Climate 586 W20 Syllabus (Tentative; here one lecture refers to a 2-hour lecture)

1. Introduction and course overview, vectorization in programming, matlab extra (1 lecture)

2. Review of Basic Statistics (3-4 lectures)

Introduction and course overview; fundamental concepts in statistics and probability; concepts frequently used in the climate sciences; probability distributions; hypothesis tests (statistical significance tests); degrees of freedom; non-parametric statistical tests; Monte-Carlo methods

3. Time series analysis (a.k.a. Spectral analysis) (5-6 lectures)

Fourier Transform (FT and DFT), FFT algorithm, power spectrum and significance test; filtering and choices of filters; autocorrelation and cross correlation; multi-taper method

Advanced techniques: wavelet analysis, singular spectral analysis, and empirical model decomposition and Hilbert-Huang transform

4. Linear regression and linear model (4-5 lectures)

Linear regression and least-square fit; estimation of uncertainty; degrees of freedom for auto-correlated data; multiple linear regressions; statistical prediction; curve fitting

5. Pattern recognition (5-6 lectures)

Principle component analysis and multi linear regression; rotation of EOFs; singular value decomposition; factor analysis; cluster analysis; multi-channel singular spectral analysis