Cloud_cci: Objectives for Phase 2

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Freie Universität Berlin

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

DWD

RAL Space

SMHI

Royal Netherlands Meteorological Institute
Ministry of Transport, Public Works and Water Management

ETH

LMD

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Home Affairs FDHA
Federal Office of Meteorology and Climatology
MeteoSwiss

Cloud_cci: Achievements phase 1

- **ESA Cloud CCI has generated two data sets spanning 2007-2009 exploiting synergistic capabilities of different sensors.**

- **Optimal Estimation technique employed improving homogeneity and stability of time series.**

- **Validation / evaluation results show**
  - **seasonal cycle is captured well**
  - **Latitudinal agreement ok except poles**
  - **General underestimation of global cloud cover**
  - **Missing high level clouds**

- **Final Data sets publicly available via ftp-server www.esa-cloud-cci.org**

- **Community code of cloud CCI is available: http://proj.badc.rl.uk/orac**

Cloud_cci: Achievements phase 1 (2)

Benefit for user community – Added value of ESA Cloud CCI products:

Spectral consistency of derived parameters, which is **achieved by an optimal-estimation approach** based on fitting a physically consistent cloud model to satellite observations simultaneously from the visible to the mid-infrared.

Uncertainty characterization, which has been inferred by the application of the optimal estimation approach as physically consistent single pixel uncertainty estimation and further propagated to the final product.

Increased temporal resolution by including **multiple polar-orbiting satellite instruments,** which also allows for mature cloud property histograms on 0.5° resolution due to high increased sampling rate.

Comprehensive assessment and documentation of the retrieval schemes and the derived cloud property datasets including the exploitation of applicability for evaluation of climate models and reanalyses.

Cloud_cci Phase 2 requirements

Global **C**limate **O**bserving **S**ystem **Target Requirements:**
Cloud Essential **C**limate **V**ariables (2011 update)

Variable	Horizontal Res	Vertical Res	Temporal Res	Accuracy	Stability (/decade)
CA	50km	N/A	3hr	0.01 – 0.05	0.003 – 0.03
CP	50km	NA	3hr	15hPa – 50hPa	3hPa -15hPa
CT	50km	NA	3hr	1K – 5K	0.2K – 1K
CWP	50km	NA	3hr	25%	5%
CRE	50km	NA	3hr	5-10%	1-2%

assuming cloud feedback similar to rad forcing of 0.3Wm^{-2} (~ 20% of current GHG forcing)

radiative forcing depends on CAE (and not CA)

=> target ranges (opt thick/ low clouds - opt thin Ci (CEM=0.2))

based on NISTIR 7047 report (March 2004)

Achieved uncertainties & accuracies ?

Cloud cover: validation results vs Cloud_cci requirements

	Cloud_cci requirement	CC4CL			FAME-C
Cloud variable	Goal, B/ T,Thres				
		AVHRR	MODIS	AATSR	MERIS/AATSR
Cloud cover	10, 15, 20%	Synop: bias -10 to 5% std 10 to 20%	Synop: bias -5 to 10% std 10 to 20%	Synop: bias -5 to 18% std 15 to 30%	Synop: bias -5 to 5 % std 10 to 20 %
		CLARA-A1: bias -5 to 1% std 10 to 11%			
			MODIS coll5 Terra: bias 9% std 9%		MODIS coll5 Terra: bias -6 to -9% std 13 to 14%
			MODIS coll5 Aqua: bias 8% std 9%		

Objective Cloud_cci Phase 2

ESA Cloud_cci phase 2 **contributes** to and **improves on the development, validation and application of heritage and novel** cloud property climate data sets derived from various space-based sensors maximizing the use of ESA data and other important space based data to fulfil the GCOS requirements

Cloud_cci process **two multi-decadal global data sets** for the GCOS cloud property ECVs including uncertainty estimates.

