Background:
LANDSAT 8 imaging has been a breakthrough in remote sensing technology (USGS, 2017). Launched in 2013, as a product of collaboration between NASA and the United States Geological Survey, this satellite system consists of the Operational Land Imager (OLI), as well as the Thermal Infrared Sensor (TIRS). These two sensors allow for 11 spectral bands to be examined within one image. The LANDSAT 8 system is returning over 400 scenes per day with a 30 meter resolution. The data obtained from LANDSAT 8 represents a revolutionary advance in technology and provided a research community with a large number of useful data. Reefs represent one such ecosystem and LANDSAT 8 data has provided useful information in the study of geomorphologic zonation, reef community classification, and the bathymetry of reefs. Being able to study the depth of reefs, or more generally the depth of the ocean remotely provides significant scientific and military benefits. It can help in the optimal planning of ship routes, improving the safety of ship transit, and provide continually updated information, something paper charts cannot provide. It also allows for further investigation into how climate change is affecting the depth of the ocean, and reefs over time, a particularly timely topic.

Materials and Methods:
Three test areas in the Great Barrier Reef were selected from LANDSAT 8 Path 92 Row 74, and images were downloaded for April, August, and December, 2016. Those images were chosen from three distinct seasons - spring, summer, and winter - and three different areas, in order to examine whether seasonal variation or location affects the accuracy of predicting the depth of the reef. The images were downloaded from the USGS EarthExplorer website. In addition, bathymetric data from the Deep Reef Explorer project (Beaman, 2010) was downloaded as a basis for comparison to our LANDSAT 8 predictions. MICRODAS, a freeware microcomputer mapping program, was used to compare the LANDSAT 8 images and the Deep Reef Explorer data. The bathymetric data was overlaid atop the LANDSAT 8 scenes, and a land correlation matrix, the band with the best reflectance-depth correlation was selected. Table 1 shows the different bands utilized by LANDSAT. Only depths from 0 to 30 meters were included, due to the fact that there is little light penetration through water below that depth. Next, using the MATLAB, a multiple linear regression was applied to each data set, generating an equation that could be used to predict water depth in each region. This model was then compared to the Deep Reef Explorer data (Beaman, 2010) in order to determine the accuracy of the model obtained from the LANDSAT data. This deviation between the predicted and actual depths was calculated using MATLAB and then plotted on the LANDSAT imagery using MICRODAS. The coefficients from the MATLAB equation were then compared to see whether the equation derived would accurately predict reef depth in the future. The MATLAB code used to calculate the multiple linear regression equation and deviation is shown below:

\[ \text{zestimate} = b_0 + b_1 \text{Band 1} + b_2 \text{Band 2} + \ldots + b_n \text{Band n} \]

Table 1: LANDSAT 8 bands and wavelengths.

Table 3: Coefficients from the exponential regression.

Table 4: Coefficients from the linear regression.

Table 5: Comparison of multiple linear regression, exponential, and linear models for depths 0 to 30 meters.