID channels, this approach will track the performance of laser, the absolute calibration for each channel, and the cross-talk coefficients.
(ii) For the stratospheric noise analysis, we build histograms of day- and nighttime r.m.s. values of the stratospheric “noise” (35-40 km layer) and analyze them in the same manner as above. For ATLID, this will help tracking issues in the detection path, in the signal treatment chain, and in the cross-talk estimates. Using CALIOP as a reference and knowing the ATLID technical specifications, we define “safe limits” for the day-to-day variability of histogram center values for surface and stratospheric ATB separately for its three channels.
(iii) To address the whole range of the detected molecular and particular ATBs, we use an advanced SR histogram approach based on our previous studies. We take advantage of the day-to-day similarity of physical processes in the atmosphere and quantify the deviation of the SR histograms built for typical scenes from the “reference” ones. To identify these scenes, we use a clustering approach. Using 8 years of CALIOP data, we show that the “clustered SR histograms” do not change dramatically over time for a well-calibrated instrument and that they are sensitive to calibration issues.
The deliverables are:
(1) an operational quality control algorithm adapted to ATLID L1 data processing;
(2) the results of day-to-day quality control for 11 parameters starting from the first day of the mission;
(3) a set of daily SR histograms;
(4) a Web-interface dynamically updating quality control results for ATLID team.
The total time of the proposed activity is 12 months (6 months of preparation before the launch and 6 months of commissioning phase).

ID: 39186	TITLE: Cabauw Lidar observations for ATLID L1 and L2a product evaluation.

PI: Dr. David Donovan (KNMI,NETHERLANDS)

SUMMARY

This proposal focuses on the evaluation of key ATLID L1 and L2 data products, namely, ATLID L1 attenuated backscatter profiles profiles along with L2 cloud/aerosol backscatter, extinction, extinction-to-backscatter ratio and linear depolarization ratio. These products are generated by the ATLID profile products algorithm (A-PRO). This activity focuses on the use of longterm 24/7 groundbased 355nm depolarization lidar observations made at the Cabauw/CESAR site (51.97N, 2.93E) in the Netherlands along with (non-continuous) observations from a multi-wavelength Raman lidar. The 24/7 nature of the UV-lidar observations make them well-suited for the collection of long term observations. Even though the main observations are performed with an elastic backscatter system (which requires the lidar ratio to be specified in order to retrieve aerosol extinction) by using the combination of Raman lidar data and ATLID derived estimates of the lidar ratio, the UVlidar observations are still well-suited for evaluating the ATLID HSRL observations and derived L2 products. The observations used will be binned according time and closest approach to Cabauw (e.g. 100 km, 50 km). The activity will focus on two main types of cases, namely, aerosol and optically thin cirrus cloud conditions. The analysis of significant discrepancies between the ground based observations and the corresponding A-PRO products will be facilitated by the team's in-depth knowledge of the A-PRO algorithm and the ability to use the EarthCARE simulator to test hypothesis related to the causes of the observed differences. In addition to the lidar observations, supporting observations may also be drawn upon including surface radiation measurements, cloud profiling radar observations, Aeronet aerosol products and IR ceilometer observations. These observations are conducted within the framework of the the Cabauw Experimental Site for Atmospheric Research, CESAR consortium. .An overview of the consortium and team is maintained at http:// www.cesar-observatory.nl Deliverables -Selected and processed co-located ground-based L1 lidar attenuated backscatter data. -Associated profiles of derived L2 extinction, backscatter and depolarization ratio. -Evaluation reports quantifying the comparison of the ground-based derived and relevant ATLID L1 and L2a products. -Monitoring of ATLID and A-PRO product stability over the observational period.

ID: 39205	TITLE: Calibration and Validation of EarthCARE s Cloud Profiling Radar Data Products

PI: Dr. Simone Tanelli (Jet Propulsion Laboratory,USA)

SUMMARY

The ESA/JAXA EarthCARE mission (Earth Clouds, Aerosols and Radiation Explorer) aims at delivering global vertical profiles of aerosol and cloud properties, and vertically resolved probability distribution functions of mass flux and vertical velocities in clouds (ESA, 2004). EarthCARE is a natural continuation and evolution of the NASA/CSA CloudSat and NASA/CNES CALIPSO missions. EarthCARE will carry a Cloud Profiling Radar (EC-CPR, Kumagai et al. 2003, Ohno et al. 2007), developed by JAXA and NICT (National Institute of Information and Communications Technology, Japan), a Lidar, a Multi-Spectral Imager and a BroadBand Radiometer.

EC-CPR is expected to provide the atmospheric sciences community with radar reflectivity measurements at the same frequency, and somewhat improved resolution and sensitivity, as CloudSat s CPR (CS-CPR, Stephens et al. 2002, Tanelli et al. 2008). It is the only instrument of this kind planned for the immediate post-CloudSat era (CloudSat successfully completed Prime Mission in Feb. 2008, and is in Extended Mission since then, the CS-CPR is still on its primary side as of 2017). It therefore represents an irreplaceable asset for the science community in regards to climate change studies. EC-CPR will also be the first spaceborne cloud radar with Doppler capability: mean Doppler velocity measurements can enable algorithms for a more accurate characterization of clouds and precipitation (classification, retrieval accuracy, monitoring of dynamics, etc.). However, the Doppler accuracies required to achieve such breakthroughs present a considerable challenge for EC-CPR in its current and final configuration. Notably, Doppler capability has been recognized as a critical capability in the NRC Decadal Survey (NRC, 2007) for a radar on board the NASA ACE (Aerosol/Cloud/Ecosystems) mission and its implementation is being studied by the ACE mission Science Working Group (ACE SWG).

We propose a 4-year effort focusing on the validation of the ESA L2b synergistic product, and in particular on the aspects that are derived primarily from the CPR measurements:

1. the development of a post-launch collaborative plan to compare CloudSat observations with EarthCARE s to establish a climate data record of cloud geometric profiles (implementation of the plan would be contingent to availability of funding and other resources);
2. The acquisition and distribution of pre-launch datasets from JPL s Cloud and Precipitation airborne radars to validate EC-CPR algorithms with airborne data, with particular emphasis on the assessment of the EarthCARE capability to observe storm dynamics.
3. the definition of a post-launch collaborative plan to study the benefits to ESA, JAXA and NASA of coordinated airborne deployments of Ku-, Ka- and W- band cloud and precipitation radars (together with other remote sensing instruments) to support validation of EarthCARE microphysical and dynamical retrievals; particular focus will be placed on the Airborne Precipitation and cloud Radar 3-rd generation (APR-3, Ku-/Ka-/W-band, mechanically scanning Doppler radar) for pre-launch activities, and on the Airborne prototype of the Multi-Application Tri-band SmallSat Radar (airMASTR, Ku-/Ka-/W-band, electronically scanning Doppler radar, currently under development) for post-2019 activities. Implementation of the plan would be contingent to availability of funding and other resources. 4. the use of an advanced time-dependent spectral radiative transfer model to validate the reliability of the CPR L2a Doppler and Reflectivity products as they are integrated in the Synergistic product, and to provide an assessment of the effectiveness of algorithms developed by the EarthCARE Science Teams for EC-CPR; This project aims at continuing a long-term collaboration between the CloudSat team and the EarthCARE team and at facilitating the synergy between the EarthCARE community and CloudSat and ACE communities.

