

Comparison of MISR CTH/CTW results with satellite, ground-based, radiosonde and NWP data

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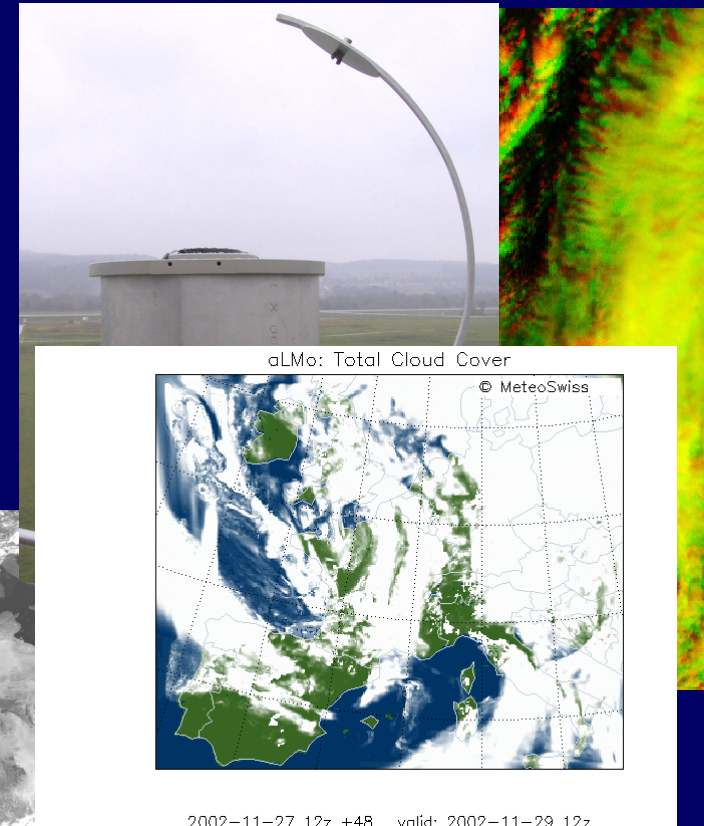
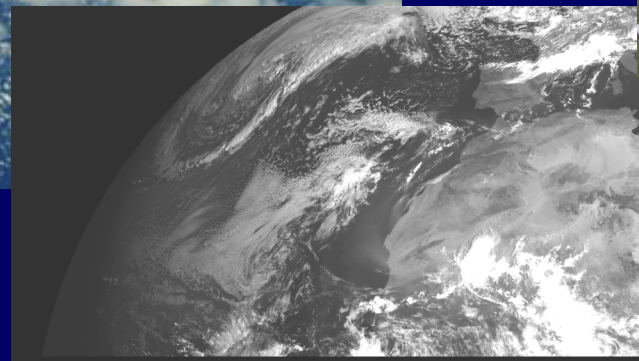
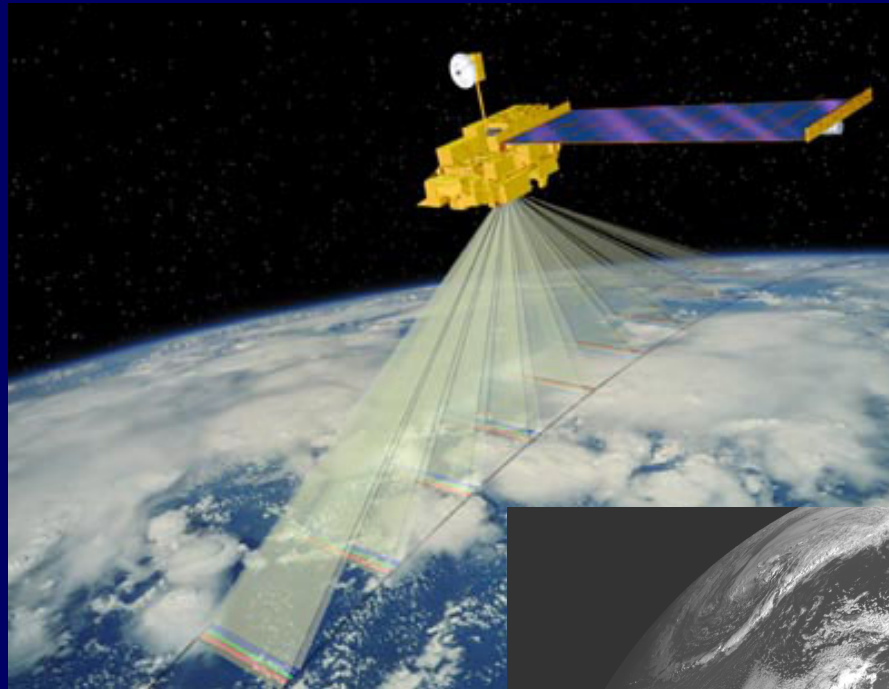
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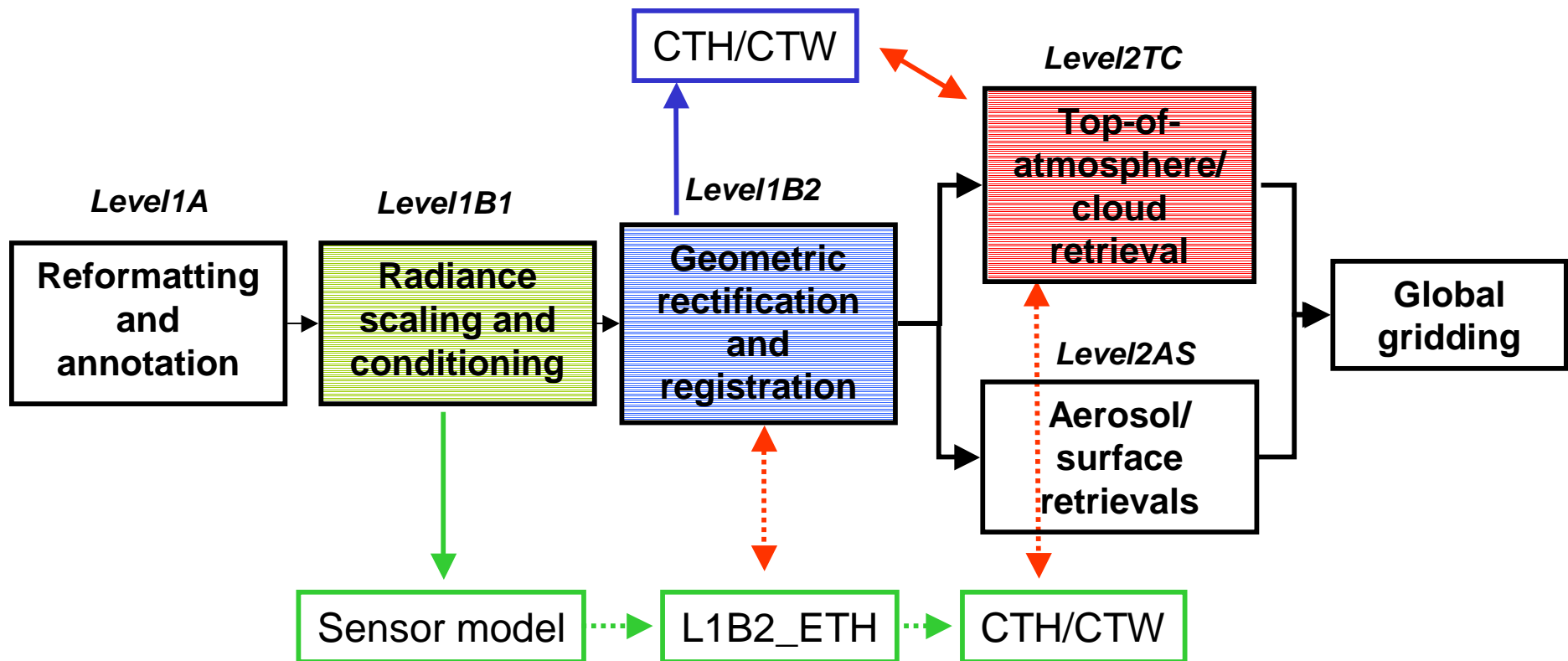
Comparison of MISR CTH/CTW results with satellite, ground-based, radiosonde and NWP data



