**BAFDR software**

The BAFDR software is a compilation of the modules from the Photonics Project radiometry calculators. They are Blackbody, Atmosphere, Flux, Detector, and ReadOut. The NETD and NIE calculation are also done although that does not appear in the pronounceable acronym name. The BAFDR\_S will run a single end to end case the same as the online modules, but without user intervention. BAFDR\_M is multi-case.

1. To learn the software, you might want to execute each module stand alone in the online versions on the website. Then, download the files from github to a directory/folder of your choosing.
2. Next look at the BAFDR\_S\_inputs.txt using notepad or some other editor. Adjust input parameters as desired. Each one is labeled and then has a colon (:) for the separator. Do not put any text after the colon. This input file and the two Modtran files all need to be in the same directory/folder. You will need the atmosphere number – a guide is given on the next page.

The outputs will appear as the BAFDR\_S\_output.txt and the plots as BBATMplt.png and ROICplt.png (unless plot option 0 is chosen which skips the plots) – these are the same as the online versions. No other plots, such as the detector dark current etc are output.

1. You must edit the python based Jupyter Notebook “BAFDR\_S.ipynb” file for the directory path to correspond to the chosen folder. This is currently at line 15 in BAFDR\_S. Look for:

*#base directory*

*bdir="C:\\Users\Owner\Documents\JWD\Calculators\Tools\BAFDR"*

Update this as needed, then you can execute the notebook. The outputs will be placed in the same folder. Sample input files and output are provided. These will be overwritten with each new execution unless they are moved or renamed.

1. For a multi-case run you will use BAFDR\_M and the associated input file. This input and output uses CSV format. You can use excel or similar program to edit the BAFDR\_M\_inputs.csv file. The input order is the same as the single case version but transposed into a row. The first row is the headers with variable names. There is no limit set on the number of cases. A sample is provided with a sweep of integration times (the final parameter), although of course any variable can be changed singly or in any combination. Again, all the files need to be in the chosen directory. The ipynb file again needs to be edited to correspond to this directory (on line 14 in this case). No plots are output for the multi-case runs, just the csv file. The execution without plots is quick.
2. The outputs are in the BAFDR\_M\_output.csv. This can again be edited in excel and any number of plots and analysis can be done. The input file was pasted into a second tab to allow the cross plot of inputs vs outputs. A sample analysis plot in excel format is provided (for Tint vs NETD) including conditional formatting to show when the well fill is over 100%, and/or if the dominant noise is not SHOT noise. Again, the output file will be over written unless moved or renamed.
3. Good Luck!

**MODTRAN Atmosphere Listing for the BAFDR and Photonics Projects online software:**

|  |  |
| --- | --- |
| 0 | LEN=0.5 ATM=ATM\_TROPICAL AER=AER\_RURAL |
| 1 | LEN=0.5 ATM=ATM\_TROPICAL AER=AER\_RURAL\_DENSE |
| 2 | LEN=0.5 ATM=ATM\_US\_STANDARD\_1976 AER=AER\_RURAL |
| 3 | LEN=0.5 ATM=ATM\_US\_STANDARD\_1976 AER=AER\_RURAL\_DENSE |
| 4 | LEN=1 ATM=ATM\_TROPICAL AER=AER\_RURAL |
| 5 | LEN=1 ATM=ATM\_TROPICAL AER=AER\_RURAL\_DENSE |
| 6 | LEN=1 ATM=ATM\_US\_STANDARD\_1976 AER=AER\_RURAL |
| 7 | LEN=1 ATM=ATM\_US\_STANDARD\_1976 AER=AER\_RURAL\_DENSE |
| 8 | LEN=10 ATM=ATM\_TROPICAL AER=AER\_RURAL |
| 9 | LEN=10 ATM=ATM\_TROPICAL AER=AER\_RURAL\_DENSE |
| 10 | LEN=10 ATM=ATM\_US\_STANDARD\_1976 AER=AER\_RURAL |
| 11 | LEN=10 ATM=ATM\_US\_STANDARD\_1976 AER=AER\_RURAL\_DENSE |
| 12 | LEN=5 ATM=ATM\_TROPICAL AER=AER\_RURAL |
| 13 | LEN=5 ATM=ATM\_TROPICAL AER=AER\_RURAL\_DENSE |
| 14 | LEN=5 ATM=ATM\_US\_STANDARD\_1976 AER=AER\_RURAL |
| 15 | LEN=5 ATM=ATM\_US\_STANDARD\_1976 AER=AER\_RURAL\_DENSE |
| 16 | LEN=50 ATM=ATM\_TROPICAL AER=AER\_RURAL |
| 17 | LEN=50 ATM=ATM\_TROPICAL AER=AER\_RURAL\_DENSE |
| 18 | LEN=50 ATM=ATM\_US\_STANDARD\_1976 AER=AER\_RURAL |
| 19 | LEN=50 ATM=ATM\_US\_STANDARD\_1976 AER=AER\_RURAL\_DENSE |

NOTE: for perfect atmospheric (zero losses, unity transmission) enter -1.