ID: 39214	TITLE: Cross-scale evaluation of ground precipitation derived from the ACM-CAP data product over Europe

PI: Dr. Yannis Markonis (Czech University of Life Sciences, Prague,CZECH REPUBLIC)

SUMMARY

During the last decade substantial improvements have been accomplished in many remote sensing systems. However, the uncertainty in precipitation estimation still persists, since it manifests (a) as measurement error, (b) in the space/time interpolation of a naturally discontinuous and erratic field and (c) in the assumptions made to transform the satellite measurements into a precipitation amounts. While several methodologies have been developed for data comparison and validation, all these efforts, to date, focus mainly on individual variables and spatiotemporal scales. The challenge is thus how to achieve a better coupling between station-derived datasets and remote sensing records, in order to scrutinize observational limitations and/or deficiencies across different spatiotemporal scales.

Further extending our previous research, here, we propose a framework for observational data comparison in Earth system sciences that confronts observed patterns across a continuum of scales, rather than focusing on univariate goodness-of-fit criteria or individual spatiotemporal scales. We aim to apply this framework in the validation of the ground precipitation derived from the ACM-CAP data product over the European continent. This includes the combination of both site-specific, i.e. station, and gridded datasets at various scales, and the investigation of their scaling behaviour during the aggregation process.

The proposed cross-scale data comparison framework is expected to result to pinpoint specific scales across the spatiotemporal continuum that observed patterns match or diverge. This will provide quantitative evidence on current ACM-CAP algorithm deficiencies and highlight potential knowledge gaps.

ID: 39217	TITLE: MMP : Monitoring MSI/EarthCARE L1 performances using concomitant intercalibration and stand-alone approaches

PI: Dr. Noelle SCOTT (LMD/IPSL,FRANCE)

SUMMARY

To be fully useful for weather or climate apllications, satellite observations must be qualitatively and quantitatively controlled during the instruments lifetime: any radiometric systematic error in the level1 (L1) radiances, not identified nor quantified, may propagate as errors in the retrieved variables (L2). The aim of our proposal is to contribute to the validation (quality control) of the observations made by the MSI (MultiSpectral Imager) as well as to assess their stability over the instrument lifetime. Our understanding so far is that MSI/EarthCARE, part of the EarthCARE mission (altitude ~400 km, 14h00 mean local solar time in descending node) to be launched in 2019 is a nadir pushbroom seven channels (Vis, SWIR, TIR) imager, sampling 500 m ╪ 500 m at nadir.

The method we propose relies upon two concomitant approaches: (i) a relative (sometimes referred to as “inter-calibration” approach and (ii) a "stand alone" approach. They combine “observations to observations” and “simulations to observations” comparisons respectively.

As early as 1982, we have developed a technique for the calibration of METEOSAT based on LEO/GEO space and time collocations with instruments on-board the NOAA series (BΘriot et al J. Appl. Meteor., vol 21, 1982). From the early 90’s (ie from our involvement in the TOVS-NOAA/NASA Pathfinder Programme) up to now, similar methods were applied to the processing of AIRS/AQUA, IASI/MetOpA and B and IIR/CALIPSO, including LEO/LEO and GEO/LEO collocations. Our findings with IIR/CALIPSO have impacted and guided part of the calibration revisions carried out at CNES, thus contributing to the Version 2 IIR level 1 products publicly released in July 2017. Results are described in Scott, 2009, Garnier et al (2017), Scott et al (2017).

We propose to extend our scientific approach to the Monitoring of MSI/EarthCARE L1 performances (MMP), first for the TIR channels with planned extension to the SWIR channels.

The MMP project includes pre-launch and post-launch activities.

The proposed work includes all geographical regions and seasons, as well as land/sea/day/night scenes, clear/cloudy/aerosols scenes, thus encompassing a broad range of brightness temperatures. Data will be processed in delayed mode (e.g. from one to three months depending on the availability of auxiliary datasets) and results made available accordingly.

Simulations will be performed with the 4A/OP model fed with adequate descriptions of the atmospheric and surface state (TIGR, ARSA, outputs from analyses/reanalyses runs, &#65533;). http://ara.abct.lmd.polytechnique.fr/. 4A/OP is the official code selected by CNES for cal/val activities of IASI, Merlin, and MicroCarb.

At pre-launch time, rehearsals based on our ongoing calval reanalysis of L1 IIR/CALIPSO channels paired with LEO MODIS/AQUA channels and GEO SEVIRI/METEOSAT channels will play a key role in setting up a MSI/EarthCare Prototype and Error-Simulator. Throughout the project, we will maintain contact with MSI/EarthCARE operator to collect up-to-date information on the orbit, spatial and spectral characteristics. Through deliverables, and/or any other preferred means, we will maintain readiness for timely availability of information on models, data and tools involved in our project. Results will be shared with the L1 and L2 cal/val EarthCARE community.

Thursday 14 June 2018 - Dedicated campaigns and regional efforts

ID: 38018	TITLE: Validation of EarthCARE products by comparison with airborne measurements and global NWP predictions
PI: Dr. Franco Marenco (Met Office,UK)	
SUMMARY	
EarthCARE cal/val activities will be undertaken using (I) airborne measurements, (II) assessment against passive satellite imagery, and global NWP predictions. (I) We endeavour to undertake airborne cal/val activities with the Facility for Airborne Atmospheric Measurements (FAAM) aircraft, equipped with instruments for in situ aerosol and cloud measurements, as well as remote sensing instruments such as backscatter lidar, the International Sub-Millimetre Airborne Radiometer (ISMAR) and the Microwave Radiometer Scanning System (MARSS). The aim of the dedicated flights will be the direct comparison of cloud and aerosol products, and studies on scene classification. Thanks to the campaign schedule of the aircraft, research flights will be executed in areas accessible from the United Kingdom and during planned campaigns in different areas of the world. (II) EarthCARE cloud and aerosol products will be assessed against passive satellite imagery and global NWP predictions. Our geostationary cloud mask has been recently validated against airborne measurements and is capable of reliably flagging areas covered by cloud. We also work with products that can retrieve cloud top height, optical thickness, and effective radius. A product is also under development to retrieve dust load from MSG/SEVIRI. Moreover, with our Global model we are able to predict the cloud and mineral dust field. A systematic comparison of the passive imagery and NWP fields will be carried out against EarthCARE . If verification against the model is successful, data assimilation can be considered at a later stage.	

