APPENDIX E: ACCURACY AND SENSITIVITY ASSESSMENT

MOBILE APPLICATION FOR GEOLOCATION OF IMAGERY AND COLLABORATION

MAGIC

Prepared By:
MAGIC Team
Jeff Carpenter
Thomas Haas
Dawin Wright
Erika Rojas Mejia

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Course Professor: Dr. Kathryn Laskey
Project Sponsor: Kurt Rogers, Integrity Applications Inc.

Objective

The system accuracies for the given two levels of uncertainty in the position and attitude data were analyzed at the 90% confidence level and the 50% confidence level. The goal was to identify the best and worst cases for system performance and determine whether position uncertainty or attitude uncertainty has a larger effect on the error estimate for the calculated POIs. For this study it is assumed that other error sources have been calibrated for or are negligible.

Scenarios

Case 1 assumes large GPS uncertainties, 4 meters for x, y and z and large attitude uncertainties 10 degrees uncertainty in azimuth and 5 degrees for pitch and roll.
Case 2 assumes small GPS uncertainties, 1 meter for x, y and z and small attitude uncertainties 1 degree uncertainty in azimuth and 0.5 degrees for pitch and roll.
Case 3 assumes small GPS uncertainties, 1 meter for x, y and z and large attitude uncertainties 10 degree uncertainty in azimuth and 5 degrees for pitch and roll.
Case 4 assumes large GPS uncertainties, 4 meters for x, y and z and small attitude uncertainties 1 degree uncertainty in azimuth and 0.5 degrees for pitch and roll.

