DigitalGlobe Geolocation Assessment and Update for 2012

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Introduction

- This presentation collects together geolocation accuracy performance assessments for the DigitalGlobe satellite constellation from imagery collected during 2012.

- All the satellites have been performing well and provided good geolocation accuracy performance for 2012.

- CE90 and LE90 estimation is based on the Percentile Method
  - Recommended by NIQU/CCAP
    - Bresnahan, P., Absolute Geolocation Accuracy Evaluation of Worldview-1 Basic 1B Stereo Pairs, JACIE 2010
    - Bresnahan, P., Absolute Geolocation Accuracy Evaluation of GeoEye-1 Basic Stereo Triplets, JACIE 2010

DigitalGlobe Constellation Mono Geolocation Accuracy for 2012

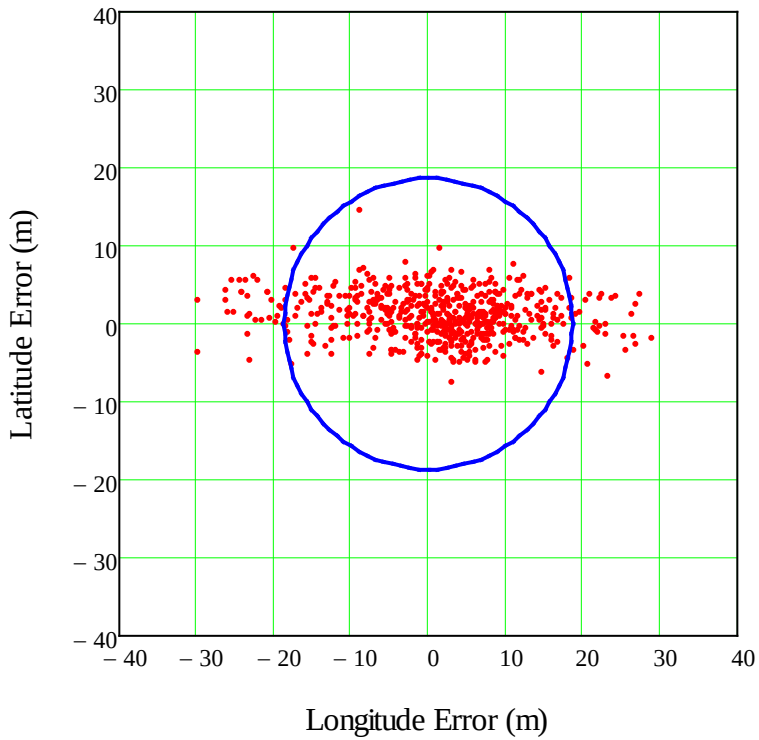
Satellite	Mono		
	# images	CE90 (m)	*RMSE XY (m)*
QuickBird	607	19	*11*
WorldView-1	1601	3.8	*2.6*
WorldView-2	4091	3.4	*2.2*
GeoEye-1	120	3.0	*2.0*
IKONOS	-	8.2*	-

