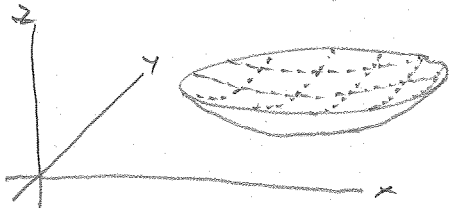
Adj. Geospa. Obs. Homework 2 (matrix solutions!)

assigned 14 Sep 2016, due 1 week, 21 Sep.

1. 

Fit the 89 observations in the accompanying data file to a circular paraboloid, by L.S. (ind. obs.) $\sigma_z = 0.002$

$$Z = a(x^2+y^2) + bx + cy + d$$

Z = observation (equal precision)

x, y = constant

* show residuals, do they seem consistent with σ_z ?

Compute the focal point.

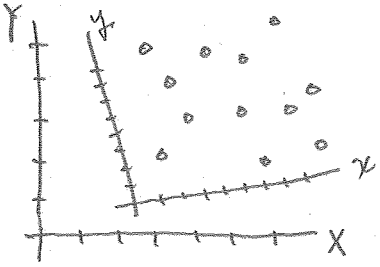
2. $$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} 1 & 0 \\ \delta & 1 \end{bmatrix} \begin{bmatrix} \lambda_x & 0 \\ 0 & \lambda_y \end{bmatrix} \begin{bmatrix} X \\ Y \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \end{bmatrix}$$ physical 6-par model (non linear)

$$x = [(\cos\theta + \underbrace{\delta}_{a}\sin\theta)\lambda_x]X + [\underbrace{\sin\theta\cdot\lambda_y}_{b}]\cdot Y + [\underbrace{t_x}_{e}]$$

$$y = [\underbrace{(-\sin\theta + \delta\cos\theta)\lambda_x}_{c}]X + [\underbrace{\cos\theta\,\lambda_y}_{d}]Y + [\underbrace{t_y}_{f}]$$

} replacement model (linear)

given a, b, c, d, e, f show how you can obtain $\theta, \delta, \lambda_x, \lambda_y, t_x, t_y$.

3. 

12 points are given in 2 systems XY and xy.

XY = constant, xy = observed

find the data in accompanying file.

$\sigma_x, \sigma_y = .25$ for points 1–8

$\sigma_x, \sigma_y = .10$ for points 9–12

solve the LS problem using the affine transf. model & indirect obs.

* again...

4. find the photographs (annotated photographs) in accompanying file. Use the linear version of the 8-par transf. to solve for the transf parameters, by LS ind. obs.

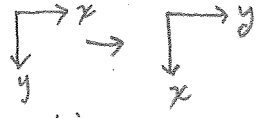
$$x = \frac{a_0 + a_1X + a_2Y}{1 + c_1X + c_2Y}$$

$$y = \frac{b_0 + b_1X + b_2Y}{1 + c_1X + c_2Y}$$

#	X	Y
1	0.00	0.00
2	32.00	0.00
3	32.00	23.00
4	0.00	23.00
5	23.22	9.49
6	10.13	16.37

constant

You observe x, y using photoshop



what is $\sigma_{x,y}$?