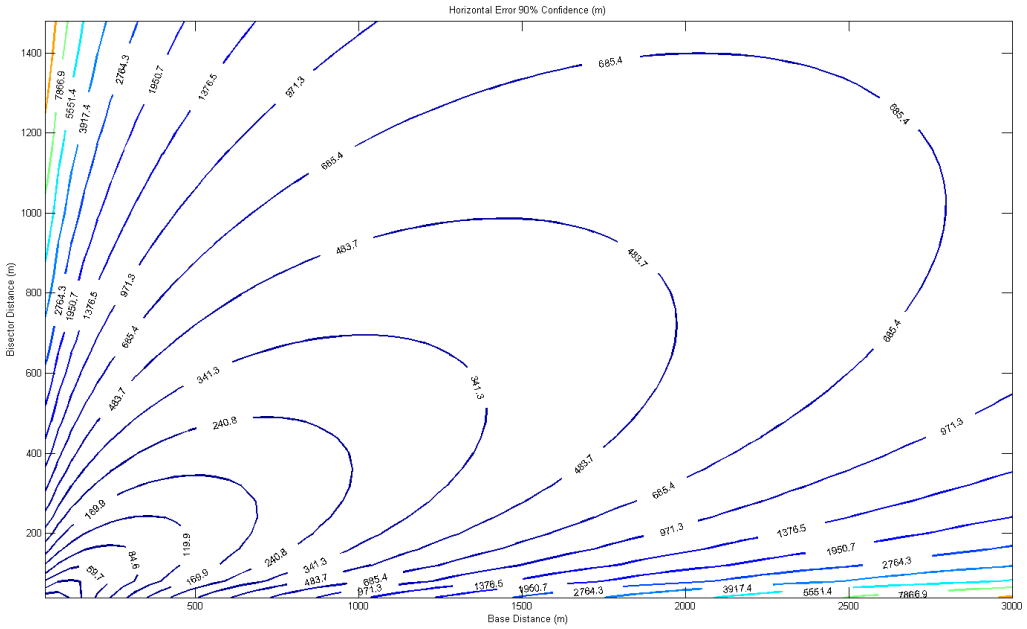
Observations

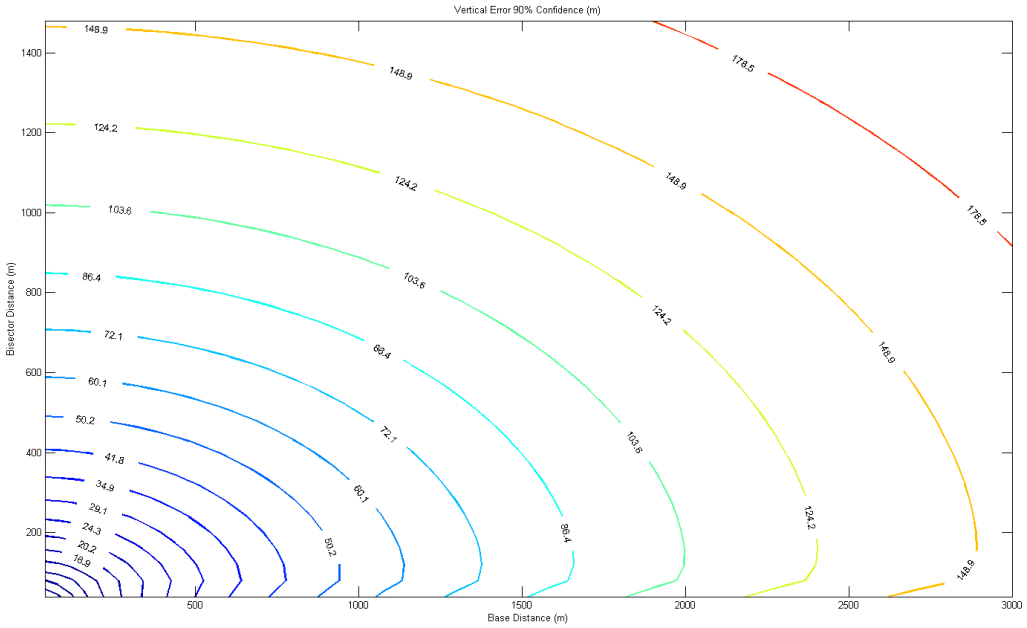
The vertical errors are much smaller than the horizontal error in every case. The vertical error is not dependant on azimuth whereas the horizontal error is heavily dependent on the azimuth.
The order of magnitude of the errors corresponds to the change in attitude uncertainties. In Case 1 the horizontal errors are large and are significantly reduced in Case 2 as expected. In Case 3 the attitude uncertainties are raised again while maintaining the low position uncertainties. The errors in case 3 are almost identical to those in Case 1. A similar correspondence is seen between Case 4 and Case 2.
These results indicate that for images with bisector and base distance larger than the GPS position uncertainties the accuracy of the geopositioning calculation is more dependent on the sensor attitude uncertainties than the position uncertainties.

Results

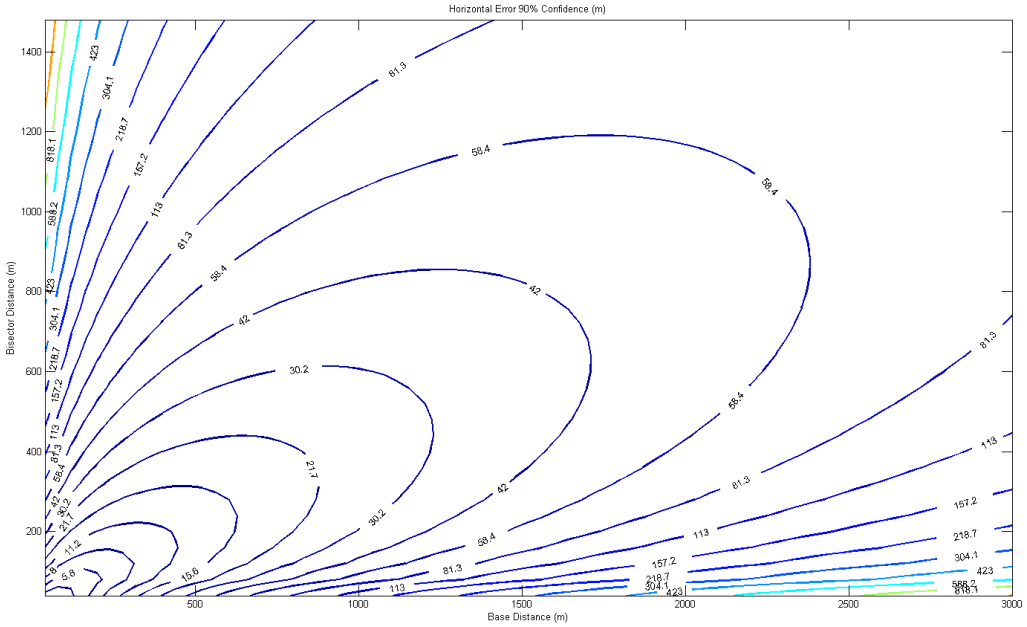
Horizontal and Vertical Error 90% Confidence