*- IKONOS CE90 reflects mission accuracy from 5/2000 to 4/2013

QuickBird Mono Geolocation Accuracy for 2012

CE90 = 19 meters

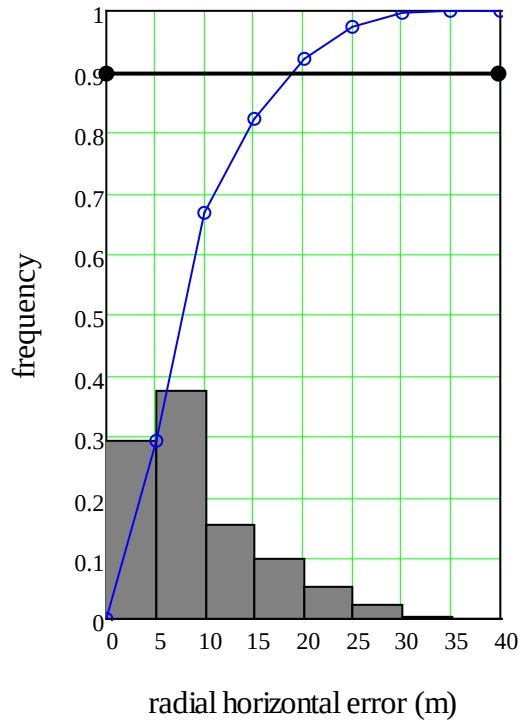
RMSE = 11 meters



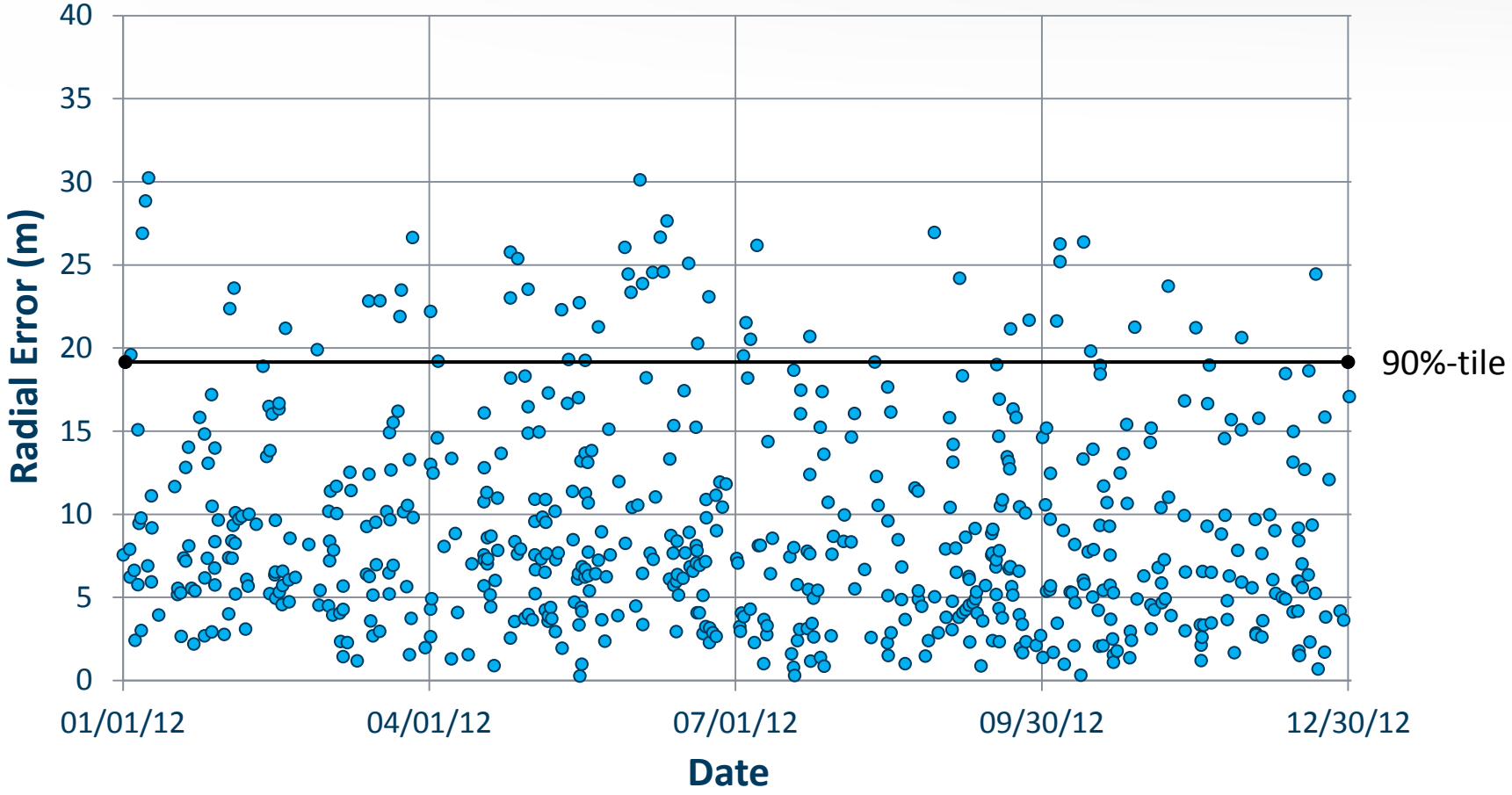
n = 607

mean(Δϕ) = 1.1 m mean(Δλ) = 1.3 m

stdev(Δϕ) = 2.9 m stdev(Δλ) = 10.5 m



QuickBird Time Series of Mono Geolocation for 2012