ID: 38809	TITLE: Balloon Aerosols Instruments for the Validation of EarthCare (BAIVEC)

PI: Dr. Jean-Baptiste Renard (LPC2E-CNRS,FRANCE)

SUMMARY

We propose to validate EarthCare extinction profiles, using suitable during good temporal and spatial coincidence between spaceborne measurements and balloon-borne measurements. These measurements will be obtained during two already existing/planned balloon campaigns: LOAC-Voltaire and Strateole 2. The balloon-borne instruments are aerosols counters, backscatter sonde and lidar. The LOAC-Voltaire campaign consists of regular flights under weather balloons up to an altitude of about 30 km, with the light optical particle counter (OPL) LOAC (Light Optical Aerosol Counter), launched at mid-latitude from Aire sur l'Adour, south-west of France (43.706242°N, -0.251423°E). These flights, conducted by the French space Agency CNES, are mainly dedicated to the monitoring of the aerosol loading in the upper troposphere and stratosphere, but measurements are also available in the lower troposphere. LOAC is a light and compact optical counter/sizer designed to perform measurements of liquid and solid particles, to retrieve the vertical profiles of the concentrations for 19 size classes between 0.2 and 100 micrometers, and to estimate the main nature of the particles (liquid, salt, mineral, carbonaceous particles, ice particles) when the medium is relatively homogeneous. Since weather balloons are easy to launch, we propose to adapt the date and the time of the LOAC-Voltaire campaign launches to ensure a very good coincidence with the EarthCARE measurements. The criterion could be a time difference less than 1 hour and a location difference less than 50 km between the launching base of Aire sur l'Adour and the satellite measurement. Flight opportunities can be foreseen from CNES zero-pressure balloon launching bases (Timmins in Canada and Kiruna in Northern Sweden), in case of better coincidences with the satellite or specific geophysical events (e.g. presence of polar stratospheric clouds). Also, occasional flights from Ury (near Paris) would be managed by LPC2E and the MeteoModem private company. Strateole 2is an international scientific project (France, USA). Its primary objective is to provide observations of the equatorial upper troposphere and lower stratosphere (UTLS), i.e. between 16 and 20 km of altitude, to better understand dynamical and transport processes in this region. The uniqueness of the project comes from the use of stratospheric balloons developed by CNES (called superpressure balloons), which are able to fly for several months at targeted altitudes. During the campaigns, each balloon will be carried by the winds and circumnavigate the Earth a few times close to the Equator. Strateole includes two major campaigns in boreal winters 2020-2021 and 2023-2024, with 20 balloons in each of those campaigns. These campaigns will be preceded by a smaller 5-balloon campaign in late 2018. Strateole contribution to EarthCARE cal/val activities will be mostly based on the use of in-situ, high-accuracy pressure and temperature sensors, flight-level aerosol counters, backscatter sonde, and backscattering lidar. Based on former long-duration balloon trajectories in the tropics and current characteristics of EarthCARE orbit, the estimated number of precise and statistical colocations are of the order of ~101−102 and ~104−105 per balloon and per month.

ID: 38810	TITLE: MORECALVAL : MObile Radar-Lidar-Radiometer EarthCare CAL/VAL project

PI: Dr. Julien Delanoe (LATMOS,FRANCE)

SUMMARY

Mobile platforms are ideal to complete the fixed ground-based systems allowing direct satellite underpasses. Fixed devices can provide a large statistic over one location for months or even years but it requires a statistical approach as the polar orbiting satellite will rarely fly exactly above the site. On the other hand mobile facilities allow direct comparisons with satellite measurements. Even for a short period (a few minutes), it is a unique manner to directly compare radar and lidar measurements. Mobile facilities are indeed very useful for processes and case studies and therefore widely involved in scientific campaigns with most of the time similar objectives to EarthCare. As a result it is envisioned here to propose to use these opportunity campaigns to contribute to the calibration (similar payload to EarthCare or even more sensitive instruments) and the validation of the EarthCare products (through a combination of multi-wavelength instruments and in-situ data). We will cover a large variety of EarthCare products with this combination of measurements and the capability to explore different locations. We will mainly focus on two field campaigns (EURECA4 and MOSAIC, both funded) but we will make the most of any other campaign, which could be set up by the time of the launch. German and French aircraft, respectively HALO (and AWI Polar 5, Polar 6) and French Falcon 20/ATR42 have very complementary payloads and are perfectly designed for the calibration and the validation of EarthCare. Airborne instruments are generally working at higher resolution (vertical and horizontal). In many cases these direct underpasses have been very valuable for assessing CloudSat and CALIPSO data for years. The Team is very experienced in conducting field campaigns all over the world with a clear ability to perform successful under flights (the last joint activity was EPATAN-NAWDEX). These aircraft board a high spectral resolution lidar (355 nm on the French Falcon and 532 nm on the HALO), a very powerful Doppler radar at 36 GHz (HALO) and a multi beam 95 GHz radar (Falcon 20/ATR42) and in-situ measurements. At European level they are the most complete possible setup to mimic and to complete EarthCare payload. Furthermore the associated scientific teams have a very large experience in algorithm development, especially synergistic radar-lidar retrieval for cloud and aerosol retrieval. Within the cal/val activities the airborne platforms are expected to provide EC like measurements (i.e. W band and 355 nm HSR), which will contribute to better understand the unprecedented nature of EC measurements and will bring material for testing/validating L2 algorithms. This unique combination provides the community with an EC like data set supported by extra radar-lidar-radiometry measurements airborne systems at different wavelengths (HSRL at 532nm, powerful Doppler Cloud radar at 35GHz). As flying aircraft can be expensive and requires an important logistic we also intend to propose other mobile systems such as a radar-lidar truck and ULA (ultra light aircraft). We also propose to use a low altitude geostationary zeppelin with a 95GHz cloud radar. It is envisioned to include in-situ data collected during arctic airborne campaigns. Objectives: - In collaboration with appropriate International Scientists and Agencies, design, plan and conduct several field campaign extensions to the existing experiment dedicated to the calibration and the validation of EC. - To provide EC like measurements (W-band radar and 355 nm HSRL), with a higher resolution than the EC mission. - To provide the most possible independent measurements of cloud, precipitation and aerosol and then compare to the EC retrievals. - Perform EC underpasses during scientific field campaigns, including remote sensing and in-situ measurements. - To provide spectral (nadir) radiance observations related to cloud cover, particle size and other EC relevant parameters.