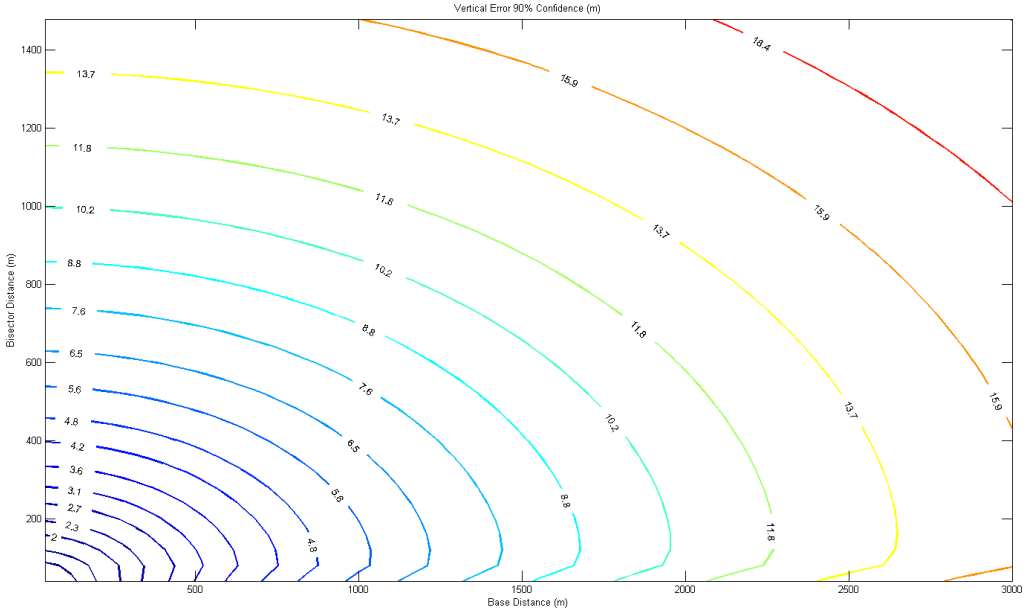
Case 1



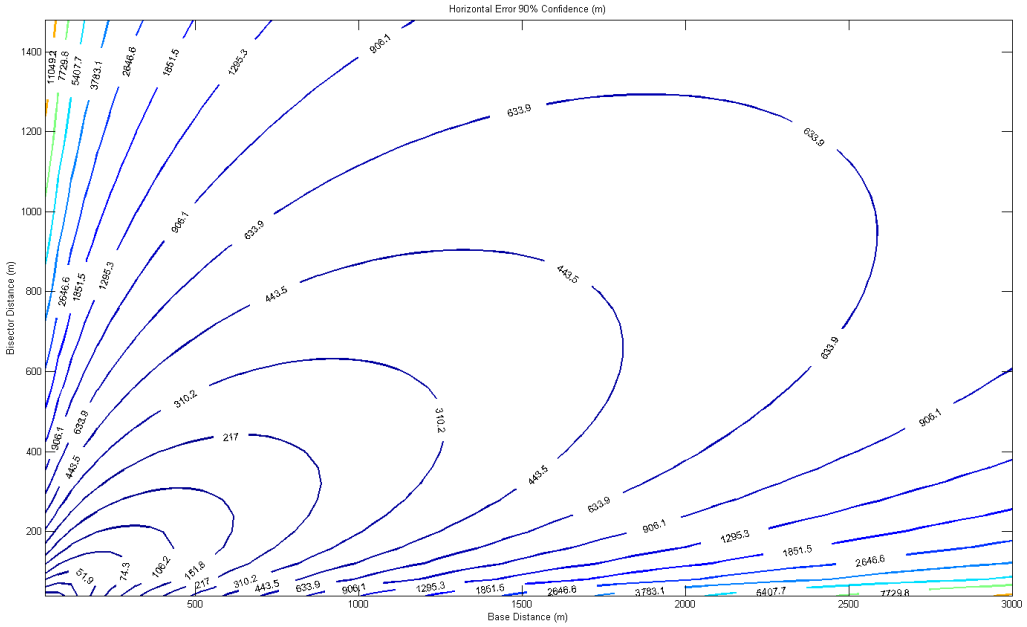


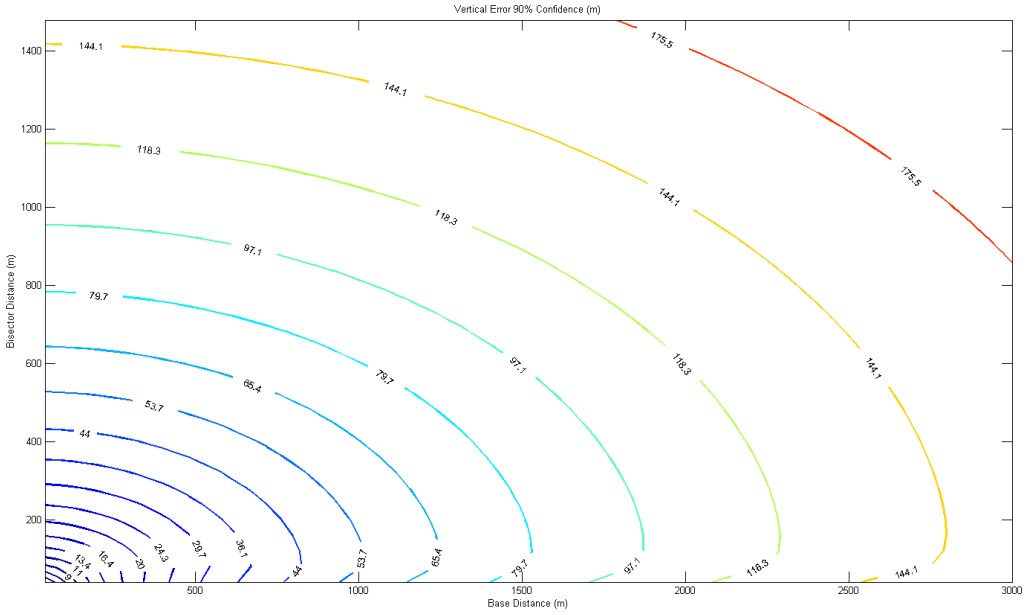
Case 2


Horizontal Error 90% Confidence (m)