WorldView-1 Mono Geolocation Accuracy for 2012

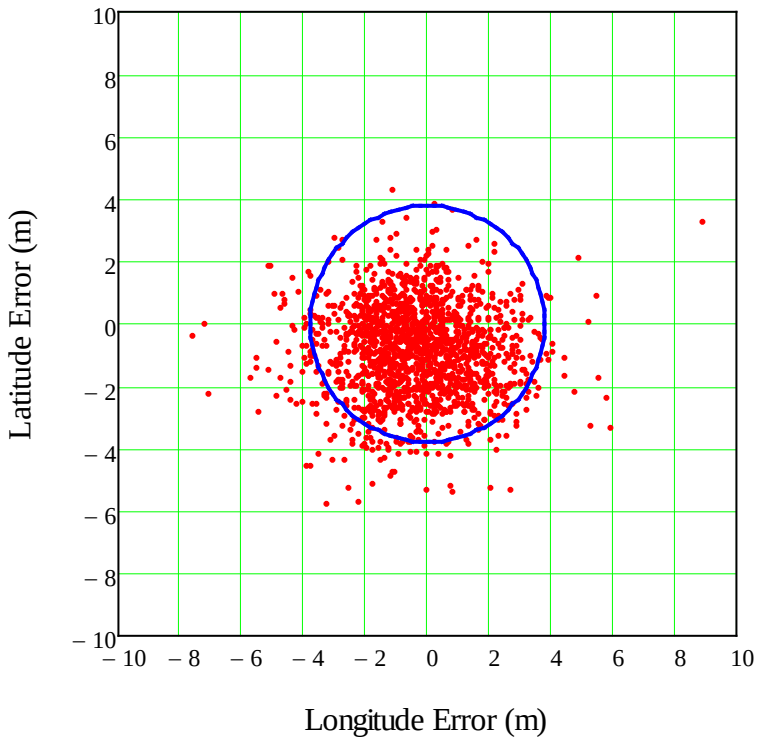
CE90 = 3.8 meters

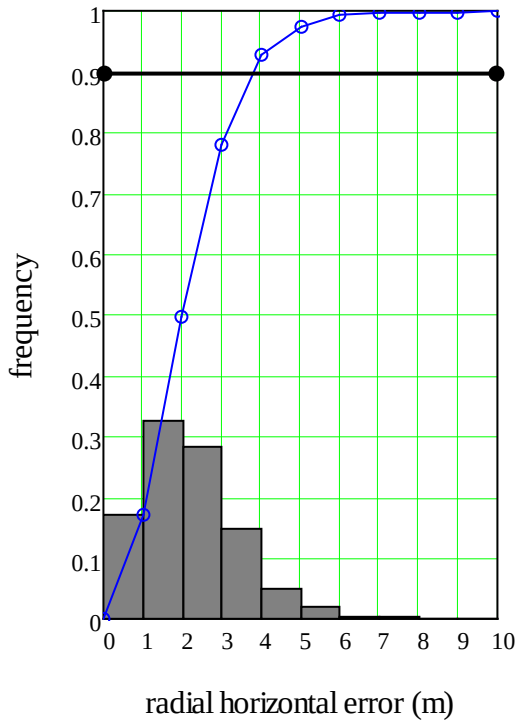
RMSE = 2.6 meters

$n = 1601$

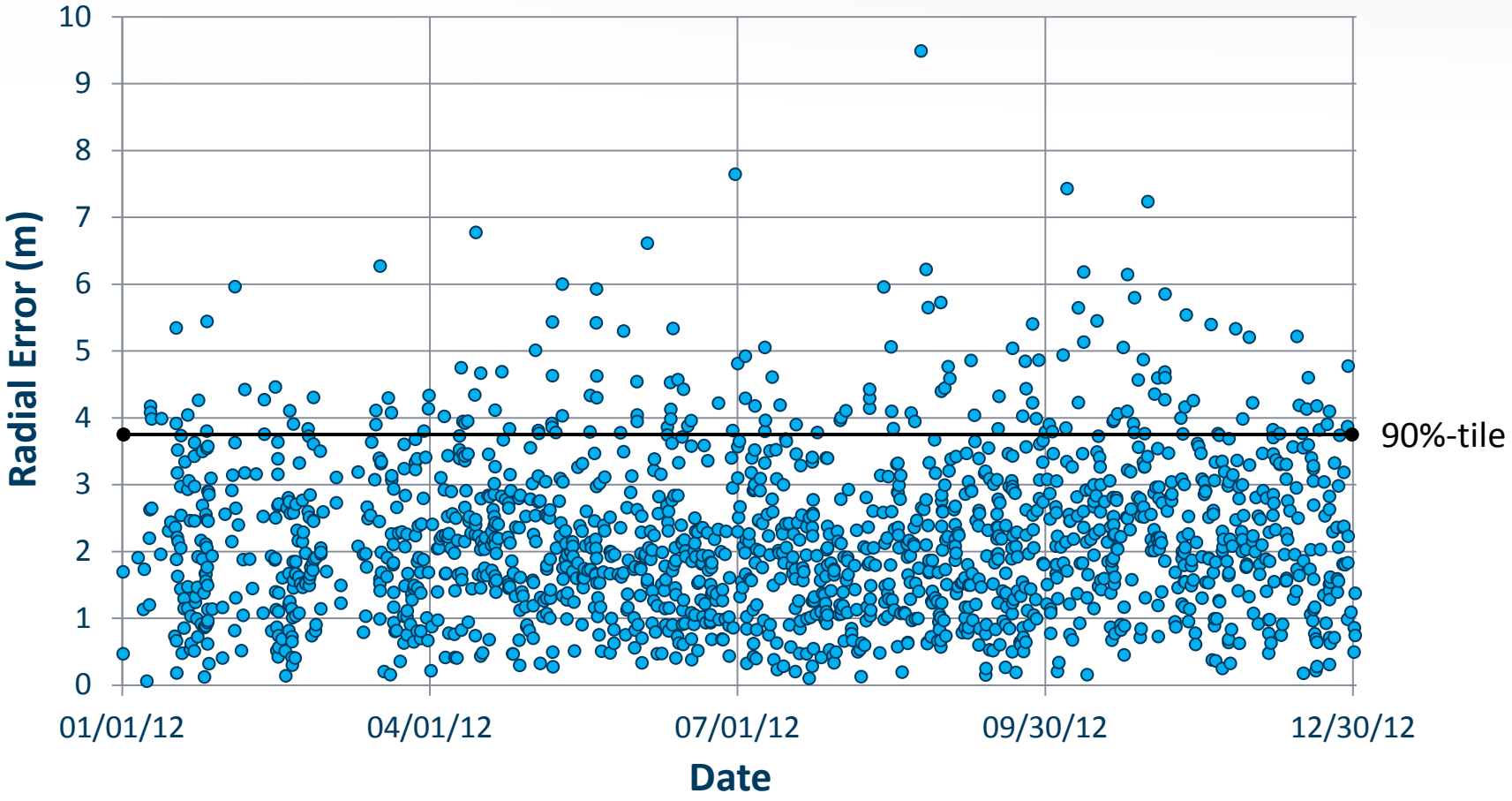
$\text{mean}(\Delta\phi) = -0.9\,\text{m}$ $\quad$ $\text{mean}(\Delta\lambda) = -0.4\,\text{m}$