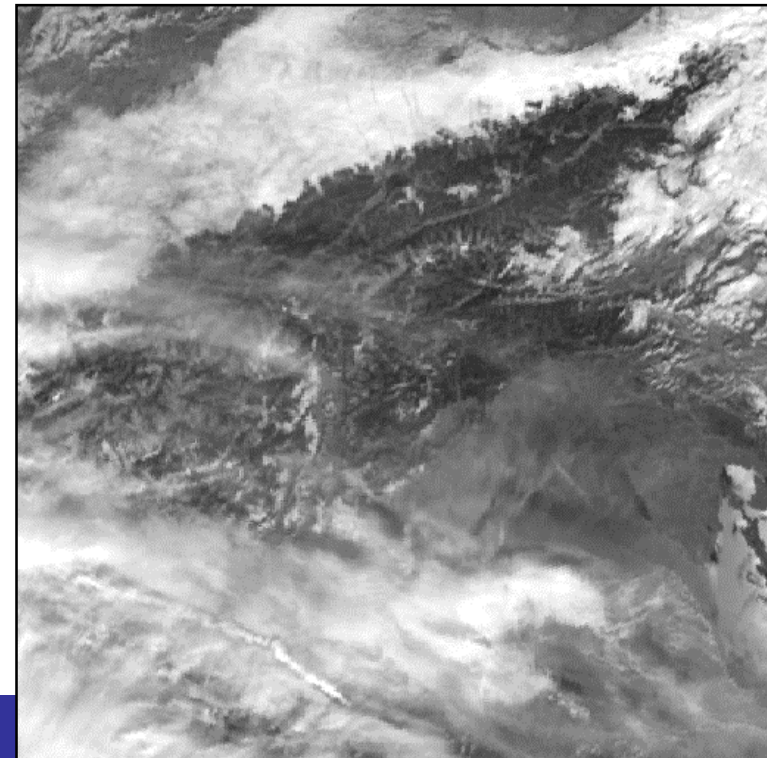
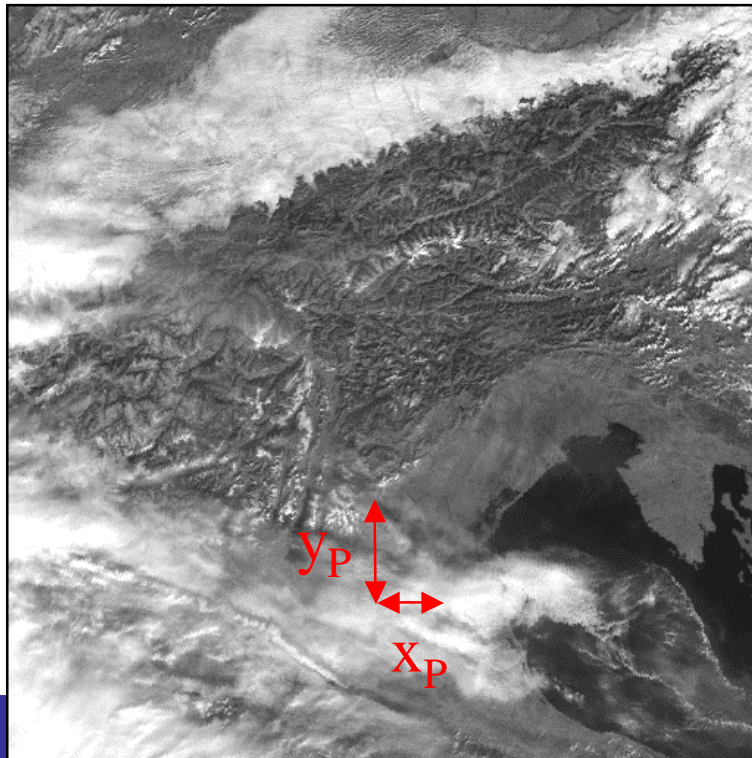
Gabriela Seiz, Daniela Poli, Manos Baltasvias, Armin Grün

ETH - Institute of Geodesy and Photogrammetry

MISR CTH/CTW retrieval



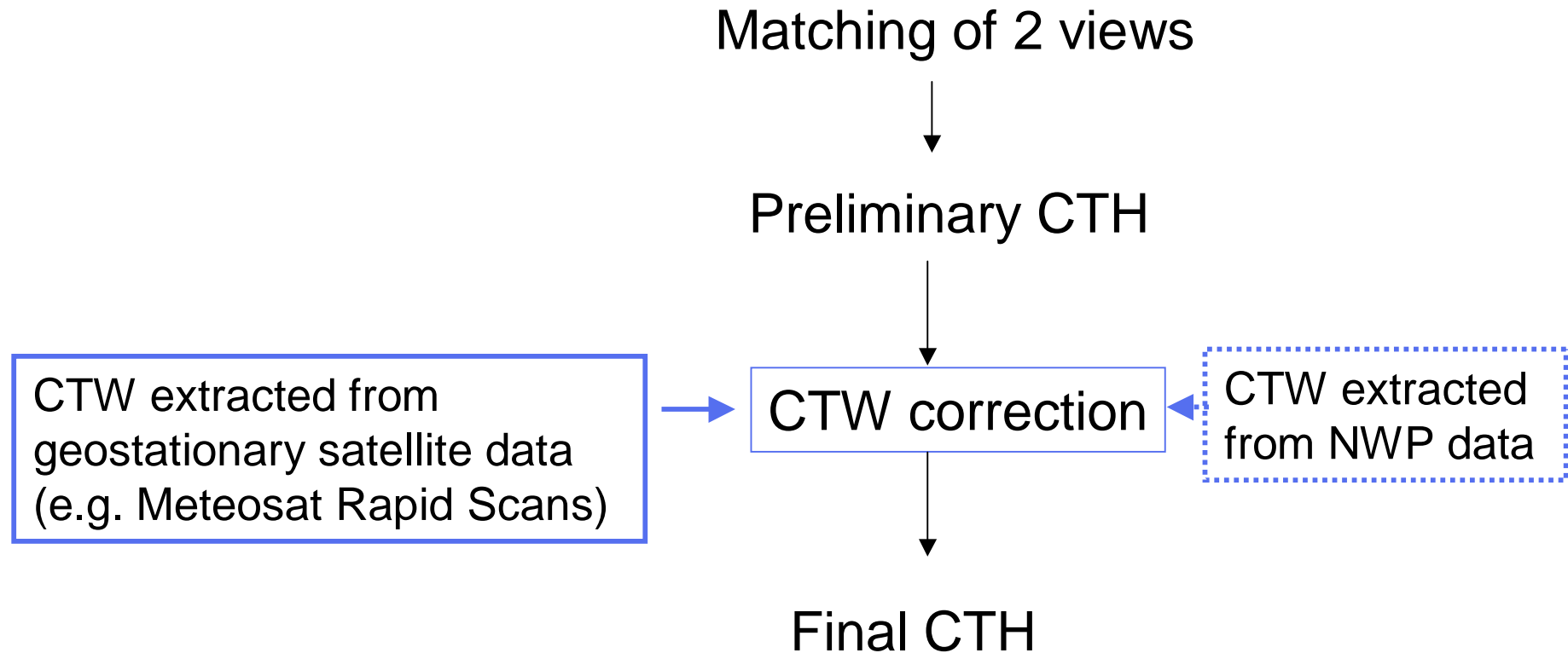
Stereo CTH retrieval



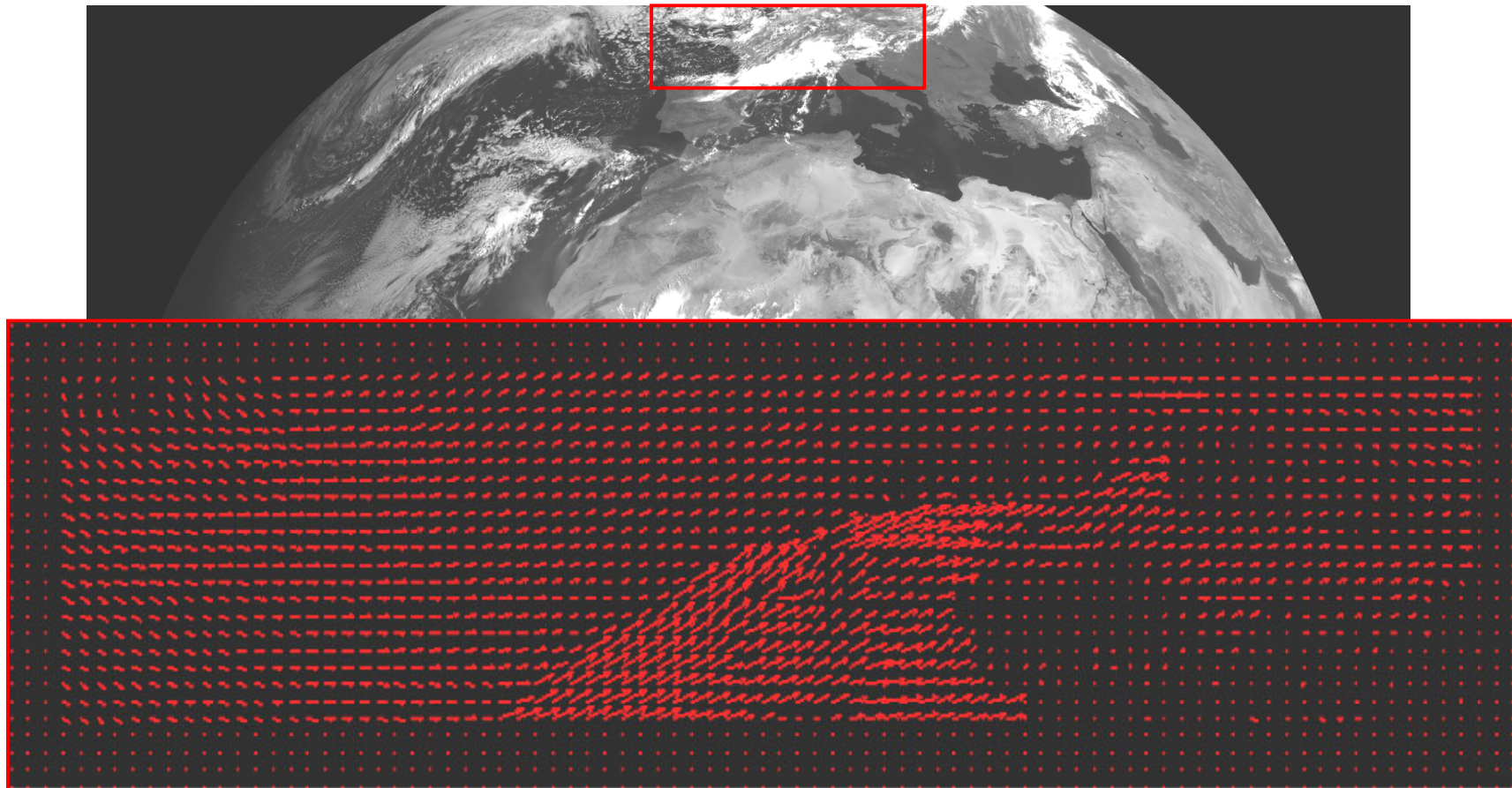
$x_P = f(\text{cross-track wind component})$

