Course description:

The goals of this course are (1) to provide a working knowledge of the objective methods used in diagnosis analysis of geophysical data especially meteorological and climate data/model output and (2) to make students capable of critically evaluating published studies utilizing these methods. We will cover techniques for extracting information from data such as time series analysis, composite analysis, spatial and temporal pattern recognition. Statistical modeling approach will also be covered. If time allows, we will touch on topics such as nonlinear time series analysis, nonlinear principal component analysis, linear stochastic modeling (linear inverse modeling). While the goal here is to seek a broadening of outlook and experience, we will also try to tailor the course to the needs and interests of the students in the class.

Course contents include:

(1) Review of basic statistics
(2) 1-D time series analysis: discrete Fourier transform, power spectrum estimation (multi-taper and maximum entropy methods), filtering and filter design, autocorrelation and cross correlation, singular spectral analysis, wavelet analysis, empirical model decomposition and Hilbert-Huang transfer
(3) Pattern recognition: principal component analysis (PCA a.k.a. EOF), rotation of PCA, singular value decomposition, cluster analysis, and multi-channel singular spectral analysis
(4) Regression and linear modeling: linear regression, assessing significance of regression for correlated data, multivariate linear regression and statistical prediction
(5) Composite analysis and assessing its significance