$\text{stdev}(\Delta\phi) = 1.5\,\text{m}$ $\quad$ $\text{stdev}(\Delta\lambda) = 1.9\,\text{m}$





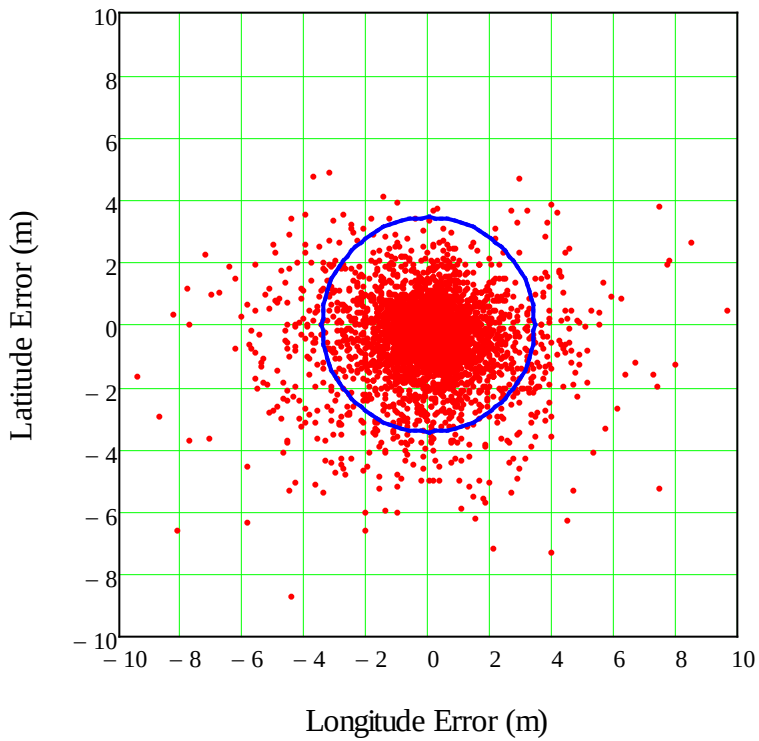
WorldView-1 Time Series of Mono Geolocation for 2012



