CO2 Songs

Gas Age Data

ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/vostok/co2nat.txt

CO2 data: file”co2nat.txt”
Column 1: Gas Age as deduced from the Barnola et al. (1991) model
Column 2: CO2 concentration (ppmv).
CO2 and CH4 measurements have been performed using the methods and analytical procedures previously described (Barnola et al., 1987, Chappellaz et al, 1990). However, the CO2 measuring system has been slightly modified in order to increase the sensitivity of the CO2 detection. The thermal conductivity chromatographic detector has been replaced by a flame ionisation detector which measures CO2 after its transformation into CH4. The overall accuracy for CH4 and CO2 measurements are ± 20 ppbv and 2-3 ppmv respectively. No gravitational correction has been applied.

ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/vostok/readme_petit1999.txt

Air trapped in ice core bubbles provides our primary source of information about past atmospheres. Air isotopic composition (15N/14N and 40Ar/36Ar) permits an estimate of the temperature shifts associated with abrupt climate changes because of isotope fractionation occurring in response to temperature gradients in the snow layer on top of polar ice sheets. A rapid surface temperature change modifies temporarily the flrn temperature gradient, which causes a detectable anomaly in the isotopic composition of nitrogen and argon. The location of this anomaly in depth characterizes the gas age.

http://www.agu.org/pubs/crossref/2001/2001JD900145.shtml

```
(* Read Directly from Internet, in this case FTP site *)
co2data =
 Import["ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/vostok/co2nat.txt ",
  "Table"]
```

```
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```

```
(* Read from a file on your machine *)
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co2 = co2data[[All, 2]];
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```
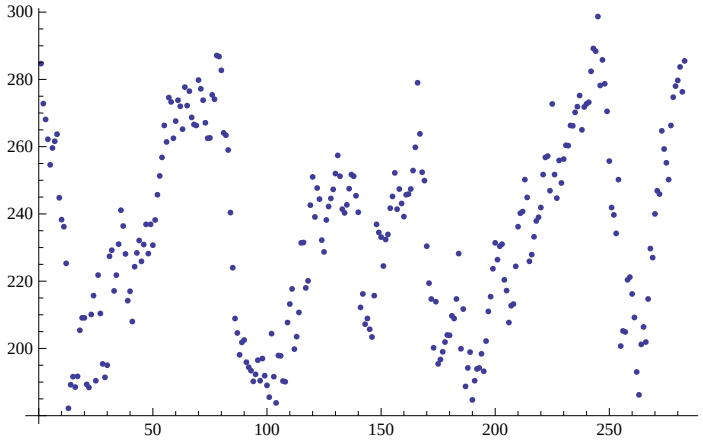
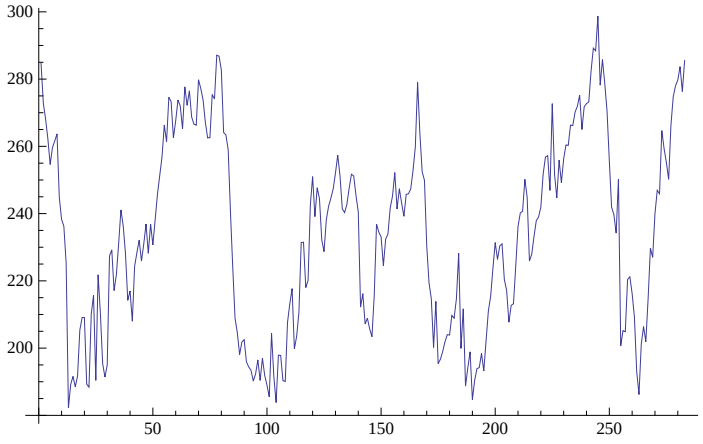