Bisector Distance (m)
Base Distance (m)

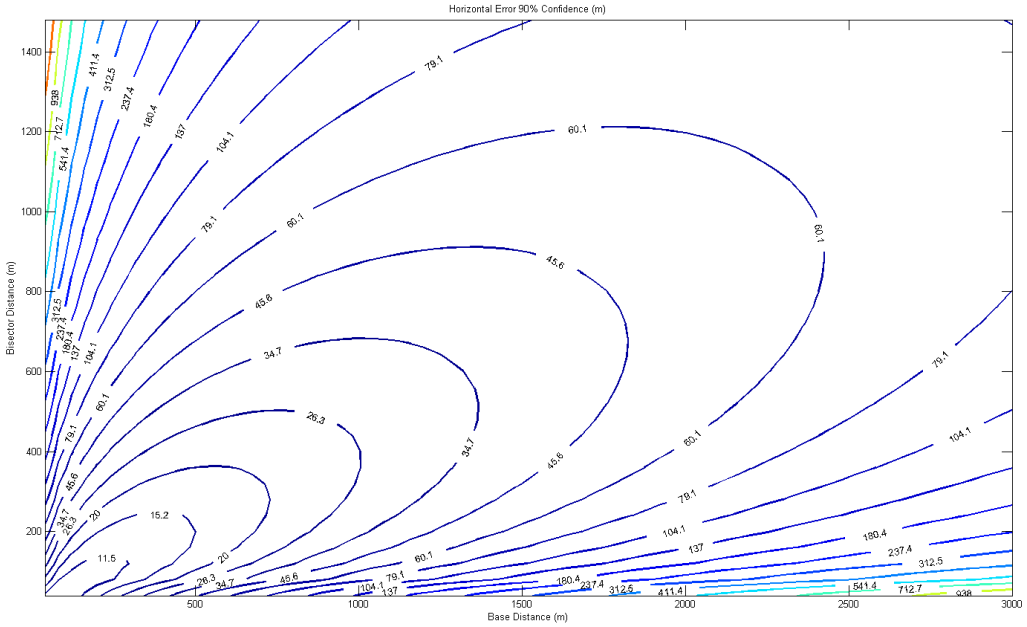

Vertical Error 90% Confidence (m)
Bisector Distance (m)
Base Distance (m)