$y_P = f(\text{height, zenith angles, along-track wind component})$

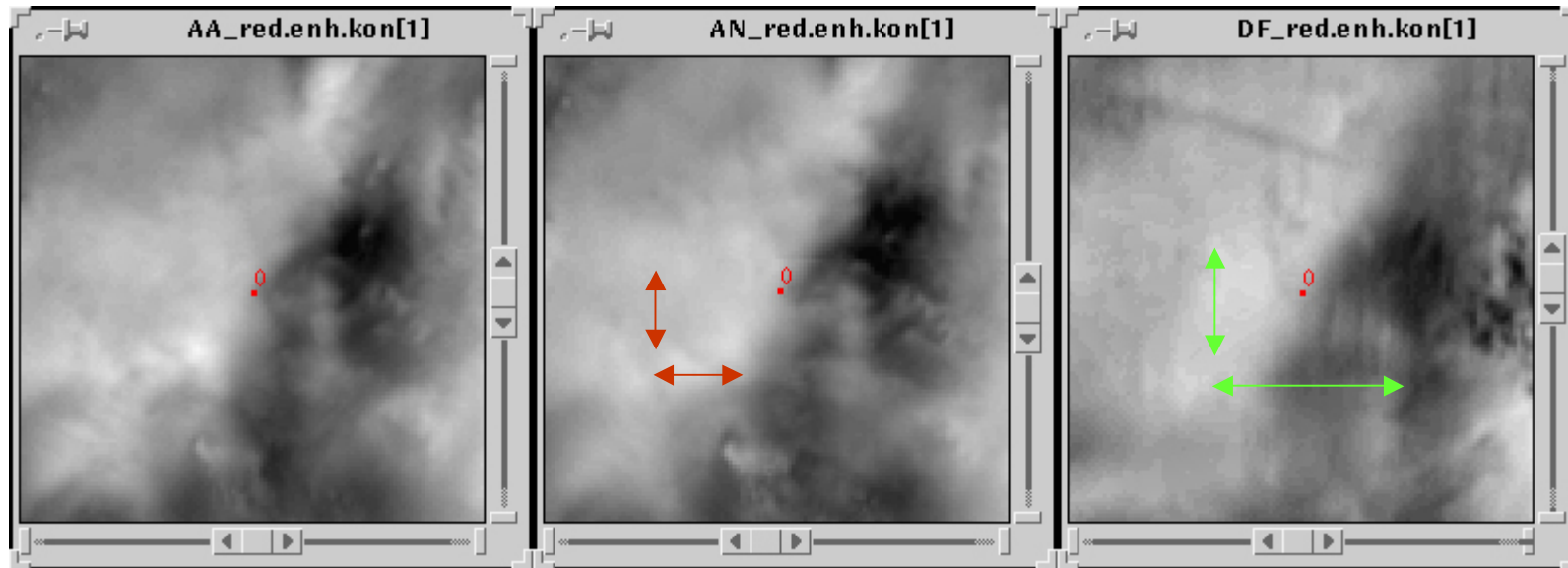
CTW correction



CTW correction



Simultaneous CTH/CTW retrieval



$$\text{xdis}_{12} = u(t_2 - t_1)$$

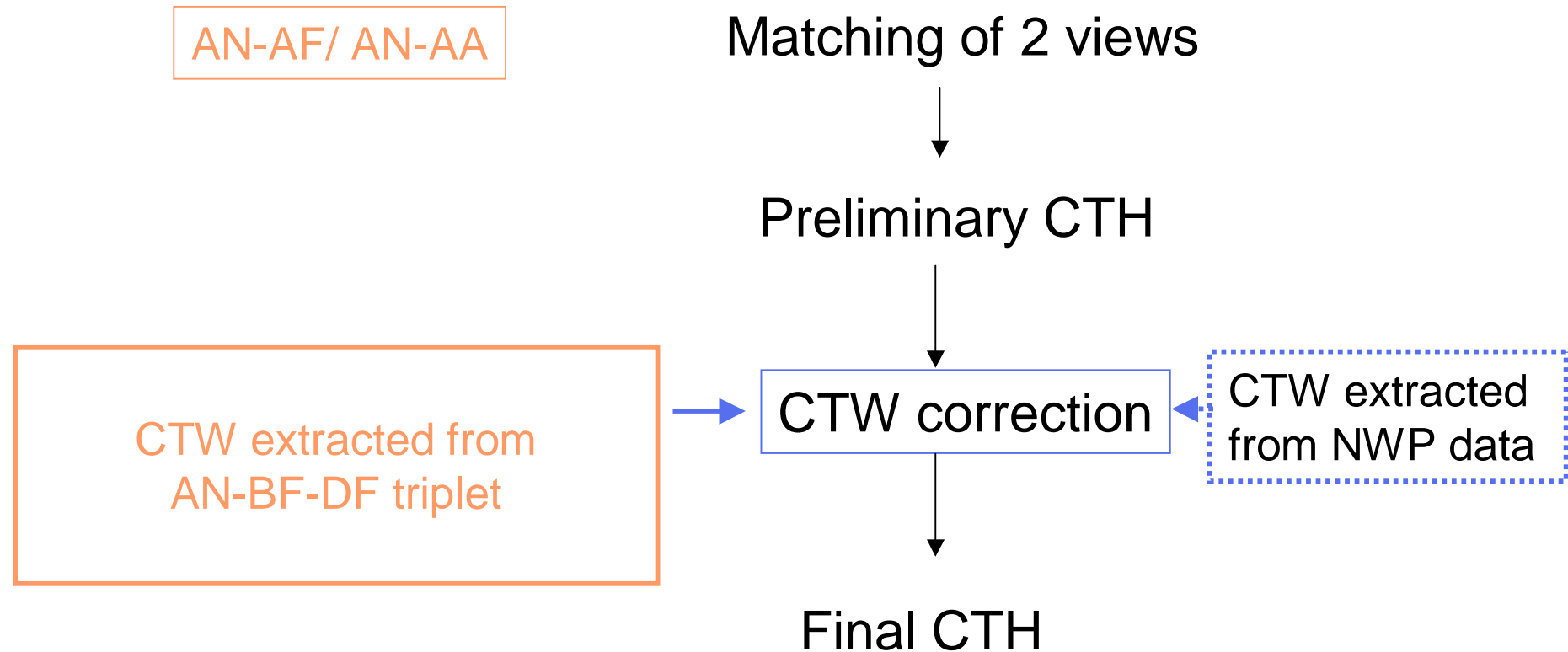
$$\text{ydis}_{12} = H(\tan \theta_1 - \tan \theta_2) + v(t_2 - t_1)$$

$$\Rightarrow H, u, v$$

$$\text{xdis}_{13} = u(t_3 - t_1)$$

$$\text{ydis}_{13} = H(\tan \theta_1 - \tan \theta_3) + v(t_3 - t_1)$$

MISR L2TC CTH/CTW



Factors which influence stereo accuracy

- **Geometry of acquisition**
base-to-height ratio, time difference, camera number and configuration
- **Geometric accuracy**
zenith angles, absolute and relative geolocation accuracy
- **Measurement/ Matching accuracy**
matcher, matching strategy
- **Definition accuracy**
wavelength, radiometric resolution, spatial resolution, preprocessing,
atmospheric conditions, etc.
- **CTW accuracy**

Factors which influence stereo accuracy

Geometric Assumptions:

- no vertical cloud motion (over time interval)
- horizontal CTW (u, v) is constant (over time interval) (3 views)
- $CTH1 = CTH2$ (CTH is constant over time interval) (3 views)

Matching Assumptions:

- Smooth surface

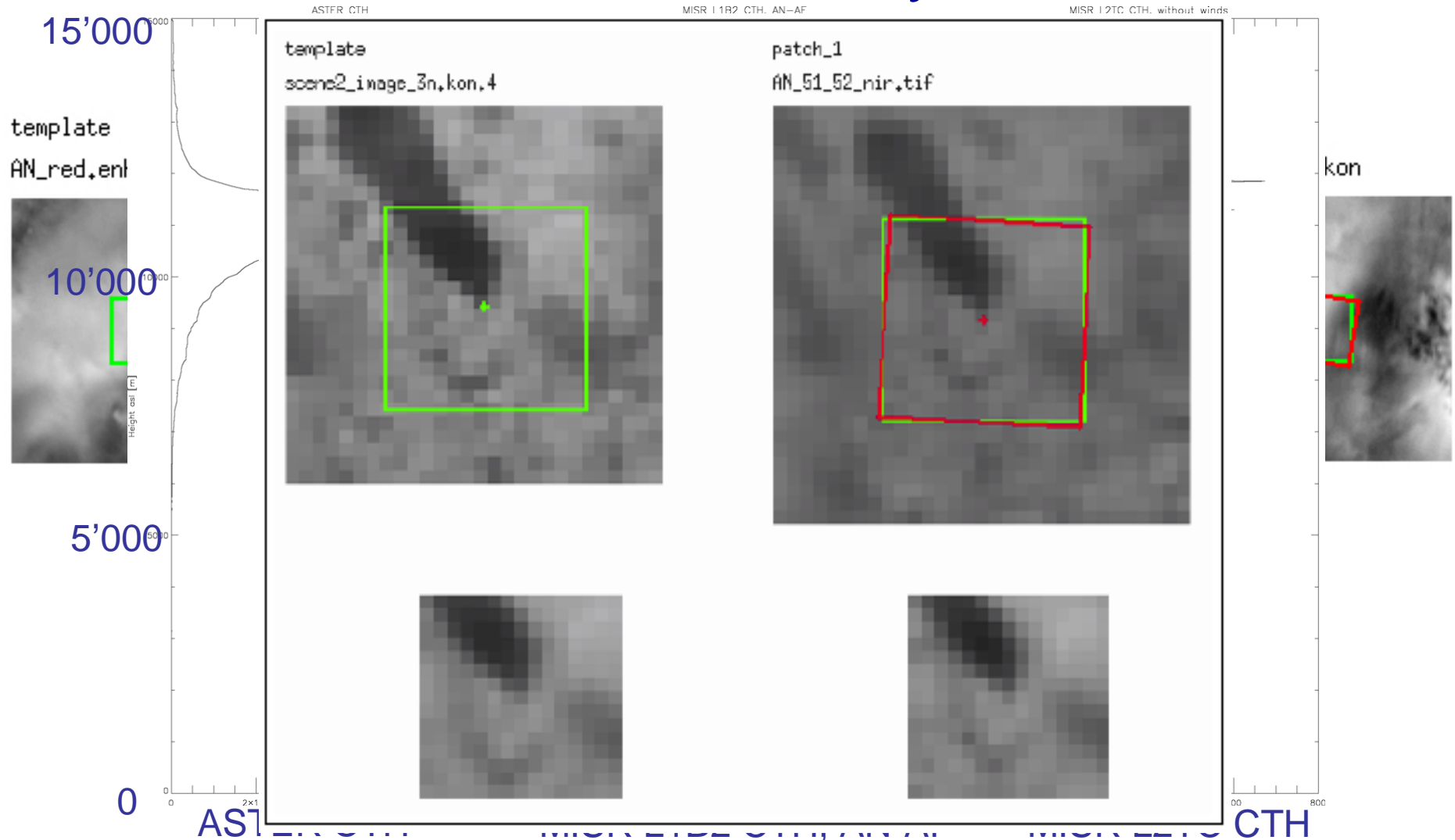
Definition Assumptions:

