



Royal Netherlands
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Environment*

CREW: Update of the evaluation of SEVIRI cloud parameter retrievals

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The CREW team!

CREW-4 | Grainau | 05 March 2014

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3. Cloud top height validation

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4. Summary / Outlook



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History of CREW

2006 Norrköping, Sweden



2009 in Locarno, Switzerland



2011 in Madison, USA



2014 in Greinau, Germany



Number of CREW participants

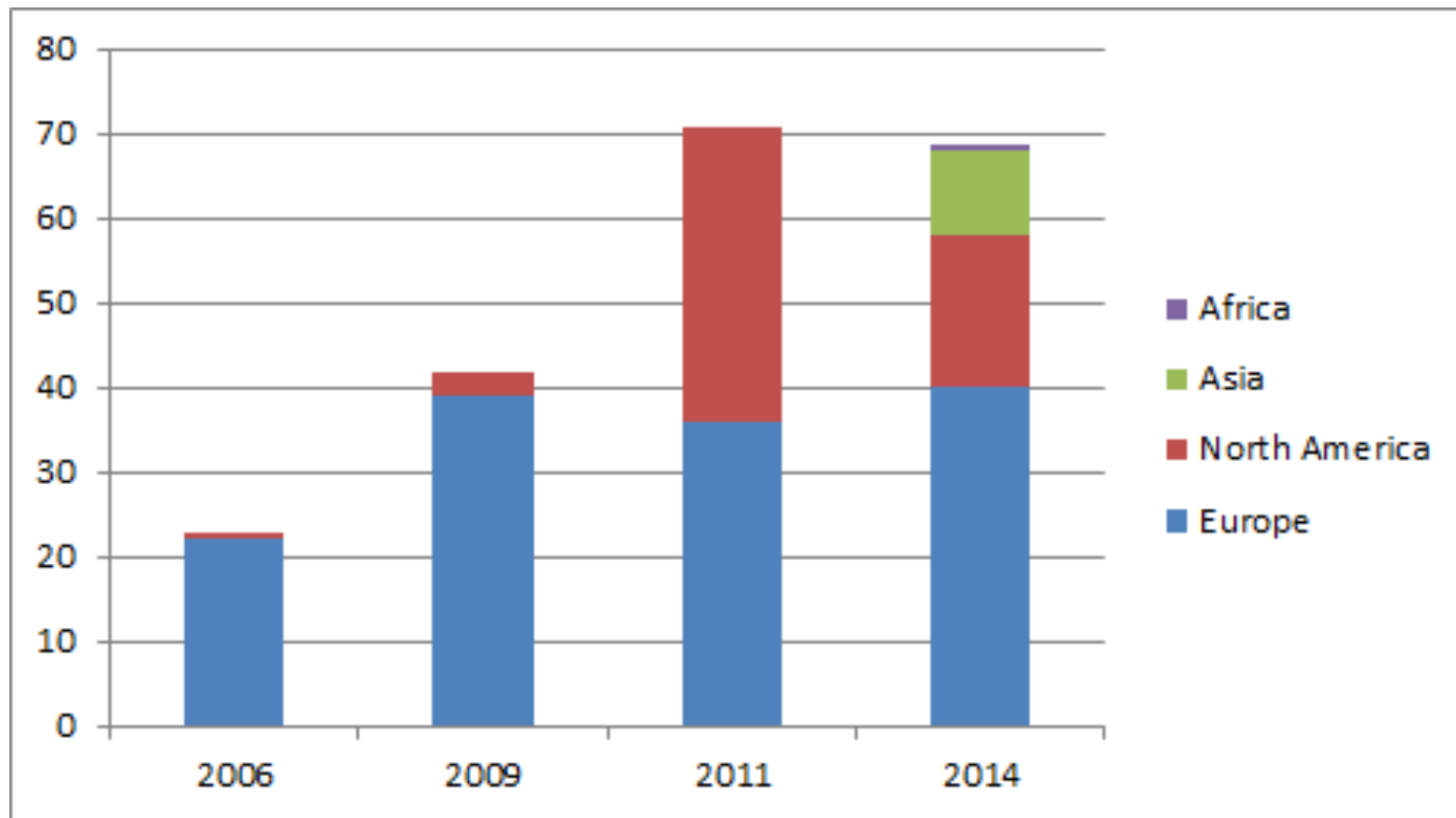


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CREW database

Group	Acronyms	Satellite Instruments	Contacts
Passive Imager Retrievals			
CM-SAF (DWD, KNMI)	CMS	SEVIRI, AVHRR and MODIS	Stengel, Lockhoff, Meirink
CNRS	CNR	AIRS	Stubenrauch
DLR	DLR	SEVIRI	Bugliaro, Kox, Gesell
University of Marburg	EIM	SEVIRI	Kühnlein, Kokhanovsky
EUMETSAT	EUL, EUJ, OCA	SEVIRI	Lutz, Joro, Watts
Free University Berlin	FUB	SEVIRI	Preusker
NASA Goddard	GSF	SEVIRI, MODIS	Platnick, Wind
NASA Langley	LAR	SEVIRI, MODIS	Minnis
NWC-SAF	MFR, SMH	SEVIRI, AVHRR, MODIS	Legleau, Dybroe, Thoss
Royal Met. Inst. of Belgium	RMB	SEVIRI	Ipe, Dewitte
University of Madison	AWG	SEVIRI	Walther, Heidinger
University of Lille	ULI	POLDER	Riedi
UK MetOffice	UKM	SEVIRI	Francis, Taylor
Reference Datasets			
CALIPSO	CAL	CALIPSO	Winker
CLOUDSAT	CLO	CLOUDSAT	Stephens
MIRS	MSR	MIRS	Horváth
CNRS	DAR	Cloudsat/Calipso	Delanoë, Hogan
University of Madison	AMS	AMSR	Bennartz



Future

- GOES
- VIIRS
- COMS
- Himawari
- Geo-KOMPSAT-2A



CREW database

Ten cloud properties

- Cloud Detection
- Top products
- Optical properties
- Macrophysics
- Synoptic

Acronym	Description	Unit
CMB	Cloud Mask	[%]
CTH	Cloud Top Height	[m]
CTP	Cloud Top Pressure	[Hpa]
CTT	Cloud Top Temperature	[K]
COD	Cloud Optical Depth	[-]
REF	Partical Effective Radius	[mm]
LWP	Liquid Water Path	[g m ⁻²]
IWP	Ice Water Path	[g m ⁻²]
CPH	Thermodynamic Phase	[water, ice, mixed]
CTY	Cloud Type	[-]

