

Instructions for Cressman scheme

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This program illustrates how a Cressman analysis scheme performs with different observation densities and in the presence of observation error. The scheme is given by

$$\mathbf{x}_a(j) = \mathbf{x}_b(j) + \frac{\sum_{i=1}^n w(i,j)(\mathbf{y}(i) - \mathbf{x}_b(i))}{\sum_{i=1}^n w(i,j)}, \quad (1)$$

where $w(i,j)$ is a weighting function, which equals one if the grid point j is collocated with observation point i and is a decreasing function of distance, with $w(i,j) = 0$ for $d_{i,j} > R$, where R is a user-defined constant, known as the *radius of influence* and $d_{i,j}$ is a measure of the distance between points i and j . Two different weighting functions are coded:

- Square

$$w(i,j) = \max\left(0, \frac{R^2 - d_{i,j}^2}{R^2 + d_{i,j}^2}\right); \quad (2)$$

- Exponential

$$w(i,j) = e^{-d_{i,j}^2/2R^2}. \quad (3)$$

The program is set up to have a sine wave as the truth and a background equal to half the truth value at every point. Before running the program the user must set the following variables at the top of the program:

n_pts Number of grid points;

obs_position Grid points at which there are observations;

obs_sign Position of observation in observation vector which user wants to have the incorrect sign (ie 1 for 1st observation, 2 for second, etc.);

obs_big Position of observation in observation vector which user wants to have the wrong value.

As the program runs the user is asked to input the radius of influence R and the choice of weighting function w .