Overview

A C4 class flare that peaked at 13:21 UTC on February 10th, 2018 with 0.000004619 W/m^2 was analyzed. This flare was selected because of its isolation in relation to other flares. Conversion of the flare irradiance to ergs/sec was found by converting to ergs and multiplying by the flare output area. Subsequently, the flare data was plotted both with time (seconds) and arbitrary units on the x-axis. Arbitrary units were implemented on the x-axis by utilizing (.iloc). To find the baseline of the flare, the .median function in python was used to find the median of irradiance data over 213 arbitrary time units just before the flare. This flare baseline was then removed from the solar flare data using the .subtract in python. The integrate.trapz function was then used to find the total energy of the flare. The flare was integrated over 107 arbitrary time units. The total energy was determined to be 3.69∗10^26 Ergs after integration.

Merits

This group correctly determined their flare class and the peak time/energy. The given values were verified in the space weather data portal. The chosen flare was reasonable in that it was not surrounded by other flare and had clear limits. The authors justified their selection of the flare. Cells throughout the document are effectively commented and markdown cells used to describe and justify methods. For example, the group justified their use of the median method to find the flare baseline effectively in a markdown cell and in the commented code. Clear and professional language was used throughout the report. As recommended, trapezoidal integration was used with the limits for integration being precise and explained. The flare was correctly integrated using the arbitrary index time units. Total flare energy was correctly reported in ergs.

Critiques

While the use of the median method for finding the flare baseline was sufficiently explained, the baseline median was taken over a large area that includes significant noise and variability that may have been other smaller flares or build up the to analyzed flare. Since the median was simply taken over a range of 213 arbitrary time units, any of these events before the flare were included. This results in a potentially inaccurate and elevated baseline, hence lower total flare energy after baseline subtraction and integration. The method for finding the baseline should be reconsidered and the group should take the median or mean from a smaller, less volatile period of pre-flare data. This may include the less variable range of approximately 270-310 arbitrary time points. The group should also consider using the method of removing a threshold of upper data values in order to display a more accurate representation of the pre-flare baseline. This method is described in the week 7 lecture video. It would effectively allow the group to exclude some of the volatile pre-flare events.

Additionally, the x-axes on the baseline correction and total energy graphs should be relabeled to “time (arbitrary units)” instead of “time (seconds)”. The axes display arbitrary units, but the label is incorrect and misleading.

Overall Recommendation

NEEDS MAJOR REVISION

Conclusion

While the majority of the flare analysis is clear and accurate without major errors, the method for baseline correction is not sufficient for obtaining an accurate baseline for the flare. Since finding the baseline for the flare is such a major component of the flare analysis, “Needs Minor Correction” would not be an inaccurate statement for the required volume of work necessary to correct the baseline correction. When baseline correction and graph labels are corrected, this flare analysis will be highly sufficient and detailed for the purposes of this lab.