Five golden days

- Satellite alignment
- Optimal validation data sets

13-6-2008
17-6-2008
18-6-2008
22-6-2008
3-7-2008



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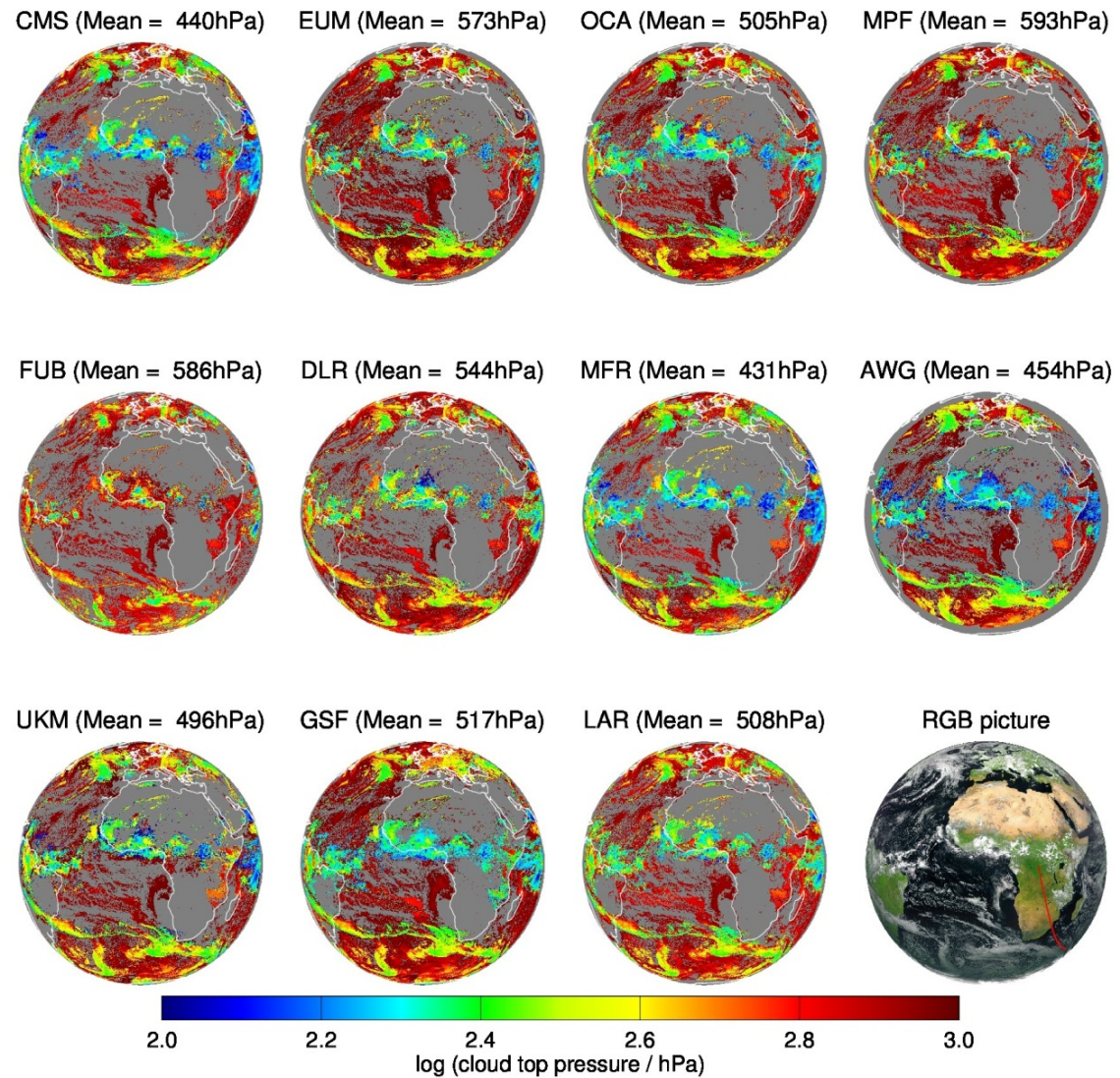
4. Summary / Outlook



Retrieval inter-comparison

2008-06-13
12:00 UTC

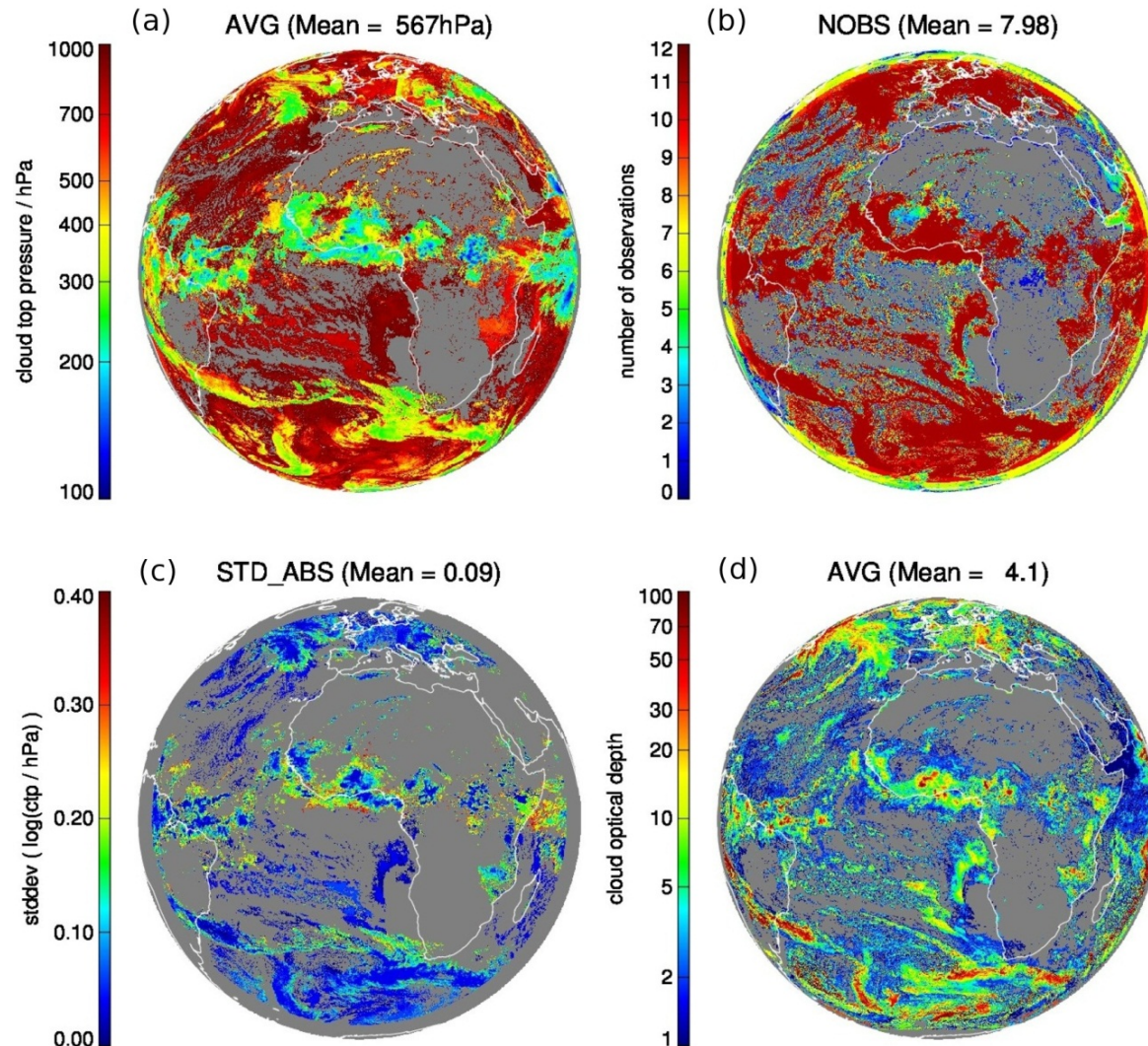
- 11 retrievals
- Different cloud masks
- Different CTP retrievals



