



Geolocation Accuracy Monitoring of High Resolution Commercial Imagery

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Outline

- Background
- Products and Specifications
- Evaluation Results
- “The World Turned Upside Down”



Background

- In the past, geolocation accuracy evaluations performed during initialization phase or sometimes after known collection mode or product processor changes
- Over time, lack of sensor performance metrics
 - 2001: Last CCAP evaluation of IKONOS
 - 2003: Last CCAP evaluation of QuickBird
 - Early 2009: GeoEye-1 initialization by CCAP
- Established monitoring program
 - Mono images collected by NGA that happen to fall over test sites
 - Statistics tracked by quarter



Products

| Provider | Satellite* | Product | Geometry | Provider CE90 Specification (m)** |
|--------------|-------------|----------|---------------------|-----------------------------------|
| DigitalGlobe | QuickBird | Basic 1B | Synthetic Pushbroom | 23 |
| | WorldView-1 | Basic 1B | Synthetic Pushbroom | 6.5 |
| GeoEye | IKONOS | Geo | Plane-Rectified | 15 |
| | GeoEye-1*** | Basic | Synthetic Pushbroom | 5 |
| | | Geo | Plane-Rectified | |

* WorldView-2 added in 4th Quarter of 2010.

** At nadir, excluding terrain effects.

*** Basic and Geo products combined for statistics.



Monitoring Results

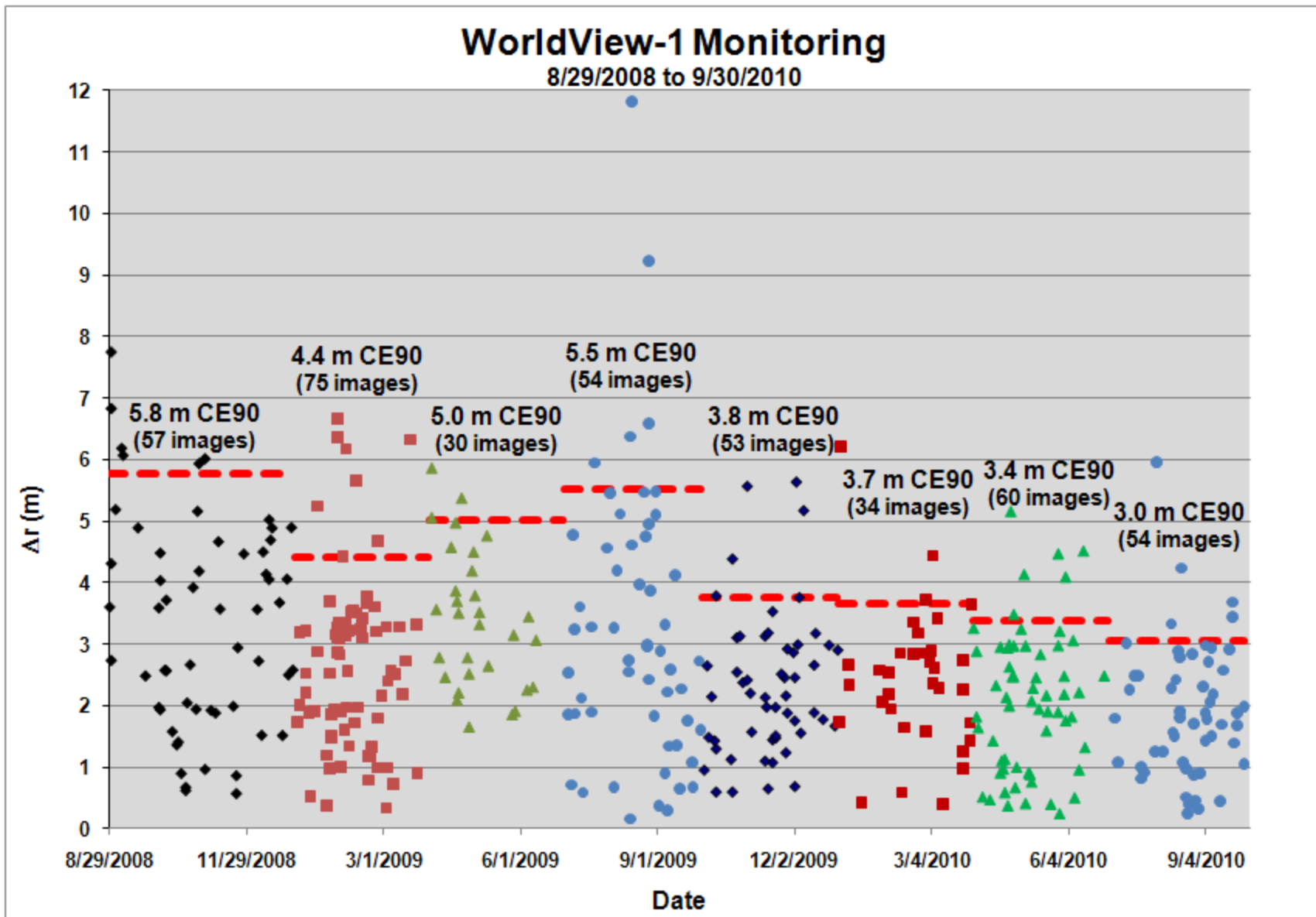


NIQU/CCAP Geolocation Accuracy Monitoring

| Quarter | Satellite | n | Assessed CE90 (m) |
|--------------|-------------|----|-------------------|
| 4th Qtr 2008 | WorldView-1 | 57 | 5.8 |
| 1st Qtr 2009 | WorldView-1 | 75 | 4.4 |
| 2nd Qtr 2009 | WorldView-1 | 30 | 5.0 |
| | GeoEye-1 | 14 | 3.8 |
| 3rd Qtr 2009 | WorldView-1 | 54 | 5.5 |
| | GeoEye-1 | 25 | 2.7 |
| 4th Qtr 2009 | WorldView-1 | 53 | 3.8 |
| | GeoEye-1 | 22 | 3.5 |
| | QuickBird | 21 | 17.5 |
| | IKONOS | 9 | 16.0 |

| Quarter | Satellite | n | Assessed CE90 (m) |
|--------------|-------------|----|-------------------|
| 1st Qtr 2010 | WorldView-1 | 34 | 3.7 |
| | GeoEye-1 | 39 | 5.0 |
| | QuickBird | 18 | 13.3 |
| | IKONOS | 16 | 17.8 |
| 2nd Qtr 2010 | WorldView-1 | 60 | 3.4 |
| | GeoEye-1 | 18 | 3.5 |
| | QuickBird | 37 | 16.3 |
| | IKONOS | 14 | 12.4 |
| 3rd Qtr 2010 | WorldView-1 | 54 | 3.0 |
| | GeoEye-1 | 20 | 3.8 |
| | QuickBird | 7 | 11.8 |
| | IKONOS | 15 | 15.2 |

