PHY408

Time Series Analysis

January 11, 2023

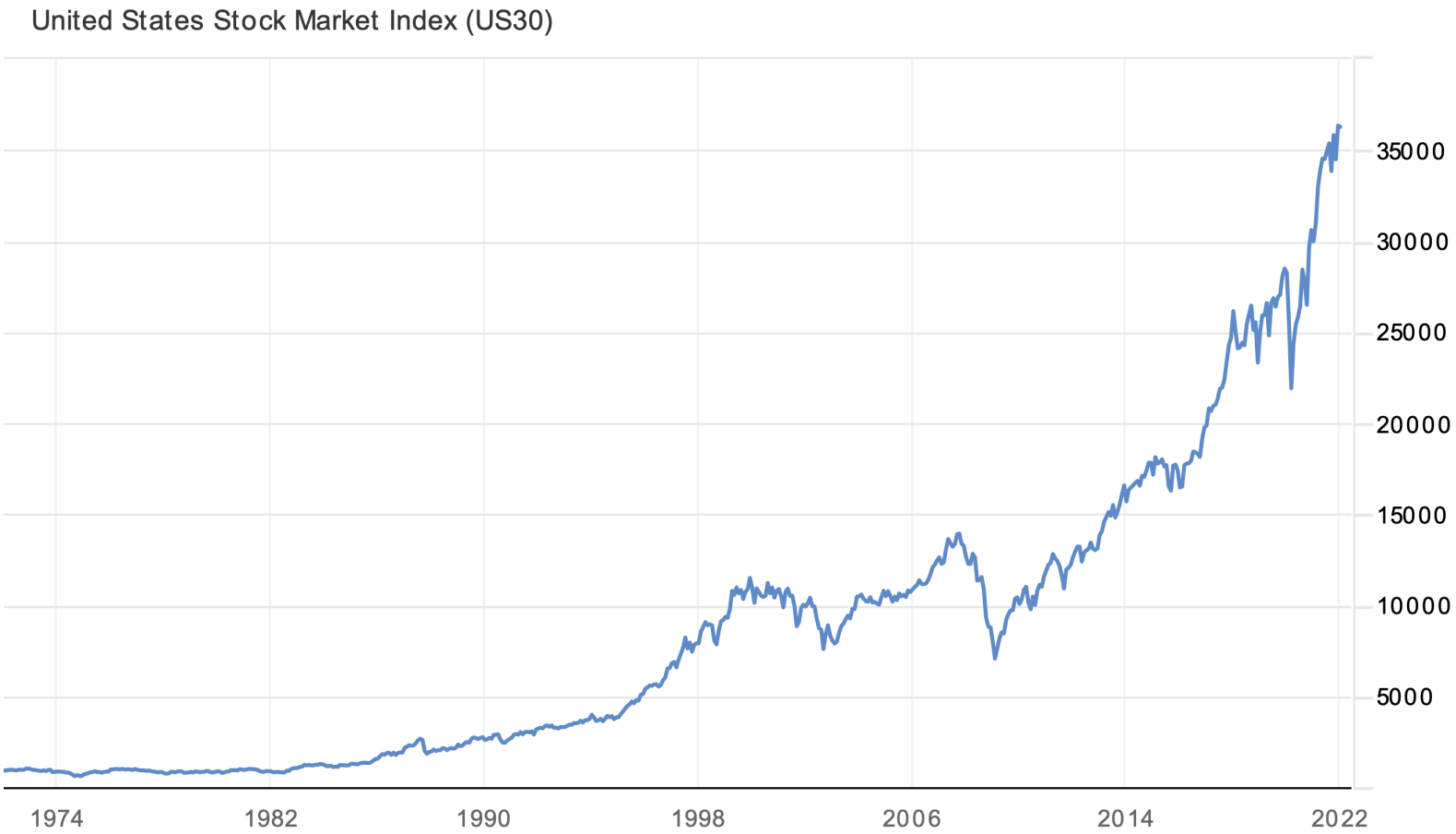
Signal and System

Signal: Something conveys information, description of a physical system, mathematically, functions of one or more variables, e.g. $f(t)$, $g(x, y)$.

