



Ispira, 10th of May, 2017

We hereby declare that the WorldView4 (WV4) sensor can be used in the CAP image acquisition program. Geometry benchmark tests has had satisfactory results.

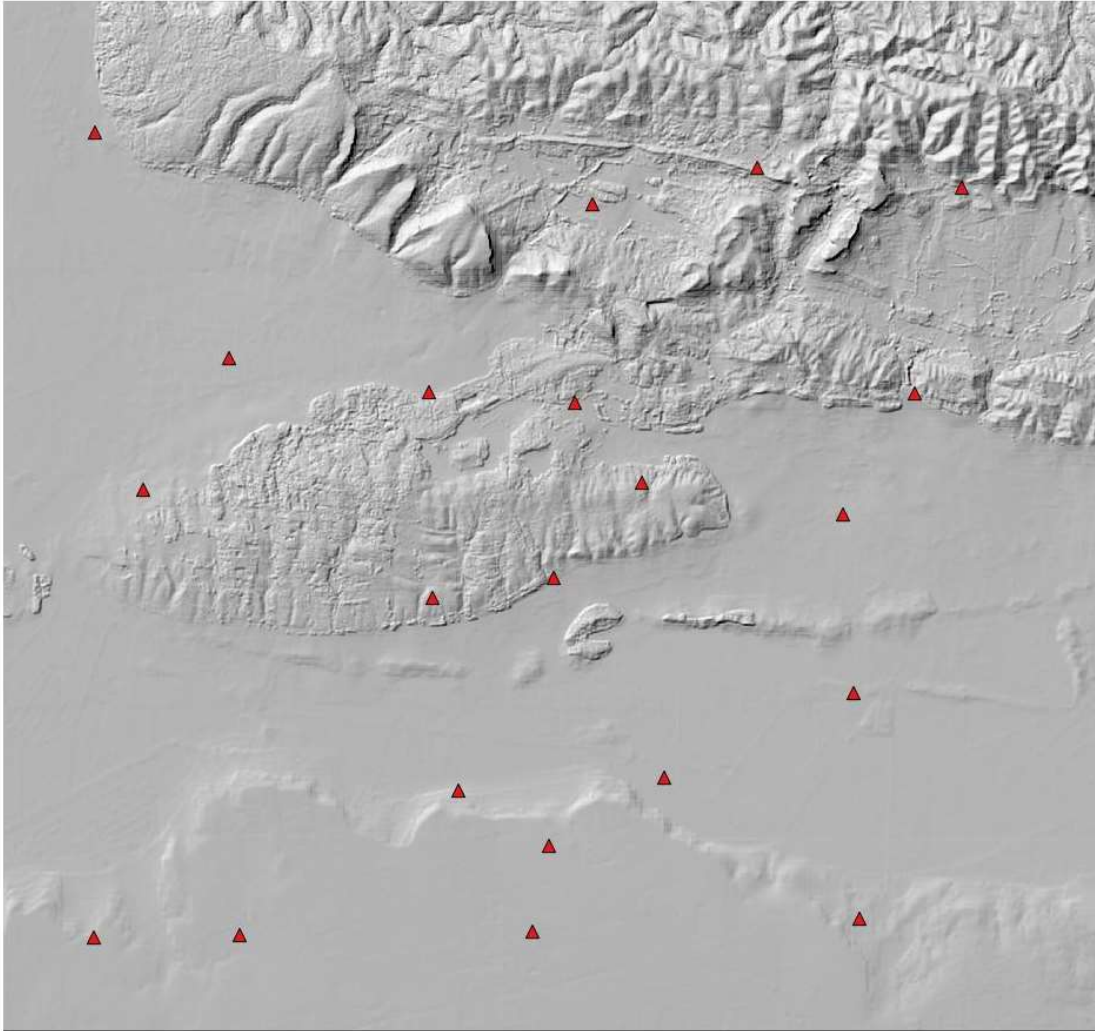
Following comments are made:

