

ASSIGNMENT 4. SPECTRUM

1. Run geosa4.m, selecting one series from either V1 or V2 for analysis. Run the script on either the full series length or some sub-period. Referring to the notes, go through the “window closing” procedure to arrive at a suitable final lag window “M”. When you have finished and have saved Figure Windows 1-3, re-run the script using a small enough M to produce a very smooth spectrum. Figure Window 3 from this second run will serve as Fig. 4 for the assignment.
2. (Caption to Fig. 1) Time series plot. From the time series plot alone, would you expect the variance of the series to be relatively high at any particular range of wavelengths? Explain, using the line tool in MATLAB© to point out an example of a fluctuation you would expect to contribute to variance at that range of wavelengths.
3. (Caption to Fig. 2) Autocorrelation function. Does this plotted autocorrelation function indicate periodicity in the time series? Explain.
4. (Caption to Fig. 3) Spectrum. At which wavelengths is the variance in the series concentrated? What does the horizontal dashed line signify?
5. (Caption to Fig.4) From this greatly smoothed spectrum, would you describe your series as generally “low-frequency” or “high-frequency” in appearance? What range of wavelengths (in the time units of your data) is represented by the frequency band $0 \leq f \leq 0.10$? Does the proportion of variance in that band appear to be less than the corresponding proportion of variance in Gaussian white noise? Explain your answer. Hint: no calculations are required; a rough estimate should be possible by visual assessment of areas in the plot.

Running goesa4.m

1. >geosa4
2. Message box: message introducing geosa4.m; click OK to remove message and move on
3. Respond to input dialog with the name of your data file; click OK
4. Menu: select either V1 or V2 as the source structure for your time series
5. Menu: click on the time series to be analyzed. You can only select one series, and when you do, an asterisk appears in its box. If you click again on another series, that series becomes your selection. When satisfied with your choice, click "Accept Selection"
6. Input dialog appears allowing you to select either the default (full length) or any sub-period for analysis. Select and press OK
7. Message box appears with information on your selected series. Read the message and then click OK to clear the box and proceed
8. Three figure windows are produced: (1) Time series plot (zoomable) (2) autocorrelation function, and (3) spectrum. Figure 3 (spectrum) is the current window. Menu appears letting you vary the truncation point (M) for the spectral estimation, and toggle between a linear and log-scale spectrum.
9. Experiment with various settings of M (refer to notes) and try log vs linear scale until you are satisfied with the spectral plot.
10. Finally, press "Accept spectrum and quit"

PROGRAMMING NOTES

Selected Matlab functions called by geosa4:

spa – estimate spectrum by Blackman-Tukey method

Selected user-written Matlab functions called by geosa4

acf -- compute sample autocorrelation function and large-lag standard error

specht1 – spectral analysis by Blackman-Tukey method; plot spectrum with confidence band and bandwidth