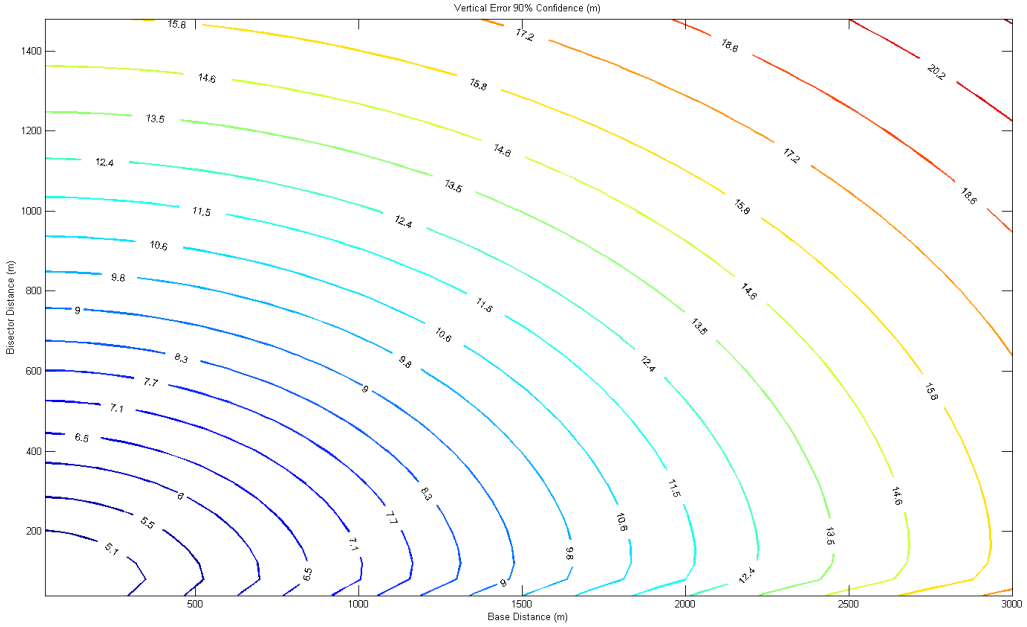
Case 3


Horizontal Error 90% Confidence (m)
Bisector Distance (m)
Base Distance (m)


Vertical Error 90% Confidence (m)
Bisector Distance (m)
Base Distance (m)