ID: 38909	TITLE: Airborne and Lidar Validation of EarthCARE (ALIVO EarthCARE)

PI: Dr. Michael Gausa (Andoya Space Center,NORWAY)

SUMMARY

The present project proposes to contribute to the validation of the EarthCARE satellite through ground based remote sensing measurements, air-borne soundings of aerosol-, cloud properties and water vapour column from the ALOMAR observatory (Andøya Island, Northern Norway, 69oN, 16oE) and its vicinity. The measurements are performed using several remote-sensing and in-situ measurement techniques at ALOMAR and airborne platforms. Our location is distinguished for the validation of polar orbiting satellites with 2-4 times higher number of near-by overpasses compared to low- and mid-latitude sites. In addition, the sub-arctic region is covered sparsely by validation sites. The ALOMAR tropospheric lidar system collects aerosol and cloud profiles. Aerosol AOD and Ångström index columns are measured by a co-located sun/moon/sky photometer. The water vapour column measures both with a Cimel sunphotometer and a GPS receiver. The Radiosonde data from the nearby autosonde station (MET-Norway) contribute to data processing and to the validation of the cloud products. The troposphere lidar is part of the EARLINET network (ACTRIS-2) and has undergone an inter-comparison and it is annually quality assured through the EARLINET procedures. The system has three elastic backscatter channels (1064, 532 and 355 nm), as well as depolarization capability at 532 nm and 355 nm and an inelastic N2-Raman channel. It covers the height region from 700 m asl to the lower stratosphere. Aerosol- and cloud properties are achieved by applying lidar pre-processed data through EARLINET's Single Calculus Chain (SCC) for retrieval of backscatter and extinction profiles. Those data are routinely uploaded to the EARLINET database since 2016. Thus, the instrument can deliver validation data profiles for attenuated backscatter, aerosol parameters, cloud height and aerosol layer description as well as extinction, backscatter and depolarization. For column products for aerosols and water vapour, we use the Cimel 318T sun/moon/sky-photometer, which is part of the global network AERONET. The instrument is quality assured through network participation and delivers products such as aerosol optical depth, Angstrom exponent and water vapour. The Cimel together with the lidar allows advanced aerosol typing and improved processing of lidar data. In addition, for the water vapour measurements with a GPS receiver from the Norwegian Mapping Authority, the Cimel gives reference values, which can be compared. To validate MSI-products, cloud type and phase will be determined through lidar and temperature data from radiosondes combined, and optical properties from the MSI can be compared with photometer data and air-borne in-situ measurements with a Nevzorov probe. We will also validate combined products, such as cloud height comparison between lidar data and radiosonde measurements of temperature and humidity. For the airborne instruments, campaign based flights with an unmanned fixed-wing drone with 5.2-meter wing span will carry the instruments for aerosol profiling and identification of the black carbon content. The UAV range allows for operations up to 200 km radius, but we aim to perform measurements close to ALOMAR for spatial co-location with the ground-based measurements, while providing supplementary data from sea level.

ID: 39821	TITLE: An assessment of EarthCARE s Cloud Property Retrieval Algorithmsfor Persistent Ice-phase Clouds in the Canadian Arcticduring Polar Night

PI: Dr. Howard Barker (Enviroment Canada, CANADA)

SUMMARY

The basis of this proposal is to assess the potential performance of EarthCARE s ice cloud, and aerosol, retrieval algorithms for polar night conditions using coordinated data obtained from surface-base instruments at Iqaluit NU, Canada (63.74 N | 68.51 W ; 11 m ASL) and theNational Research Council (NRC) of Canada s Convair-580 aircraft. Both platforms are equipped with a suite of active and passive remote sensing instruments that closely mimic those that will fly on the EarthCARE satellite. Most importantly, the Convair-580 has a 94 GHz Dopplerized cloud radar, a 355 nm backscattering lidar, and passive narrowband radiometers.Data will be collected continuously from surface-based instruments at Iqaluit during winter 2019/20, along with NRC aircraft flights for both low-Arctic conditions and polar night during Feb. - Mar. 2020. The low-Arctic flights will coordinate with the Iqaluit site. Since Iqaluit does not experience full polar night, polar night flights will be coordinated with the research surface-site at Eureka, NU (80 N | 86 W).

ID: 39873	TITLE: EarthCARE Calibration and Validation Using an Airborne HSRL

PI: Dr. Chris Hostetler (NASA LaRC, USA)

SUMMARY

We propose to participate in EarthCARE calibration and validation program using data from NASA s airborne High Spectral Resolution Lidar Generation 2 (HSRL-2) instrument. The HSRL-2 instrument developed and operated by NASA Langley Research Center (LaRC) implements the HSRL technique at 355 nm and 532 nm and the backscatter technique at 1064 nm. It is also polarization sensitive at all three wavelengths. HSRL-2 has flown on numerous deployments from a variety of aircraft and the data have been used extensively for science as well as CALIPSO calibration/validation assessments. Because HSRL-2 provides accurate aerosol and cloud products at both 355, 532, and 1064 nm, the measurements also provide a bridge between the ATLID 355-nm and CALIOP 532/1064-nm data records. This bridge may prove to be important for statistical calibration/validation comparisons between ATLID and CALIOP as well as a means to connect the two data records for trend studies. Under the assumption that NASA provides the necessary funding and also that the schedules for NASA aircraft, the HSRL-2 instrument, and our team members allow, we will contribute in one to three ways. First, we will participate in planning activities of the EarthCARE Cal/Val Team and share our experience from conducting CALIOP validation flights. Second, we will provide HSRL-2 data from aircraft flights along the EarthCARE ground track. These data will provide the measurements necessary to assess ATLID calibration and the accuracy and precision of several ATLID and ATLID-MSI Level-2 products. Third, we will execute calibration and validation assessments and produce reports/journal articles on the results, as we have done for the CALIOP lidar on the CALIPSO satellite.