- retrieved CTHs/ CBHs = actual cloud boundaries

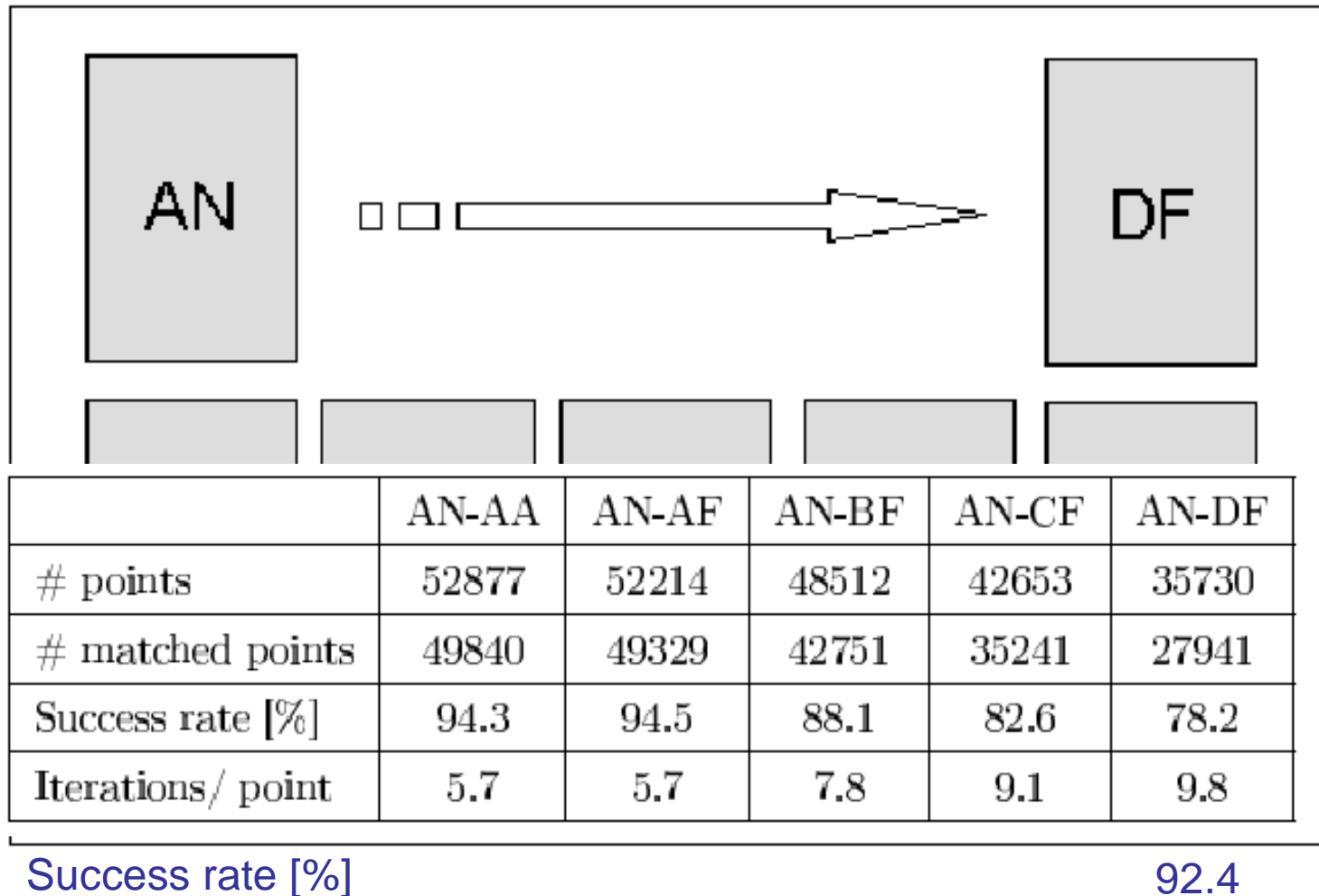
Stereo configurations

Sensor	B/H ratio	Δt [s]	Δh [m] for $\Delta y_p = 1.0$ pixel	Δh [m] for $\Delta v' = 5.0$ m/s
ATSR2	0.7-1.2	100-130	830-1430	420-930
MISR AN_AF	0.49	45	560	460
MISR AN_BF	1.02	91	270	450
MISR BF_DF	1.83	112	150	310
MISR AN_CF	1.73	144	160	420
MISR AN_DF	2.85	204	95	360
MISR BF_CF	0.71	53	390	370
MISR CF_DF	1.12	59	250	260
ASTER	0.60	55	25	460
Meteosat-6/-7	0.16		15'600	