Retrieval inter-comparison

2008-06-13
12:00 UTC

- 11 retrievals
- Different cloud masks
- Different CTP retrievals
- Uncertainties

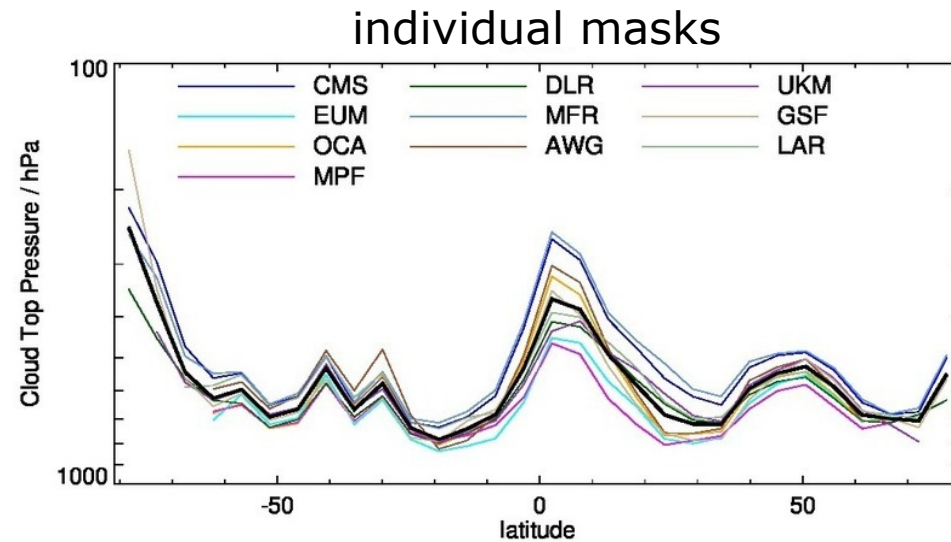


Retrieval inter-comparison

Individual masks

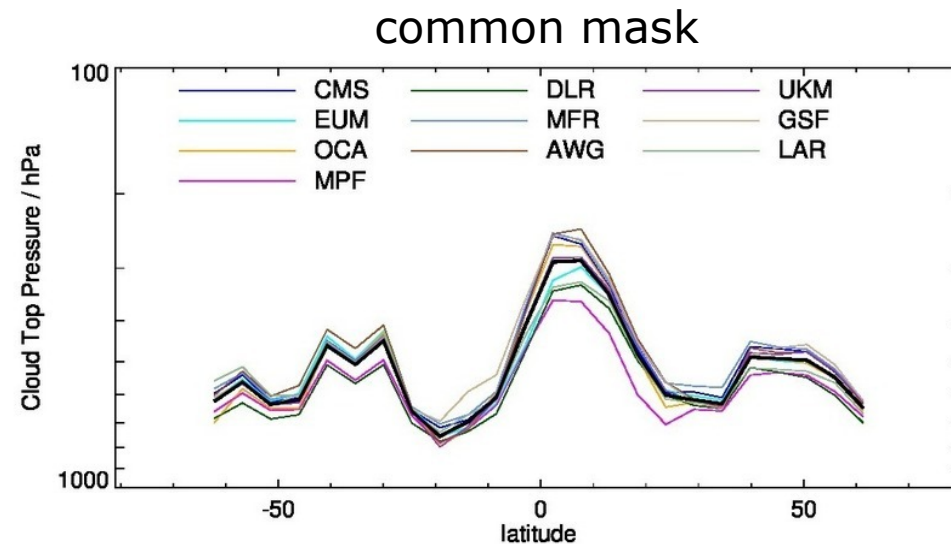
Differences caused by

- CTH retrievals and
- Cloud detection



Common mask

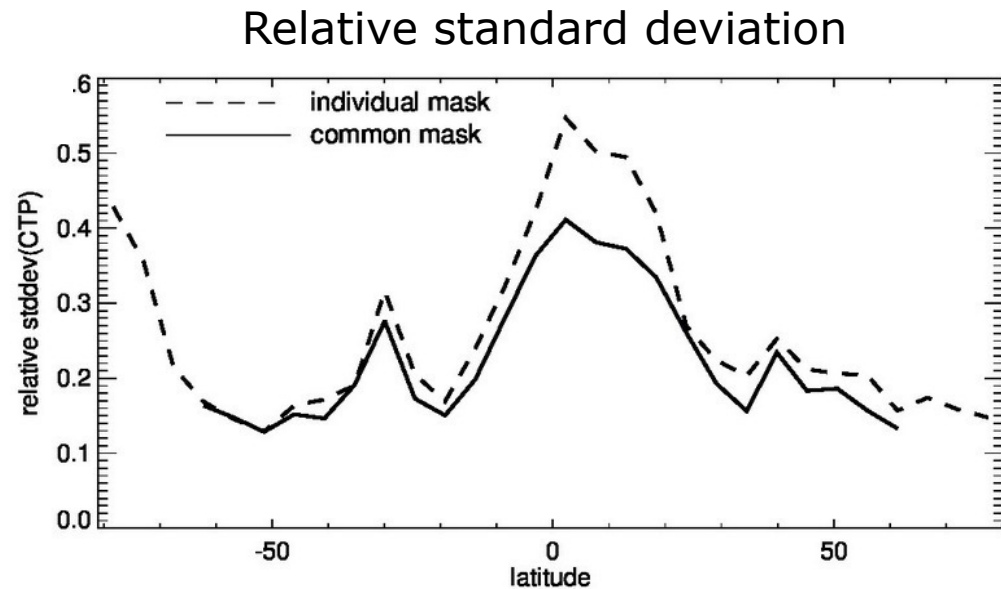
- Use common pixels only
- No cloud mask effect



