

Time Series Recap and Wavelets Intro

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We have been doing time series analysis. Today we introduce the *continuous wavelet transform* (follow the links below).

1. DFT/FFT
 - (a) Properties of the DFT
 - (b) FFT efficiency
2. Power spectral estimation
 - (a) Windowing
 - (b) Smoothing (by segmenting the data into many windows)
3. Digital filtering $\kappa(t) * f(t) = \mathcal{F}^{-1} [\tilde{\kappa}(\omega) \tilde{f}(\omega)]$
 - (a) Example: Integration of data
 - (b) There are enough types of digital filters to do a whole course...
 - i. High pass, low pass, band pass and band stop filters
 - ii. Savitzky-Golay (*Numerical Recipes* 2nd ed. § 14.8)
 - iii. Wiener filtering (*Numerical Recipes* 2nd ed. § 13.3)
 - iv. Template matching
 - v. Nonlinear filters, *etc.*
4. Next up: **Continuous Wavelet Transform**
 - (a) Inspiration: fig. 1 of GW discovery paper
 - (b) Highlights of Torrence & Compo's *Practical Guide*
 - i. CWT definition
 - ii. Mother wavelets and scaling
 - iii. White noise, red noise, and significance testing
 - iv. Reconstruction—and the prospect of wavelet filtering
 - (c) Software and Examples