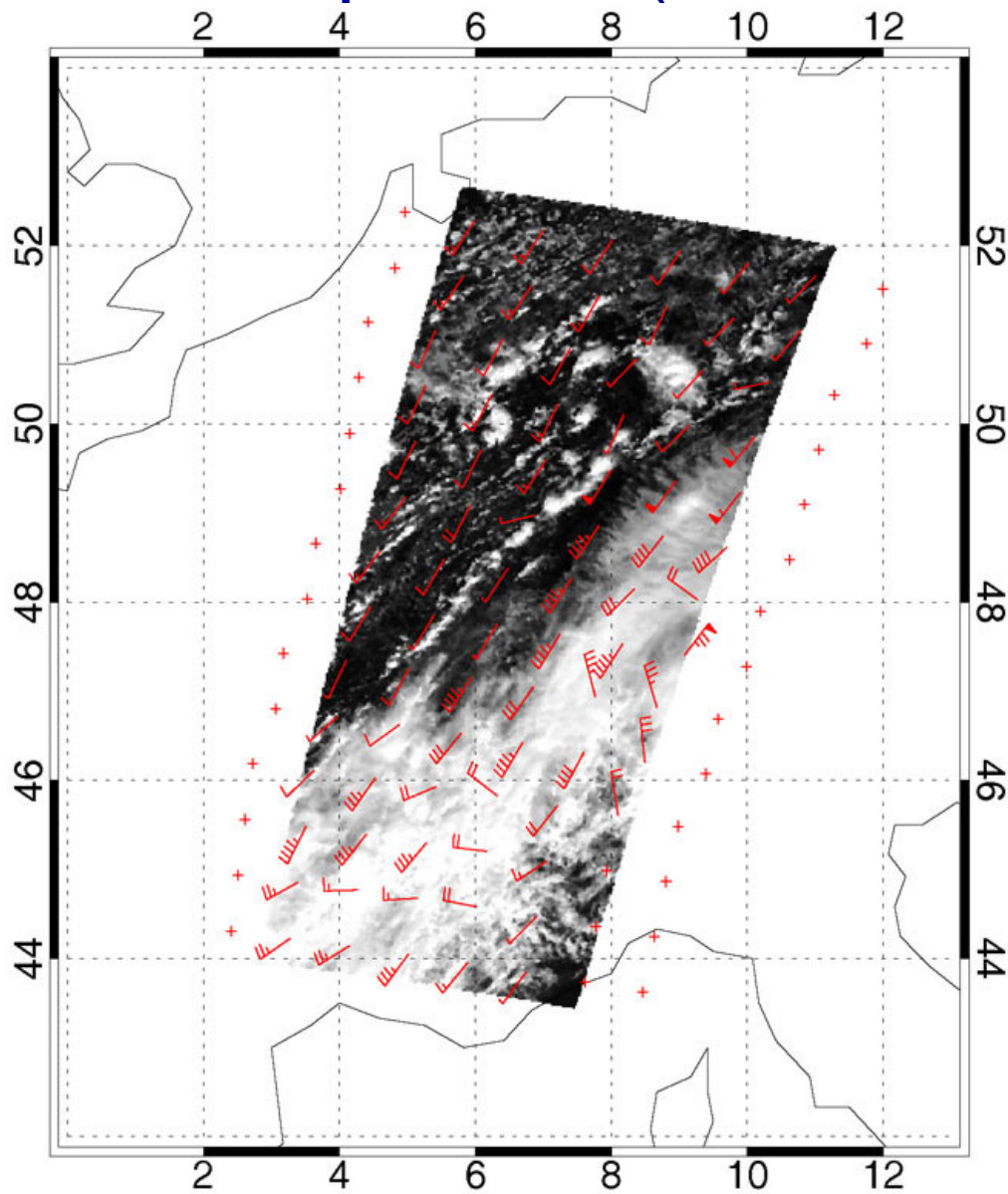
Measurement accuracy: matcher



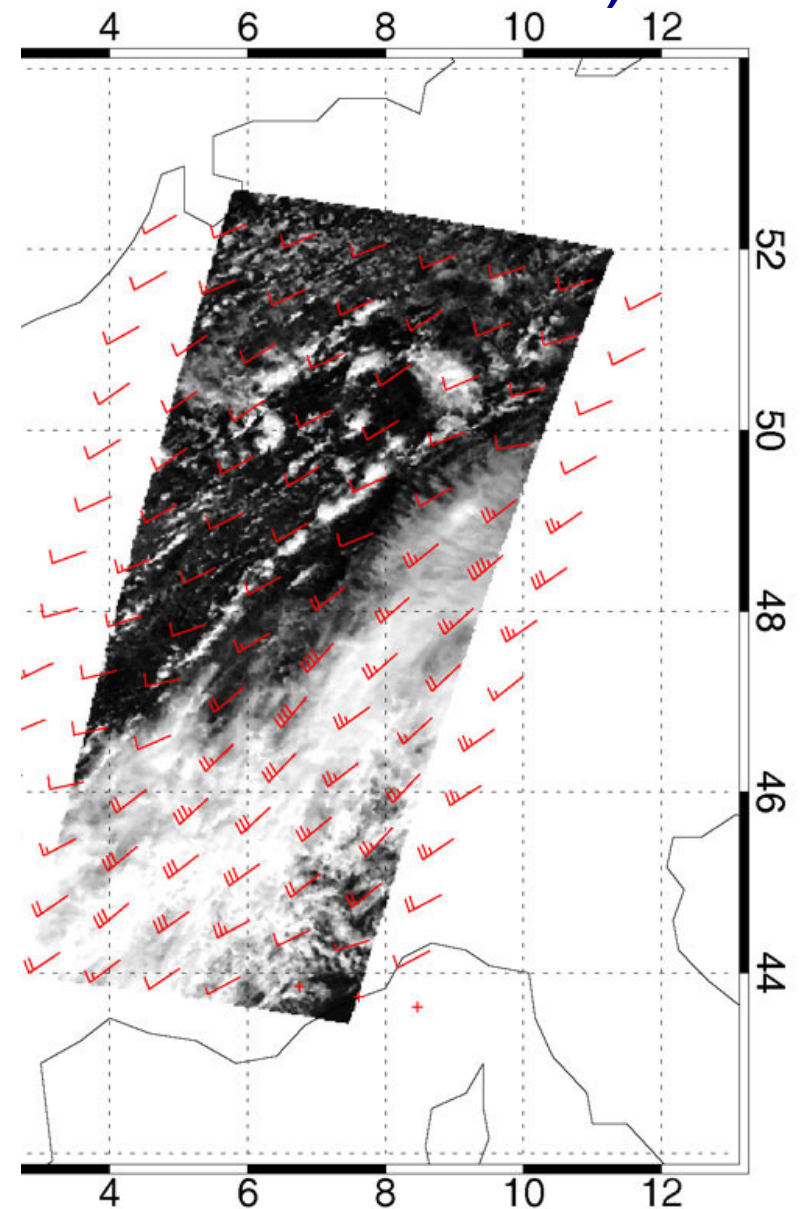
Measurement accuracy: matching strategy



Comparison (NM vs. M23 vs. Meteosat-6)



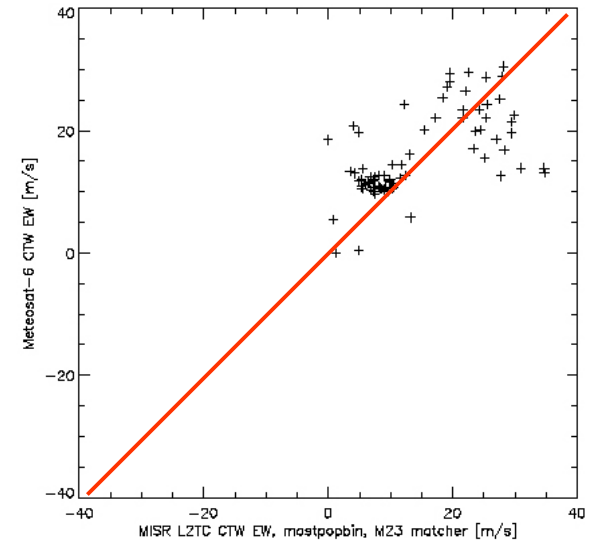
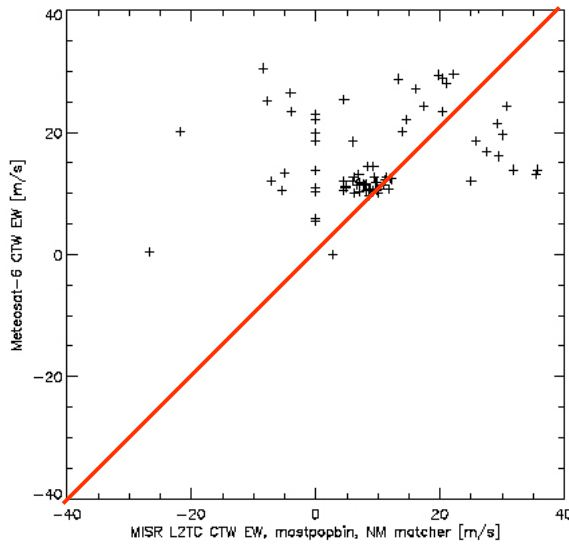
MISR L2TC CTW, M23 matcher



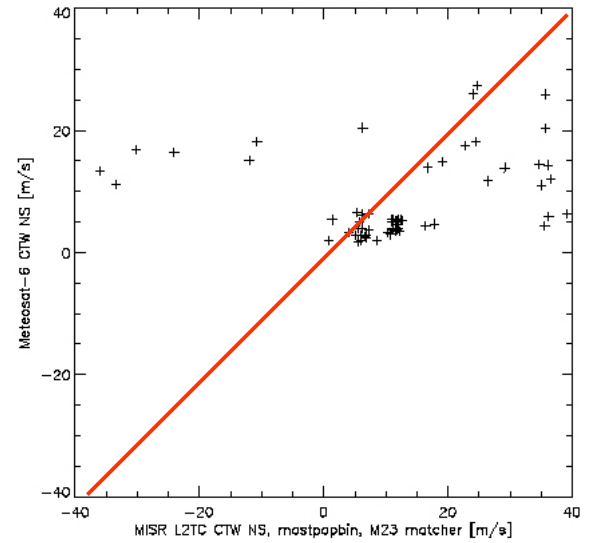
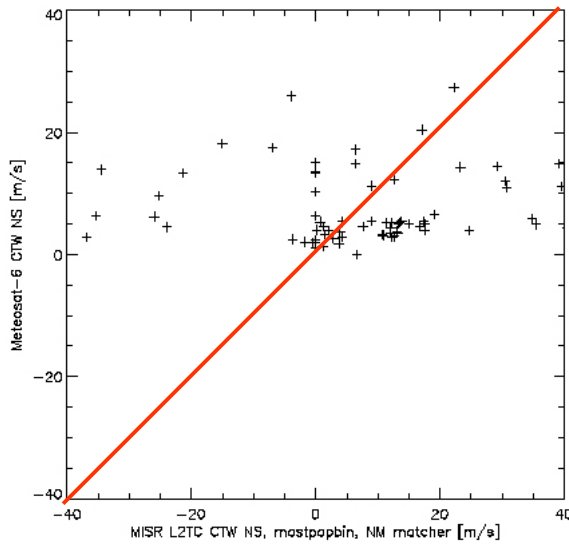
Meteosat-6 CTW

