

Geography 507 -- Time Series Analysis in Biogeoscience

Term Project

Assignment

Students will choose a technique or approach for time series analysis that is not covered in the lecture and laboratory components of the course and prepare a report that is essentially a practical introduction to the technique. The target audience should be researchers or practitioners with a basic background in calculus and statistics (i.e., a group similar to the Geography 507 participants).

The report should clearly identify what the technique does and in what sorts of circumstances it may be relevant (and, conversely, under what conditions the technique may not be valid). It should also cover the conceptual, mathematical and statistical foundations of the technique, as appropriate, and include an application of the technique to a real data set chosen by the student. In some cases, the application could be based on simulated time series.

Learning objectives

Upon successful completion of all components of the term project, students should:

- have gained experience in self-directed learning and research on advanced topics
- have gained a deeper understanding of a specific approach to time series analysis in the biogeosciences
- have gained experience in scientific communications, both oral and written

Components

The term project comprises three components: (1) a proposal, (2) an oral presentation, and (3) a formal report submitted as a manuscript. We encourage students to consult with the instructors regarding their choice of technique in the first week or two of the course, certainly prior to submitting the proposal.

Proposal

The proposal should be submitted in the form of a memo to the course instructors, and must be written in proper English with complete sentences and correct grammar and punctuation. It should include the following information:

- the technique or approach to be addressed and how it relates to applications in the biogeosciences (e.g., provide examples of studies that have used the technique and in what contexts)
- an annotated bibliography including a few relevant sources on the technique (sources can include text books, journal articles and authoritative web sites), including a full citation for each source and up to a few sentences explaining how it relates to the term project
- the nature and source of the data set to be used for the application

The proposal will be worth 5% toward the final course grade.

The proposal will be due in **week 4** of the course.

Oral presentation

Students will make an oral presentation of their term project to the class. Each student will be allocated 20 minutes; students should aim for their presentations to take 15 minutes to allow 5 minutes for questions.

The presentation will be worth 20% toward the final course grade.

Formal report

The formal report should be prepared in the format of a manuscript submitted to a journal relevant to the biogeosciences.

The formal report will be worth 40% toward the final course grade.

The formal report should be submitted in duplicate hard copy on or before **April 15, 2009**.

Examples of relevant topics

The list below provides examples of techniques that would be appropriate for the term project. The list is not comprehensive, and students are encouraged to consider other topics that are of interest to them, particularly a technique and/or data set that is relevant to their thesis research. All topics must be approved by the course instructors prior to the oral presentation. Students must be aware that some techniques require a relatively sophisticated background in mathematics or statistics, and should choose a topic commensurate with their own capabilities.

- wavelet analysis
- modelling discrete events (e.g., Poisson model)
- intervention analysis
- principal component analysis (aka empirical orthogonal function analysis) for multiple time series
- neural networks
- composite analysis
- advanced regression modelling
- ARIMA models
- formal frequency-domain digital filtering
- fuzzy logic models
- fractal dynamics
- deterministic chaos
- trend analysis for spatial fields
- estimation of missing data