

Effect of statistical analysis parameters

Stefano Migliorini & Amos Lawless

Effect of statistical analysis parameters: Definitions

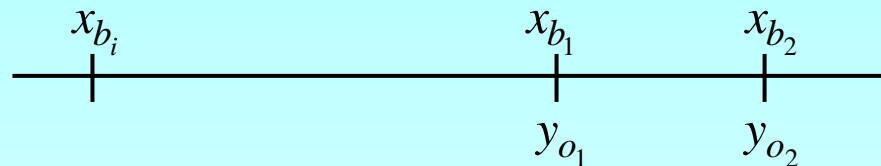
- Optimal interpolation:

$$\mathbf{x}_a = \mathbf{x}_b + \mathbf{B}\mathbf{H}^T (\mathbf{H}\mathbf{B}\mathbf{H}^T + \mathbf{R})^{-1} (\mathbf{y}_o - \mathbf{H}\mathbf{x}_b)$$

$$\mathbf{B}_{ij} = \sigma_b^2 \mu_{b_{ij}} \quad \mu_{b_{ij}} = (1 + r_{b_{ij}} / L_b) \exp(-r_{b_{ij}} / L_b)$$

$$\mathbf{R}_{ij} = \sigma_y^2 \mu_{y_{ij}} \quad \mu_{y_{ij}} = (1 + r_{y_{ij}} / L_y) \exp(-r_{y_{ij}} / L_y)$$

\mathbf{H} is a simple interpolation operator



$$x_{a_i} = x_{b_i} + W [\mu_{b_{i1}} ((y_{o_1} - x_{b_1}) - C(y_{o_2} - x_{b_2})) + \mu_{b_{i2}} ((y_{o_2} - x_{b_2}) - C(y_{o_1} - x_{b_1}))]$$

$$C = \frac{(\sigma_b^2 \mu_{b_{12}} + \sigma_y^2 \mu_{y_{12}})}{(\sigma_b^2 + \sigma_y^2)} \quad W = \frac{\sigma_b^2}{\sigma_b^2 + \sigma_y^2} (1 - C^2)^{-1}$$

Effect of statistical analysis parameters: Example

- ANALYSIS_2OBS

Constructs 1-D analysis from 2 idealised obs with specified values and error characteristics

You may change the analysis parameters at the prompt, or press ENTER to retain previous values

- Current value o1 of ob#1 1.00000
- New o1 (between -2 and +2):
- Current position x1 of ob#1 4.00000
- New x1 (between 0 and 10):
- Current value o2 of ob#2 -1.00000
- New o2 (between -2 and +2):
- Current position x2 of ob#2 6.00000
- New x2 (between 0 and 10):



Effect of statistical analysis parameters: Example

- Observation error σ_y (used for both obs) **1.00000**

- New σ_y :

The observation error correlation depends on the distance between obs

- Current observation error correlation length L_y : **0.00000**

- New L_y (put $L_y = 0.0$ for uncorrelated errors):

