Royal Netherlands Meteorological Institute
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EARTHCARE

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Cabauw Experimental Site for Atmospheric Research CESAR for EarthCARE evaluation (CECARE)

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Introduction

CECARE focusses 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.

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 from 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 EarthCare Cal/Val, 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.

Approach

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 products 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, including the radiation aspects.

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.

Innovation

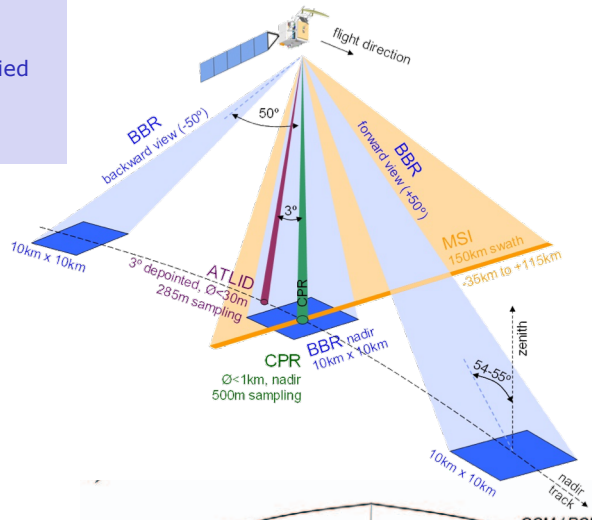
- The analysis on any significant anomalous discrepancies between the ground based observations and the corresponding EarthCARE products will be facilitated by the CECARE-team's in-depth knowledge of the EarthCARE algorithms and the ability to use the EarthCARE simulator in order to test hypothesis related to the causes of the observed differences (e.g. instrument calibration issues or specific algorithm issues). Deliverables

- While CESAR is presently equipped to comprehensively measure the profile and atmospheric column, including a horizontal scanning drizzle radar, the 'soda straw' view of the atmosphere will be extended in the Ruisdael Observatory to a 3D view by extending the number of scanning instruments and expanding the domain to a number of square kilometres, including high resolution modelling. Implementation starts now.

Figure 1. Location of the Cabauw site: well positioned to measure air masses from differen origins, ranging from clean to polluted.

Table 1. Main CESAR instruments used for the EartCare CAL/VAL efforts

Instrument		Wind	Temperature	Backscatter	Extinction	Optical Depth	Clouds	Polarisation	Humidity	Precipitation	Profile	24/7 operation
Wind profiler	LAP3000 1290 MHz WINDPROFILER/RASS	x	x								x	x
Caeli	Multiwavelength Raman lidar		(x)	x	x	x	x	x	x		x	(x)
UV-lidar	Leosphere ALS-450			x			x	x			x	x
Ceilometer	CHM15k			x			x				x	x
3 GHz cloud radar	TARA	x					x	x		x	x	x
35 GHz Cloud radar	PDN100	x					x			x	x	x
Microwave radiometer	RPG-HATPRO		x						x	x	x	x
AERONET	Cimel					x						x
Nubiscope							x					x
Total Sky Imager							x					
Radio sonde	Vaisala RS41	x	x						x		x	
Doppler lidar	Zephir, (HALO)	x									x	x
BSRN	radiation sensors					x	x					x
IDRA	Suveilance drizzle radar						x			x	x	x



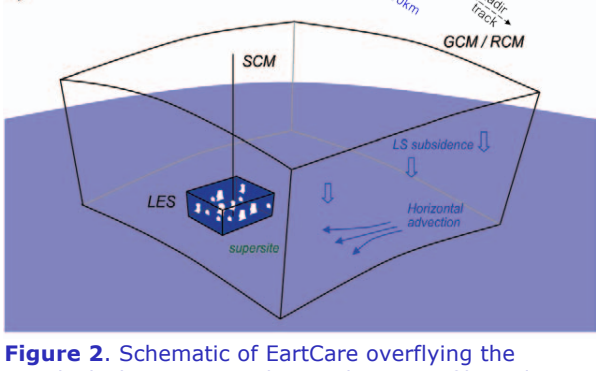


Figure 2. Schematic of EartCare overflying the Ruisdael Observatory, where column, profile and 3D observations of the atmospheric state around Cabauw will be recorded. Observations at various scales can be used for validation and representativity studies. (figure from Neggers, BAMS, 2012).

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