Thursday 14 June 2018 - Global coverage and long-term global mission support by observational networks and stations

ID: 38644	TITLE: ACTRIS for EarthCare L2 product evaluation (AECARE)
PI: Mr. Arnoud Apituley (Royal Netherlands Meteorological Institute,NETHERLANDS)	
SUMMARY	
Objective This proposal focuses on assessment of the validation and representativity of EarthCARE observations of aerosol and cloud products using pan-European ground based observations from ACTRIS stations with aerosol and cloud profiling capabilities. Methods The proposed work in AECARE is aimed at the long-term validation of the EarthCARE L2 data products through building a long-term collocated database from ground based observations at ACTRIS stations. The aerosol and cloud measurements made at ACTRIS sites are particularly suited for this purpose, since very similar techniques are being used at the ground and from space (i.e. quantitative aerosol lidar, cloud radar). Therefore, the data products can often be compared directly, and auxiliary and redundant ACTRIS observations from the ground serve to further clarify differences. Furthermore, the distribution of ACTRIS stations over Europe (and in addition a number of ACTRIS stations in overseas areas), the harmonised processing, and the common data formats make the ACTRIS research infrastructure particularly suited for EarthCARE validation. Noting that the EarthCARE ground track is likely to pass the closest ground based stations at distances that can increase up to tens of kilometres, which are large compared to the (in-)homogeneity of aerosol and cloud structures, representativity in space and time is an issue to be considered in the validation. This will be addressed through clustering of ACTRIS stations and comparison of statistics of aerosol and cloud observations. AECARE will validate EartCare L2 products by 1. Comparison of EarthCARE and ACTRIS aerosol and cloud profiles using observations from close proximity overpasses. Observations at ACTRIS stations that are not running continuously will be triggered by an alerting system based on predicted EarthCARE ground tracks. 2. Comparison of synergistic EarthCARE produts by comparing them to similar products build up from ground based observations at ACTRIS stations. The work proposed in AECARE will consider the broadest range of atmospheric conditions realistically possible, e.g. from clear-sky up to overcast and multi-layered clouds. Although direct validation of products will not be possible under all atmospheric conditions, the added value in this approach is that the EarthCARE observations suffer from the same limitations as those from the ground. Therefore, the resulting cloud and aerosol (typing) masks, should be studied to understand their representativity - for the atmospheric state observed - and usability with relation to these specific atmospheric conditions. The analysis on any significant anomalous discrepancies between the ground based observations and the corresponding EarthCARE products will be facilitated by the AECARE-team s in-depth knowledge of the EarthCARE algorithms and the ability to use the EarthCARE simulator in order to test hypothesis related to the causes of the observed differences (e.g. instrument calibration issues or specific algorithm issues). AECARE is the overall contribution of ACTRIS to the EarthCARE validation to the AO call. Since national funding is needed to execute the activities, additional AO proposals will be put in place that are aligned or partially overlapping with AECARE from various countries or individual research groups that are member of ACTRIS. Deliverables • Long-term database of ground based observations of clouds and aerosols from selected clusters of ACTRIS stations based on observing capabilities, geographical coverage and	

clustering of stations (see detailed description) suitable for direct comparison and representativity studies of EarthCARE L2 products (e.g. aerosol backscatter, aerosol extinction, lidar ratio, cloud geometrical parameters, LWP, LWC, IWC, etc.). • Evaluation reports

ID: 38757	TITLE: LALINET EARTHCARE CAL/VAL
PI: Mr. Eduardo Landulfo (IPEN,BRAZIL)	
SUMMARY	

LALINET is a leading network in quantitative aerosol profiling performing a schedule of routine measurements and presently consists of 09 stations distributed over South America. The construction of an un-biased spatio-temporal database of vertical profiles of aerosol optical properties on a regional scale for climate and air quality research is the main objective of LALINET and is accomplished by the application of Raman lidars. Raman lidars, like HSRL, are capable of providing vertically resolved aerosol and cloud backscatter and extinction profiles as well as the lidar ratio without critical assumptions.
The perspectives from space observations and ground based measurements are complementary: from space a global overview is obtained, built up from snap-shot like observations over different locations, while a temporal development over one place is obtained from a ground based station. A network of ground-based stations, therefore, has the ability to provide spatio-temporal development of aerosol fields and offers a unique opportunity for validation of observations from space. These notions are the basis for this proposal.
The main objectives of this proposal are:
1) Validation of EARTHCARE products of aerosol and cloud profiles of backscatter, extinction and lidar-ratio,
2) Assessment of spatio-temporal representativeness of EarthCare aerosol and cloud products.
The objectives will be accomplished through correlation between ground based lidar data from LALINET stations. For this, data will be used from: 1) The (historical) LALINET database, 2) Correlative measurements performed by selected LALINET stations during close proximity EarthCare overpasses. LALINET stations perform regular lidar measurements simultaneously at three fixed instances a week, guaranteeing unbiased data collection: one daytime measurement around noon, when the boundary layer is well developed, and two night-time measurements per week, in low background-light conditions, to perform Raman extinction measurements. Since the launch of CALIPSO in April 2006, LALINET maintains a correlative measurement schedule that takes advantage of the network structure. This is done so that close overpasses are captured by a particular station and also by its nearest-neighbour stations to capture the spatio-temporal variability. It is proposed to use a similar strategy for the validation of EarthCare.
Deliverables are:
1) Vertical profiles of aerosol optical properties (backscatter, extinction and lidar ratio) obtained from routine network observations,
2) Vertical profiles of aerosol optical properties obtained from correlative observations.
3) Reports

ID: 38768	TITLE: Validation of EarthCARE level2 radar products in high-latitude and Arctic climates
PI: Prof. Dmitri Moisseev (University of Helsinki,FINLAND)	
SUMMARY	
The current project is aiming to carry out ground validation of level 2 CPR products using Finnish cloud profiling stations located in HyytiΣlΣ (61▒51┤ N, 24▒17┤ E) and Pallas-SodankylΣ (67▒58'N, 24▒07'E). The stations are part of the national and European Aerosols, Clouds, and Trace gases Research Infrastructures (ACTRIS). The cloud profiling part of the infrastructure include W- and Ka-band cloud radars, humidity and temperature profiling radiometer, Doppler lidar and ceilometers. In addition to the cloud profiling capabilities, comprehensive measurements of precipitation, both frozen and liquid, are carried out at the HyytiΣlΣ station. This station is also part of NASA Global Precipitation Measurement Mission ground validation network.	

ID: 38811	TITLE: An Italian coordinated contribution to the Validation of EarthCare products from three atmospheric observatories in the Central Mediterranean Sea.