Retrieval inter-comparison

Agreement

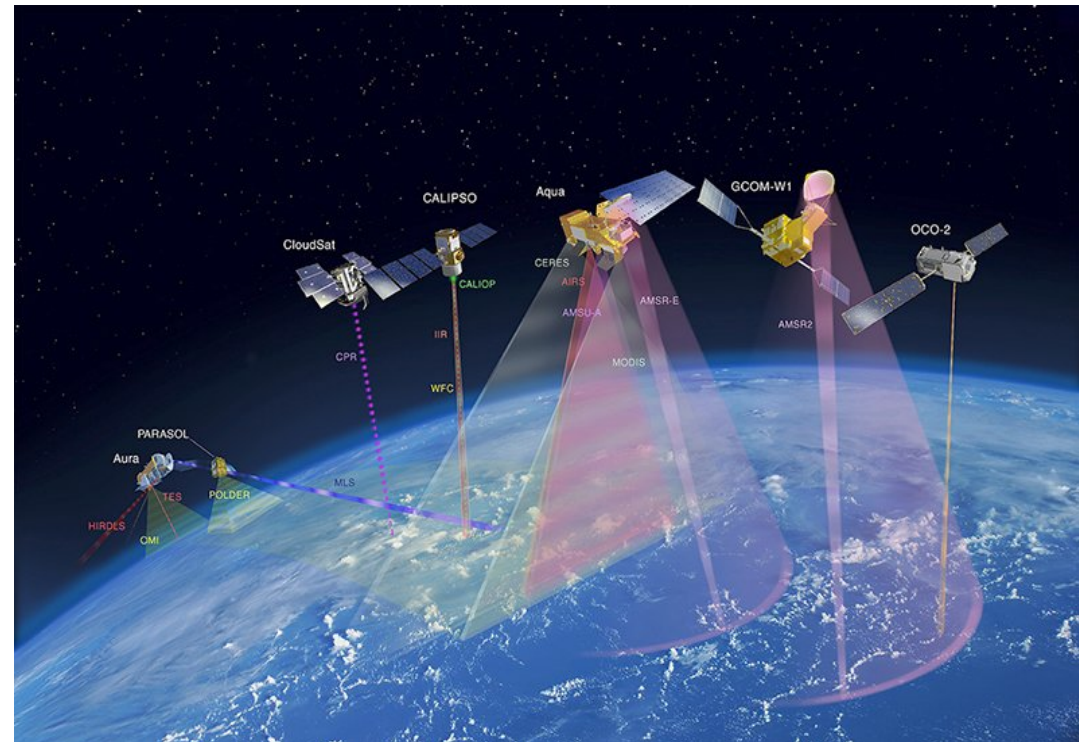
- Extra-tropics
Agreement within 15-30%
2-5% effect of common mask
- Tropics
Agreement within 30-55%
5-15% effect of common mask