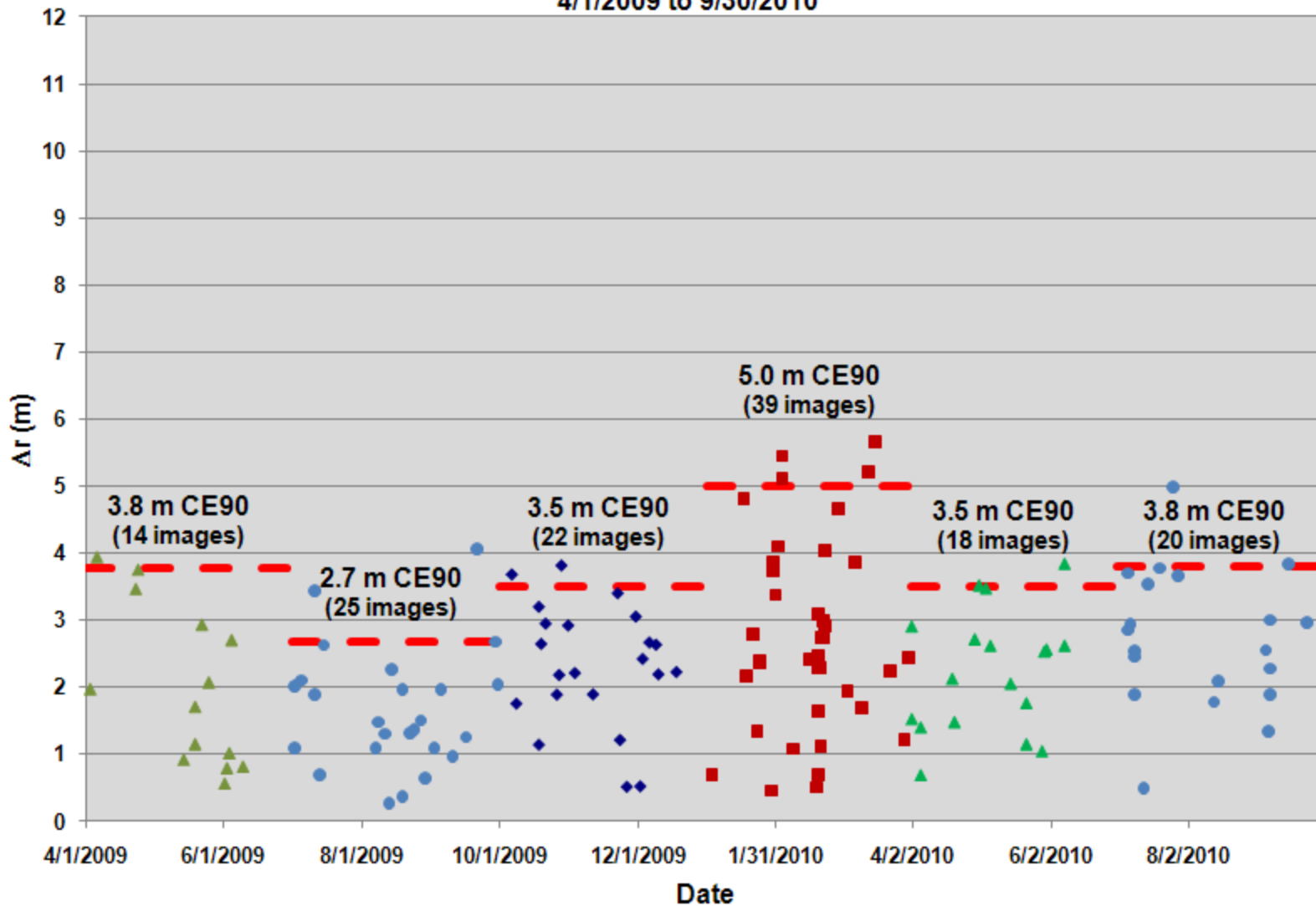
n is number of products

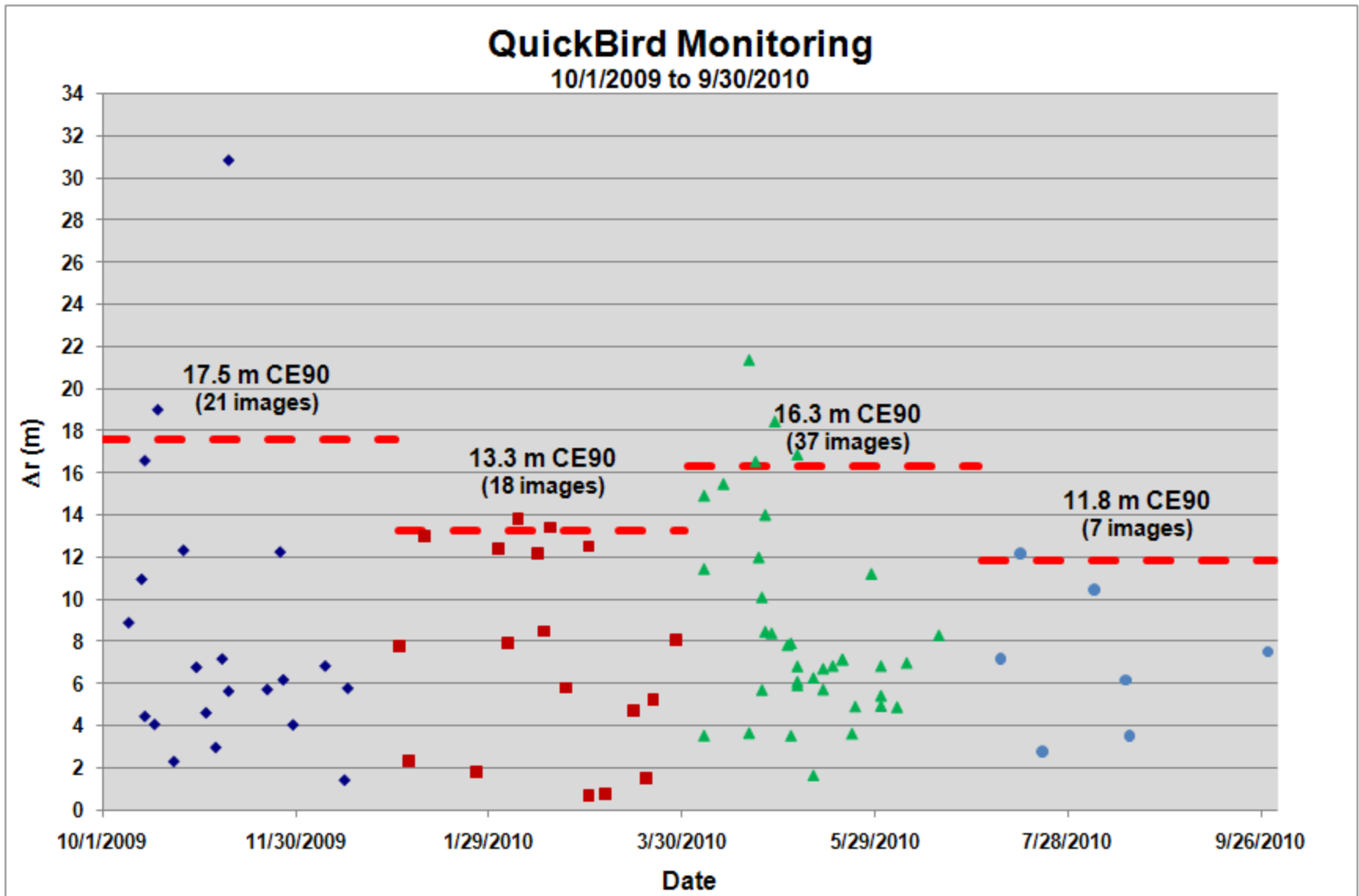


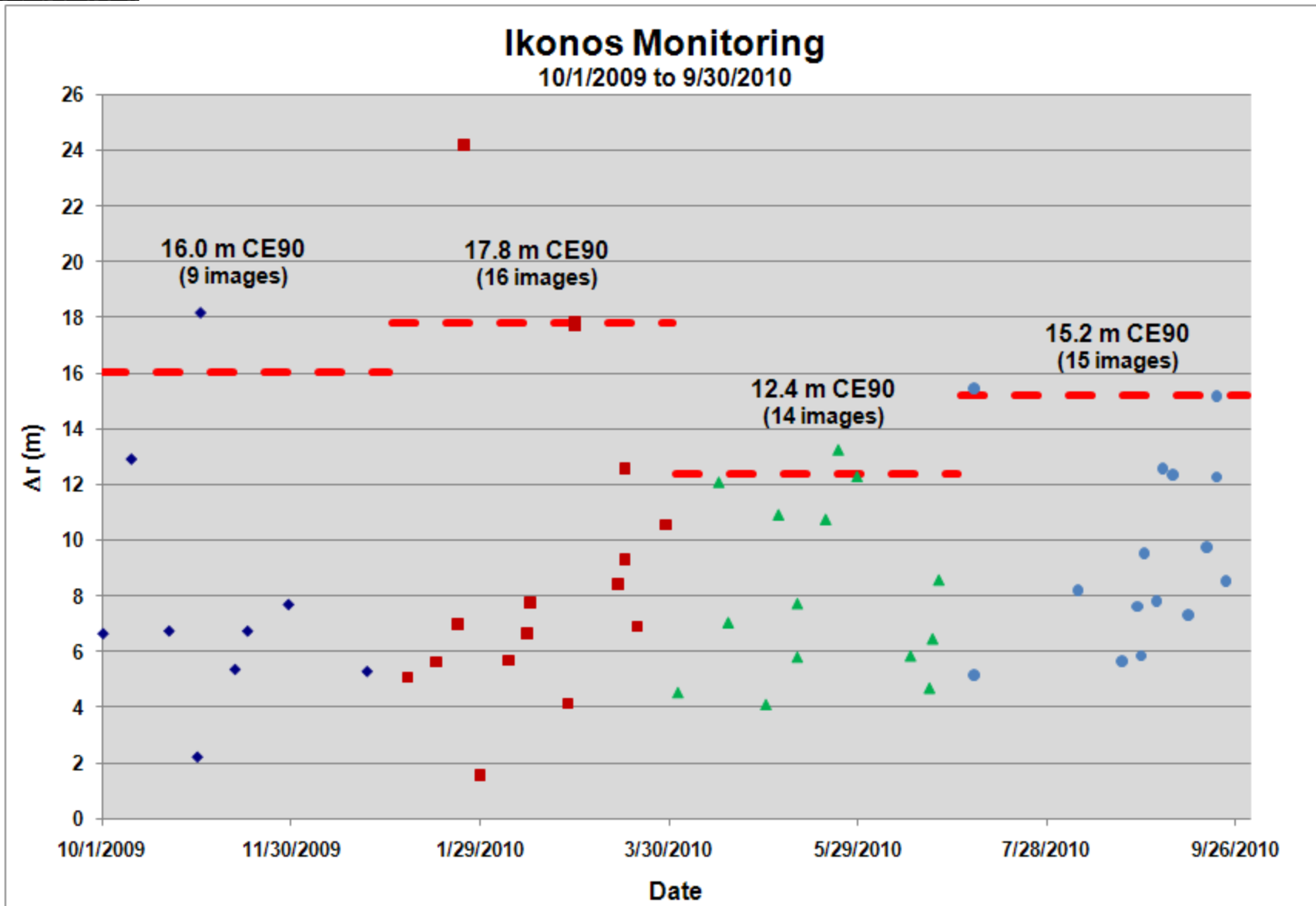