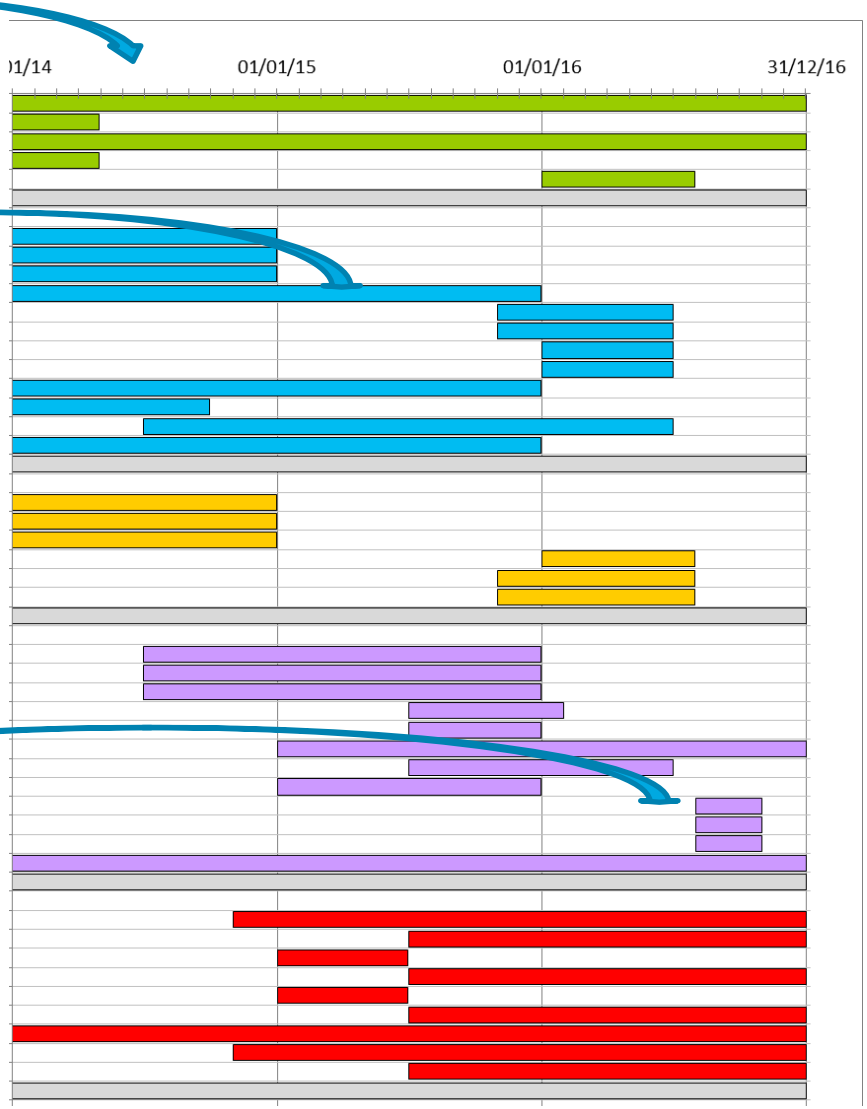
- multi-decadal multi-instrument product from (A)ATSR – AVHRR – MODIS (1982-2012 (2014))
- decadal product that uses complimentary information from AATSR and MERIS on-board of ENVISAT (2002-2012)
- Extent the data sets to use SLSTR and OLCI (2015)

Cloud_cci Phase 2 Schedule

2014:
- Feedback loop with CRG
- Algorithm improvement
- Level 1 preparation

2015:
- Processing cloud properties AVHRR-MODIS-(A)ATSR 1982-2013
- Processing FAME-C AATSR-MERIS 2002-2012
- Validation & Evaluation
- Orbital drift investigations
- Preparation for sentinels

2016:
-Extension of CDR‘s to 2014
-Processing OLCI & SLSTR
-Validation
-Final Evaluation/Assessment



Cloud_cci Phase 2

- Continuous international evaluation assessment supports a sustained improvement of Cloud_cci algorithms
  - Cloud Retrieval Evaluation Workshops (CREW))
  - Integration in GEWEX cloud assessment data base

- Development and application of inter-calibrated radiance data sets for ESA and non ESA instruments in collaboration with SST_cci on the FCDR on AVHRR
  - IR Intercalibration with SST_cci;
  - VIS intercalibration with Cloud_cci

Cloud_cci Phase 2

- Algorithm improvements
  - Advancement in the understanding of cloud property retrieval investigating **multi-layer clouds**
  - Implementation of the **dual view mode** for AATSR taking full advantage of its capacities
  - Improvements in the **day/night consistency** of the algorithms
  - develop, apply and evaluate methods to bridge interrupted time-series e.g. going from ENVISAT instruments **towards** the **Sentinel-3** instrument
  - Include Cloud albedo

- CDR Evaluation
  - Assess and investigate the temporal stability of the records
  - Advance in the composition of different sensor towards a global cloud climatology with a rigorous error characterisation in time and space

Cloud_cci Phase 2 Validation and Assessment

- CDR Validation and Assessment
  - Novel Validation approach with IASI using the European expertise of IR sounders as validation source for the long-term data sets which is complementing the VIS/IR observation with the enhanced observation capabilities of cloud top properties.
  - Development of a cloud-simulator package to strengthen the application of Cloud_cci products for global and regional climate model analysis.
  - Comprehensive validation with external satellite data records, surface observations and cloud climatologies
  - Assessing cloud climatologies in terms of TOA fluxes

Assessing cloud climatologies in terms of TOA fluxes

L3 COD-CP histograms to determine cloud radiative effects

1) determine radiative fluxes of cloud types over the globe, at different seasons

Cloud Radiative Effect per cloud type *(Chen et al. 2000)*

CP (hPa)	SW CRE (COD 3.6)	SW CRE (COD 23)	SW CRE (COD COD)	LW CRE (COD 3.6)	LW CRE (COD 23)	LW CRE (COD COD)	net CRE (COD 3.6)	net CRE (COD 23)	net CRE (COD COD)
440	-25	-87	-126	31	60	61	5	-28	-66
680	-29	-81	-99	13	22	21	-16	-59	-78
680 hPa	-34	-75	-85	4	8	8	-30	-67	-77

or radiative flux kernels of *(Zelinka et al. 2012)*

2) weight fluxes by COD-CP histograms *(monthly 1° x 1° map resolution)*

ISCCP

0.21	0.09	0.04
0.13	0.11	0.03
0.19	0.18	0.03

AIRS-LMD

0.29	0.11	0.0
0.12	0.06	0.0
0.17	0.24	0.0

differences in COD-CP distributions lead to differences in radiative effects
(transformation of IR emissivity to COD -> COD < 10 => underestimation of SW effect)

Thank you for your attention

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