Analyzing SURFRAD Data

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Needed: Linux/UNIX OS, Bash
Main site: https://www.esrl.noaa.gov/gmd/grad/surfrad/dataplot.html

I analyze data for one year: 2018.
To Download all 2018 Desert Rock, NV data, copy-paste following line into terminal:

```
$ for day in `seq -w 001 365`; do wget -c
  ftp://aftp.cmdl.noaa.gov/data/radiation/surfrad/dra/2018/dra18${day}.dat; done
```

This will take up to 15 minutes to run. You will have 365 daily files.

Create a new file called `analyze.sh`, with the following code:

```
1 G=$1; shift
2 awk -v G=$G '$1=/201./{if ($9<0)$9=0;print $9" "$23" "G}' $* |\
3 awk '{if ($3>=$1) print $0" "$3;else print $0" "$1}' |\
4 awk '{S+=$1;U+=$2;C+=$4}END{print "AVG "S/NR" "U/NR" "C/NR}'
```

This program takes 2 or more arguments. The first argument is a presumed geothermal flux from surface to space. You can leave it at 0 on first run. The rest of the arguments are the filenames to analyze. Thanks to bash shell expansions, all our data can simply be referenced by `dra*`.

Line 1: Assigns constant G (geothermal flux) to first argument, then shifts arg list, so that all our data files can be referred to as `$*`.

Line 2: Extracts Solar Radiation (column 9) and Upwelling Radiation (column 23) from file. For some reason, column 9 contains some negative data, which is not possible for Solar Radiation. If it's negative, I correct it to zero. Only use lines that begin with 201X (Year).

Line 3: This applies MAX(Geothermal Radiation, Solar Radiation) and creates a third column.

Line 4: Compute averages for all 3 columns.

Now let's run the code (with Geothermal Radiation = 335 W/m^2):

```
$ bash analyze.sh 335 dra*
```

The result is:

```
AVG 236.361 440.523 440.737
```

The three numbers are average: Solar Radiation, Upwelling Radiation, MAX(Solar, Geothermal)