WorldView-2 Mono Geolocation Accuracy for 2012

CE90 = 3.4 meters

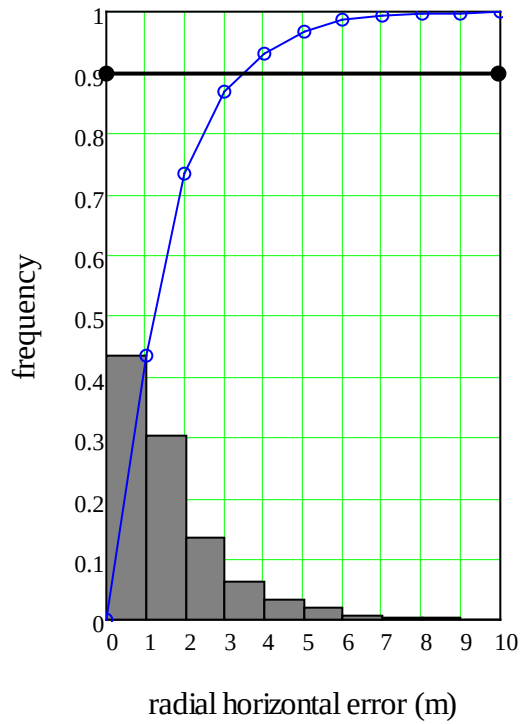
RMSE = 2.2 meters



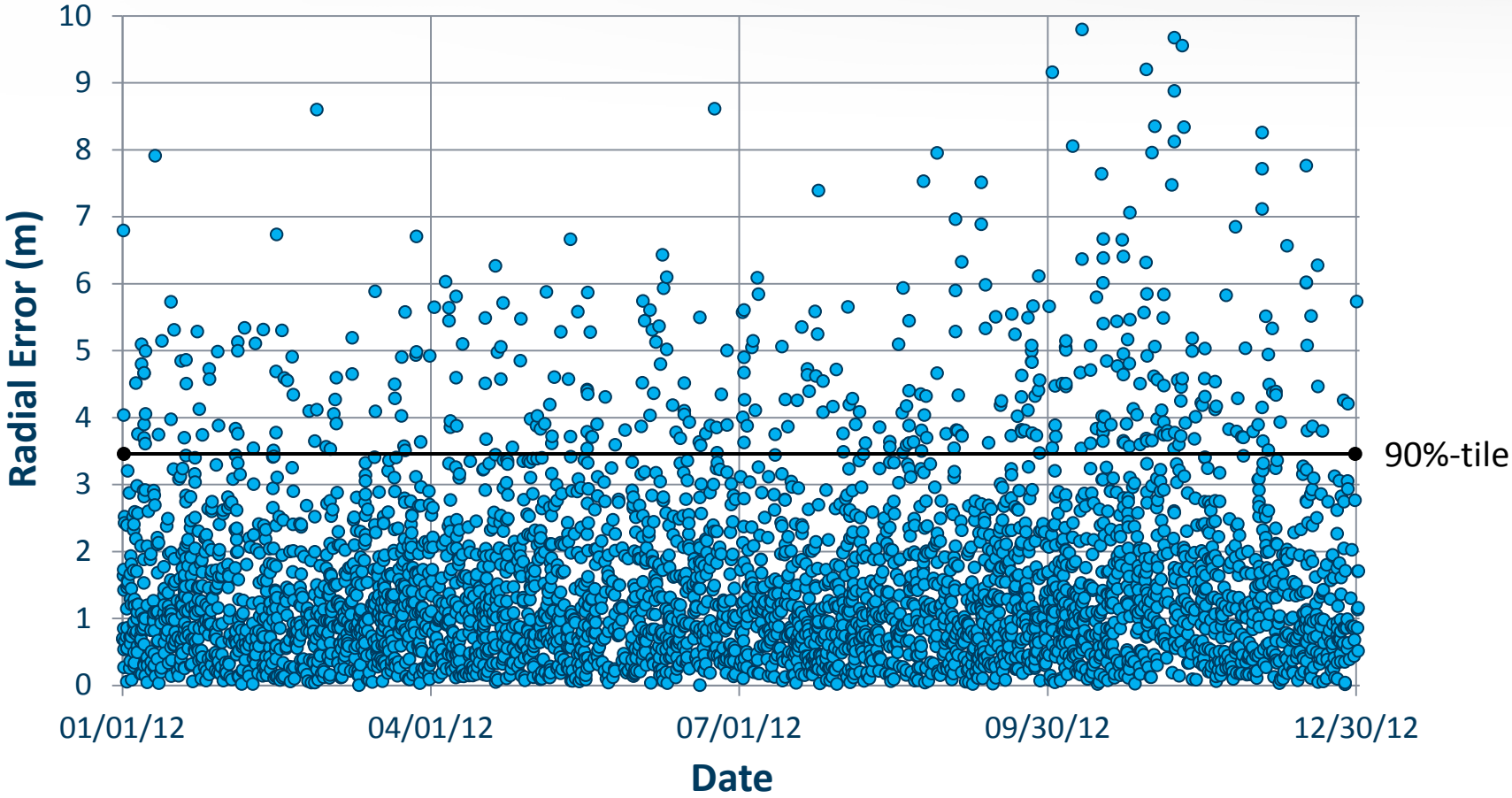
n = 4091

mean(Δϕ) = –0.4 m mean(Δλ) = –0.0 m

stdev(Δϕ) = 1.3 m stdev(Δλ) = 1.7 m



WorldView-2 Time Series of Mono Geolocation for 2012



GeoEye-1 Geolocation Accuracy Test Results

Period	Mono			Stereo				
	# images	CE90 (m)	*RMSE XY (m)*	# pairs	CE90 (m)	*RMSE XY (m)*	LE90 (m)	*RMSE H (m)*
2009 Q2-Q4	530	3.6	*2.3*	222	3.4	*2.2*	3.2	*2.0*
2010	136	3.8	*2.4*	65	3.5	*2.2*	3.5	*2.3*
2011	193	2.8	*1.9*	43	2.8	*1.9*	2.9	*1.8*
2012	120	3.0	*2.0*	28	2.6	*1.8*	2.7	*2.0*

- Based on rigorous (physical) model
- Direct positioning
  - No adjustment of imagery
- Typical collection geometry was up to 35 degrees off nadir angle and stereo convergence angle of 45 degrees