Plot the data and visualize best you can:

```
ListPlot[co2]
```



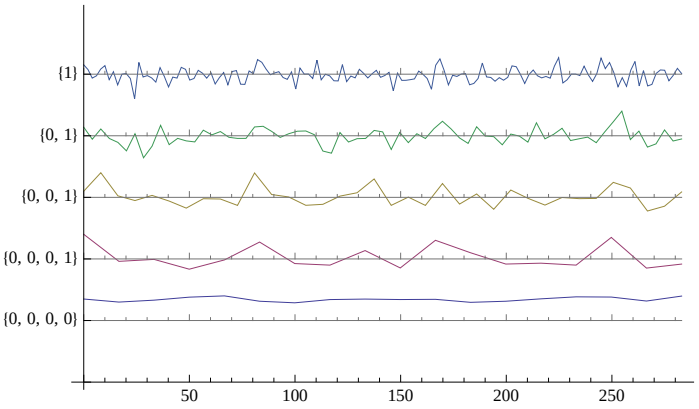

```
ListLinePlot[co2]
```



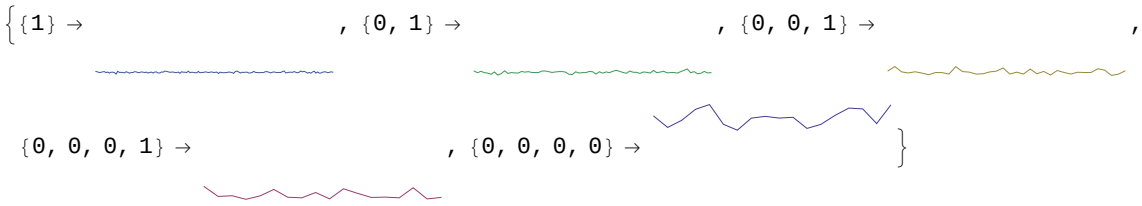
Wavelet Analysis

Use Wavelets to find the Trend and shape of the underlying data, in this case the real shape is {0,0,0,0} in the plot below i.e. fairly periodic, Haar Wavelet is used as the default:

```
co2dwd = DiscreteWaveletTransform[co2, Automatic, 4];
WaveletListPlot[co2dwd, Ticks → Full]
```




```
co2dwd[Automatic, {"ListPlot"}]
```



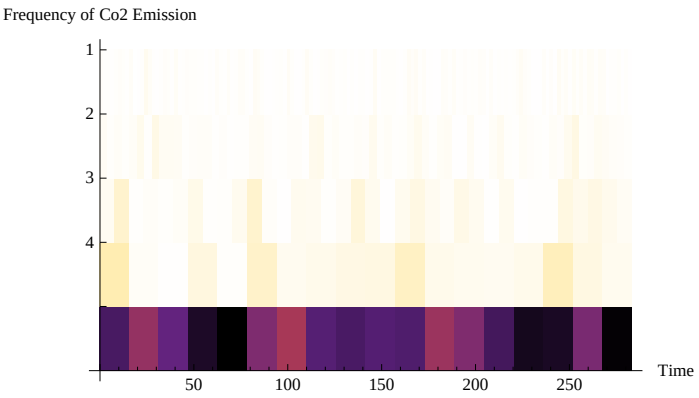
Calculate the energy of the Wavelt decoposition this would tell you which decomoposition has more impact on the shape of the data. In this case {0,0,0,0}→0.994732 is the largest contribution i.e. the periodicity of the data:

```
co2dwd["EnergyFraction"]
```

```
{{1} → 0.000362013, {0, 1} → 0.000707318,
 {0, 0, 1} → 0.00151631, {0, 0, 0, 1} → 0.00268285, {0, 0, 0, 0} → 0.994732}
```

Darker colors indicate larger coefficients and lighter colors indicate smaller coefficients, therefore most of the CO2 emission range of frequency change is in low frequencies:

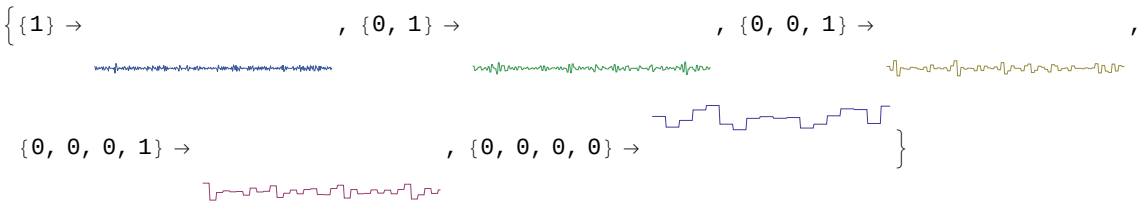
```
WaveletScalogram[co2dwd, AxesLabel → {"Time", "Frequency of Co2 Emission"}]
```