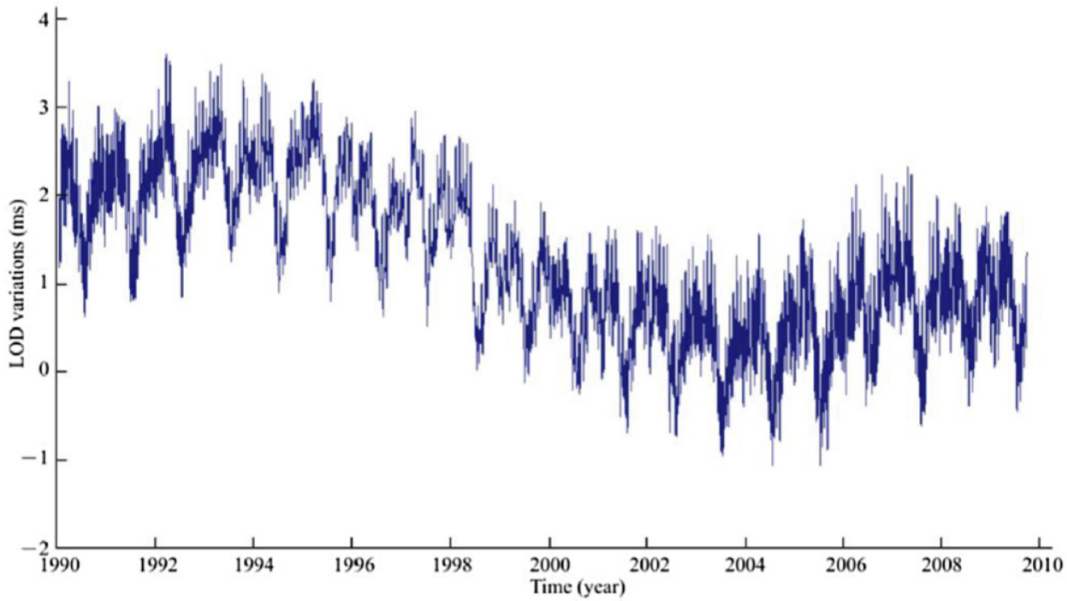
Audio signals

Images

Example: Time Series

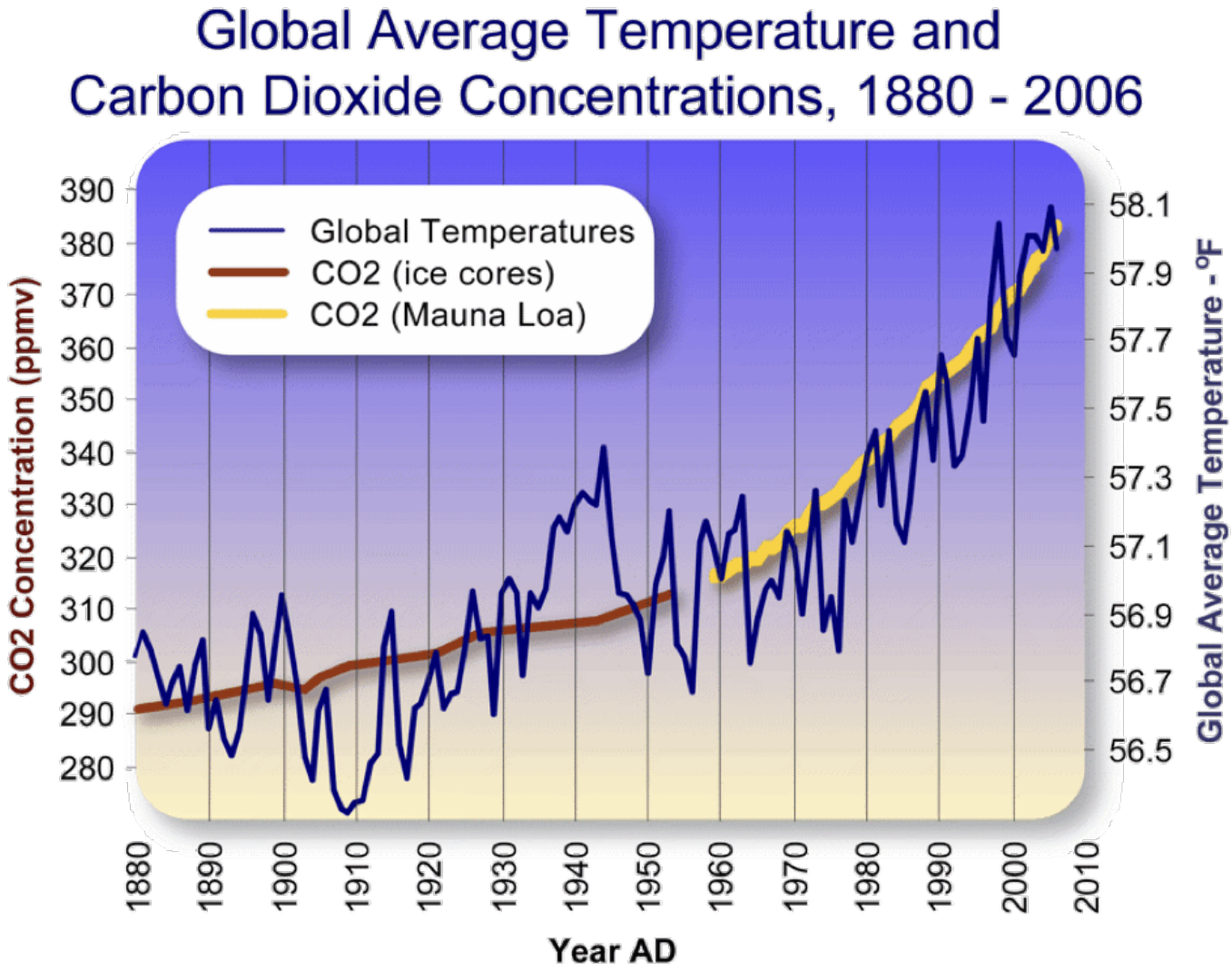


Example: Time Series



[Yu et al., 2015]

