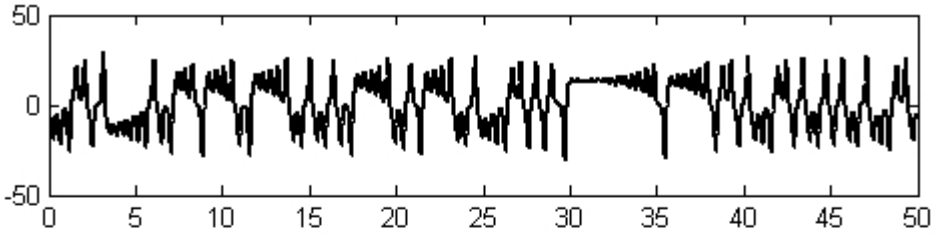
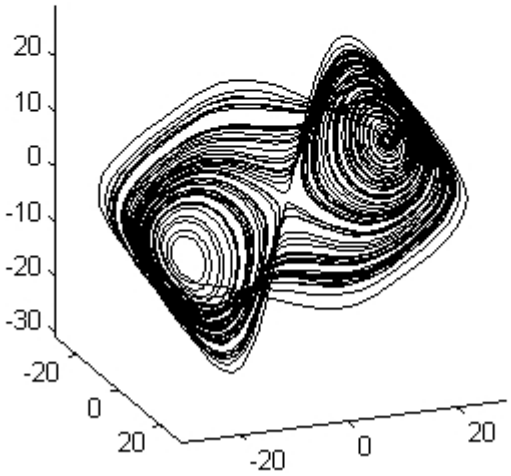
Notes on Parameter Sensitivity for the Complexity Toolbox

Osbert Zalay, Feb. 2009

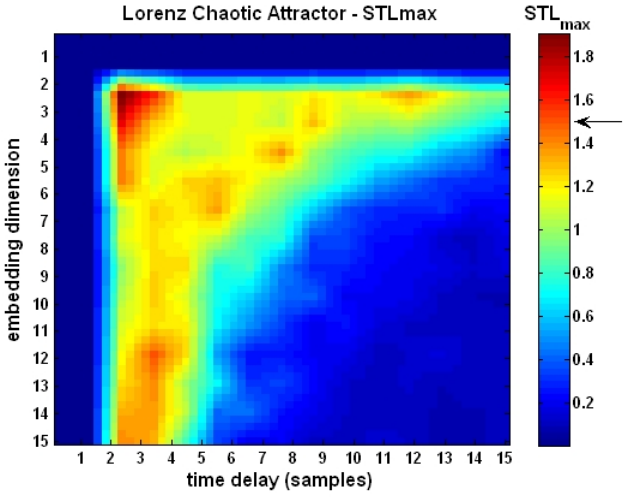
Chaotic Lorenz:

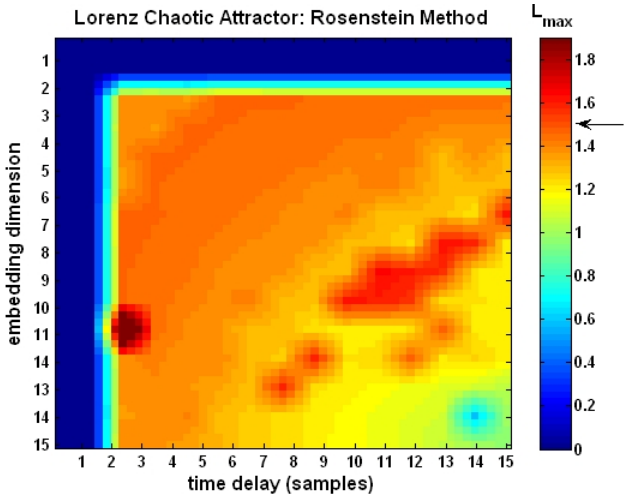


Reconstructed Attractor (Using automated parameter-finding settings on the program):

