

**Meteorology 5323**  
**Time Series Analysis**  
**Fall Semester 2012**  
MWF 11:00 – 11:50 am  
Room 5600 NWC

Course Objective

The objective of this course is to develop an understanding of selected methods for analyzing one-dimensional data ordered in time or space. We will do this by deriving and interpreting certain equations that are useful in explaining the structure of data and then applying them, using computer programs, to a variety of data sets. TSA is primarily an introductory course in the application of statistics to the analysis of time series. At the same time we want to use time series analyses to gain insight into the physical processes that generate the data.

The topics covered should be relevant to anyone in any science where events are observed in time and/or space. By the end of the course you should have acquired sufficient understanding of basic time series terminology and methodology to better deal with more advanced time series analysis, for example, that found in radar and atmospheric turbulence measurements, analysis, and theory. Also, you should be able to confidently read many journal articles that employ time and/or space series analyses.

Course Outline

- I. Univariate Fourier Analysis
  - A. Purpose, formulas and examples
  - B. Statistical properties of the periodogram
  - C. Working with the periodogram
  
- II. Measurement Systems
  - A. Linear systems and convolution
  - B. Input-output relationships
  
- III. Filtering Data
  - A. Definitions
  - B. Filter design considerations
  - C. Examples
  
- IV. Autocorrelation in Data
  - A. Autocovariance (acvf) and autocorrelation (acf) functions
  - B. Acfs for selected processes
  - C. Effect of autocorrelation on statistical properties
  
- V. Lagged-product Spectrum Analysis
  - A. Relationship between the acvf and the spectrum
  - B. Spectrum smoothing

Prerequisites

Calculus and an upper-division course in statistics. Familiarity with complex variables will be advantageous. A working knowledge of a scientific programming language is necessary.

Text

Time Series Analysis in Meteorology and Climatology: An Introduction. C. Duchon and R. Hale, Wiley-Blackwell, 250 pp., 2012.

Computer needs

Everyone should have a computer account on an appropriate machine.

Problem Sets

There will be 5 to 7 problem sets.

Exams

I plan to have a 6-week exam, a 12 week exam, and a final exam.

Office hours

Usually after class and always by appointment.

Instructor

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Note to students: If you have a disability that might prevent you from fully demonstrating your abilities, please contact me as soon as possible so we can discuss accommodations necessary to ensure your full participation and to facilitate your educational opportunities.