- The WV4 sensor has had positive results with RMSE values below requested thresholds for all VHR prime profiles used in the CAP image acquisition programme and as of FWC “VHR prime II” (#931.886)¹. Formal benchmark report will be issued later on. Due to the urgency to increase capacity of the image provider’s fleet of sensors and due to relatively bad weather conditions over Europe at this moment, it is therefore accepted to start the use of this sensor as from now.
- The sensor may be used in the CAP image acquisition programme as of today’s date subtracted the contractually allowed 2 working days for upload of imagery (i.e. for acquisitions made from 08/05/2017 inclusive).
- Any imagery of WV4 taken on ‘speculative’ grounds earlier than above date may be uploaded as backup imagery to be used if no new acquisition has been made at end of acquisition window.
- Further discussion on WV4 sensor performance (within above thresholds) will be made in bilateral contacts between JRC and EUSI, which will be included in the final Formal benchmark report.

Benchmarking of positional accuracy of WV4

- 21 ICP selected
- 3 different viewing angles tested : 9°, 24°, 36° ONA
- 2 software packages : PCI (RPC + rigorous), ERDAS (RPC only)

¹ Technical Specifications chapter 3.3.2 VHR Profiles, and in particular according to note under Table 5, page 30/51.



Distribution of ICPs over Maussane test area (France)

