OCEANOGRAPHIC TIME-SERIES ANALYSIS
GEOL 783 / MSCI 783 – Fall 2016
Location: SUMWALT 241

Meeting Times:  Mon & Wed @ 02:20PM – 03:35PM

Instructor’s name:  Prof. George Voulgaris
Office location:  SUMWALT 241
Office hours:  Monday & Wednesday 02:30 pm – 03:35 pm
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TA information:  N/A

I. Course Description

a. Bulletin description: Techniques in the analysis of oceanographic data sequences, including filtering techniques, fast Fourier transform, least square fitting and harmonic analysis, empirical orthogonal functions. Use of MATLAB for practical exercises. Students are encouraged to bring their own research problems to be used as examples.

b. Course credit: 3 Credits

c. Intended audience: Graduate students interested in carrying out quantitative numerical analysis and equipped with basic statistical and numerical skills.

II. Goals and Learning Outcomes

Goals. The Goal of this course is to provide the graduate student with the basic skills to analyze and correctly present time-series data in an advanced format. The course intends to be a practical reference guide to both established and modern data analysis techniques widely used in Earth and Ocean sciences. It is intended for both beginner and advanced graduate students who are concerned with data acquisition, recording, processing and presentation. Methods on statistical analysis and error handling will be examined as well as analysis of spatial and temporal data fields. Basic concepts such as sampling strategy, stationarity and aliasing will be presented, as well as some basic signal conditioning methods (e.g., filtering, de-spiking etc.). Topics to be covered include: coherence functions; Fourier analysis, harmonic analysis (tidal and at any arbitrary frequency), spectral and cross-spectral analysis, Empirical Orthogonal Functions (EOF), empirical mode decomposition (EMD) methods including the Hilbert-Huang Transform.

Learning Outcomes. By the end of the course students will be familiar with modern techniques of data analysis. They should be able to:

1. Design a data acquisition scheme in accordance of the specific objectives.
2. Implement an appropriate data pre-processing, analysis and processing scheme and justify its selection.
3. Be familiar with the MATLAB® programming language.
(4) Be able to use basic time-series analysis and presentation methods.
(5) Be able to use basic spatial analysis and presentation methods.

III. Textbooks, Readings, and Other Materials


(2) MATLAB Manual [Available online].

(3) Access to College or Private Computer systems with MATLAB® installed.

(4) A thumb drive (USB) for keeping all class work together in a single portfolio.

(5) Students are advised to purchase their own copy of MATLAB® (price $49 through Mathworks®: http://www.mathworks.com/academia/student_version/?s_tid=srchtitle).

IV. Overall Structure of the Course

The overall structure of the course will be informal and interactive. Student involvement is the paramount factor as it will require examples from student’s own research problems; these will be introduced and analyzed as a group project. Every lecture should be considered as a group project and students are expected to learn from the instructor but also from each other.

V. Course Requirements

The course requires homework and preparation in terms of practicing data analysis and study of methodologies. These will be presented in class. Attendance is not a requirement but it is highly recommended as the structure of the course is based on input by all participants.

VI. Course Policies

The USC student code of academic responsibility will be enforced. Each student is required to read the section on the student discipline system, which details student affairs policy STAF 6.25 (available at: http://www.sc.edu/policies/ppm/staf625.pdf).

Intellectual and academic honesty from all class members is expected.

VII. Assessment and Grading

The final exam will be a collection of a portfolio of various assignments carried out in class. Each assignment will be typed and appropriately formatted and will consist of the following sections:

Problem Statement

Data Availability/Description

Data Analysis Methods,

Results, and Conclusions.

Three or Four assignments will be used for the final grade. All graduate students will be evaluated based on class participation (50%) and performance as indicated by portfolio submitted by the end of the course (50%).

Note: Presentation Matters!!
VIII. Course Outline / Course Schedule

The course will take place over 28 class days (Mon & Wed) that correspond to approximately 14 weeks. The topics covered are explained below while the exact time allocated is indicative and depends on class progress. Over 50% of the classes will be student lead interactive data analysis.

All students are required to come up with a data analysis problem from their own research that they feel they should be able to handle by the end of the course. Depending on the nature of the problems, the syllabus shown below might change to accommodate specific data analysis requests demanded by the students research needs.

First Day of Class: Monday 22nd August 2016

No Class on: Labor Day Holiday (Sep. 5th, Monday); Thanksgiving Recess (Nov. 23rd, Wednesday)

Sept. 5, Monday

Last Day of Class: Wednesday 30th November 2016

For more details see: http://sc.edu/about/offices_and_divisions/registrar/academic_calendars/2016-17_calendar.php

Weeks 1-2: Introduction to MATRIX Algebra and MATLAB Language and Programming


Weeks 6-8: Data Processing and Presentation.

Weeks 6-7: Statistical Methods and Error Handling.

Weeks 8-10: The Spatial Analyses of Data Fields.

Weeks 11-14: Time-series Analysis Methods.

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