- Background error σ_b (constant) **1.00000**

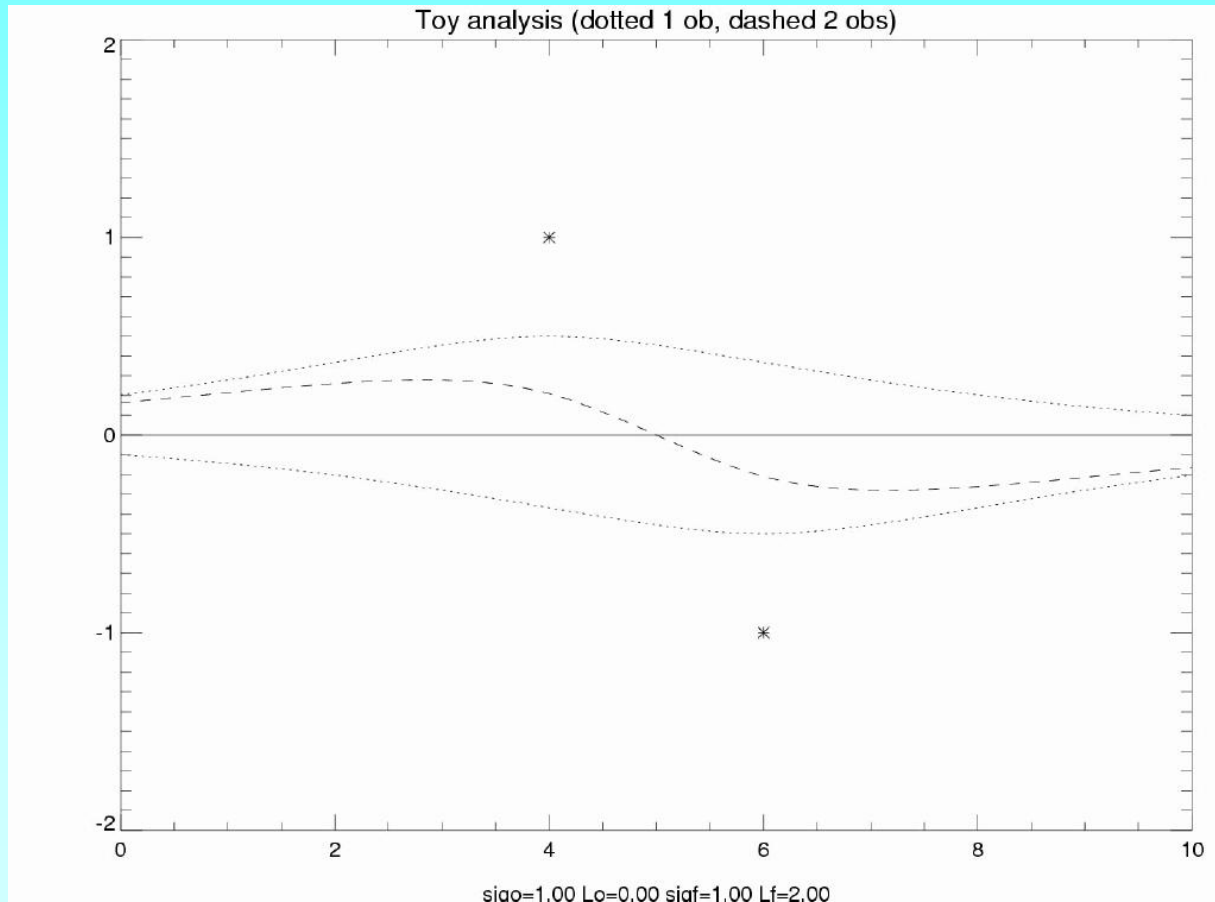
- New σ_b :

- Background error correlation length L_b **2.00000**

- New L_b (put $L_b = 0.0$ for uncorrelated errors):



Effect of statistical analysis parameters: Example



Effect of statistical analysis parameters: Example

- `ANALYSIS_MOBS`

Constructs 1-D analysis from multiple idealised obs with specified values and error characteristics

- In this programme, we use two different ob types (A and B).
- The number of obs of each type should be in range 0 to 7.
- Press ENTER to retain previous values

- You may specify two separate observation types (A and B)
- Different observation types have different error characteristics



Effect of statistical analysis parameters: Example

- TYPE-A OBSERVATIONS

- Number of type A obs, noa: 3
- New noa (up to 7; 0 if none):
- Current type A ob locations 5.00000 4.00000 6.00000
- Current type A ob values 1.00000 1.00000 1.00000
- Do you want to change them (y or n)? n
- New type-A ob locations 5.00000 4.00000 6.00000
- New type-A ob values 1.00000 1.00000 1.00000
- Observation error for type A, σ_{yA} : 2.00000
- Observation error correlation length L_{yA} : 0.00000