MISR CTW vs. Meteosat-6 CTW

EW



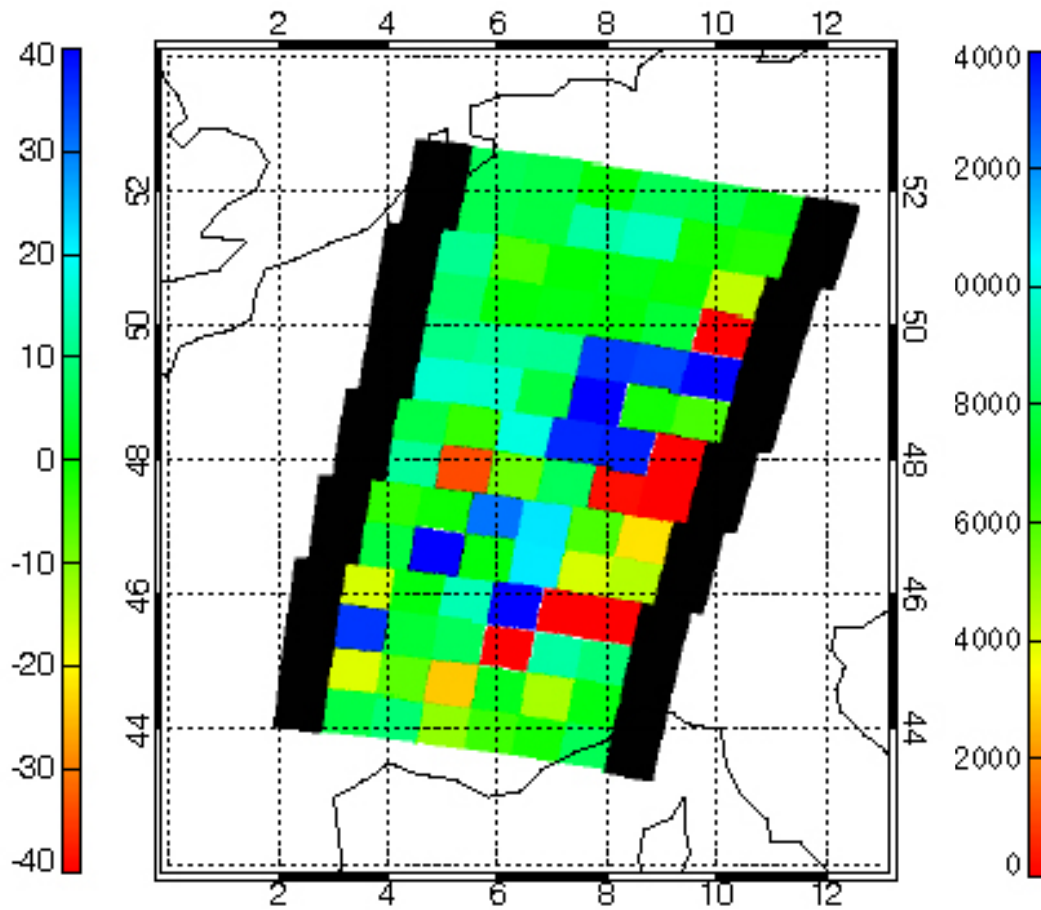
NS



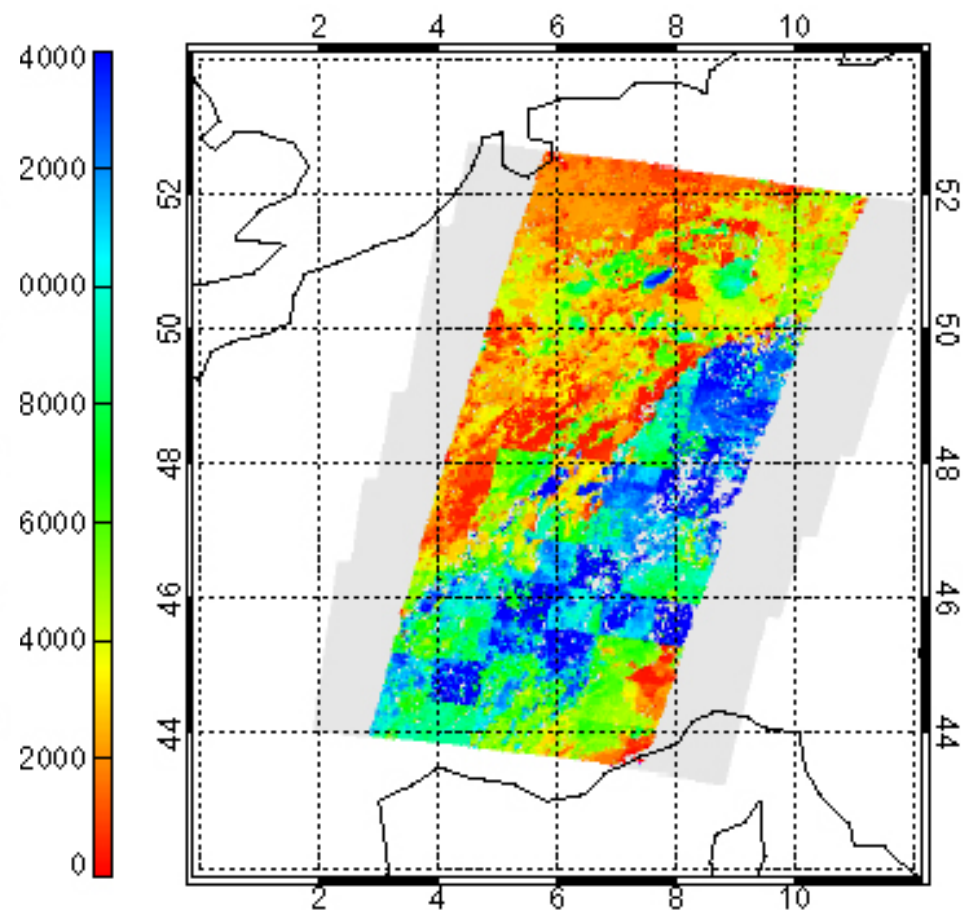
NM

M23

Effect of CTW errors in CTH product



MISR CTW NS component,
along-track disparity,
operational AN-AM matcher
[m/pixels]



Stereo Height,
AN-AF CTH-CTW NS
[m]

Definition accuracy: wavelength

Payerne, 46.82 N, 6.95 E	CTH [m]	M6 u' [m/s]	M6 v' [m/s]	CTH corr [m]	CTH2 [m]	MISR u' [m/s]	MISR v' [m/s]
ATSR2, 0.67 μm	11013.9	21.2	33.6	-3235.4	7778.5	16.1	-
ATSR2, 11.0 μm	12227.2	21.2	33.6	-3235.4	8991.8	22.0	-
MISR AN-AF	11034.6	22.8	33.7	-3315.1	7719.5	25.1	-
MISR AN-BF	10821.3	22.8	33.7	-3114.9	7706.5	25.6	-
MISR AN-AF-BF	-	-	-	-	7506.8	25.4	36.2

Payerne, CH

Definition accuracy: comparison data

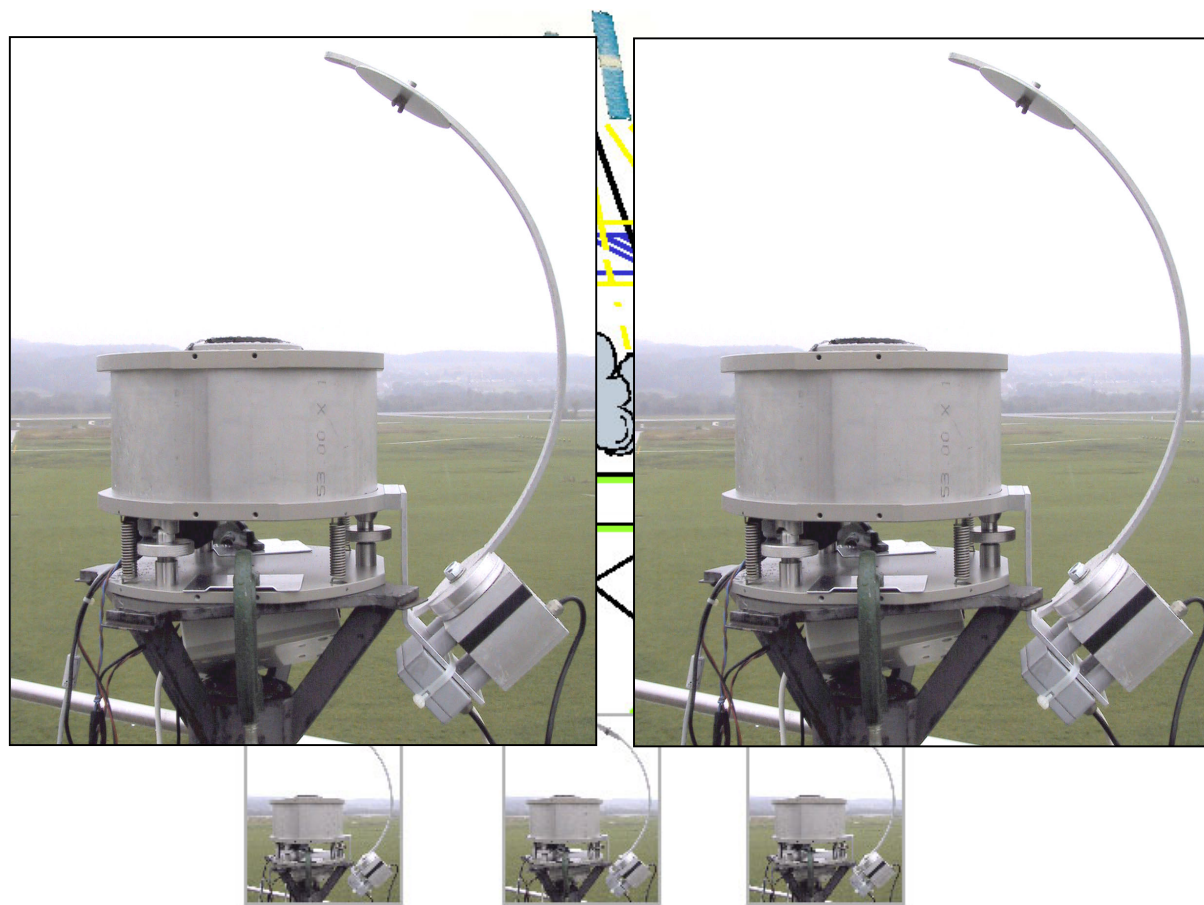
Payerne, 46.82 N, 6.95 E	Cloud height [m]	Fin Options Zoom Print	d NS [m/s]
	1900 - 2200		1.0
	3700 - 3900		0.8
	7450 - 7600		0.3
	8850 - 8950		0.1
	9800 - 9900		0.2

Radiosonde data

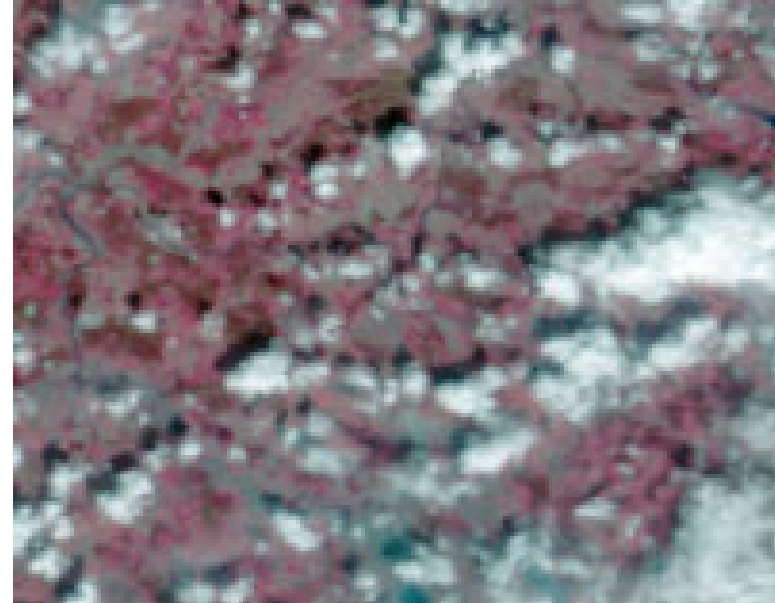
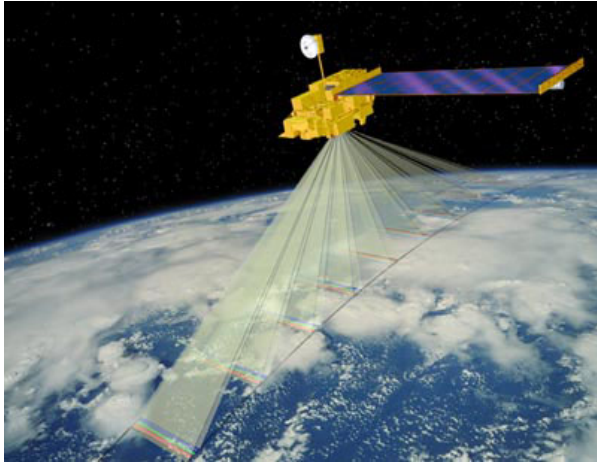
- humidity measurement and
- different delay of temperature
- trajectory