GeoEye-1 Mono Geolocation Accuracy for 2012

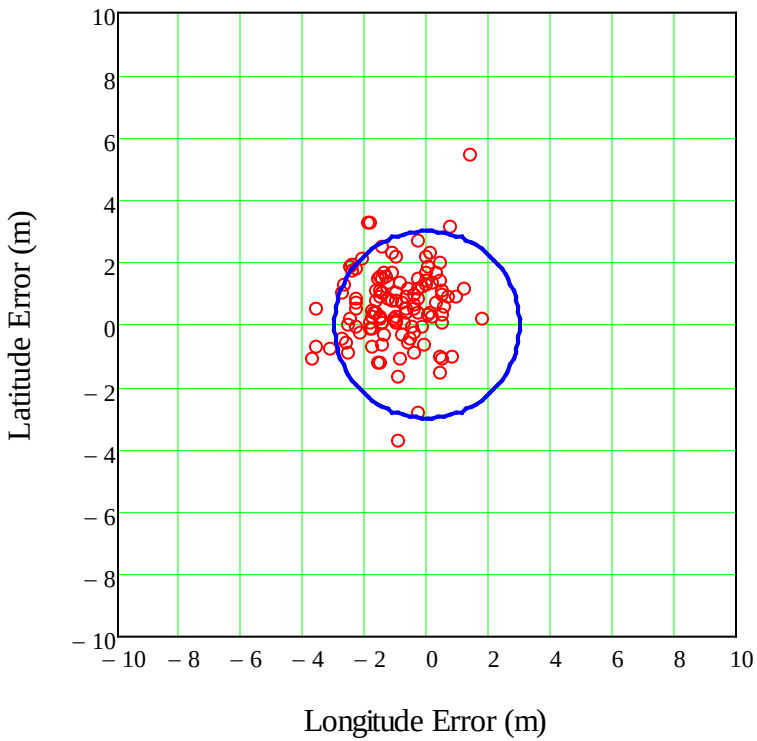
CE90 = 3.0 meters

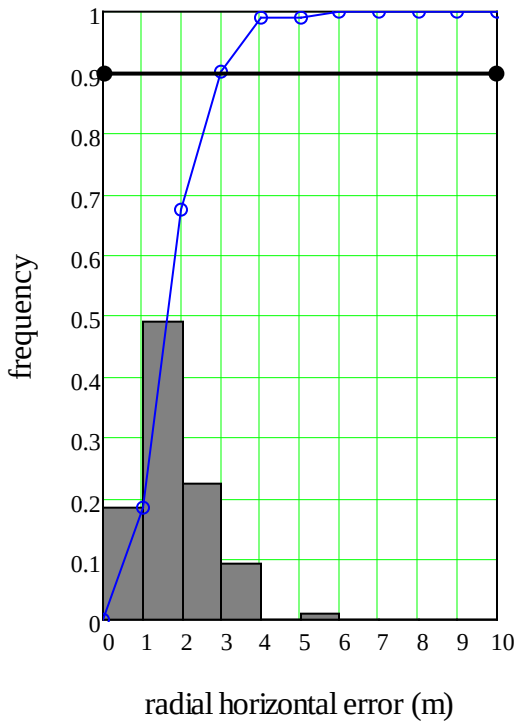
RMSE = 2.0 meters

$n = 120$

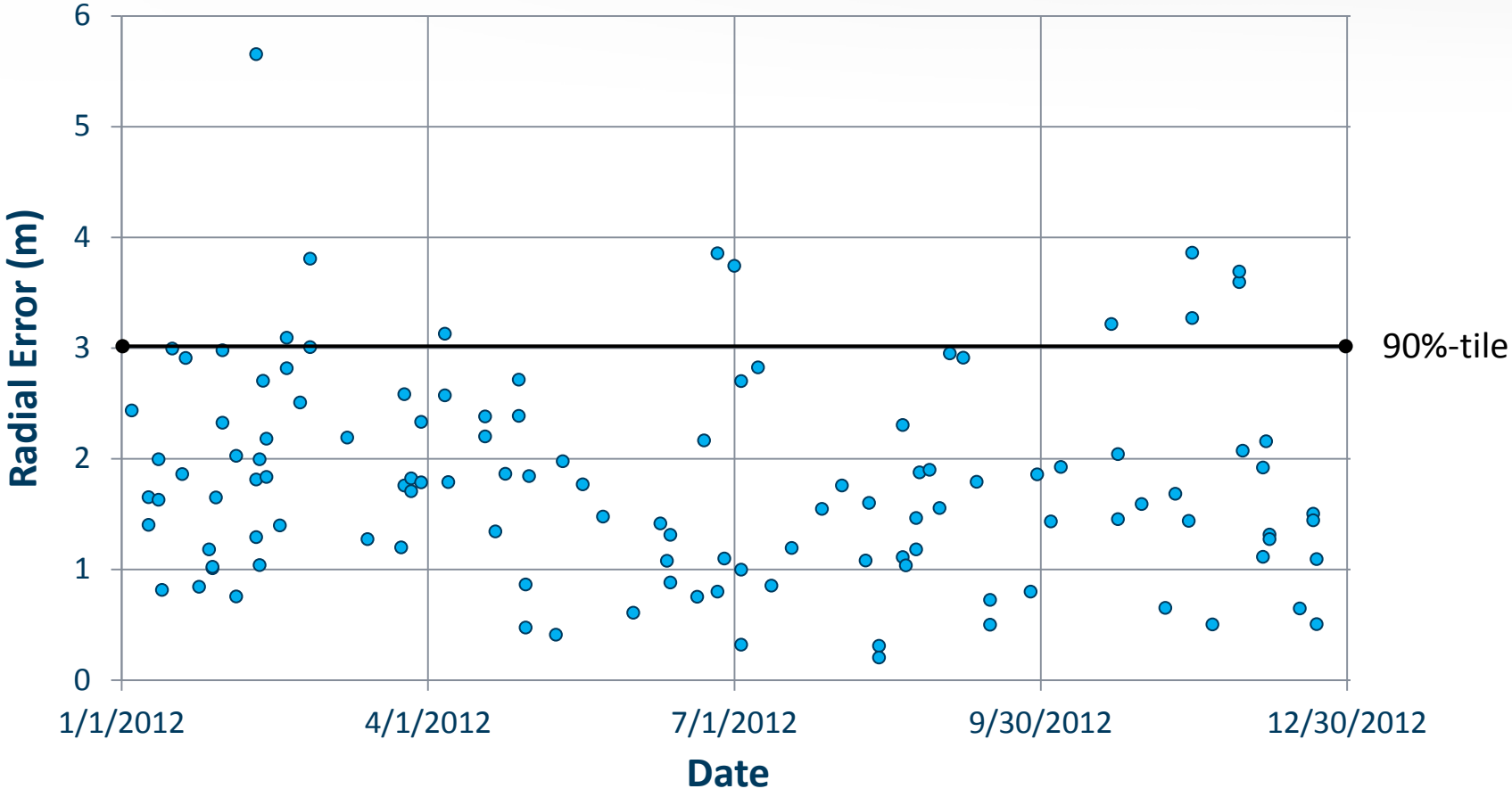
$\text{mean}(\Delta\phi) = 0.6\,\text{m}$ $\quad$ $\text{mean}(\Delta\lambda) = -1.0\,\text{m}$