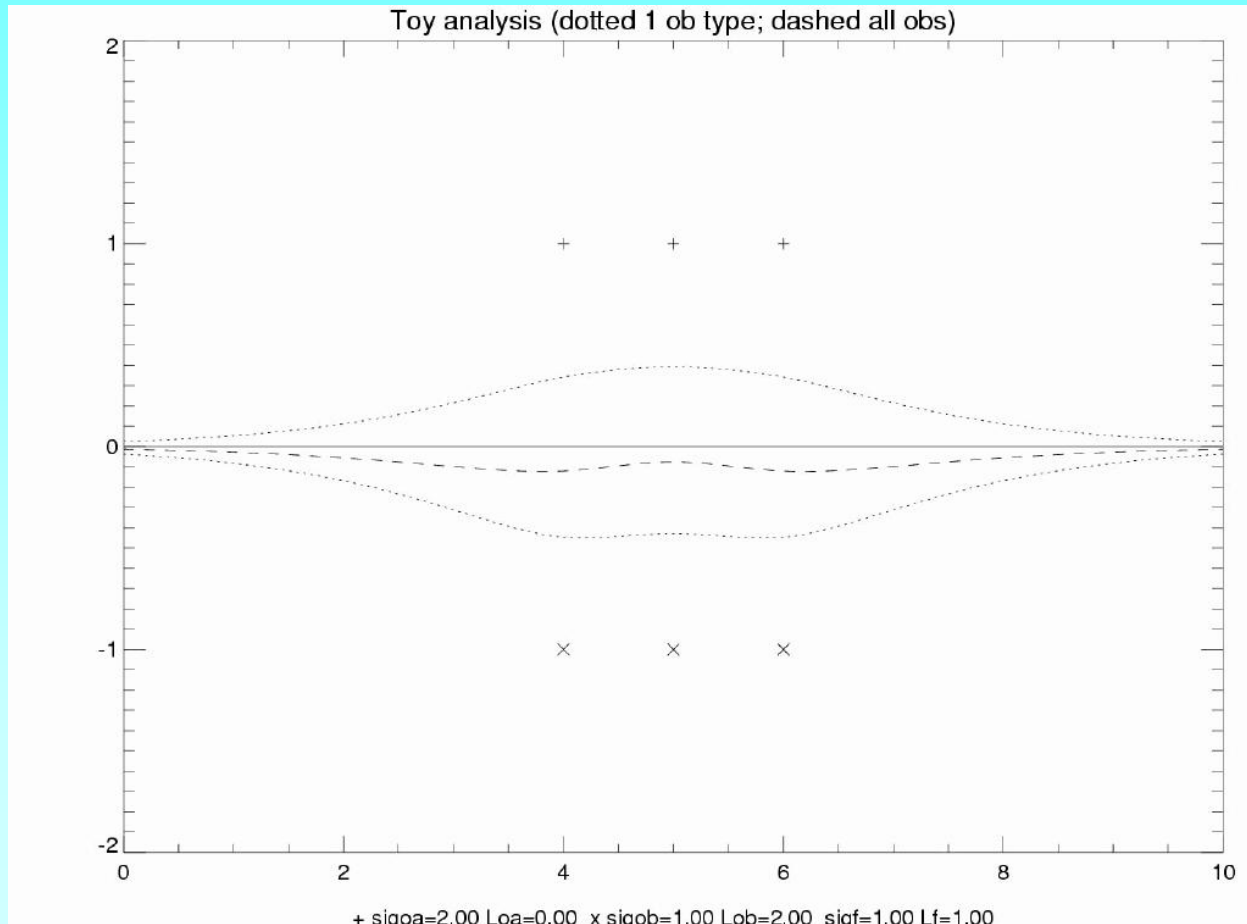
Effect of statistical analysis parameters: Example

- TYPE-B OBSERVATIONS

- Number of type B obs, nob: 3
- New nob (up to 7; 0 if none):
- Current type-B ob locations 5.00000 6.00000 4.00000
- Current type-B ob values -1.00000 -1.00000 -1.00000
- Do you want to change them (y or n)? n
- New type-B ob locations 5.00000 6.00000 4.00000
- New type-B ob values -1.00000 -1.00000 -1.00000
- Observation error for type B, σ_{yB} 1.00000
- Observation error correlation length L_{yB} 2.00000
- BACKGROUND ("FORECAST") ERROR STATISTICS
- Background error σ_b (constant) 1.00000



Effect of statistical analysis parameters: Example



Effect of statistical analysis parameters: Example

- ANALYSIS_SIM - Toy Analysis System
- Constructs 1-D analysis from simulated truth, forecast and observations with specified values and error characteristics
- You may change parameters, or just press ENTER to keep existing values
- The truth field is one of the following:
 - 0 - zero everywhere
 - 1 - pseudo step function
 - 2 - sum of several sinusoidal curves
 - 3 - statistically generated
- Current truth type: 0



Effect of statistical analysis parameters: Example

- BACKGROUND FIELD
- You may use a background field that is shifted relative to the "truth"
- OR a background equal to truth + random perturbation
- Current amount of background shift (positive on left):
0.00000
- New shift:
- Current background error, σ_b : 2.00000
- New σ_b :
- Background error correlation length L_y 2.00000
- New L_y (put $L_y = 0.0$ for uncorrelated errors):



Effect of statistical analysis parameters: Example

- OBSERVATIONS

- Number of obs, no: 5

- New no (up to 11):

- Current ob locations 5.00000 6.00000 4.00000
7.00000 3.00000

- Do you want to change them (y or n)? n

- Current observation error, σ_y : 1.00000

- New σ_y :

- Observation error correlation length L_y : 0.00000

- New L_y (0.0 for uncorrelated errors):



Effect of statistical analysis parameters: Example