PI: Dr. Gian Luigi Liberti (CNR - ISAC,ITALY)

SUMMARY

The objective of this proposal is to take full advantage of available instrumentation and knowhow from 3 Italian atmospheric observatories in Central Mediterranean to provide high quality correlative data for EarthCARE L1 and L2 products validation. The observatories are located in the Island of Lampedusa (35.5°N, 12.6°E), in the Rome city center (BAQUNIN 80 aslm 41.90°N,12.50°E) and in its outskirts (CIRAS 110 aslm, 41.84°N,12.65°E) allowing the sample of different regimes/processes of interest for EarthCARE validation. Lampedusa observatory (www.lampedusa.enea.it), located south of Sicily at more than 100 km from mainland, is composed by atmospheric and oceanographic sections, the latter represented by an instrumented buoy in open ocean, about 15 km SW of the atmospheric observatory. At this site, data are collected since 1997, and are mainly representative of clean maritime regime. The geographical position of the island allows to investigate several specific processes, relevant for aerosol-radiation, and aerosol-cloud-radiation interactions (e.g. Saharan dust transport, ship emissions, long range transport of anthropogenic aerosols). The two sites in Rome are equipped with twin active and passive instrumentation. They are representative of typical near-coastal Mediterranean conditions. Their relative position can provide useful information on the impact of the urban environment. All sites are characterized by high probability of clear sky during summer season. The different longitude of observatories will increase the probability of a match-up with satellite observations. They share similar instrumentation and homogeneous processing will be carried out thanks to a well established collaboration with exchange of knowhow, personnel and instruments. The proponent team has a documented experience on atmospheric measurements including instrument development, processing algorithm, participating to experimental campaigns and atmospheric monitoring networks (NDACC, Skynet, AERONET, Pandonia, ACTRIS/EARLINET, LINET etc.). The team has been involved in several activities in the development of satellite missions at different levels from feasibility studies, SAG and MAG participation, algorithm development and implementation, operational processing (e.g. H-SAF, CMEMS). In particular, the team is involved in the validation of satellite missions (e.g. ERS-1, ERS-2, ENVISAT, GPM, S3). In addition, the team can employ two instrumented vans and one aircraft (payload=680 kg, max altitude 5500 m) certified to carry scientific instrumentation. The team will provide, in the required format, routine measurements and ad-hoc periodic lidar and C band radar measurements based on overpass schedule and meteorological conditions. In addition to the methodology for match-up suggested in the requirements documents, alternative approaches to compare statistical properties of the variables will be explored based on the analysis of acquired long term datasets. Rigorous estimation of ground based observation uncertainties, including product/site dependent estimation of spatio-temporal representativity, will be applied, documented and exploited in the validation exercises. In the framework of this validation activity, synergistic processing algorithms could be developed to take full advantage of the information carried by the different instruments. The impact of urban environment on the EarthCARE products will be investigated. In terms of deliverables the project will produce. Instruments and algorithms description, including the estimation of uncertainties. Statistical description of the geophysical variables of interest for a statistical comparison. Data sets of paired ground based and satellite observations. Validation results.

Friday 15 June 2018 - Global coverage and long-term global mission support by observational networks and stations (continued)

ID: 38813	TITLE: British and Korean lidars for ATLID validation (BAKLAVA)
PI: Dr. Matthias Tesche (University of Hertfordshire,UK)	
SUMMARY	
Measurements with two unique spectrometric aerosol Raman lidars located in the United Kingdom (51.75°N; 0.24°W) and the Republic of Korea (35.23°N;126.84°E) will be conducted during EarthCARE overpasses to validate the aerosol and cloud profile products obtained from ATLID observations. The Lidar Spectroscopy Instrument (LiSsI, Tesche et al., 2017) at the University of Hertfordshire (UH), Hatfield, UK, and the Multiwavelengths Raman Spectrometer Lidar in East Asia (MRS.LEA, Noh et al., 2008; 2014; 2017), at the Gwangju Institute of Science and Technology (GIST), Gwangju, Republic of Korea are two of only three instruments worldwide that enable multiwavelength spectrometric profiling of Raman scattering and depolarisation of atmospheric constituents. LiSsI and MRS.LEA are designed for measurements of gaseous and particulate pollution, while a third lidar with spectrometric capabilities, RAMSES of the German Met Service (Reichardt et al., 2016), focuses on the detection of the Raman spectrum of water molecules in the atmosphere. Objectives The objective of this proposal is to enable validation measurements of ATLID observations with two unique instruments located in the United Kingdom and the Republic of Korea. Apart from their spectrometric capabilities, the two instruments stand out as (1) LiSsI features one of the most powerful lasers (repetition rate of 10 Hz with a pulse energy of 2.5 J at 355 nm) to ever be implemented into a ground-based aerosol lidar and (2) MRS.LEA which is located downwind of anthropogenic pollution sources in China and in the pathway of dust outbreaks from the Asian deserts is the most advanced aerosol lidar in East Asia. Method We will perform regular validation measurements during EarthCARE overpasses in the vicinity of the two lidar sites in the UK and South Korea following the protocol established by the European Aerosol Research Lidar Network (EARLINET) for the validation of measurements with the lidar aboard the Cloud Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite (Pappalardo et al., 2010; Schwarz, 2016). Validation measurements will be performed within a time window of about 3 h around an EarthCARE overpass. The measurement time window will be shifted depending on the distance and location of an individual overpass. Co-location will be assured using the trajectory approach outlined in the CALIPSO validation study of Tesche et al. (2013). The measurements of elastically and inelastically scattered light will be analysed as described in Ansmann and Müller (2005) to obtain the aerosol profile products for the validation of ATLID measurements. The spectrometric measurements will be analysed following Tatarov et al. (2010). Aerosol and cloud base and top heights will be obtained by detecting strong gradients in the range-corrected signal at 1064 nm using the wavelet covariance transform method of Brooks (2003). Deliverables The parameters of relevance for the validation of ATLID data products that will be delivered from measurements with LiSsI and MRS.LEA are profiles (all at 355 nm) of the attenuated backscatter coefficient (up to an altitude of at least 30 km), the aerosol backscatter and extinction coefficient, the lidar ratio and the particle linear depolarisation ratio. Both instruments also provide the base and top heights of aerosol layers as well as the base height of optically thick cloud layers and the base and top heights of optically thin cloud layers. In addition, the measurement capabilities of both instruments enable the retrieval of aerosol type – by the conventional method of using optical parameters (Groß et al., 2015) and by means of spectrometric measurements of Raman scattering of selected chemical compounds (Tatarov et al., 2010).	

