Training Course on

Practical Applications on Climate Variability Studies

Exercises, day 1

1) Read the netcdf file ‘skt.mon.mean.nc’ (skin temperature derived from NCEP, monthly mean values for the period 1948-2004). Select the Southern Ocean region (southward of 50°S) and save the skt sub-sample as well as the latitude and longitude information, in matlab format.

2) Read the netcdf file ‘skt.mon.mean.nc’ and create El Niño 3 time series for the period 1970-1999 (El Niño 3 box is defined as 5°S-5°N, 210°E-270°E). Save the series in binary format.

3) Read the netcdf file ‘skt.mon.mean.nc’, mask the continents using the land-sea mask ‘lsmask.19294.nc’, select the first year and compute the SST global mean.

4) Read the matlab files of skin temperature ‘skt.25x25.year.mat’ for the years 1980-1989. Calculate the annual mean value and save a matlab file with 10-annual mean values of the skt field.

Exercises, day 2

5) Read the 30-yr time series of El Niño 3 (output from exercise 2) and plot the series. Perform a running average (3 month window) and plot the smoothed series.

6) Study the following vectorizing loops:

a) Vectorizing a double FOR loop
b) Vectorizing code that finds the cumulative sum of a vector every fifth elements
c) Create a code that repeats a vector value when the following value is 0

7) Read the netcdf file ‘skt.mon.mean.nc’, mask the continents (using the land-sea mask ‘lsmask.19294.nc’), estimate the annual mean SST value for 1948 and plot the map in different projections.

8) Create scatter plots…

Exercises, day 3

9) Read the netcdf zonal wind file ‘uwnd3.mon.mean.nc’. Select the period 1990-1999, estimate the mean and the standard deviation. i) Plot the maps at 1000 hPa; ii) Plot the zonal mean

10) Read the 30-yr time series of El Niño 3 (output from exercise 2) and the slp files ‘slp.25x25.year.mat’. Plot the correlation maps between El Niño 3 series and the SLP everywhere. Moreover, highlight only those regions where the correlations are significant (at 0.05). Repeat the exercise but filtering (high-pass, low-pass and band-pass filters).

11) Read the SST HadISST dataset ‘SST_19821999.T42.grd’. Select the latitude of 56°S, calculate the anomalies band pass filtered, retaining interannual band 3-7yr of variability and plot the Hovmöller displaying the Antarctic Circumpolar Wave.

12) Study two scripts for interpolation. In the first case, interpolation is done between two regular grids. In the second case, discretization of the output field is an irregular grid.

13) Read the geopotential field ‘z500.25ond.grd’. The file contains the variable at 500 hPa, and time series is 25 years length (October-November-December mean values). Calculate the EOF in the global domain, from linear detrended anomalies. Plot the EOF-1, the PC-1 and save the output files in grd format.

Exercises, day 4

14) The same as 13) but performing the EOFs in the southern extratropical domain (south of aprox 42°S) and saving the output files in netcdf format.

15) The same as 14) but including a varimax rotation.

16) The same as 13) but performing the EOFs of SST masking fields. Input data are ‘sst.25x25.year.mat’.

17) Study the script that performs a combined EOF (CEOF) analysis over the tropical Pacific region. Variables for the CEOF are SST, ORL, u(850 hPa) and v(850 hPa). Input dataset is ‘ssta_olra_u-v850a_1979_2002.mat’.

18) Perform the spectrum of El Niño 3 time series (output from exercise 2) using diverse methods (e.g., covariance method, Welch’s method).

19) Study the script that performs a wavelet analysis of a long El Niño 3 time series ‘ninio3_1871-1999.grd’.

20) Probability density function: an example of using interactive screens (pdftool).