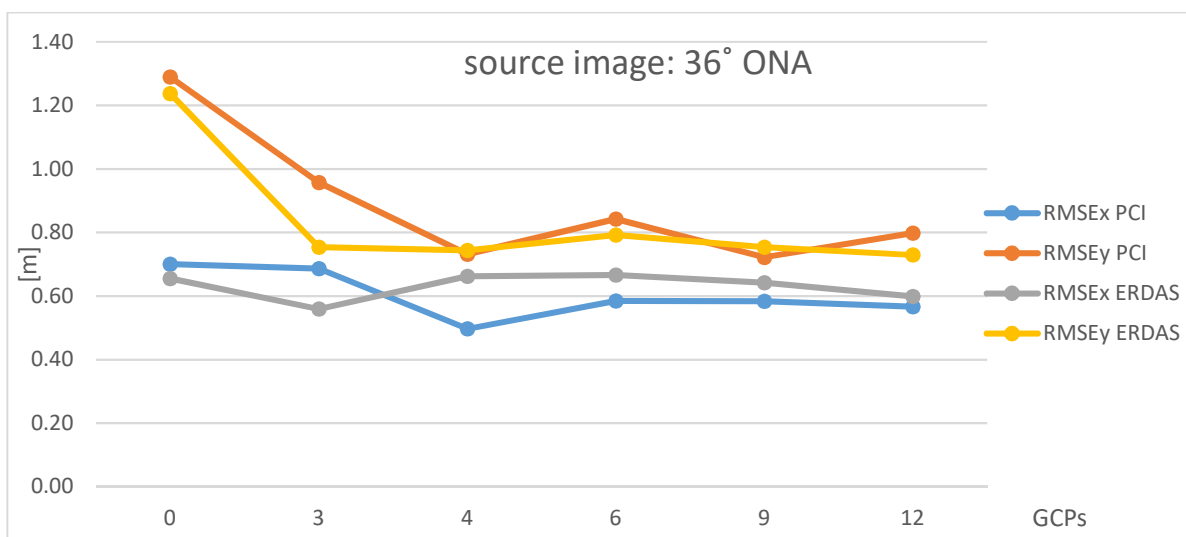
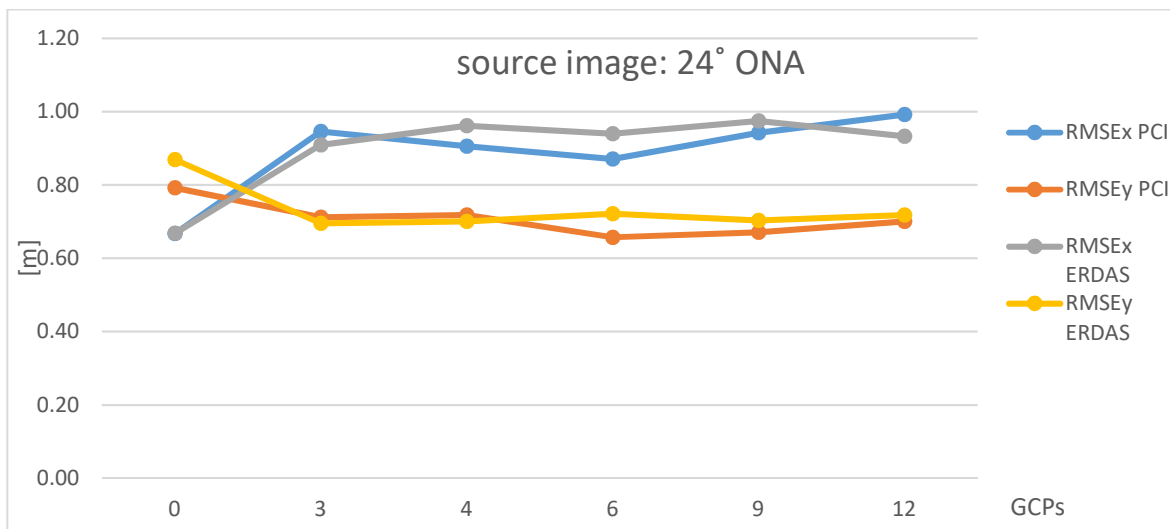
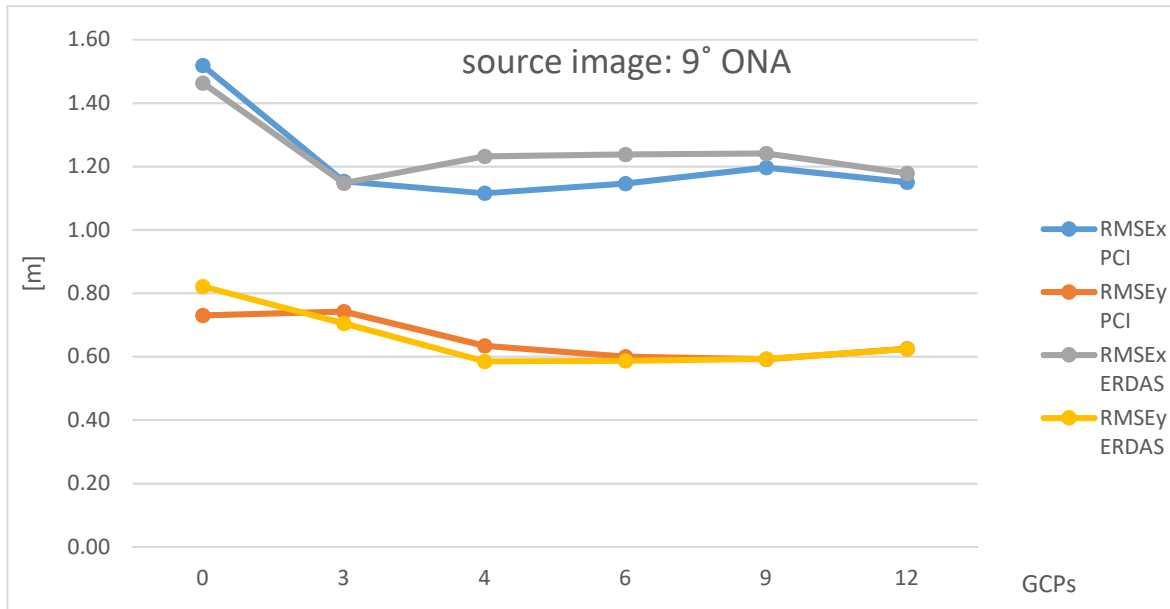
Dataset	Point ID	RMSE _x [m]	RMSE _y [m]	N. points
VEXCEL_GCP_dataset_Maussane_prepared_for_VEXEL_in_2005	44XXX	0,49	0,50	2 points
Multi-use_GCP_dataset_Maussane_prepared_for_multi-use_in_Oct-2009	66XXX	0,30	0,30	15 points
Maussane GNSS field campaign 21-26 November 2012	CXRX	0,15	0,15	4 points