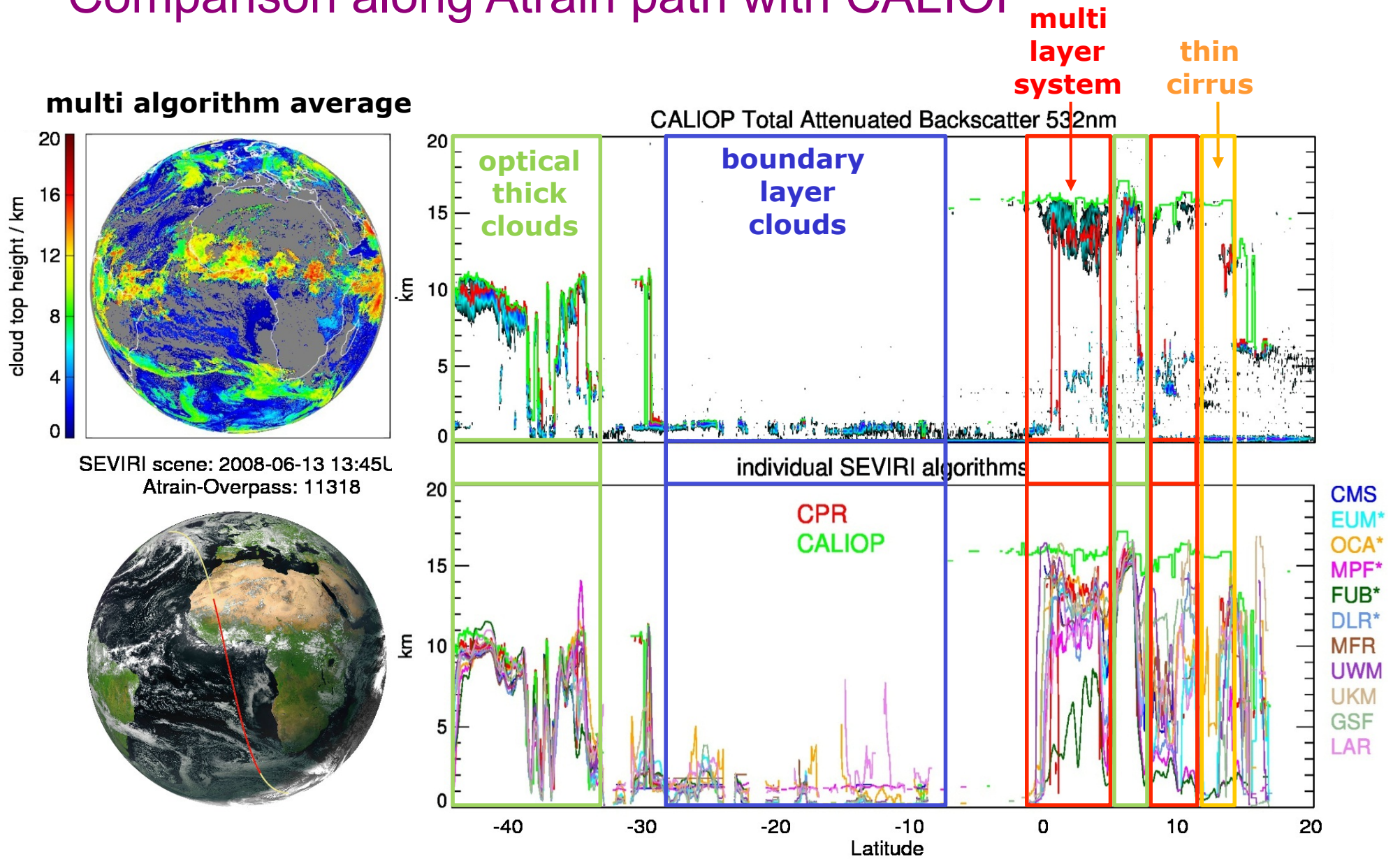
Comparison with CALIOP and CPR

The A-train satellite constellation

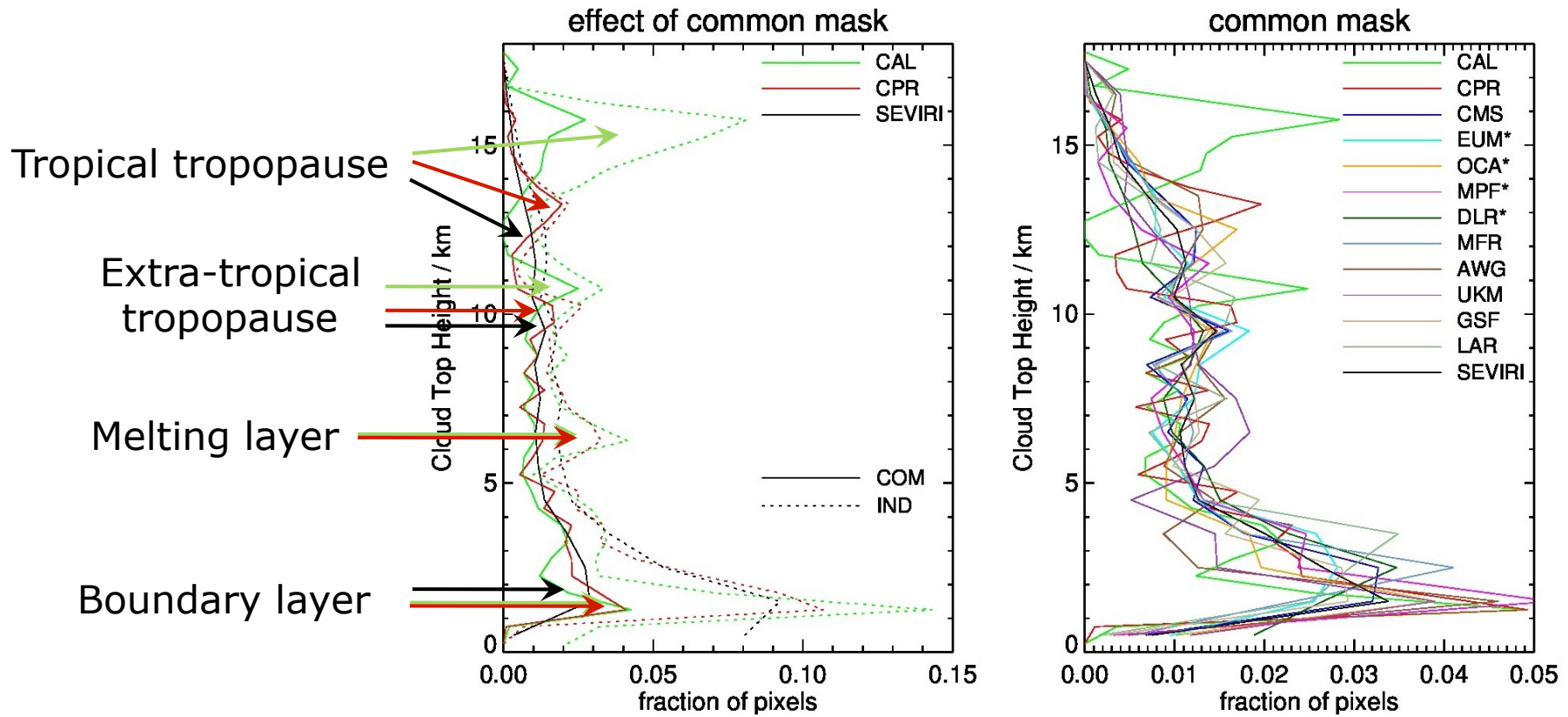
- 6 satellites in polar orbit
- Sun synchronous orbit
Local time: 13h30
705 km height
99min for one rotation
- Near simultaneous observation
- Various instrumentations
Active instruments dashed
Microwave in red/purple
Solar wavelength in yellow
Solar & IR wavelength in grey



