Structure Functions

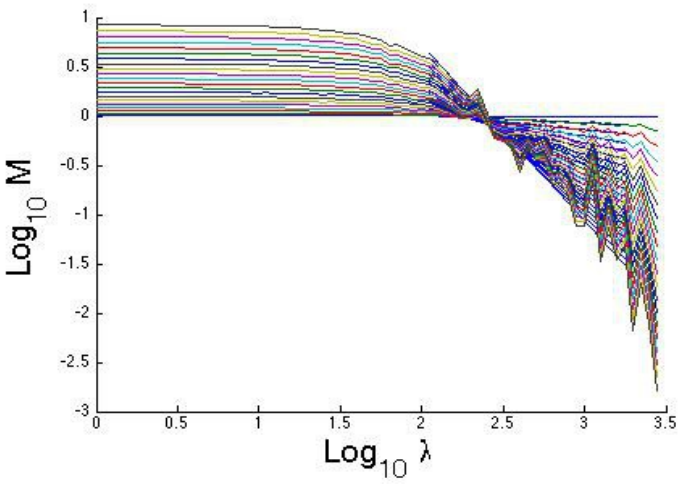
Basic Summary
When 0<H<1, one can define fluctuations using differences. For -1<H<0 one can define fluctuations using the mean at a given scale (i.e after removing the overall series mean one analyzes average anomalies). The Difference structure function corresponds to the former while the Tendency structure function corresponds to the latter. Both find values of H (scaling exponent of mean field), C1 (codimension which measures mean inhomogeneity), and α (multifractality index).

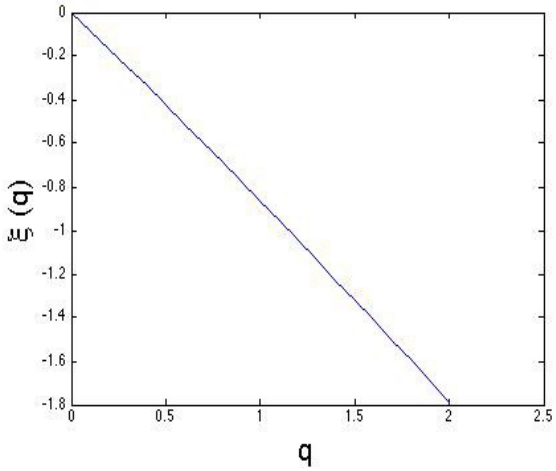
Inputs
Both of functions have the inputs "field","low", and "high". "field" could comprise of one or many independent data series in a matrix where the number of rows is the number of data sets and the number of columns is the number of data points. "low" and "high" specify the bounds for the fit. They can be altered to obtain the best fit.

Outputs
Both functions output values of H,C1, and α. When compared these values should be similar but not necessarily identical. The functions also output two graphs, one of Log(M) as a function of Log(λ) and one of ξ as a function of q.

Example

Tendency
Input: field = "Epica" (1x2895 series of interpolated ice core temperature data)
low= 30
high= 55
Output: H = -0.8645
C1 = 0.0319
alpha = 1.7743

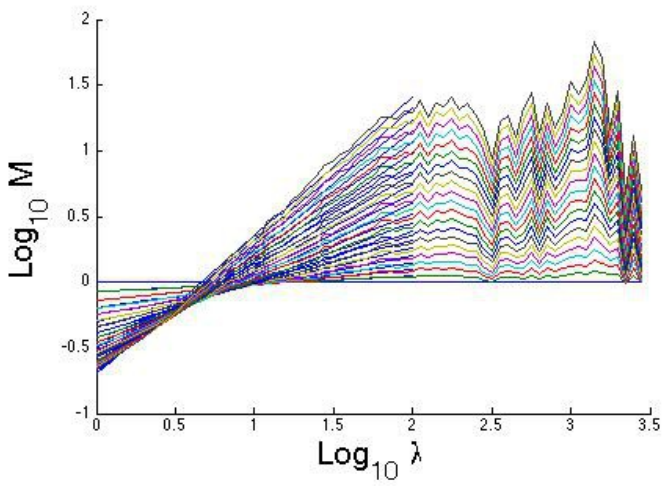


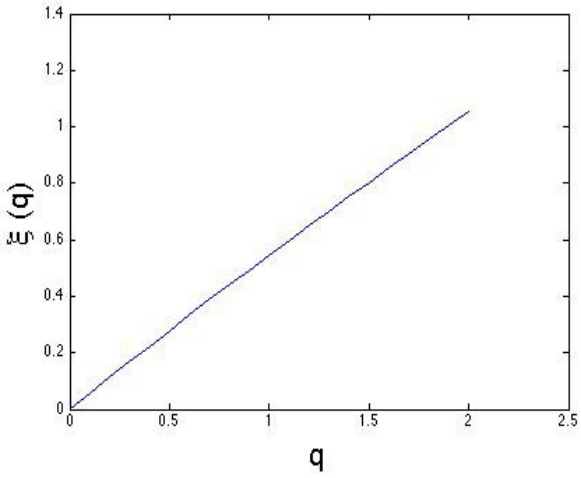


DifferenceStructure

Input: field= “Epica” (1x2895 series of interpolated ice core temperature data),
low=1
high=30

Output: H = 0.5453
C1 = 0.0214
alpha =1.5431





Errors

(These errors apply to both structure functions)

Index exceeds matrix dimensions.
Error in Tendency (line 58)
take=T(low:high,1:2);

- This error will occur if the inputted value for “high” is larger than points

Index of element to remove exceeds matrix dimensions.
Error in Tendency (line 19)
ddelt(ind)=[];

- This error will occur if “dim” is too small. A possible cause is that “field” needs to be transposed (see inputs section)