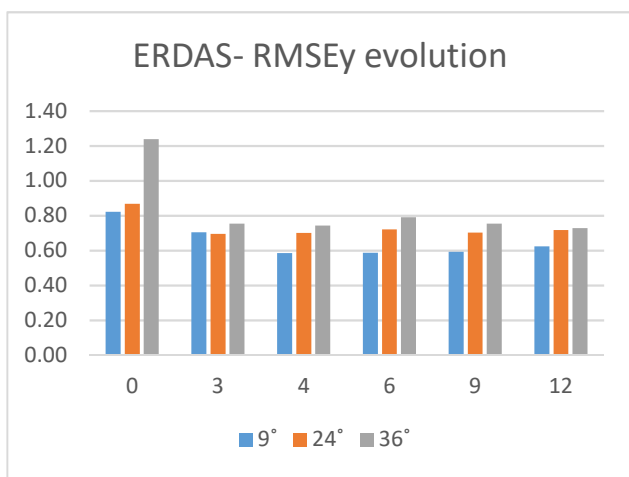
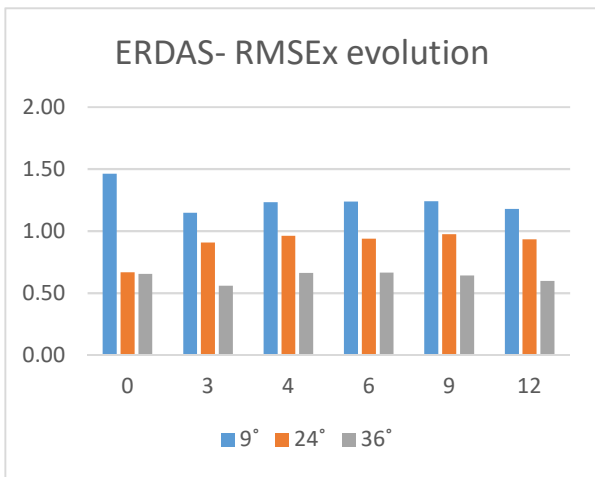
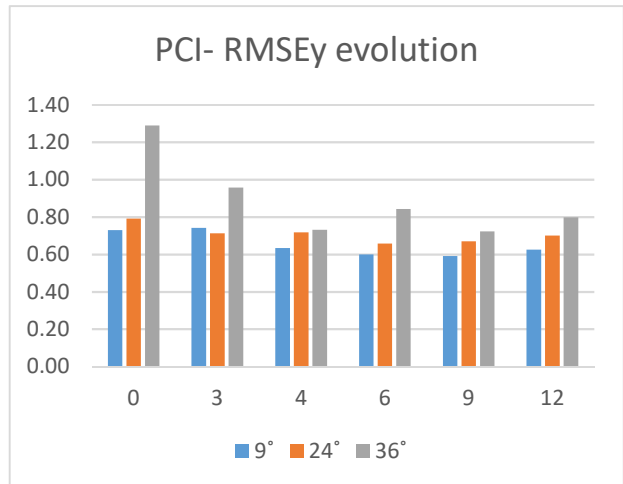
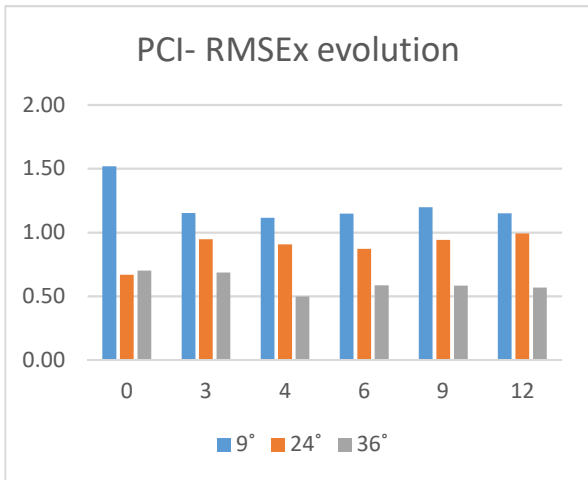
Results – source image