Comparison along Atrain path with CALIOP

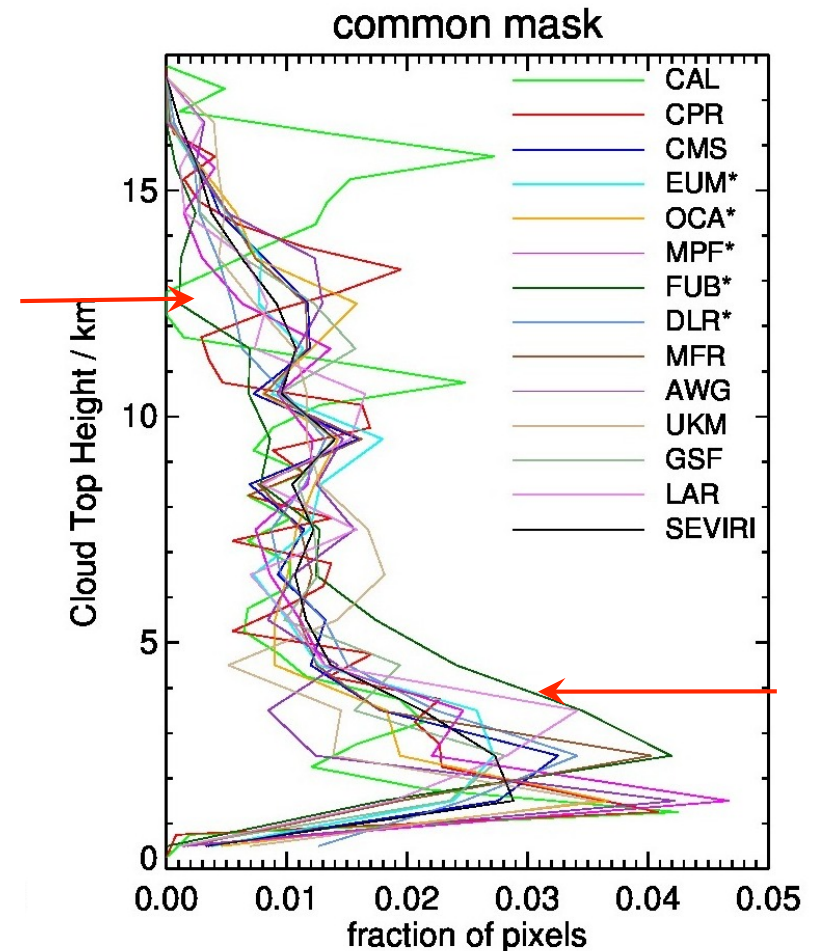
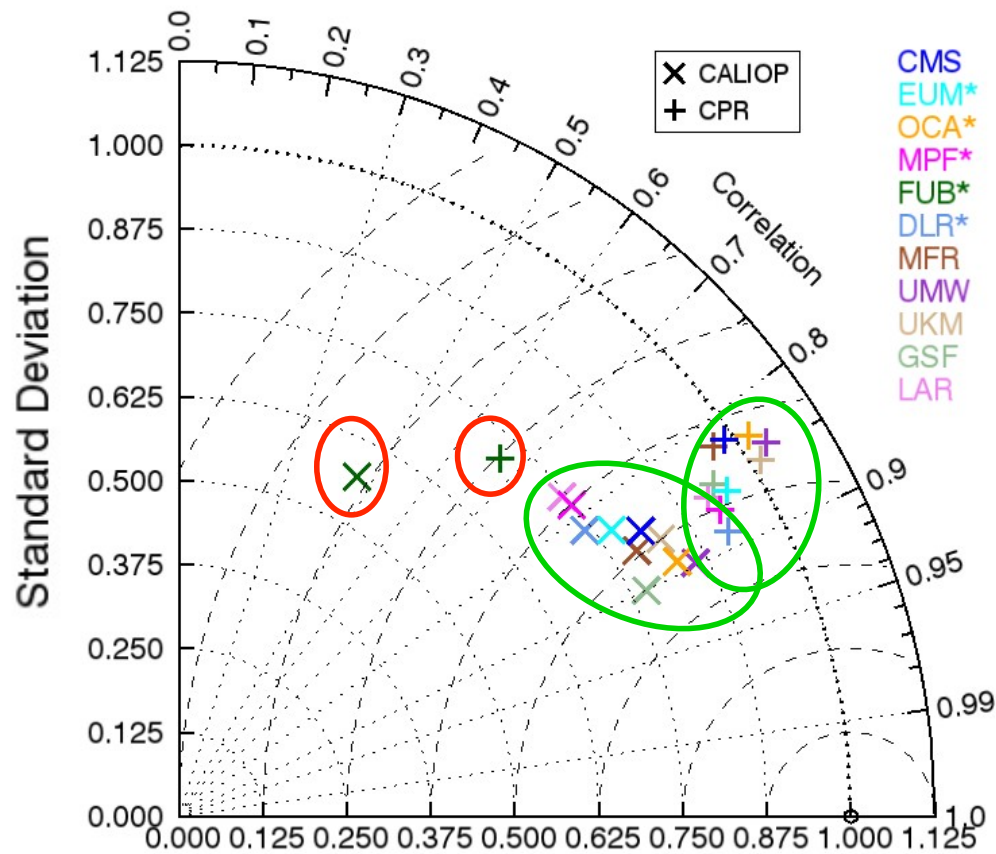


Cloud top height histograms



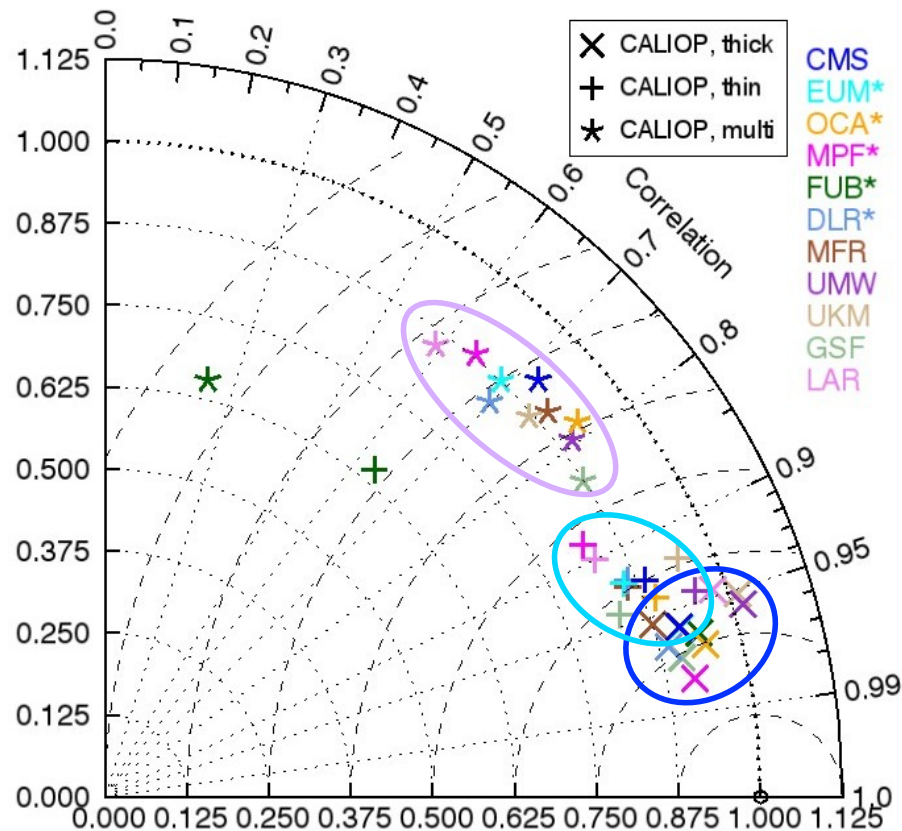
Taylor diagram comparing CALIOP and CPR

Taylor diagram (CALIOP/CPR)



Taylor diagram CALIOP with cloud regimes

Taylor diagram (CALIOP/cloud regimes)



