Brief Introduction

Downwelling Light

1. The downwelling light, $E_d(\lambda, d)$, attenuates exponentially underwater with respect to depth.

$$\overbrace{E_{dz}(\lambda, z)}^{\substack{\textit{Downwelling}\\ \textit{light}}} = \underbrace{E_0(\lambda)}_{\substack{\textit{Light}\\ \textit{at the}\\ \textit{surface}}} \cdot e^{-\left[\overbrace{K_d(\lambda)}^{\substack{\textit{Attenuation}\\ \textit{coefficient}}} \cdot \underbrace{z}_{\textit{Depth}}\right]}$$

- **Note:** $K_d(\lambda)$ is the *diffuse downwelling attenuation coefficient*

2. Re-write the equation as follows:

$$\ln\left[\frac{E_0(\lambda)}{E_{dz}(\lambda, z)}\right] = K_d(\lambda) \cdot z$$

Radiometer Data

The *.csv* file that you will get contains measurements from the underwater radiometer. This radiometer has 2 different subunits:

1. Surface unit $Ed0$ that measures light at the sea surface.

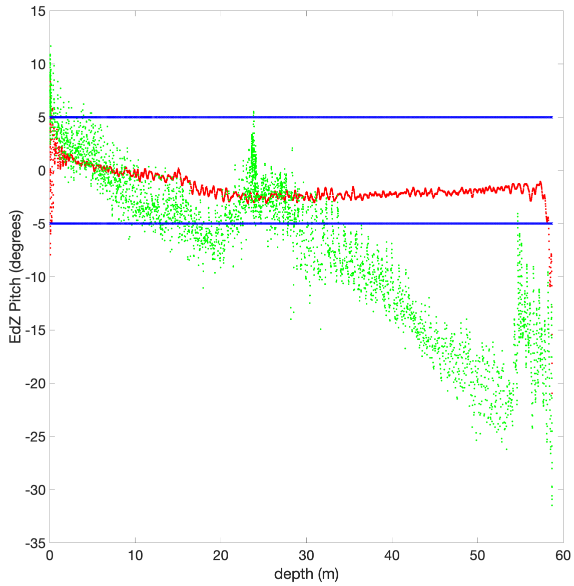
2. Water unit EdZ that measures light underwater as a function of depth.

Both subunits measure light at 19 different wavelengths.

Exercise 1: Clean & Visualize Your Data

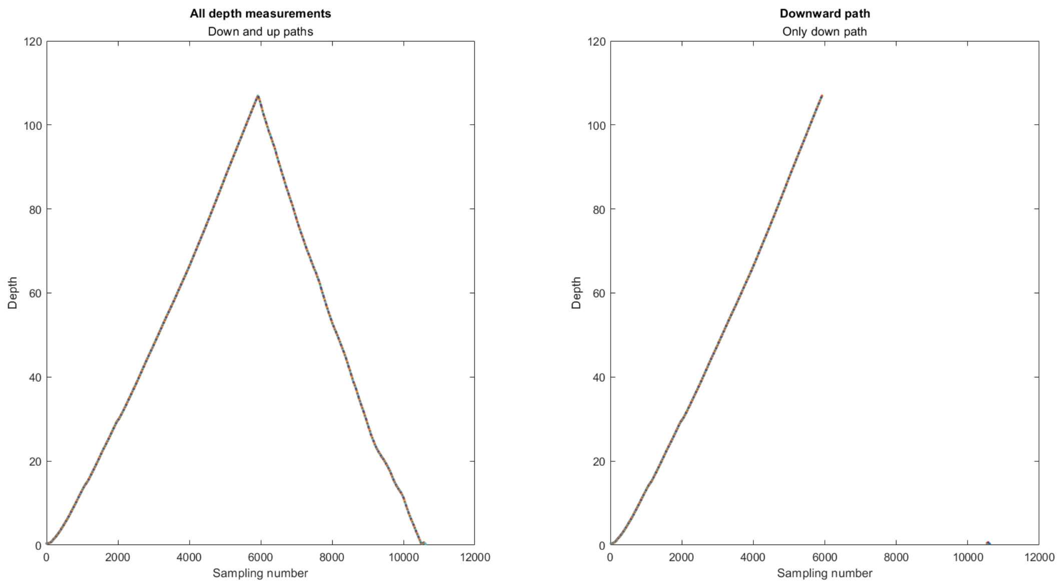
1. **Pitch & Roll:** Each subunit has pitch and roll readings, filter out all values above 5 degrees from your data.