ONA	RMSE _x [m]	RMSE _y [m]
9°	6,38	4,67
24°	7,53	22,90
36°	21,59	33,97

Results - RPC

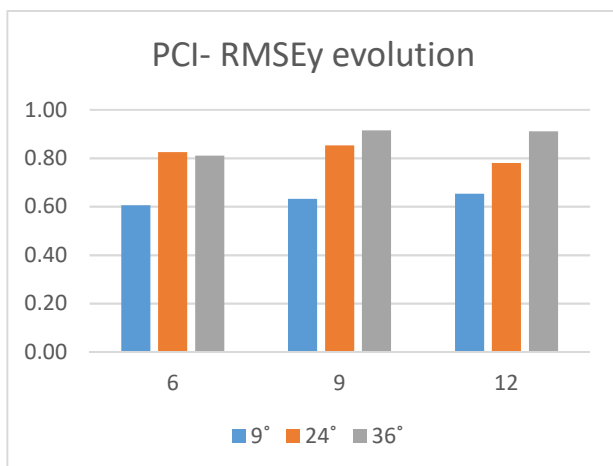
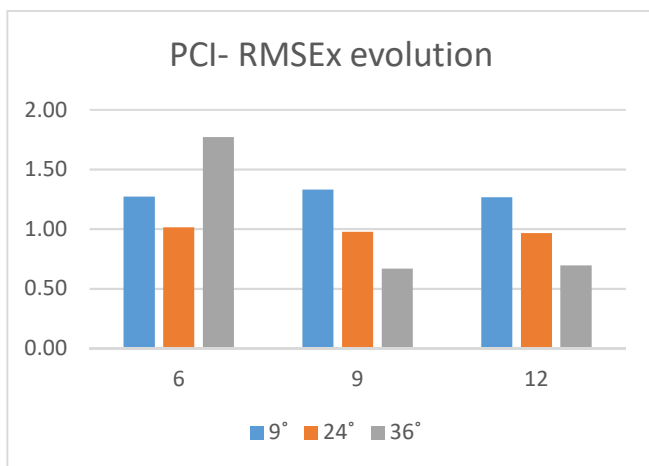
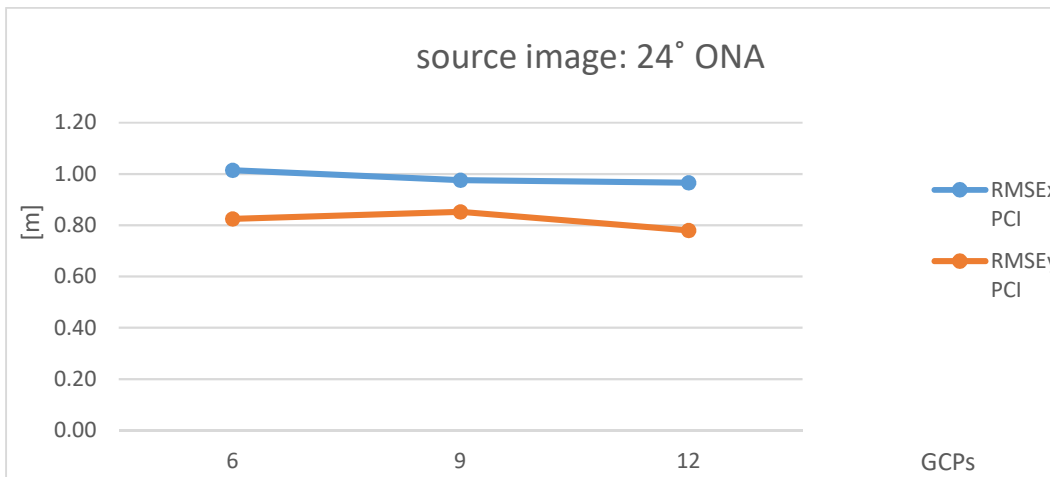
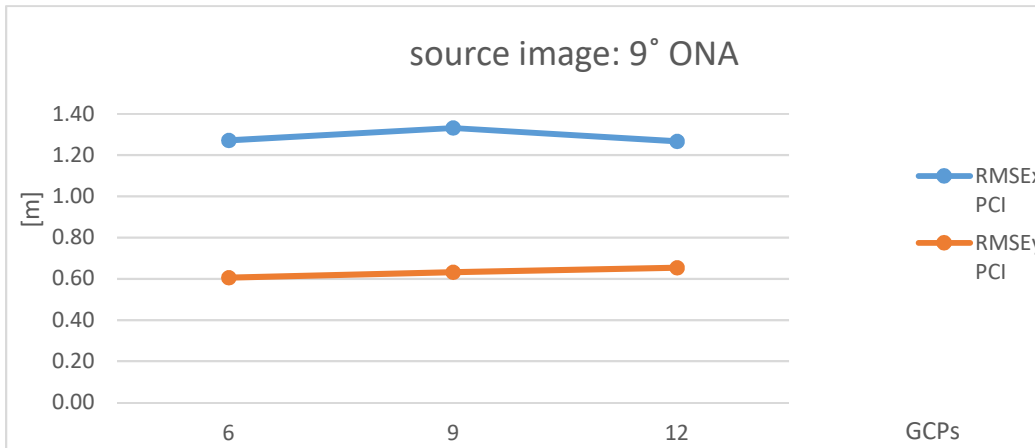
ONA	RPC	PCI		ERDAS	
	GCPs	RMSE _x	RMSE _y	RMSE _x	RMSE _y
9°	0	1,52	0,73	1,46	0,82
	3	1,15	0,74	1,15	0,71
	4	1,12	0,63	1,23	0,59
	6	1,15	0,60	1,24	0,59
	9	1,20	0,59	1,24	0,59
	12	1,15	0,63	1,18	0,62
24°	0	0,67	0,79	0,67	0,87
	3	0,95	0,71	0,91	0,70
	4	0,91	0,72	0,96	0,70
	6	0,87	0,66	0,94	0,72
	9	0,94	0,67	0,97	0,70
	12	0,99	0,70	0,93	0,72
36°	0	0,70	1,29	0,66	1,24
	3	0,69	0,96	0,56	0,75
	4	0,50	0,73	0,66	0,74
	6	0,58	0,84	0,67	0,79
	9	0,58	0,72	0,64	0,75
	12	0,57	0,80	0,60	0,73