ID: 38834	TITLE: CESAR for EarthCARE evaluation (CECARE)

PI: Mr. Arnoud Apituley (Royal Netherlands Meteorological Institute,NETHERLANDS)

SUMMARY

Objective This proposal focuses on assessment of the validation and representativity of EarthCARE observations of aerosol and cloud products using comprehensive observations at the Cabauw Experimental Site for Atmospheric Research (CESAR) in the Netherlands. Methods The proposed work in CECARE is aimed at the long-term validation of the EarthCARE L2 data products and will look into the overall EarthCARE mission goals through building a long-term collocated database from the CESAR Observatory. The unique combination of profiling, column integrated and in-situ observations carried out at CESAR make the dataset particularly suited for studying the very same subjects as those underlying the EarthCARE mission concept, i.e. study of the Earths' radiation balance by studying radiation, radiative forcing (direct, indirect) and feedbacks. While EarthCARE will be making global observations form a polar orbit, taking snapshots of particular location with a recurrence over the same site in the order of several days, the detailed ground based observations cover long time periods over a fixed location. Therefore, the ground based and space borne perspectives should be considered complimentary. The aerosol, cloud and radiation measurements made at CESAR are particularly suited for this purpose, since very similar techniques are being used at the ground and from space. Therefore, the L2 data products can often be compared directly, and auxiliary and redundant CESAR observations from the ground serve to further clarify differences. Noting that the EarthCARE ground track is likely to pass over CESAR at distances that can increase up to tens of kilometres, which are large compared to the (in-)homogeneity of aerosol and cloud structures, representativity in space and time is an issue to be considered in the work. We remark here that in case the EarthCARE ground track would be configured such that CESAR would be a preferred location would uniquely enable to study individual profiles and scenes, as well as representativity over larger spatial and temporal domains. CECARE will validate EartCare L2 products by 1. Comparison of EarthCARE and CESAR aerosol and cloud profiles and radiation products using observations from close proximity overpasses. Observations at CESAR that are not running continuously will be triggered by an alerting system based on predicted EarthCARE ground tracks. 2. Comparison of synergistic EarthCARE produts by comparing them to similar products build up from ground based observations at CESAR. The work proposed in CECARE will consider the broadest range of atmospheric conditions realistically possible, e.g. from clear-sky up to overcast and multi-layered clouds. Although direct validation of products will not be possible under all atmospheric conditions, the added value in this approach is that the EarthCARE observations suffer from the same limitations as those from the ground. Therefore, the resulting cloud and aerosol (typing) masks, should be studied to understand their representativity - for the atmospheric state observed - and usability with relation to these specific atmospheric conditions. The analysis on any significant anomalous discrepancies between the ground based observations and the corresponding EarthCARE products will be facilitated by the CECARE-team's in-depth knowledge of the EarthCARE algorithms and the ability to use the EarthCARE simulator in order to test hypothesis related to the causes of the observed differences (e.g. instrument calibration issues or specific algorithm issues). Deliverables • Long-term database of ground based observations of aerosols, clouds and radiation CESAR suitable for direct comparison and representativity studies of EarthCARE L2 products (e.g. aerosol backscatter, aerosol extinction, lidar ratio, cloud geometrical parameters, LWP, LWC, IWC, etc.). • Evaluation reports

ID: 38836	TITLE: ACTRIS-FR proposal for EarthCARE Cal/Val

PI: Mr. Philippe Goloub (CNRS/University of Lille,FRANCE)

SUMMARY

Objectives :

This proposal is an ACTRIS-FR (French Research Infrastructure dedicated to support aerosol, cloud and reactive trace gas research) contribution to the calibration/validation of Earth-CARE for aerosols and cloud properties. The core activity of the proposal consists in performing a multi-site calibration/validation based on ground-based active (LiDAR/Radar) and passive (photometer, radiometer) remote sensing observations performed at the main French atmospheric stations. The stations involved are located in the Tropics (La RΘunion (OPAR), Dakar (LOA/IRD)), in the Arctic (Alomar, LATMOS), and in the mid-latitudes (Southern France, rural: OHP, LATMOS; central France, mountainous: CO-PDD, LaMP; Northern France, Urban: Palaiseau, SIRTA, IPSL, and Lille, LOA). The main objectives of this ACTRIS-FR contribution are (i) the evaluation of aerosol properties, (ii) evaluation of the optical signature of volcanic aerosols and stratospheric clouds and (iii) evaluation of cloud properties.

Methods :

Accumulation of relevant collocated ground-based and satellite data at multiple stations and archiving them at a unique Data Center (AERIS). The centralisation of the data will optimize resources allocated to the global project and simplify the access to and use of, and application/development of common tools. Following national rules, each laboratory will have access to the data to perform its tasks as defined in their objectives and working plan.

Each atmospheric station will produce aerosols and/or clouds profiles based on Lidar and/or Radar measurements as well as column integrated properties. All stations are contributing to European and international networks, therefore fitting QA criteria, so as to provide, for example, reference profiles, for the purpose of calibration/validation.

Results and Deliverables :

The deliverables will be reporting, presenting and publishing (i) on the data used and the methodologies for the validation, (ii) the results of comparison studies between coincident ground-based and satellite data/products, based on multiple overpasses at 6 locations., (iii) a database managed AERIS National Data Center.

ID: 38841	TITLE: EarthCARE Cal/Val Using the NASA Micro Pulse Lidar Network (MPLNET)

PI: Dr. Ellsworth Welton (NASA Goddard Space Flight Center,USA)

SUMMARY

The NASA Micro Pulse Lidar Network (MPLNET) is a global network of Micro Pulse Lidar (MPL) instruments and was designed to provide data on aerosol and cloud vertical structure and properties for studies of climate change, assessment of aerosol and cloud models, aerosol forecasting of air quality, and calibration and validation of satellite sensors. MPLNET began in 2000 and has deployed over 60 long and short-term sites worldwide. Eighteen long-term sites are currently operating with approximately 10 more in planning or proposal stages. Sites span all latitudinal bands from the South Pole to the Arctic. MPLNET was built upon the successful approach pioneered by the NASA Aerosol Robotic Network (AERONET): a federated network utilizing standardized commercially available instrumentation, standard calibration protocols, operations, and centralized data processing and archiving with full open access to all data. MPLNET has contributed to over 100 publications, several thesis and dissertations, and provided calibration and validation support for NASA satellite sensors (ICESat, MODIS, TOMS, and CALIPSO) as well as support for numerous large scale international modeling efforts (Aerocom, ICAP, SDS-WAS). MPLNET is a member of the WMO GAW Aerosol Lidar Observation Network (GALION), which helps to coordinate our activities with other lidar networks. The MPL was developed at NASA Goddard Space Flight Center (GSFC) in the early 1990s as the first eye safe, green lidar designed for long-term autonomous operation in the field. The MPL was patented and licensed to industry, and since then hundreds of MPL systems have been sold worldwide. The MPL is an elastic backscatter lidar at 532 nm, and provides profiles of backscattered photon counts from aerosols, clouds, and the molecular atmosphere at variable temporal and vertical resolutions from the surface to 60 km effective range. The usable range of the data are typically 0 – 30 km. The original MPL design was unpolarized, but a new polarized MPL model is now in use throughout MPLNET, providing additional information on the shape of the scattering particles. MPLNET Level 0 (raw) data are collected continuously, day and night, at 30 second or 1 minute temporal resolutions, and 15, 30, or 75 meter vertical resolutions. All Level 0 data are sent to our MPLNET data center, archived and automatically processed into standardized Level 1 signal data. Level 1 signal data are produced at 1 minute temporal, and 30 or 75 meter vertical resolutions and include profiles of range corrected, energy normalized signals, the volume depolarization ratio, and all diagnostic data. MPLNET is finalizing development of our new Version 3 processing system. Level 1 retrieved products include cloud and aerosol layer heights, extinction profiles, optical depths (layer and column), cloud phase, and the mixed layer depth of the boundary layer. All data are archived, processed, and available in near real time (< 1.5 hours from collection). Near real time, quality assured Level 1.5 products will be available soon, as well as final Level 2 quality assured products. MPLNET Version 2 archived results from 2000 - 2010 are available for retrospective analysis. This proposal will serve as a means to coordinate NASA MPLNET cal/val support for the ESA EarthCARE mission. MPLNET data are publicly available on our website with an open data policy (with offers of co-authorship). Data from any available site may be used for cal/val studies, and MPLNET will support use of our data as with any research request since this already falls within our funded activities. Specific EarthCARE cal/val studies using MPLNET data conducted by this proposal team will be submitted in the form of an MPLNET-EarthCARE cal/val proposal to the first available NASA announcement of opportunity.