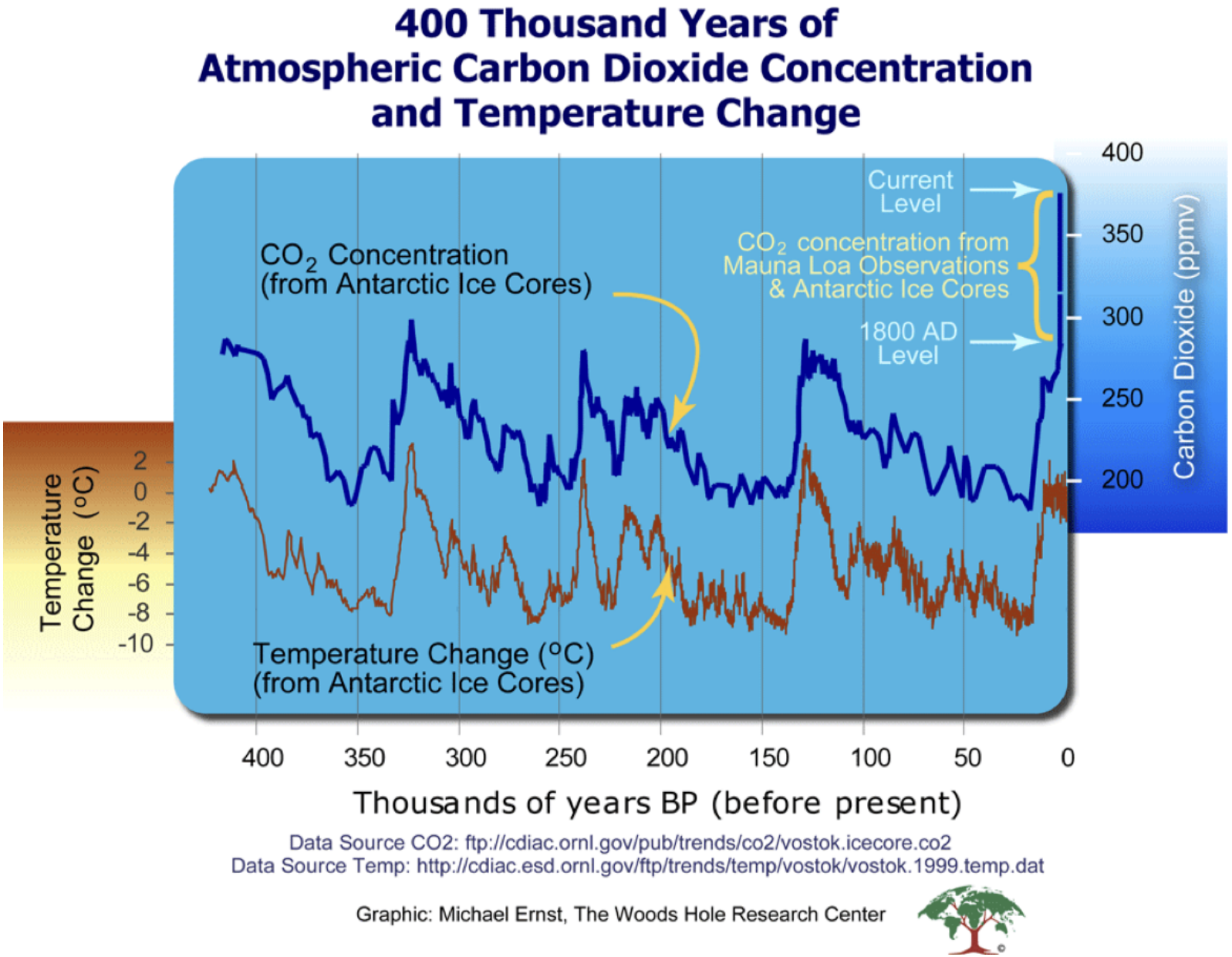
Example: Time Series



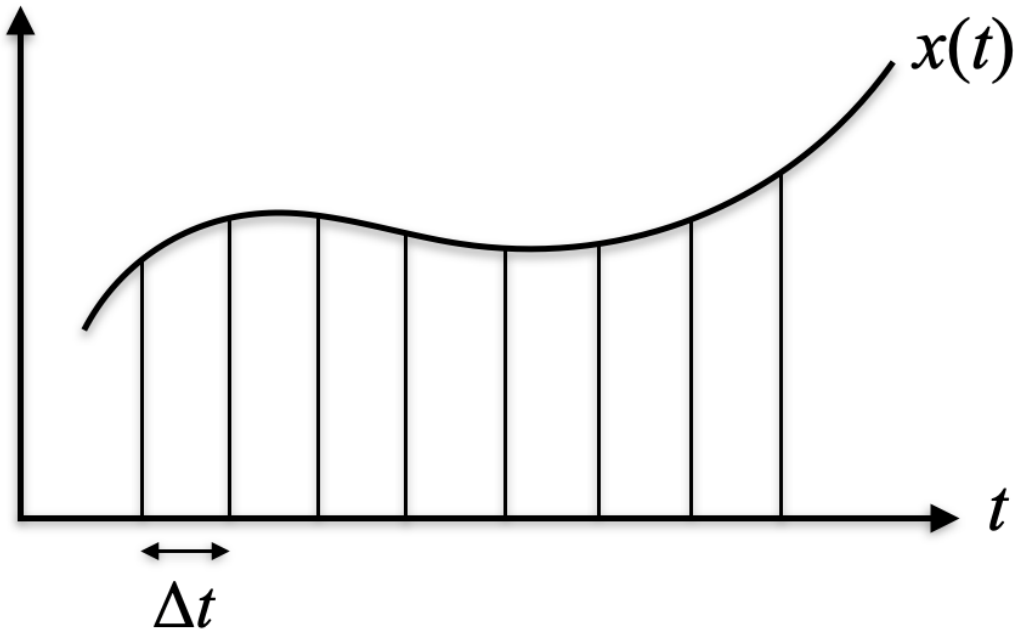
Data Source Temperature: ftp://ftp.ncdc.noaa.gov/pub/data/anomalies/annual.land_and_ocean.90S.90N.df_1901-2000mean.dat
Data Source CO2 (Siple Ice Cores): http://cdiac.esd.ornl.gov/ftp/trends/co2/siple2.013
Data Source CO2 (Mauna Loa): http://cdiac.esd.ornl.gov/ftp/trends/co2/maunaloa.co2
& http://www.esrl.noaa.gov/gmd/webdata/ccgg/trends/co2_mm_mlo.dat