$\text{stdev}(\Delta\phi) = 1.2\,\text{m}$ $\quad$ $\text{stdev}(\Delta\lambda) = 1.1\,\text{m}$





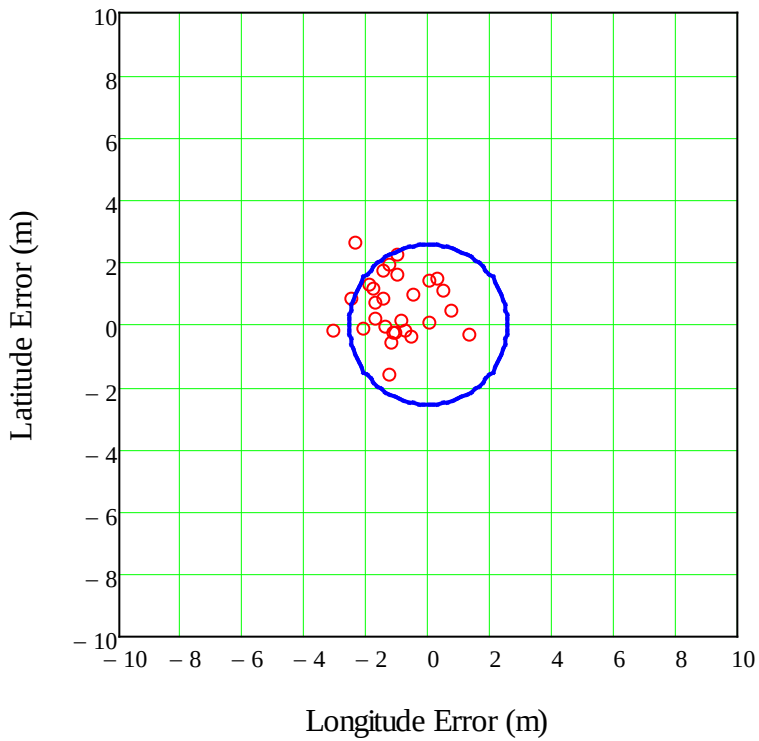
GeoEye-1 Time Series of Mono Geolocation for 2012