Definition accuracy: comparison data

Ground-based imager data

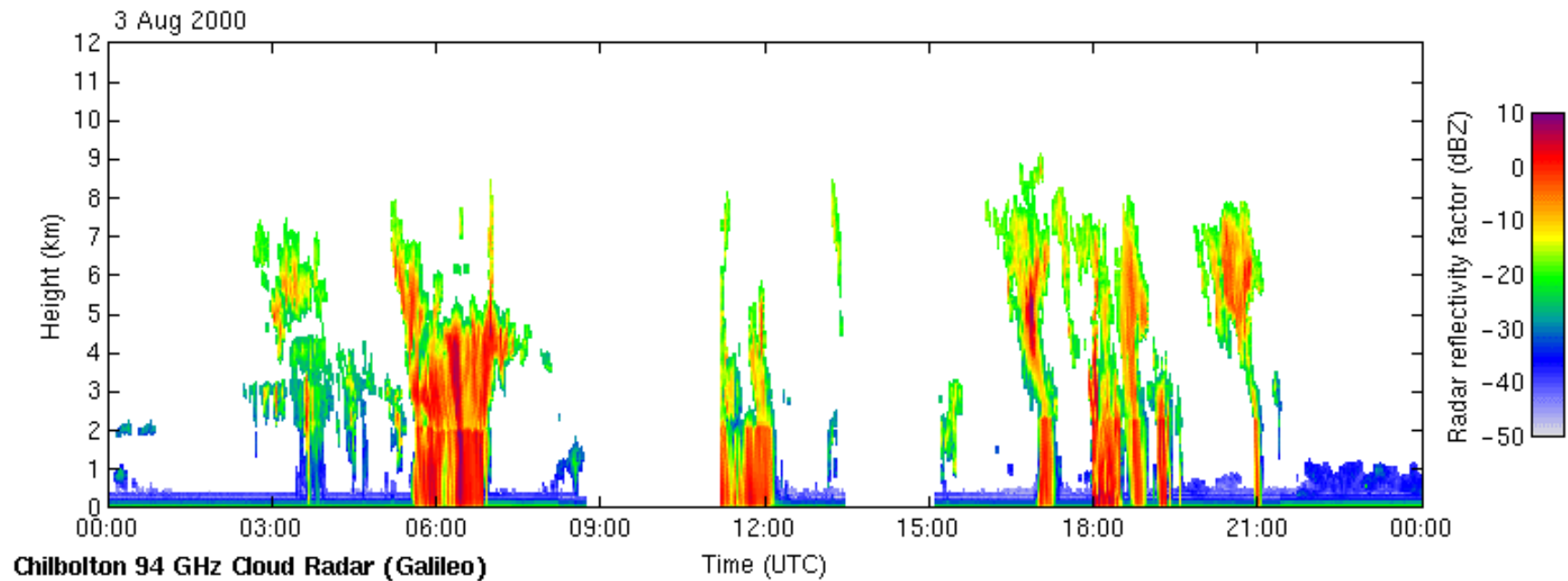


3D Cloud field data from EO and GBS



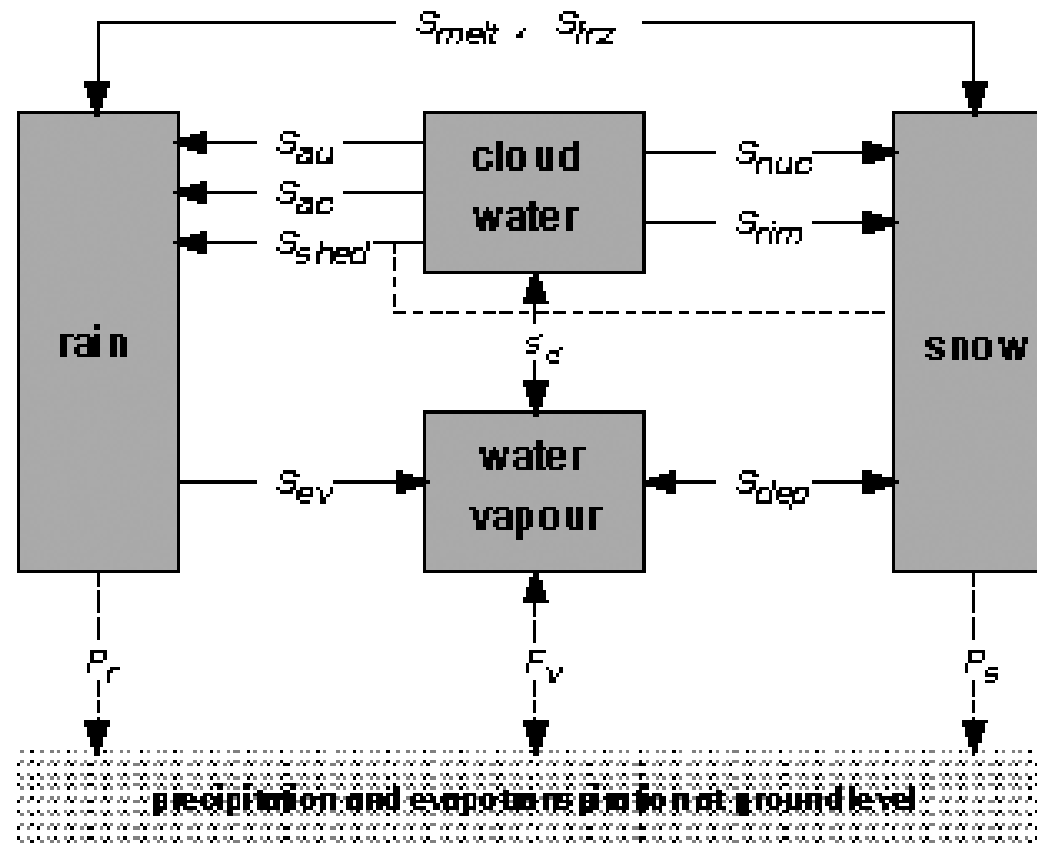
Definition accuracy: comparison data

Cloud radar data



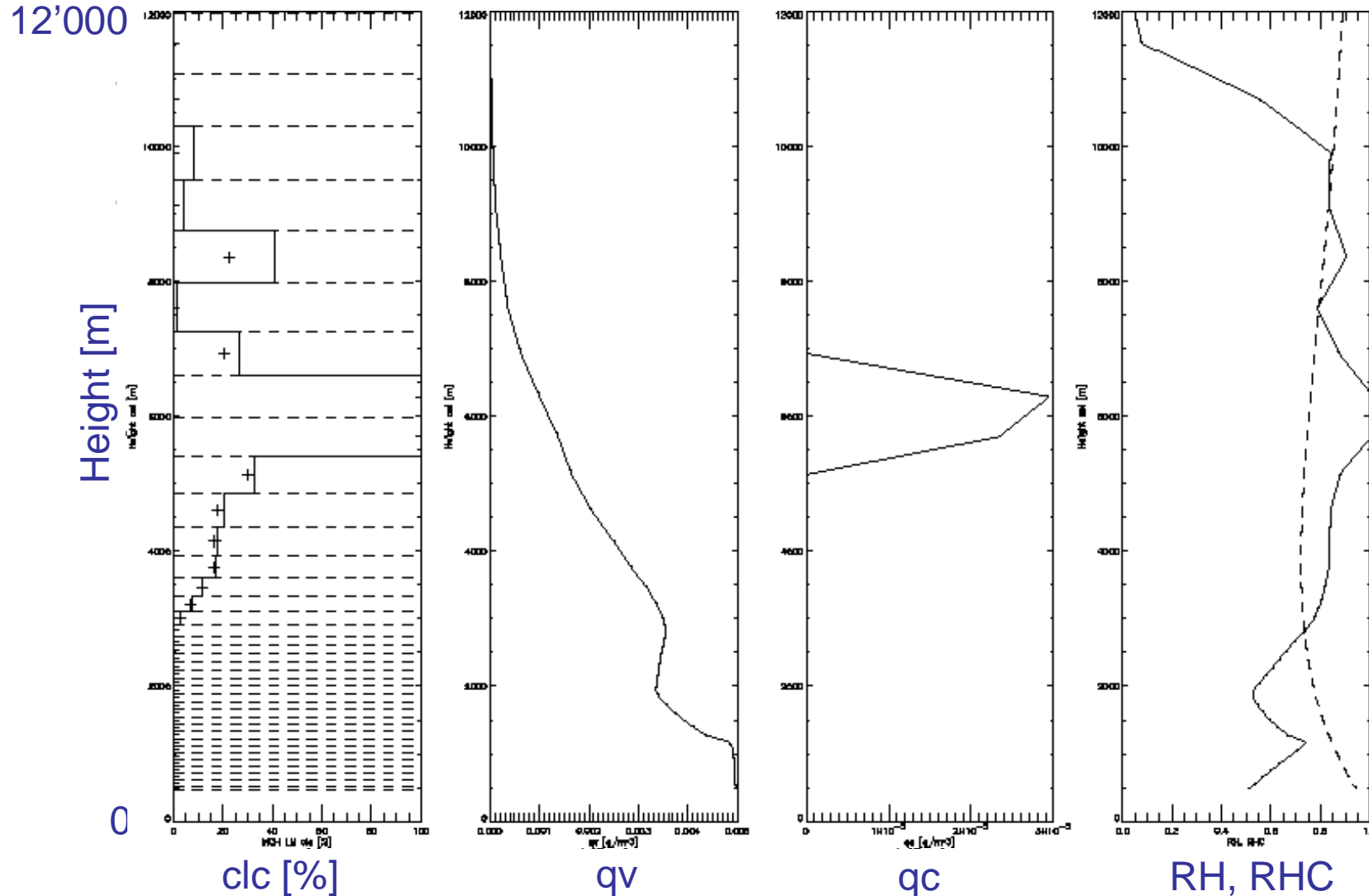
--> Comparison study with Eumetsat, RAL.