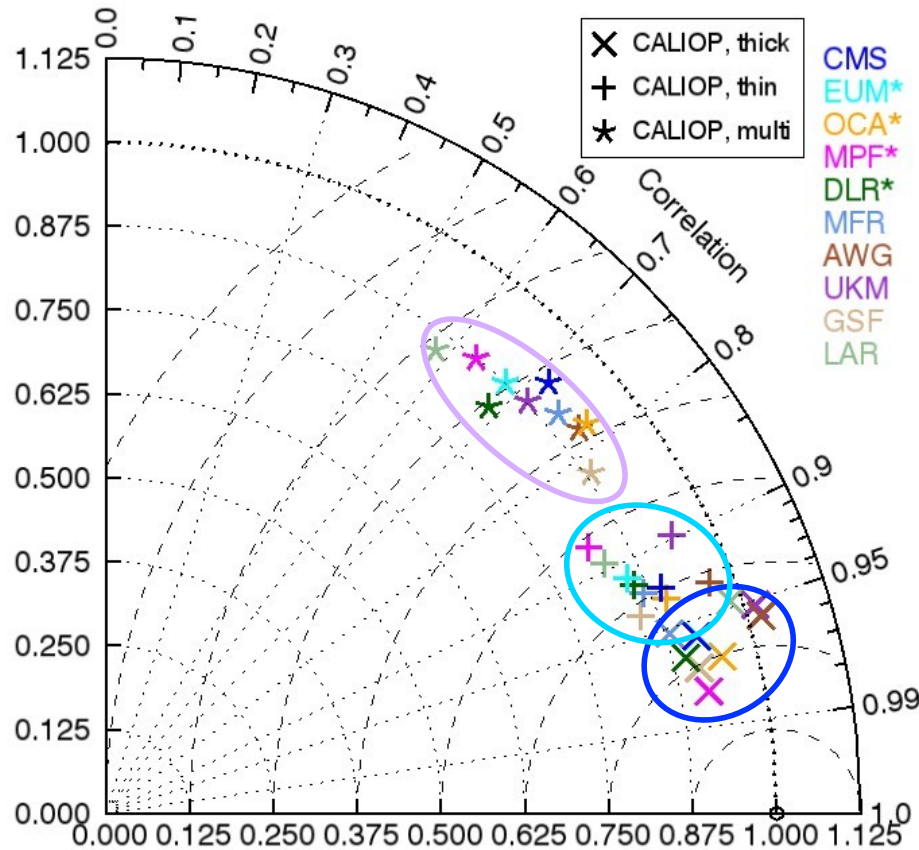
Definition of cloud regimes with Cloud optical depth and NLF (number of layers found), both measured by CALIOP

Cloud category	Criteria
Single layer thin cloud	NLF = 1 and $\tau_{cal} < 3$
Single layer thick cloud	NLF = 1 and $\tau_{cal} \geq 3$
Multi-layer clouds	NLF > 1

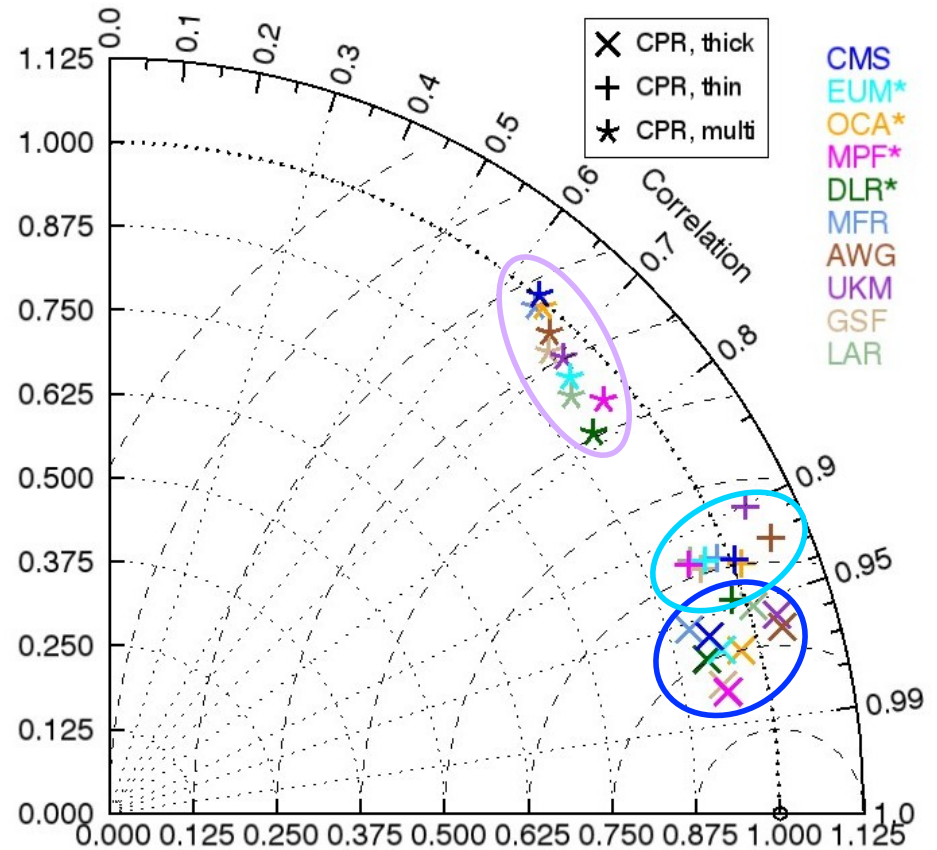


Taylor diagrams with different cloud regimes

CALIOP & cloud regimes



CPR & cloud regimes



Summary (1)

Cloud Retrieval Evaluation Workshops (CREW)

CREW database created

- 12 SEVIRI algorithms
- 5 days in 2008
- 10 cloud parameters
- 5 reference data sets

Inter-comparison and validation

- Good agreement with CALIOP and CPR
- CALIOP correlation coefficients: 0.78 ... 0.90
- CPR correlation coefficients: 0.82 ... 0.88

Cloud conditions and uncertainties

- Best accuracy for thick clouds
- Good accuracy for thin clouds
- Multi layer clouds are challenging

Paper submitted to AMT, 2014: Remote sensing of cloud top pressure/height from SEVIRI
Hamann, Walther, Baum, Bennartz, Bugliaro, Derrien, Francis, Heidinger, Joro, Kniffka,
Le Gléau, Lockhoff, Lutz, Meirink, Minnis, Palikonda, Roebeling, Thoss, Platnick, Watts,
and Wind




Summary (2)

CREW project website

CREW database available for registered participants

CREW validation software package



The screenshot shows the website interface for the Cloud Retrieval Evaluation Workshop. At the top, there is a navigation bar with the workshop logo (a globe), the title "Cloud Retrieval Evaluation Workshop", a search bar with "Go" and "Search" buttons, and a secondary navigation menu with "Page", "Discussion", "View source", and "History" buttons. On the left side, there is a "Navigation" sidebar with links for "Welcome", "Meetings", "Satellite Sensors", "CREW Data Set", "CREW Software", "Results", "Documents", "Acronyms", "Contact", and "Related projects". The main content area is titled "CREW Software Package" and contains a paragraph of introductory text followed by a bulleted list of features.