GeoEye-1 Stereo Geolocation Accuracy for 2012

CE90 = 2.6 meters

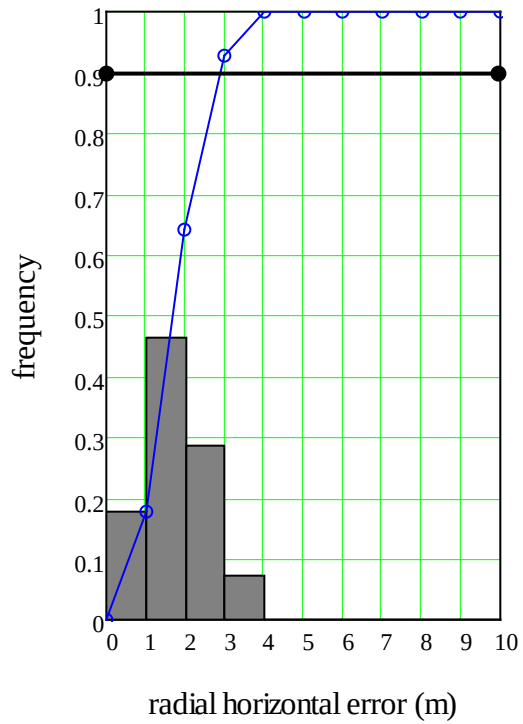
RMSE = 1.8 meters



n = 28

mean(Δϕ) = 0.6 m mean(Δλ) = −1.0 m

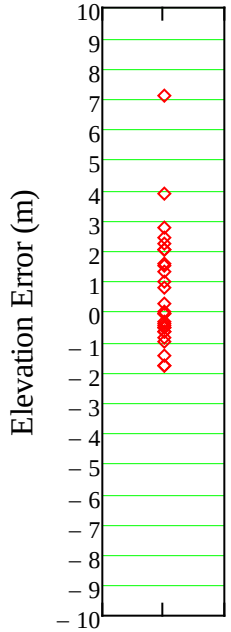
stdev(Δϕ) = 1.0 m stdev(Δλ) = 1.0 m



GeoEye-1 Stereo Geolocation Accuracy for 2012

LE90 = 2.7 meters

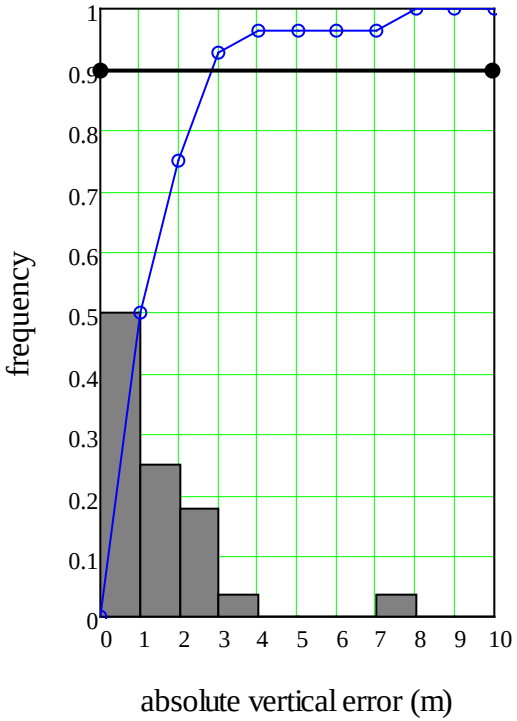
RMSE = 2.0 meters



$n = 28$

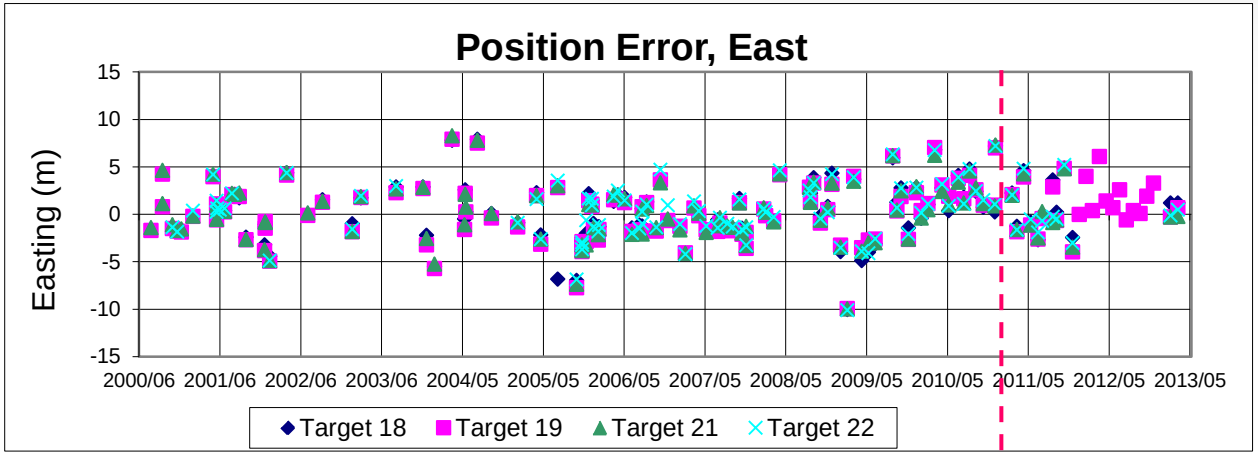
$\text{mean}(\Delta h) = 0.7\,\text{m}$

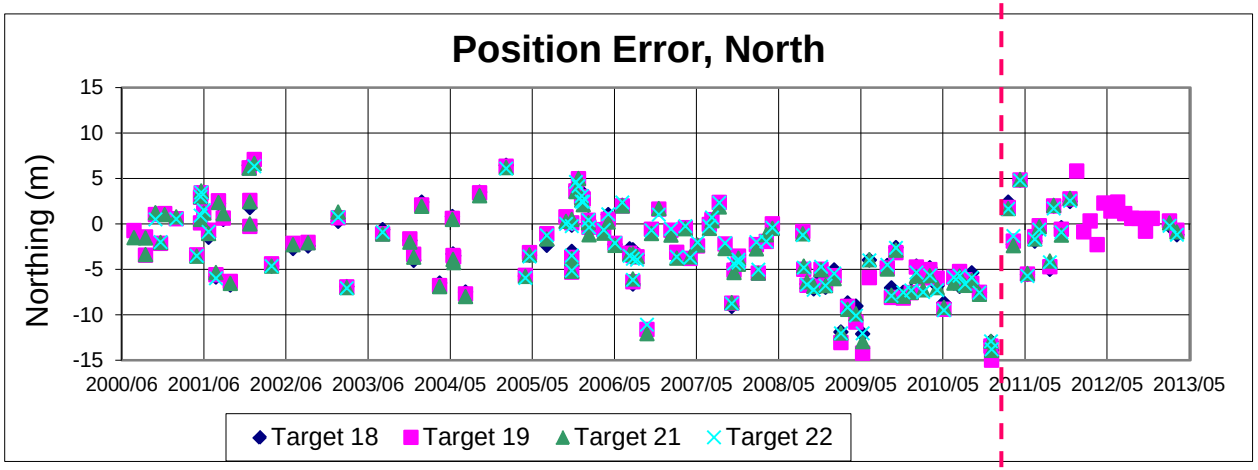
$\text{stdev}(\Delta h) = 1.9\,\text{m}$



IKONOS Metric Accuracy & Stability History

- Absolute Accuracy
  - How close the points are to zero error.
- Relative Accuracy
  - How close the points on a given date are to each other
- Stability
  - Consistency from year to year.
- Mission Accuracy
  - 8.2 m CE90 measured
  - 15 m CE90 specification





Interlock Adjusted 2011-03-14

Concluding Remarks

- The satellites continue to meet their geolocation accuracy product specifications.
- WV01, WV02, and GE-1 provide very good CE90 geolocation accuracy performance in the 3-4 meter range.

Team Acknowledgements

- QuickBird, WorldView-1, WorldView-2
  - Chris Comp and Woodson Bercaw
- GeoEye-1
  - David Mulawa and Waynette Turner
- IKONOS
  - Gene Dial

www.digitalglobe.com