Course Description:

This course provides an introduction to the techniques and tools used to analyze oceanographic and atmospheric datasets. Students will learn statistical and computational methods to process, visualize, and interpret data collected from field observations, remote sensing, and model outputs. Emphasis is placed on practical applications relevant to physical, chemical, and biological processes in the ocean and atmosphere.

Course Objectives:

By the end of the course, students will be able to:

- Understand different types of oceanographic and atmospheric data (in situ, satellite, and model-based).
- Apply statistical methods for analyzing environmental time series and spatial datasets.
- Conduct quality control and error analysis.
- Use tools such as MATLAB, Python, and R for data visualization and analysis.
- Interpret findings in the context of environmental processes and variability.

Prerequisites:

Background in basic statistics and familiarity with oceanography and/or atmospheric science.

Textbooks (Recommended):

- *Statistical Methods in the Atmospheric Sciences* by Daniel S. Wilks
- *Data Analysis Methods in Physical Oceanography* by William J. Emery and Richard E. Thomson

Software and Tools:

- MATLAB or Python (NumPy, SciPy, Matplotlib, Pandas, Xarray)
- R (for advanced statistical analysis)
- Panoply, Ferret, or Ocean Data View (ODV) for NetCDF data visualization
- Access to reanalysis datasets (ERA5, HYCOM, CMEMS)

Weekly Topics:

Week	Topics
1	Overview of Oceanographic and Atmospheric Observations
2	Data Types and Sources (CTDs, Buoys, Satellites, Reanalysis Products)
3	Introduction to MATLAB/Python for Environmental Data
4	Data Quality Control and Pre-processing

Week	Topics
5	Descriptive Statistics and Data Summarization
6	Time Series Analysis: Trends, Seasonality, and Anomalies
7	Fourier Analysis and Spectral Methods
8	Empirical Orthogonal Functions (EOFs) and Principal Component Analysis (PCA)
9	Spatial Data Analysis and Gridding Techniques
10	Case Study 1: Analyzing Sea Surface Temperature (SST) Trends
11	Case Study 2: Analyzing Wind and Current Data
12	Extreme Value Analysis (Storms, Heatwaves)
13	Machine Learning Basics for Environmental Data (Optional)
14	Final Project Presentations and Course Wrap-up

Assessment:

- Homework Assignments and Labs (35%)
- Midterm Exam (20%)
- Final Project (30%)
- Participation and Discussion (10%)
- Short Quizzes (5%)

Final Project:

Each student will analyze a dataset of their choice (e.g., sea surface height anomalies, precipitation data, wind speed trends) and prepare a written report and oral presentation.

Course Policies:

- Attendance and participation are essential.
- All assignments must be submitted on time.
- Academic integrity is required.

Important Dates:

- Midterm Exam: Week 7
- Final Project Proposal Due: Week 9
- Final Project Due: Week 14