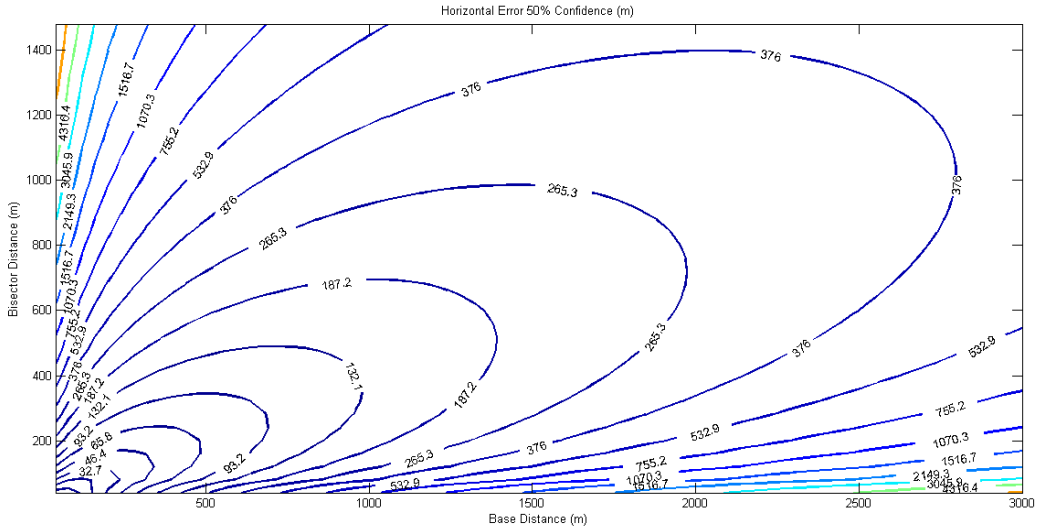
Case 4

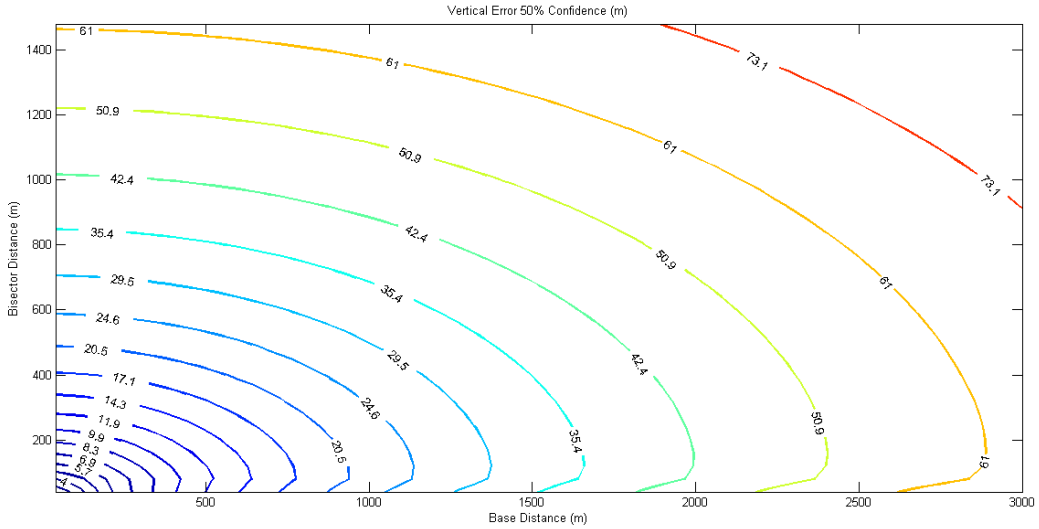

Horizontal Error 90% Confidence (m)
Bisector Distance (m)
Base Distance (m)


Vertical Error 90% Confidence (m)
Bisector Distance (m)
Base Distance (m)

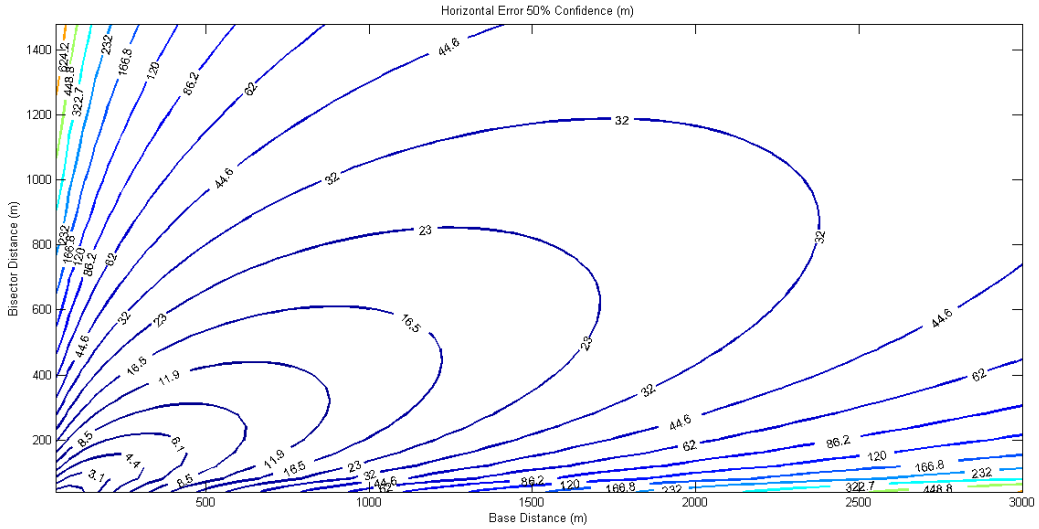
Horizontal and Vertical Error 50% Confidence