Results –Rigorous

ONA	RIG	PCI	
	GCPs	RMSEx PCI	RMSEy PCI
9	6	1,27	0,61
	9	1,33	0,63
	12	1,27	0,65
24	6	1,02	0,82
	9	0,98	0,85
	12	0,97	0,78
36	6	1,77	0,81
	9	0,67	0,91
	12	0,70	0,91



Conclusions

- The WorldView-4 PSH ortho imagery geometric accuracy meets the requirement of 5, 2.0, 1.5m 1D-RMSE corresponding to the VHR prime and backup profiles defined in the VHR profile based Technical Specifications².
- The RMSE_x, and RMSE_y threshold of 1:5.000 scale imagery of 1.25m is fulfilled for all angles 24°, 36°, 9° ONA orthos when GCPs (≥3) are applied in addition to RPC function. For the ortho image produced from the 9° ONA image without use of GCPs, the RMSE_x result is at the limit of this value.
- For near nadir imagery (9° ONA) a tendency of higher RMSE error was observed compared to the 2 image sets at 24° and 36° ONA. This has to be further investigated.
- The RMSE_x obtained in the rigorous tests (36° ONA) for 6 GCPs needs further investigation since it appears exceptionally high.
- Both software Erdas and PCI perform equally.
- From the results obtained, it is suggested to always use ≥ 4 GCPs.
- RMSE_x – is slightly decreasing with higher ONA angle of source image.
- RMSE_y – is increasing with higher ONA angle of source image.

² https://g4cap.jrc.ec.europa.eu/g4cap/Portals/0/Documents/21955_2017%20VHR%20specifications.pdf