ID: 39173	TITLE: Validation of the EarthCARE ATLID and MSI products using ground-based lidar and sunphotometry measurements in East Asia.

PI: Dr. Tomoaki Nishizawa (National Institute for Environmental Studies,JAPAN)

SUMMARY

The proposed validation exercise covers ATLID and MSI products. It thus prioritizes aerosol-related products. The main target parameters are as follows: (1) ATLID L1B; (2) ATLID-L2A: A-AER, A-EBD, and A-ALD; (3) MSI-L2A: M-AOT; and (4) ATLID-MSI L2B: AM-ACD. Two ground-based observation networks will be used in this validation observation. The first is the Asian Dust and Aerosol Lidar Observation Network (AD-Net), a collaborative ground-based lidar network covering a wide area in East Asia. This lidar network uses multi-wavelength lidar instruments synergistically with Mie lidar, a high spectral resolution lidar (HSRL), and Raman lidar (RL) techniques. The other network is a radiation observation network called SKYNET, which covers a wide area in Asia as well as Europe, with skyradiometers measuring and retrieving columnar aerosol optical properties. The primary investigator (PI) and co-investigators (CIs) of this validation observation are familiar with AD-Net and SKYNET because they are the core persons engaged in developing and maintaining the requisite hardware and software. In addition, most of the personnel belong to the EarthCARE science team and are engaged in developing the EarthCARE L2 algorithm for Japanese (JAXA) products. In this validation analysis, we will mainly use data measured by multi-wavelength Raman lidar (MRL), multi-wavelength HSRL (MHSRL), multi-wavelength Raman-HSR lidar (MRHSRL) and skyradiometers at the AD-Net and SKYNET observation sites as well as the AD-Net-related observation sites. The MRL measurements built at three sites in Japan (Fukuoka, Toyama, Hedo) provides extinction coefficients (a), backscatter coefficients (b), and depolarization ratios (d) of particles at 355 and 532nm; attenuated backscatter coefficient (b) at 1064nm (i.e., 2a+3b+2d data) in nighttime; and attenuated backscatter coefficients at the three wavelengths and total depolarization ratios at 355 and 532nm (i.e., 3b+2d) in daytime. After January 2019, similar MRL observations are planned at Koror Island in Palau and over the ocean using the research vessel MIRAI operated by JAMSTEC (Japan Agency for Marine-Earth Science and Technology). Furthermore, a MHSRL providing 2a+3b+2d data all day and night will be built at Koganei, Tokyo, Japan, with observations commencing from April 2019. The MRHSRL established at Tsukuba in Japan, which uses both the nitrogen-vibrational Raman lidar technique at 387nm and iodine HSRL technique at 532nm, also provides 2+3+2. We will use 1a+1b+1d data at 355 nm, derived from the MRL, MHSRL, and MRHSRL measurements for the ATLID L1B and ATLID L2A validation. We will evaluate downward attenuated backscatter coefficients to validate the ATLID L1B data. 1a+1b+1d data of aerosols and clouds at 355nm (ATLID L2A: A-AER and A-EBD) and their layer-integrated (layer-mean) parameters with the lidar ratio (ATLID L2A: A-ALD) estimated from ATLID measurements will be validated with the parameters derived from the ground-based lidar measurements. The aerosol optical thicknesses (AOTs) at 670 and 865 nm estimated from the MSI measurements (MSI-L2A: M-AOT) and the spectral AOTs from 355 nm to 865 nm inferred from the ATLID-MSI synergy measurements (ATLID-MSI L2B: AM-ACD) will be validated with the parameters derived from the skyradiometer measurements. We will statistically validate the parameters derived from the ATLID and MSI measurements using ground-based measurement data observed when the EarthCARE satellite passes close to the observation sites in time and space.

Friday 15 June 2018 - Validation against other satellites

ID: 39266	TITLE: Plan for EarthCARE/ATLID Calibration and Science Product Validation Using CALIPSO
PI: Dr. David Winker (Nasa,USA)	
SUMMARY	
CALIOP cloud observations have been used extensively as a reference dataset for the evaluation of cloud products derived from passive sensors. These comparisons have shown lidar to provide the highest accuracy and the best vertical resolution for evaluating cloud fraction and height. The CALIPSO team is now in the process of constructing Level 3 cloud data products which will serve as benchmark climate data records over the period of the CALIPSO mission. The climate community has an interest in extending this type of data record to multi-decadal scales, as a more accurate active-sensor analogue to the ISCCP dataset. Characterizing the consistency of cloud data from the CALIOP and ATLID instruments is a necessary step in this development. Therefore our objective is to globally intercompare cloud observations from CALIOP and ATLID, focusing on three-dimensional cloud occurrence, cloud top height, and cloud ice/water phase. We assume the CALIPSO mission will end before the launch of EarthCARE in 2019. Therefore, comparisons of CALIOP data with that from ATLID will be done statistically. A meaningful mean climatology can be derived from the 11-year CALIOP data record, along with characterizations of interannual variability which can be used to estimate uncertainties due to lack of temporal matching between the CALIOP and ATLID datasets. This intercomparison will involve an evaluation of the ATLID depolarization calibration and consideration of differences in sensitivity. Wavelength differences between CALIOP and ATLID should pose minimal difficulties as cloud scattering and attenuation is largely independent of wavelength. CALIPSO Level 1, Level 2, and Level 3 data products are already freely available to the public. We will present our intercomparison results to the EarthCARE team in the form of presentations and a written report, and also publish the results in a scientific paper.	