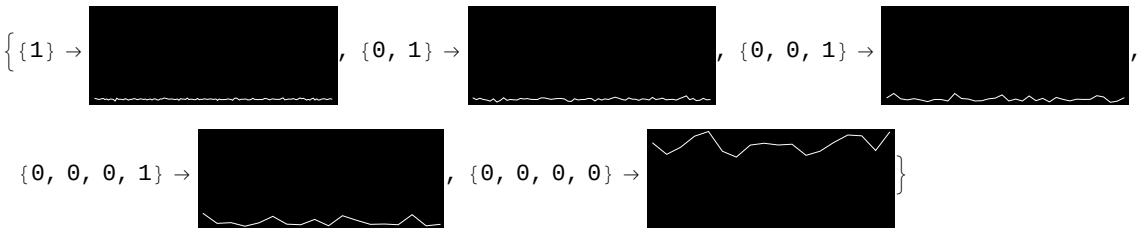
```
(* Get the data for individual decomposition *)
co2dwd[{0, 0, 0, 0}]
```

```
{{0, 0, 0, 0} → {955.85, 819.95, 905.35, 1038.5, 1094.85, 857.375, 787.025, 931.475, 953.275,
   932.575, 941.875, 808.175, 857.125, 963.75, 1052.63, 1043.18, 866.2, 1086.53}}
```

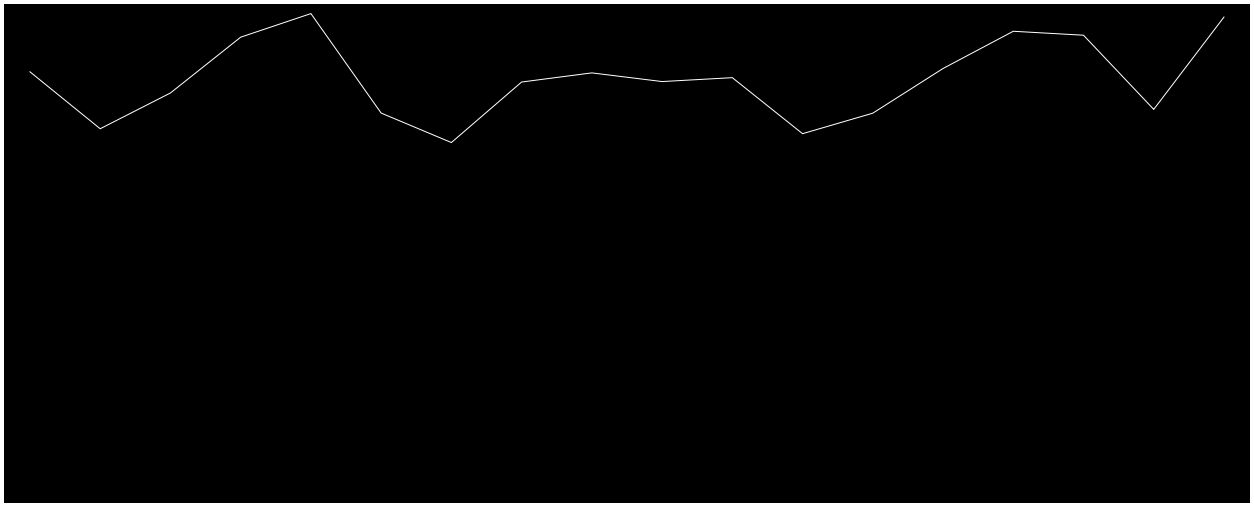
```
(* Use each decomposition alone and inverse it back to reconstruct
 the original data. This removes the unwated features e.g. jitters. *)
co2dwd[{{1}, {0, 1}, {0, 0, 1}, {0, 0, 0, 1}, {0, 0, 0, 0}}, {"Inverse", "ListPlot"}]
```



```
co2dwd[Automatic, {"ListPlot", Background → Black, PlotStyle → White}]
```



Trend



DeTrend