Clouds in aLMo

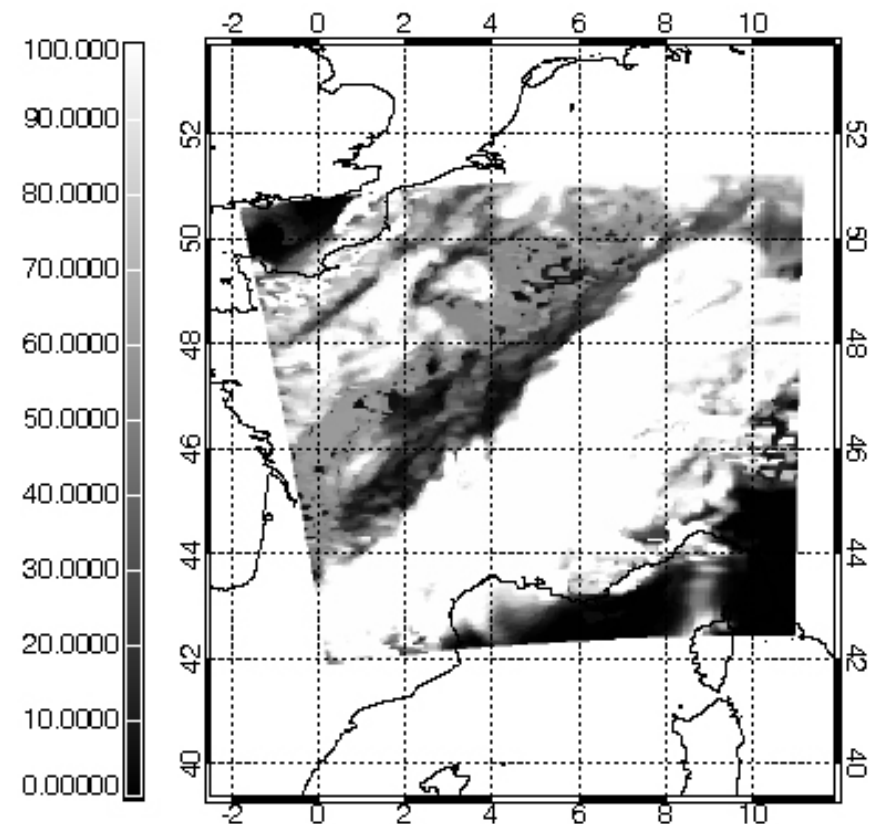
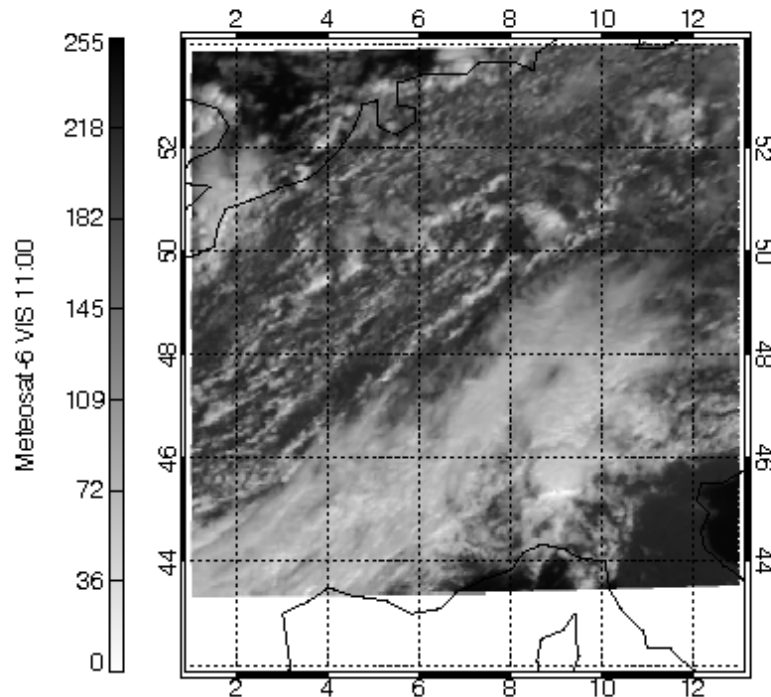


- Prognostic variables: water vapour q_v , cloud water q_c
- Diagnostic variables: cl_c (3D), cl_{wc} (3D), cl_{ct} , cl_{ch} , cl_{cm} , cl_{cl}

Clouds in aLMo: clc



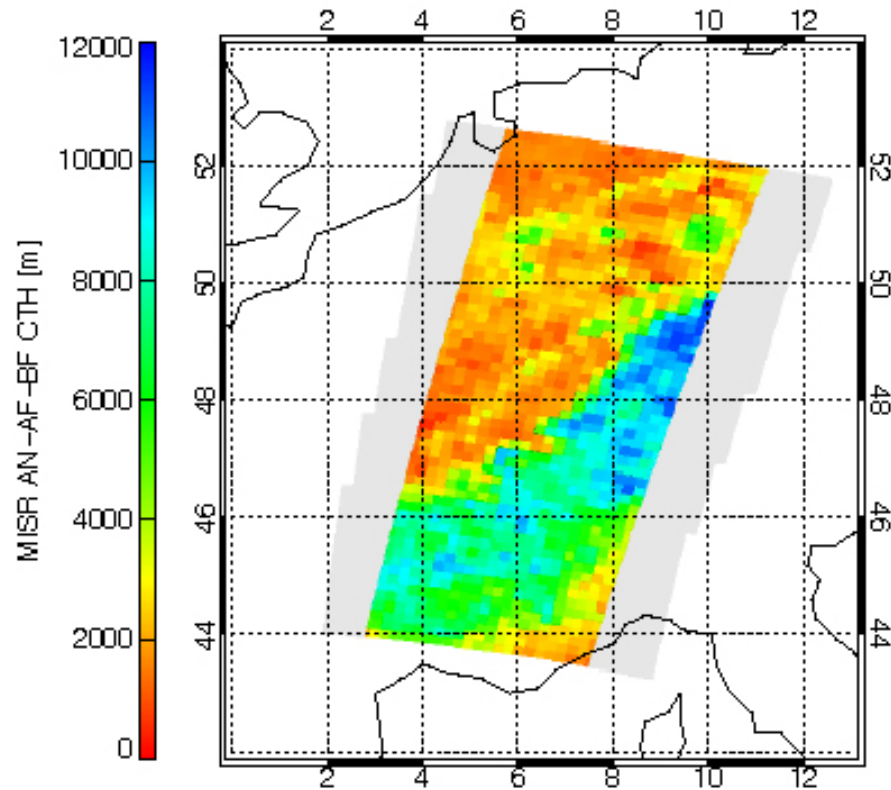
2D comparison: cloud cover (clct)



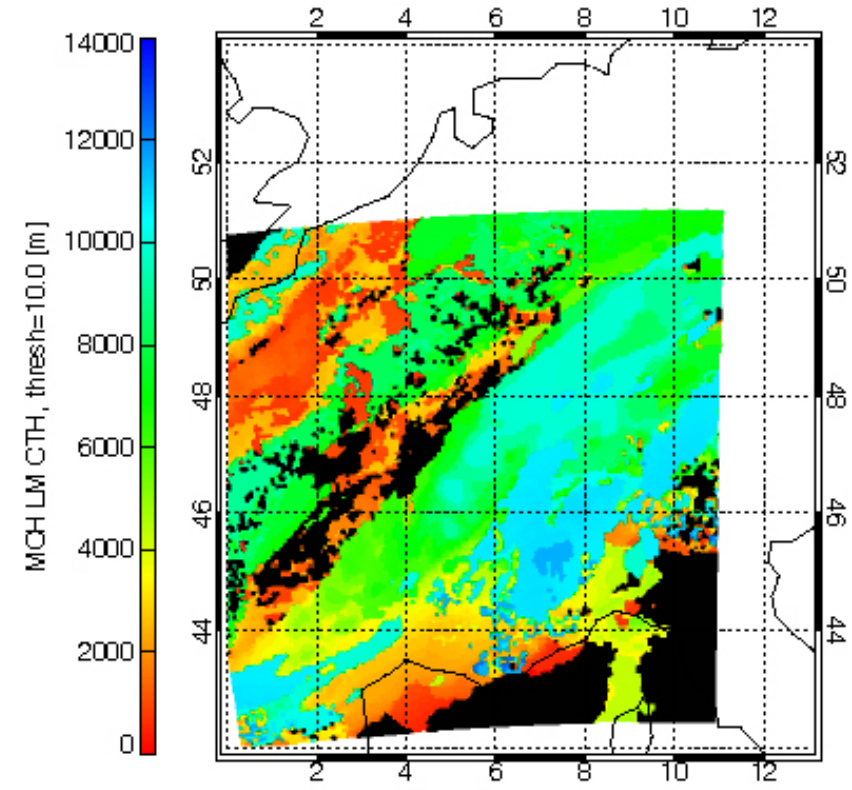
Meteosat-6 Rapid Scan, 11:00

aLMo total cloud cover (clct) [%], 11:00

3D comparison: CTH (clc)



MISR CTH (AN, AF, BF)



aLMo CTH (h_{mean} of highest
layer with $clc > clc_{\text{min}}$)

Conclusions

- Factors that influence the stereo accuracy
- Importance of CTW and definition
- Comparison instruments
- Use of NWP model fields

Outlook

- Combination of EO and GBS measurements -> aLMo
- MSG