Navigation

- Welcome
- Meetings
- Satellite Sensors
- CREW Data Set
- CREW Software
- Results
- Documents
- Acronyms
- Contact
- Related projects

CREW Software Package

Within the CREW project a software package was developed for the inter-comparison and validation against CALIOP, CPR and AMSR-E data. The software package currently has a beta version status. We would like to invite every user to give us feedback to improve the software package. The functionality of the CREW software package includes:

- Displaying cloud properties on the SEVIRI disk or other user specified areas
- Multi algorithms ensemble means and standard deviations
- Histograms
- Latitudinal means
- Plotting cloud property against viewing zenith angle
- Scatter plots (SEVIRI algorithm A against SEVIRI algorithm B)
- ISCCP type plots (frequency distribution in dependence of cloud optical thickness and cloud top pressure)
- Scatter plots (SEVIRI algorithm against CALIOP/CPR/AMSR-E)
- Cross section plots along the ATRAIN tracks
- Taylor diagrams

Please contribute to CREW with datasets and inter-comparison and validation activities





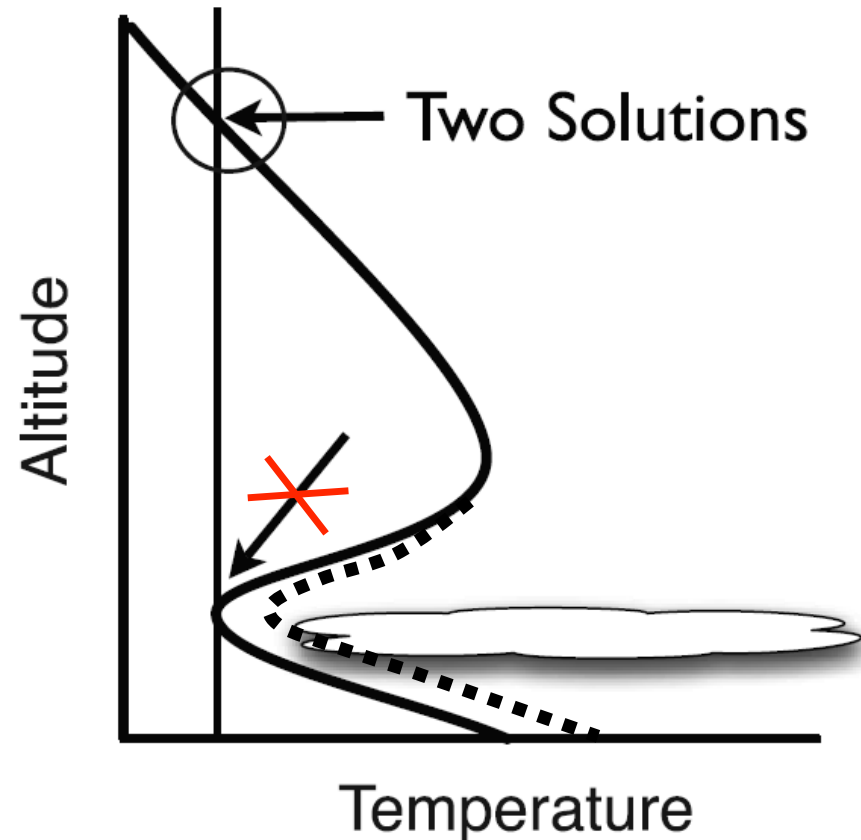
Boundary layer challenges

1. Ambivalence

In case of temperature inversion several Solutions may be possible.

2. Temperature uncertainty

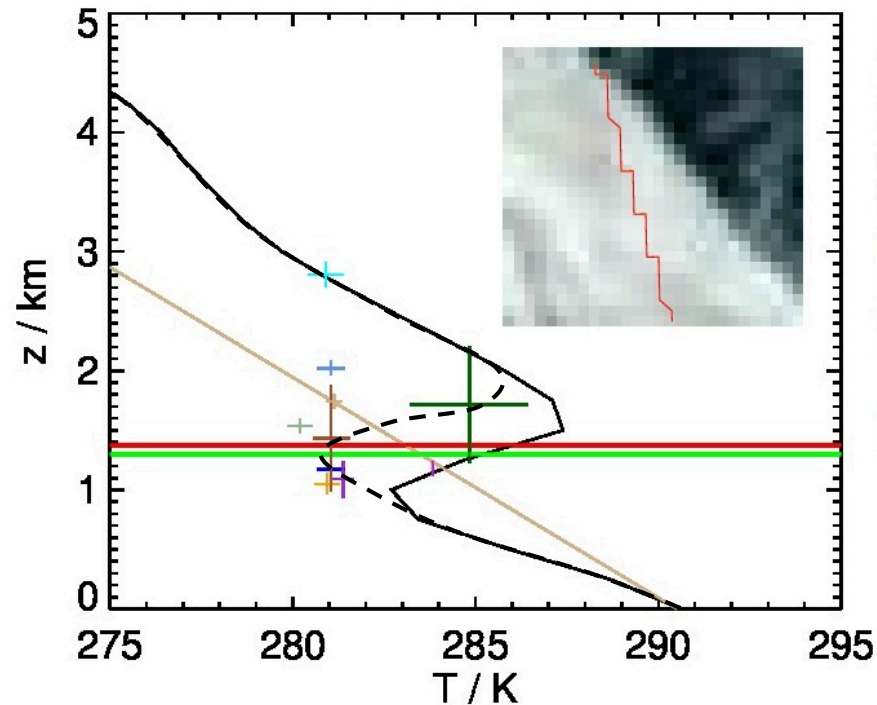
Possibility to miss the right solution if assumed temperature profile has uncertainties.



Holz et al, 2008, modified



Boundary layer challenges



CALIPSO

CPR

CMS

EUM*

OCA*

MPF*

DLR*

MFR

AWG

UKM

GSF

LAR

CMS inversion correction

EUM no correction

OCA no correction, but
usage of WV channels

MPF CTH inversion correction
with CTT modification

MFR inversion correction

UKM inversion correction

GSF assuming constant
temperature gradient

LAR constant lapse rate