2. Plot pitch and roll function of depth.

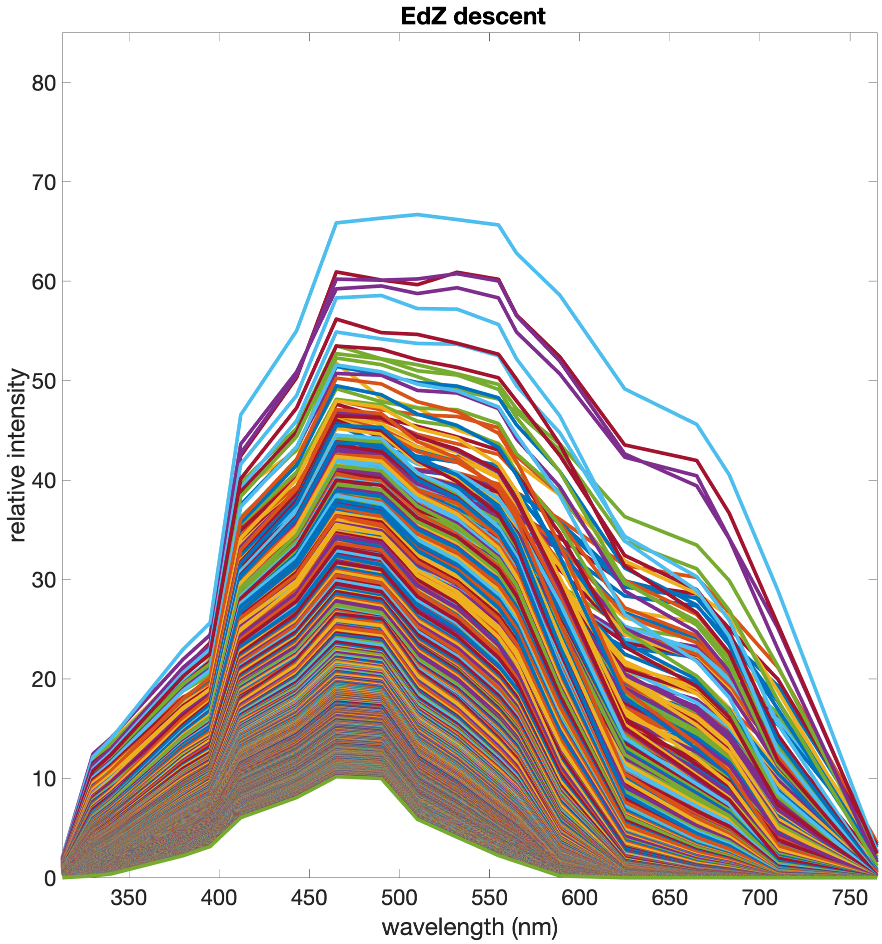


3. **Depth measurements:** use only the downward movement of the water unit, **Do Not** use the retrieving of the unit (the way back up).

4. Plot [sampling number] versus [depth measurements] as follows:

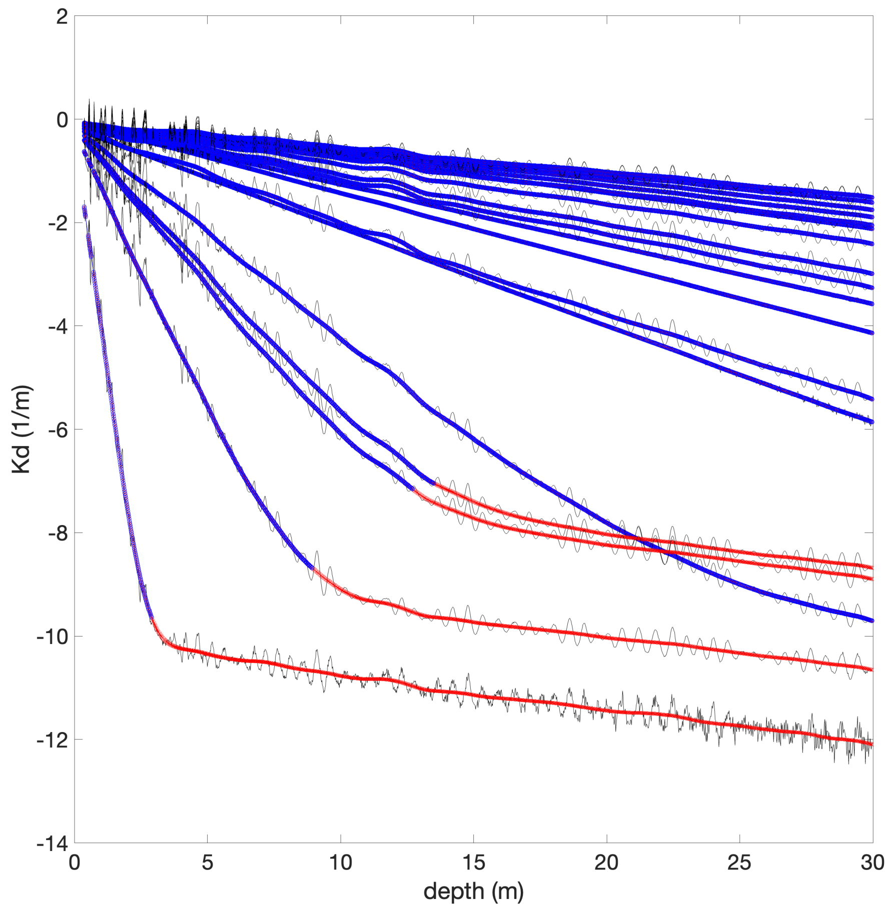


5. Plot the downwelling light $E_d(\lambda, z)$ vs. λ in all measured depths (z).



Exercise 2: Estimating $K_d(\lambda)$

1. Plot: $\left\{ \ln \left[\frac{E_0(\lambda)}{E_{dz}(\lambda,z)} \right] \right\}$ vs. $\{z\}$



2. Use only the linear (blue) part of each one of the 19 channels and fit linear trend to it.
3. The slope of that trend is $K_d(\lambda)$, plot K_d as function of wavelength λ. Remember to interpolate the wavelength range to 400 : 10 : 700.