Exercises: Random errors

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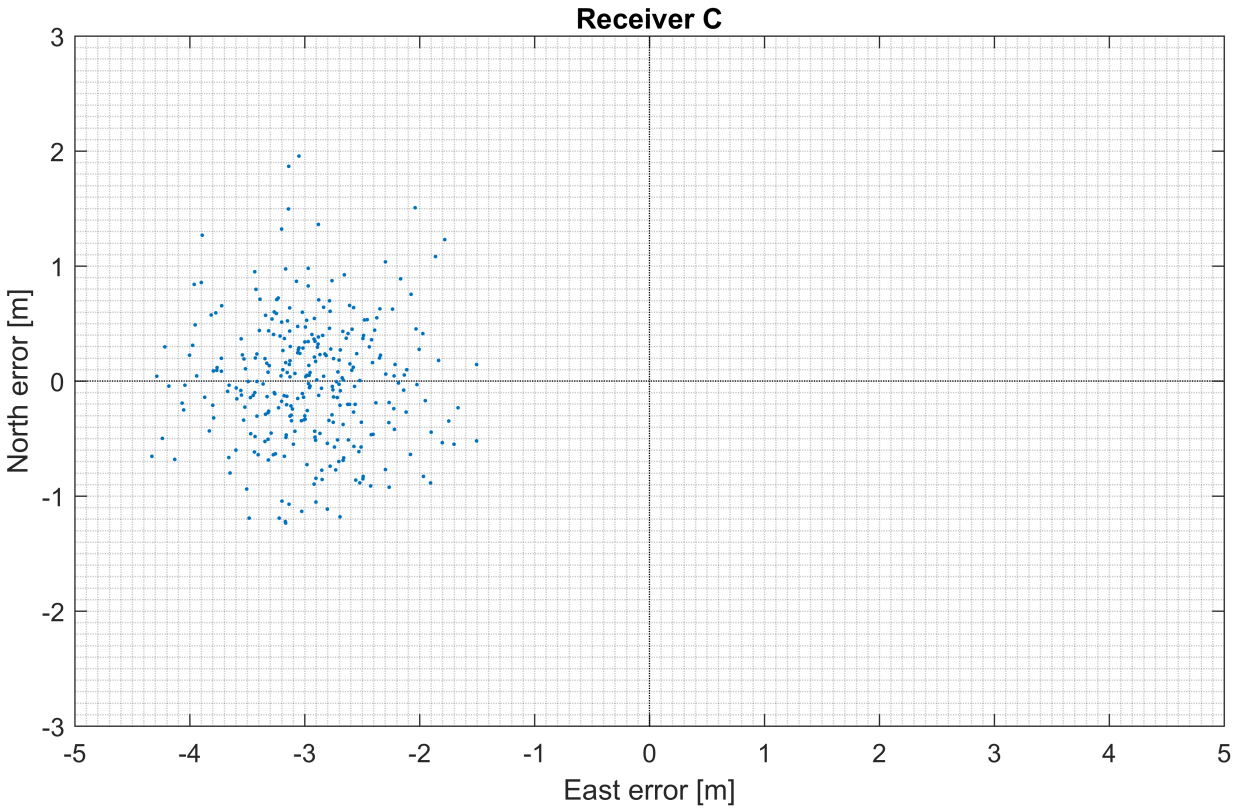
GPS positioning

5/5 points (ungraded)

The figure shows the errors in a set of estimated GPS positions. Values specific for this receiver may be graphicaly derived.

- 3. Least Squares Estimation (LSE)
- 4. Best Linear Unbiased Estimation (BLUE)
- Pre-knowledge Mathematics
- MATLAB Learning Content



1. What is the standard deviation for the East error (σ_E) (in meters)?

0.5 ✔ **Answer:** 0.5

2. What is the standard deviation for the North error σ_N (in meters)? (up to 1 digit)

0.5 ✔ **Answer:** 0.5

3. What is the absolute value of the mean error (in meters)?

3 ✔ **Answer:** 3

4. This mean error is due to:

a systematic bias ✔ **Answer:** a systematic bias

5. What is the probability that the absolute value of the North error is larger than σ_N?

0.32 ✔ **Answer:** 0.32

? **Hint (1 of 4):** Question 1: Only look at the values on the 'East-West' axis. The range from ± 1 times the standard deviation includes roughly 68% of all values. Next Hint

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✔ Correct (5/5 points)

OUTLIER INFLUENCE (EXTERNAL RESOURCE)

Outlier Influence

In this demo you will calculate the influence of one bad data point. What will happen to the mean and standard deviation? What will be the influence when you have only a small data set? To find out, finish the Matlab code below.

You may also copy the Matlab code below to the Matlab Online environment.

Your Solution

Save Reset MATLAB Documentation (https://www.mathworks.com/help/)

```
%% The following two lines will generate a random data set
%% with random errors, with variance of 0.3 m2
x        = mvnrnd(0,0.3,500);

%% task 1. compute the mean and standard deviations (std)
%% of the data set
x_mean   = mean(x)
x_std    = std(x)

%% Now we add a blunder (outlier) in the data.
x_outlier      = x;
outlier        = 10;
x_outlier(10)  = x_outlier(10)+outlier;

%% task 2. Find the new std and mean of the new data set with the blunder.
x_outlier_mean   = mean(x_outlier);
x_outlier_std    = std(x_outlier);

%% Now we shorten the data set to the first 10 entries. This will affect the
%% influence of the outlier on the mean and std.
x_outlier_10     = x_outlier(1:10);

%% task 3. Find the new std and mean of the shorter data set with the blunder.
```

```
x_outlier_10_mean= mean(x_outlier_10);
x_outlier_10_std = std(x_outlier_10);

%% task 4. Run the code and compare the means and standard deviations
%% You will see that the influence is larger in case of fewer observations.
```