HOMEWORK 12 – ANSWERS

1. The script HW12.m will show all the calculations and make all the plots. In addition we note:

a) The slopes represent the linear rate of change in relative sea level rise. In a tectonically active area like the Big Island it is mostly reflecting the subsidence of the volcano. At Hilo we find the slope to be \( r = 3.86 \text{ mm/yr} \), and at Honolulu it is \( r = 1.58 \text{ mm/yr} \).

b) Assuming the eustatic sea level component is the same at Hilo and Honolulu, and that Honolulu is no longer subsiding (or uplifting), we get the tectonic subsidence rate at Hilo by subtracting out the Honolulu rate, and find \( r = 2.28 \text{ mm/yr} \).

c) Since the oceanographic effects may show similar variations at the two stations, their differences should better reflect the tectonic component at Hilo. Thus we subtract the actual Honolulu observations from those at Hilo and work on the differences; this should roughly eliminate the eustatic effect as well as shorter period fluctuations in sea level. Doing so we find the rate to be \( r = 2.23 \text{ mm/yr} \), pretty close to our answer in b).

d) The Nyquist period \( P_N \) is related to the sampling interval \( \Delta t \) which is 1 month = 1/12 year. We find the Nyquist frequency to be

\[ f_N = \frac{1}{2 \Delta t} = \frac{1}{2 \cdot \frac{1}{12}} = 6 \text{ cycles/year} \]

and the period is thus

\[ P_N = 2 \Delta t = 2 \text{ months} \]

e) From the raw periodogram we see the dominant period in both plots occur for the period \( P = 12 \text{ months} \), i.e. the annual variations. There is also a clear local maxima at \( P = 6 \text{ months} \). Longer periods do not appear to be significantly well represented.