

### **ASSIGNMENT 3. AUTOCORRELATION**

1. Run geosa3.m, selecting one series from either V1 or V2 for analysis. Run the script on either the full series length or some sub-period. You will turn in five figures, with answers in the figure captions. Note that geosa3 makes only four figure windows. You will use the figure in figure window 1 as Figure 1a in the assignment, but must operate on figure-window 1 with the figure editor to produce Figure 1b.
2. Save your original Figure 1 as Fig1a.fig using File/save from the figure-window menu. Then use figure window tools (see “running geosa3, below) to make Fig 1b:
  - a. zoom/horizontal zoom to zoom in on a time segment of 30 or fewer observations
  - b. Edit/current\_object\_properties to put markers (circles, say) at the data points
  - c. Insert/text\_arrow to point to a sequence of observations that would contribute to positive autocorrelation in a time series series.
  - d. Insert/text\_arrow to point to a sequence of observations that would contribute to negative autocorrelation in a time series.
3. (Caption to Fig. 1) Time series plot. Describe your plotted time series, commenting on at least one feature related to autocorrelation
4. (Caption to Fig. 2) Lagged scatterplots, lags 1-4. Which of these visual patterns, if any, suggests autocorrelation at lags 1-4. Is the significance of linear relationship (at top of plots) consistent with the visual patterns of orientation in the plots?
5. (Caption to Fig. 3) Lagged scatterplots, lags 5-8. Which of these visual patterns, if any, suggests autocorrelation at lags 5-8. Is the significance of linear relationship (at top of plots) consistent with the visual patterns of orientation in the plots?
6. (Caption to Fig. 4) Sample autocorrelation function with large-lag standard error. Does this plot indicate that your series is autocorrelated? If so, to how many lags does the significant autocorrelation extend? How are the plotted values of the autocorrelation function related to the linear correlations ( $r$ ) annotated on the lagged scatterplots?
7. Put your figures with captions in a single word processing document. Zip that document and email it to me as an attachment. Give your zip file the same name as your last name, with “3” appended to indicate assignment # 3 (e.g., “smith3.zip”)

## Running goesa3.m

1. >geosa3
2. Message box: message introducing geosa3.m; click OK to remove message and move on
3. Edit dialog: enter name of your .mat data file, without the suffix; click OK
4. Menu: Select the data set the time series is to come from. Can be V1, V2 or V3.
5. Menu: Select the time series. An "\*" appears opposite the selection. If OK, click to accept.
6. Edit dialog: select the start and end year for analysis and click OK  
(The default initially in box is the full period of coverage of the time series)
7. Message box: summary information on selected series. Click OK.
8. The four figures windows appear, along with a message box telling how you can extract some statistics after running the script. Click OK to close message box

**Fig 1.** Time series plot, with horizontal line at analysis-period mean

**Fig 2.** Lagged scatterplots for lags t-1 to t-4, with annotated correlation coefficient, sample size, and threshold correlation value significant at 0.05 alpha level for two-tailed test

**Fig 3.** Lagged scatter plots for lags t-5 to t-8

**Fig 4.** Estimated sample autocorrelation function, with approximate 95% confidence band, a band twice the large-lag standard error around zero

9. Save figure window 1 as Fig1a.fig using File/save\_as from figure window menu. Then operate on figure window 1 as instructed below and save as Fig1b.fig
  - a. Zoom/horizontal zoom to zoom in on a time segment of 30 or fewer observations
  - b. Edit/current\_object\_properties to put markers (circles, say) at the data points
  - c. Insert/arrow and insert/text\_box to point to and identify a sequence of two or more observations that would contribute to positive autocorrelation in a time series. (Only if such features are characteristic of your entire series will the series actually be positively autocorrelated.)
  - d. Likewise identify a sequence that would contribute to negative autocorrelation.
  - e. Use tools/pin\_to\_axes to pin any new annotation to the axes (so that retains position if you happen to resize figure later)
  - f. Use Desktop\_undock\_figure to free the figure from the figure-editor
  - g. Resize the figure if desired by pulling on the figure handles
  - h. Use file/saveas Fig1b to save the figure you have just created
  - i. Use File/open from figure-menu to open fig1a.fig. That original figure 1 will now appear in figure-window 5.

## PROGRAMMING NOTES

Empirical nonexceedance probabilities in plots in figure 3, top, computed from  $j/(N+1)$ , where  $j$  is the rank and  $N$  is the sample size

Selected Matlab functions called by geosa3:

**mean** – discrete sequence or "stem" plot. Plots the data sequence as stems from the x axis terminated with circles for the data value.

Selected user-written Matlab functions called by geosa3

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

**lagscat** – plot lagged scatterplots