Graphic Design: Michael Ernst, The Woods Hole Research Center

Example: Time Series



Signals

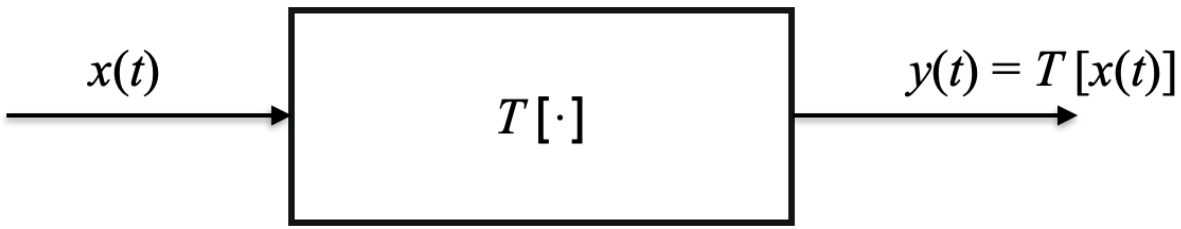


- Continuous-time signal: $x(t)$ represented by a continuous independent variable.
- Discrete-time signal: x_k, the independent variable has discrete values

$$x_k = x(k\Delta t) \qquad k = 0, 1, 2, ..., N \tag{1}$$

where Δt is the sampling interval.

System



A system maps an input signal $x(t)$ onto an output signal $y(t)$.