Appendix J: Filtering of data in GMT

The GMT programs *filter1d* and *grdfilter* allow low-pass filtering of data by convolution in the spatial domain. (To filter a grid by Fourier transform use *grdfft*). The filter type and width are specified by an argument -F<type><width>. The boxcar, cosine arch, and Gaussian filters are all linear operators and their effect on the frequency content of the data (the transfer function) can be calculated. The median and mode estimators are not linear operators, strictly speaking, and their effect on frequency content cannot be calculated. In *filter1d* the width is a length of the time or space ordinate axis, while in *grdfilter* it is the diameter of a circular area whose distance unit is related to the grid mesh via the $-\mathbf{D}$ option. The boxcar filter is a simple running average, while the cosine and Gaussian filters are weighted running averages. The weight functions (impulse responses) and transfer functions of the linear filters are shown below.

Impulse Responses



There are many definitions of the gaussian impulse and its transfer function (e.g., see Bracewell[†]). We define σ equal to 1/6 of the width, and then the impulse response as exp(-0.5 * $(t/\sigma)^2$). With this definition the transfer function is exp(-2($\pi\sigma$ f)²), and the wavelength at which the transfer function equals 0.5 is about 5.34 σ .





[†] Bracewell, R. N., 1978, The Fourier transform and its applications, McGraw-Hill, London, 444p.