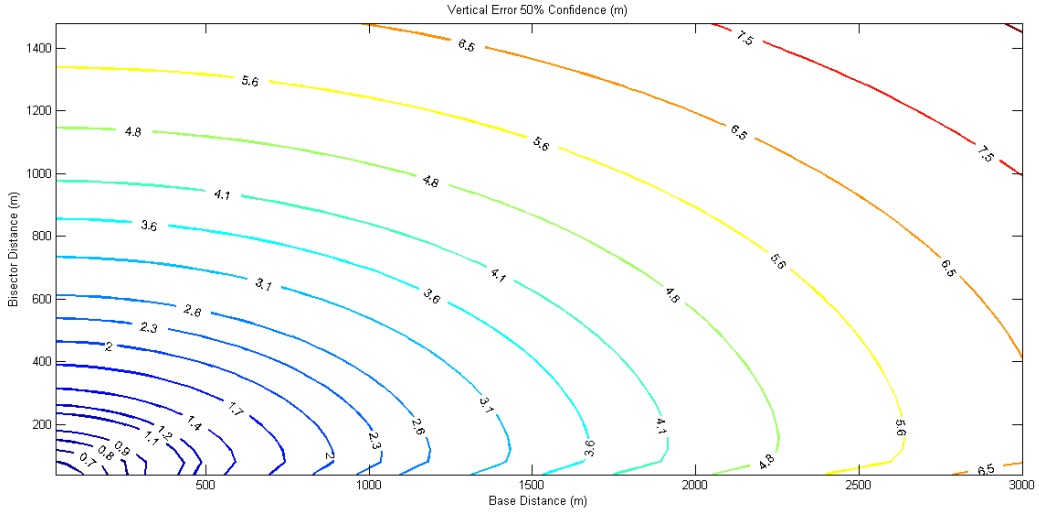
Case 1



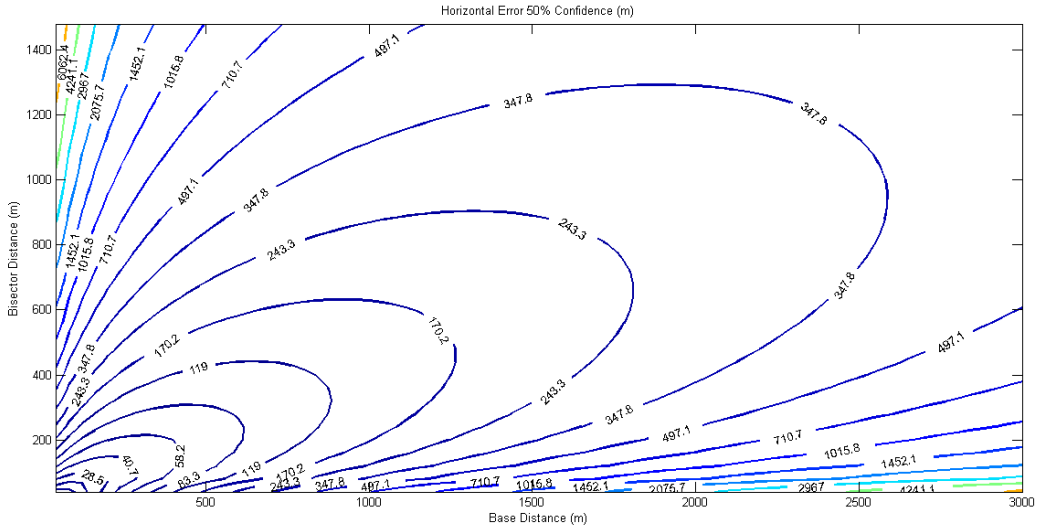


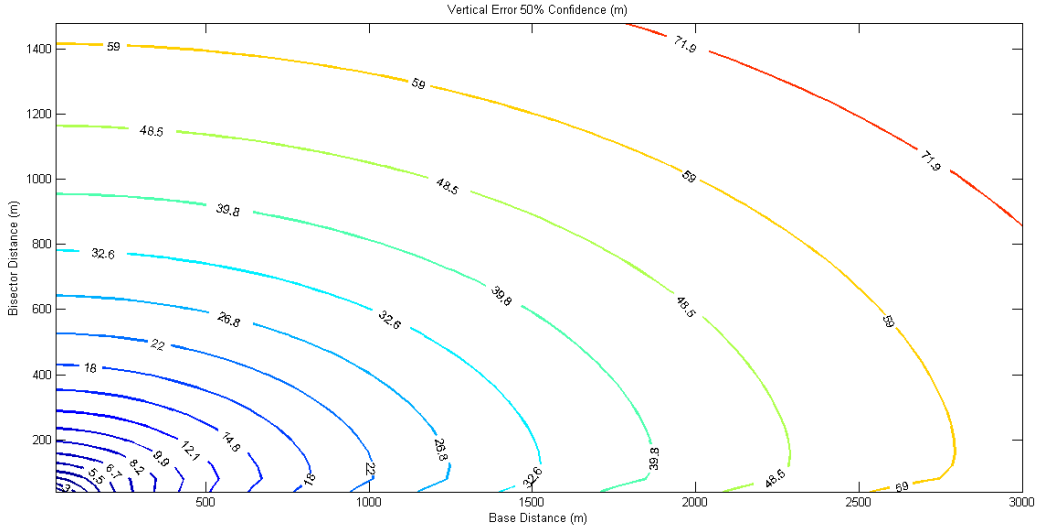
Case 2


Horizontal Error 50% Confidence (m)
Bisector Distance (m)
Base Distance (m)
200
400
600
800
1000
1200
1400
500
1000
1500
2000
2500
3000