GeoEye-1 Monitoring

4/1/2009 to 9/30/2010

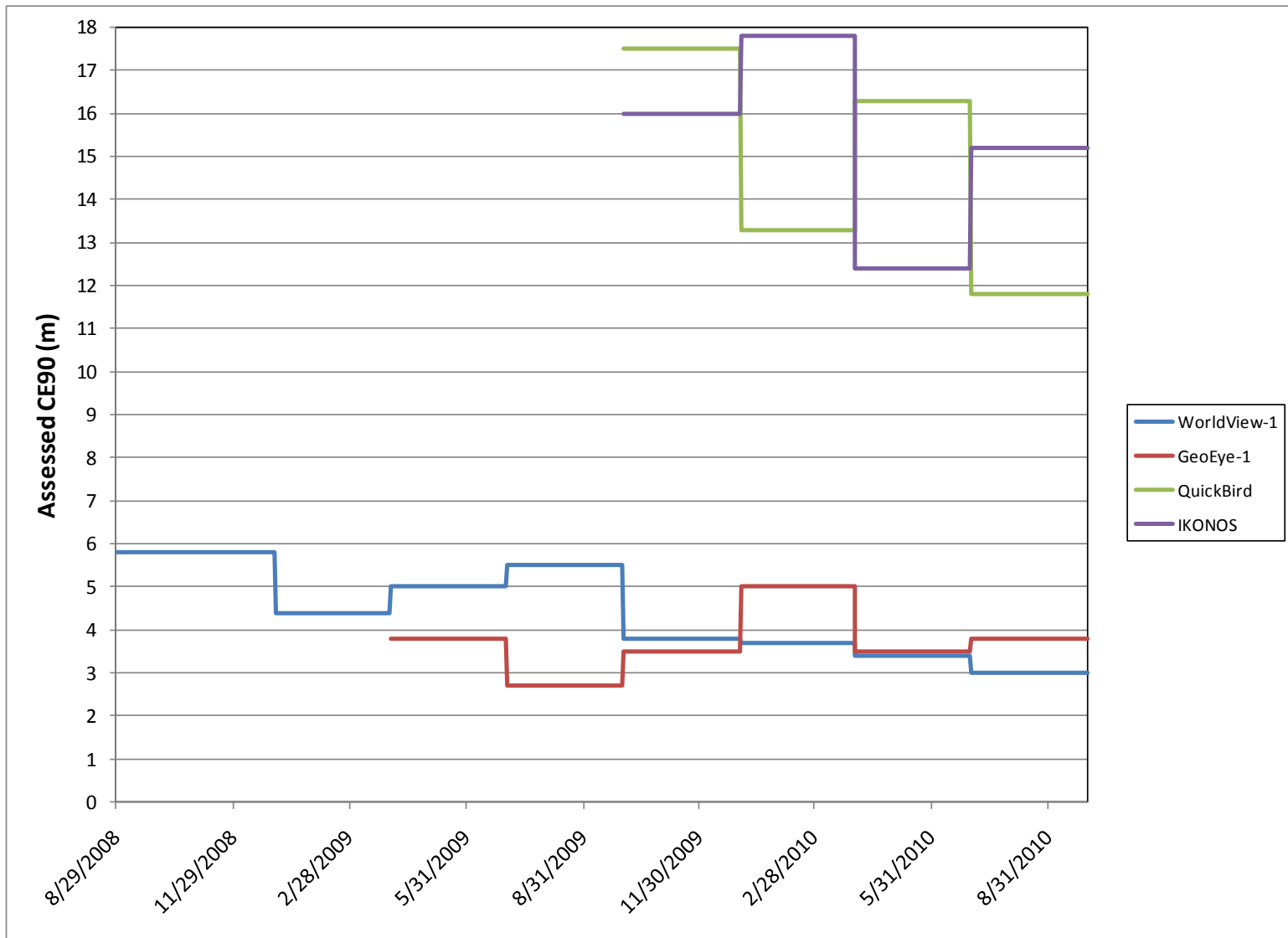








Geolocation Accuracy Monitoring Results





High Accuracy Imagery Used to Test Ground Control Points ("The World Turned Upside Down")

If buttercups buzz'd after the bee,...
If ponies rode men and if grass ate the cows,
And cats should be chased into holes by the mouse,...
If summer were spring and the other way round,
Then all the world would be upside down.