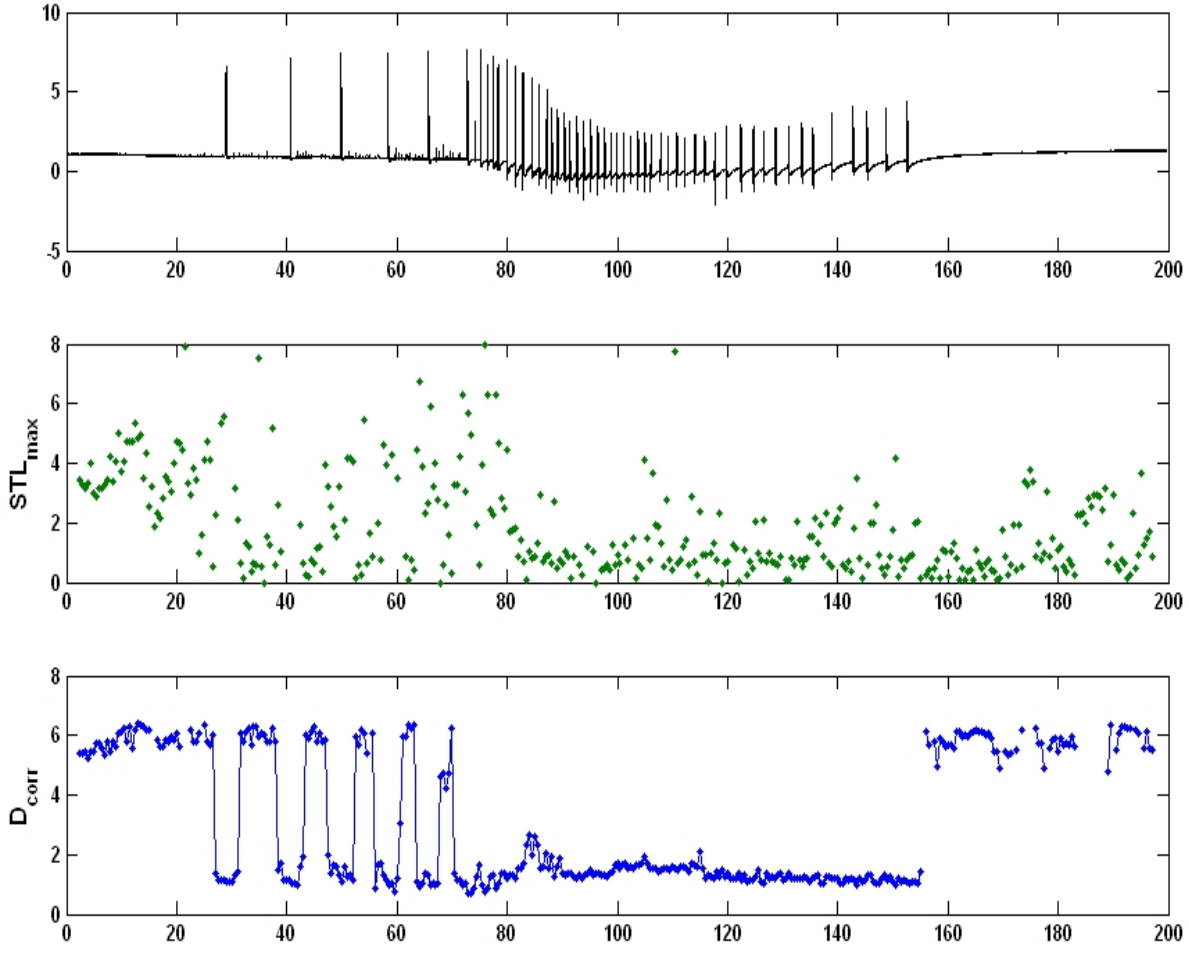


Theoretical value for maximum lyapunov exponent (calculated analytically for parameters of this chaotic time series) is 1.5. Below, the short-time (5000 samples) L_{max} values are computed over a range of embedding dimensions and time-delays, using both the STLmax (Iasemidis et al.) and Rosenstein methods. From these results, the Rosenstein method is more robust to parameter changes.





Example extracellular seizure-like event using STLmax, and with Correlation Dimension also computed through the Grassberger-Procaccia method (window: 2000 samples; shift-step: 200 samples). The program was set to automatically optimize for the embedding and delay parameters and select the convergence region for each window. The signal was not decomposed into separate frequency bands. From the results, there appears to be a drop in both the STLmax value and correlation dimension for the seizure duration:



<u>Note</u>: these results indicate the importance of interpreting the RELATIVE change in complexity measures, not their absolute numerical value, as the measures are sensitive to parameter choices (but degree of sensitivity also depends on the method, e.g. Rosenstein method vs. STLmax, or Grassberger-Procaccia vs. Takens method).