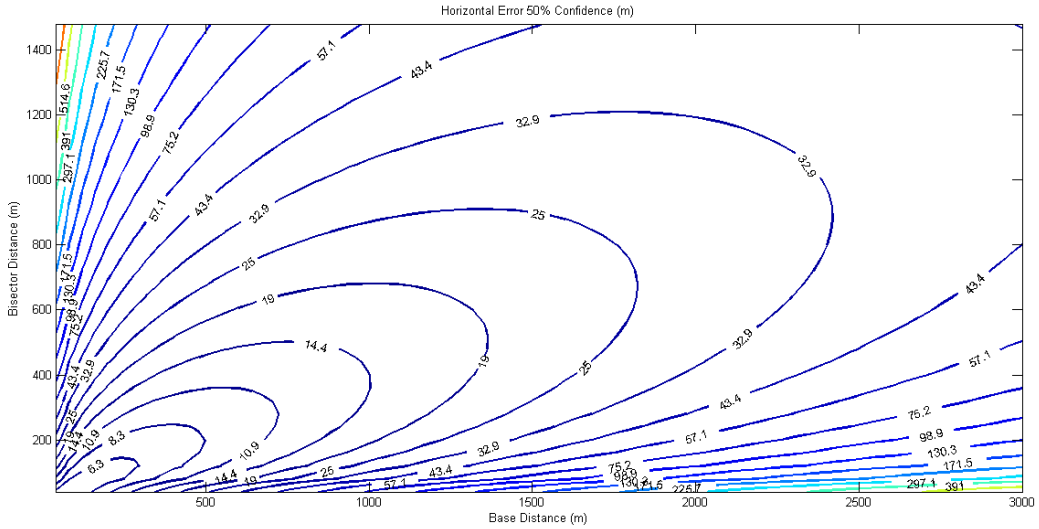

Vertical Error 50% Confidence (m)
Bisector Distance (m)
Base Distance (m)
200
400
600
800
1000
1200
1400
500
1000
1500
2000
2500
3000

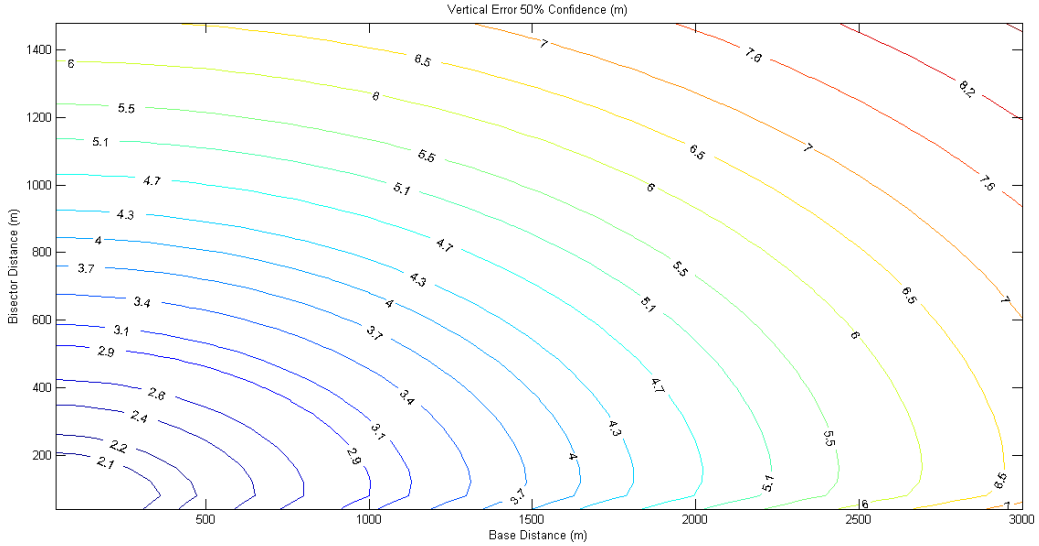
Case 3


Horizontal Error 50% Confidence (m)
Bisector Distance (m)
Base Distance (m)
1400
1200
1000
800
600
400
200
500
1000
1500
2000
2500
3000
6092.4
4241.1
2967
2075.7
1452.1
1015.8
710.7
497.1
347.8
243.3
170.2
119
83.3
58.2
40.7
28.5


Vertical Error 50% Confidence (m)
Bisector Distance (m)
Base Distance (m)
1400
1200
1000
800
600
400
200
500
1000
1500
2000
2500
3000
71.9
59
48.5
39.8
32.6
26.8
22
18
14.8
12.1
9.9
8.2
6.7
5.5

Case 4


Horizontal Error 50% Confidence (m)
Bisector Distance (m)
Base Distance (m)


Vertical Error 50% Confidence (m)
Bisector Distance (m)
Base Distance (m)