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ESA Climate Change Initiative (CCI) project GHG-CCI: A project to deliver the Essential Climate Variable (ECV) Greenhouse Gases

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Carbon dioxide (CO_2) and methane (CH_4) are the two most important anthropogenic greenhouse gases (GHGs). Satellite observations combined with modeling can add important missing global information on regional CO_2 and CH_4 sources and sinks required for better climate prediction. The ESA project GHG-CCI aims at delivering the high quality satellite retrievals needed for this application. GHG-CCI is one of several projects of ESA's Climate Change Initiative (CCI) which will deliver Essential Climate Variables (ECVs). An overview about the GHG-CCI project will be given. The GHG-CCI core ECV data products are column-averaged mole fractions of CO_2 and CH_4, i.e. XCO_2 and XCH_4, retrieved from SCIAMACHY on ENVISAT and TANSO on GOSAT. Other satellite instruments will be used for constraints in upper layers. Important aspects also covered are calibration, validation and user assessments. Two satellite instruments are currently in orbit performing radiance measurements which are sensitive to near-surface CO_2 and CH_4 concentration changes: SCIAMACHY on ENVISAT and TANSO on GOSAT. Both sensors enable the retrieval of near-surface sensitive XCO_2 and XCH_4. These data products are the core data products generated within GHG-CCI. Using SCIAMACHY it has already been demonstrated that regional methane emissions can be well constrained. Within GHG-CCI the SCIAMACHY XCH_4 time series will be extended and SCIAMACHY XCO_2 retrieval algorithms will be further improved. GOSAT has only recently been launched and only initial data products are currently available. With GHG-CCI European GOSAT retrieval efforts will be strengthened. Which of the advanced algorithms, which are under development, will be the best for a given data product still needs to be assessed. For each of the 4 GHG-CCI core data products - XCO_2 and XCH_4 from SCIAMACHY and GOSAT - several algorithms will be further developed and the corresponding data products will be inter-compared to identify which data product is the most appropriate. This activity, the so-called "Round Robin exercise", will be performed in the first two years of this project. Within this phase a number of other activities will also be performed. This includes calibration improvements, detailed error characterization of the algorithms and corresponding data products, inter-comparisons, comparisons with reference data, and user assessments. Data sets and documents will be generated, including a User Requirements Document (URD), and the compliance of the data products with the user requirements will be assessed. A number of retrieval algorithms for other satellite data products will also be further developed and assessed within GHG-CCI using AIRS, IASI, MIPAS and ACE-FTS. At the end of the 2 year Round Robin phase a decision will be made which of the algorithms performs best. The selected algorithms will be used to generate the first version of ECV GHG. Six months of processing time will be available for processing. The goal is to process all data but it still needs to be assessed how much computer time is required by time consuming so-called "full physics algorithms". As a minimum one year of global data will be processed (mid 2009 to mid 2010 to ensure overlap between SCIAMACHY and GOSAT). In the last six months of this 3 year project the resulting data products will be validated and made available to all interested users for user assessment. The validation will be conducted using the highly accurate and precise ground based Fourier Transform Spectrometer (FTS) retrievals conducted within the Total Carbon Column Observing Network (TCCON). In addition, FTS retrievals from NDACC and in-situ measurements from the GAW and AGAGE networks will be used.