M8.8 Earthquake in Chile

(27 February 2010)

Continuously-Operating GPS Receivers

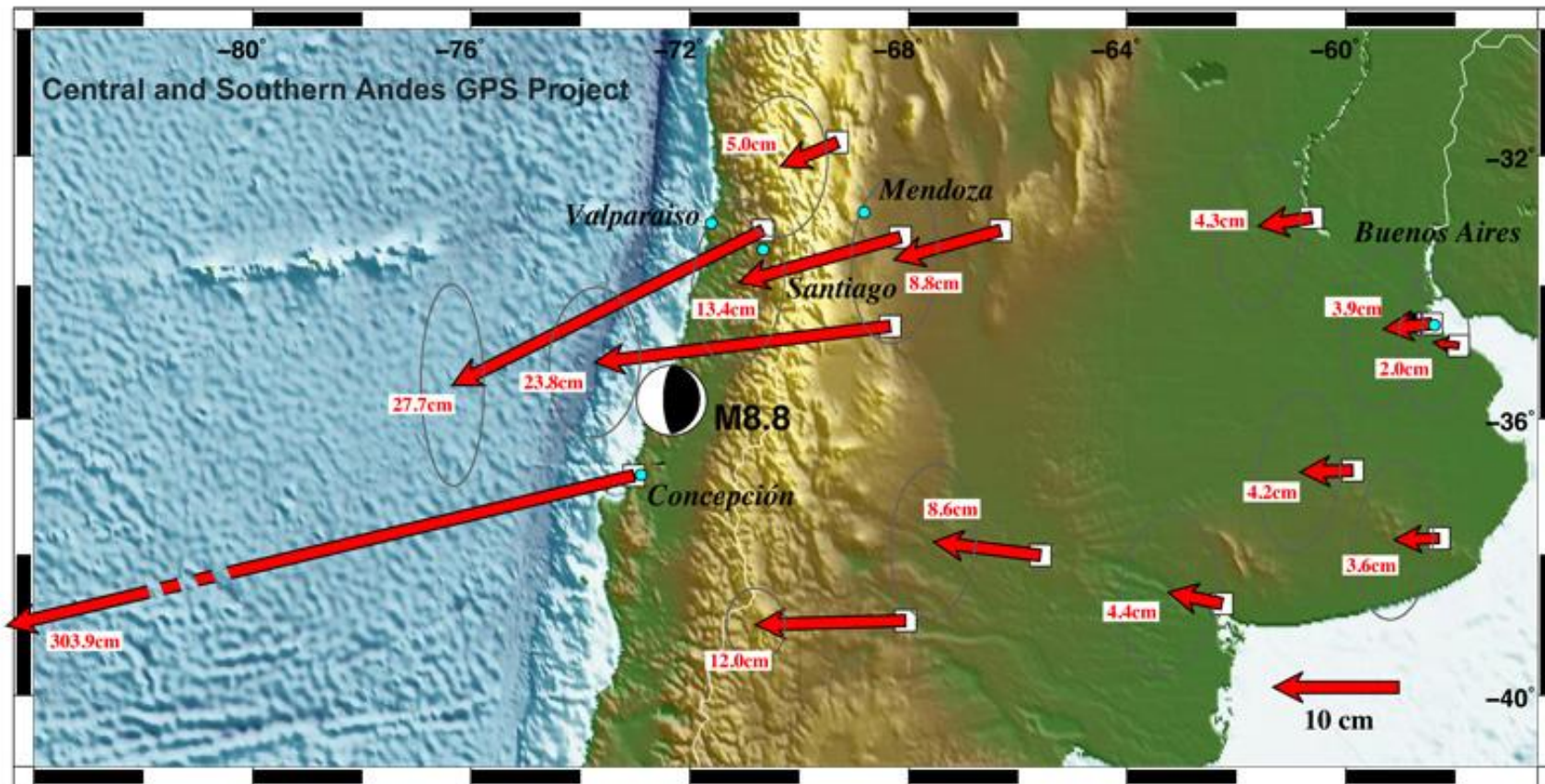
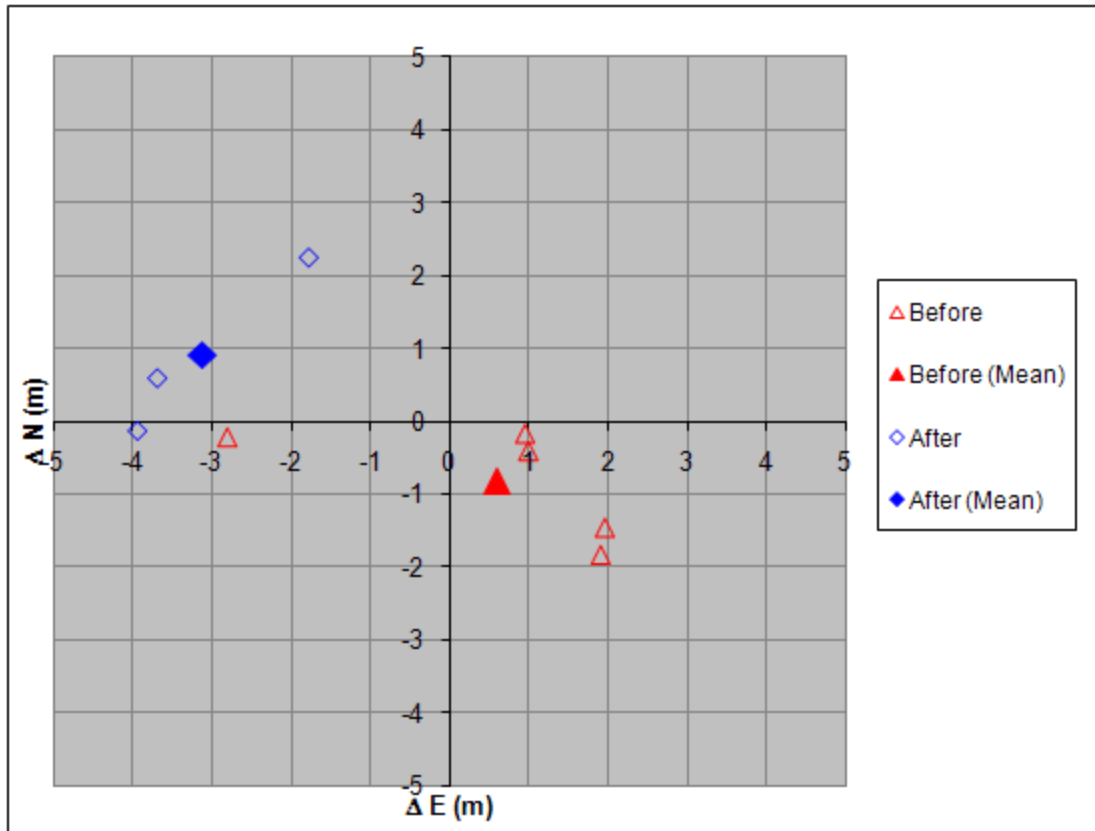


Image courtesy of Dr. Michael Bevis, Department of Earth Sciences, The Ohio State University. (Used with permission.)



Impact on Carriel Sur International Airport, Concepcion, Chile (TAGGS Test Site)



| Satellite | Date | Δ E (m) | Δ N (m) |
|-------------|-------------|---------|---------|
| WorldView-1 | 28-Jul-2008 | -2.8 | -0.2 |
| GeoEye-1 | 2-Sep-2009 | 1.0 | -0.4 |
| WorldView-1 | 2-Sep-2009 | 1.9 | -1.5 |
| GeoEye-1 | 10-Sep-2009 | 0.9 | -0.2 |
| WorldView-1 | 10-Sep-2009 | 1.9 | -1.8 |
| GeoEye-1 | 5-Mar-2010 | -1.8 | 2.2 |
| WorldView-1 | 8-Mar-2010 | -3.9 | -0.1 |
| WorldView-1 | 29-Mar-2010 | -3.7 | 0.6 |
| Mean | Before | 0.6 | -0.8 |
| | After | -3.1 | 0.9 |

- Preliminary Conclusion: Westerly shift detectable via apparent imagery geolocation errors; Test site not useable until re-surveyed.



Questions?



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