Homework #4

Linear inverse problem.

Approximate the geometry of a subduction zone by fitting two-dimensional planes to the depth of earthquake hypocenters to (see Menke Fig. 3.6)

A. Load the earthquake data. Create the design matrix for a linear plane and estimate the three model parameters using a linear inversion. The function form of the plane is $z=m_0 + m_1*x + m_2*y$.
   Plot the hypocenters together with the inferred plane in 3 dimensions. Also plot the model-preducted depth versus the observed depth. Is the linear plane an appropriate model for this problem?

   For the 3D plot use some transparency for the plane (alpha=0.5) so that you still can see the earthquakes. Also, use %matplotlib widget to manually rotate the 3D plot.

B. Same as A) but use a quadratic plane in x direction: $z=m_0 + m_1*x + m_2*y + m_3*x*y + m_4*x^2$. Also try a quadratic plane in y direction. Is this model appropriate for this problem? Is this still a linear model?

Note: we could utilize a Chi-Square test to the residuals to determine whether the residuals are Gaussian distributed, i.e. whether the model is a good fit (assuming errors are Gaussian).