Comparing magnetograms

I was interested in comparing magnetograms from my magnetometer with those of professionally observatories to begin getting an idea if my local magnetometer placement in a suburban yard was going to produce anything useful. More broadly I was interested in ways of checking HamSCI magnetometer data in general.

Long story short, I tried using some "distance" metrics commonly used to compare time series data. I'm not sure it was particularly useful, and certainly if our data perfectly matched NOAA magnetometers there would be no reason to have a larger network (so we don't expect perfect matches).

I chose to use data from my station (KE8QEP in Ohio), data from Jules station in NY and data from Fredericksburg, VA (obtained from interMagnet) for July 20 and 21. Data from myself and Jules were reduced to 1 minute intervals to compare with the Fredericksburg 1 minute data available. I compared only the X component values, and in retrospect using H or F might avoided any issues with differing magnetic alignments between stations. Below are plots from July 20 and July 21 with data from the 3 stations.
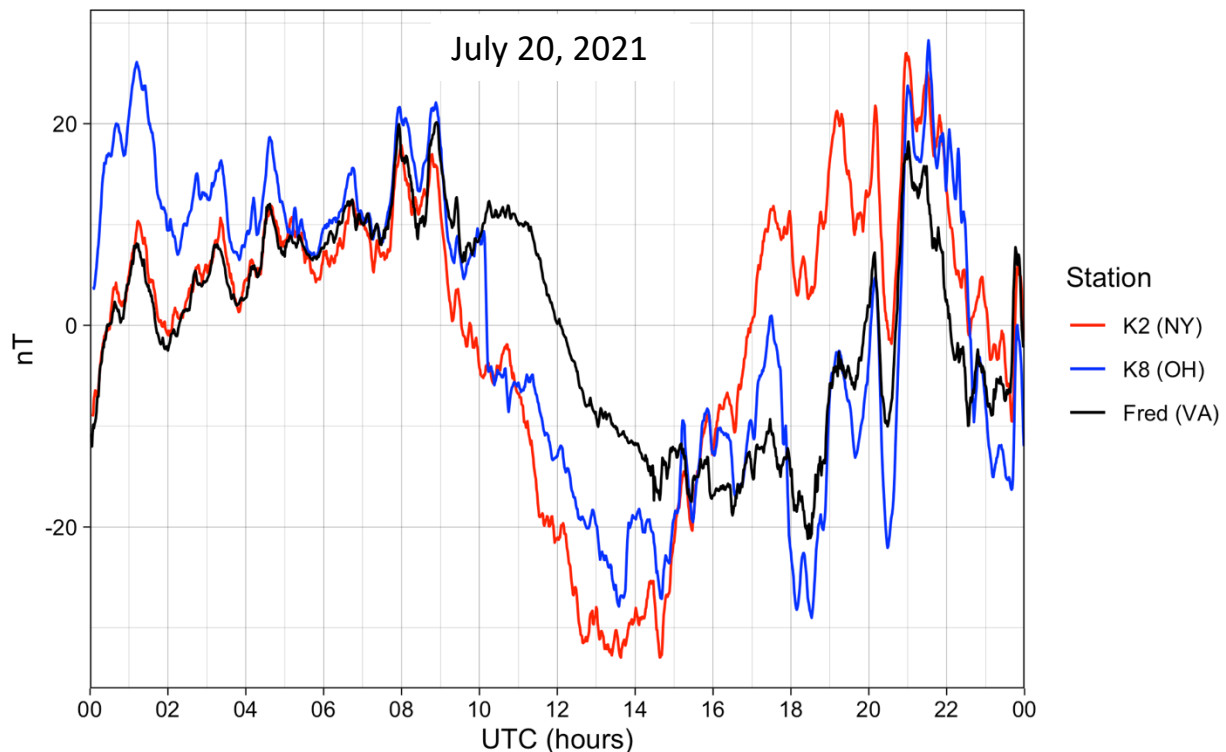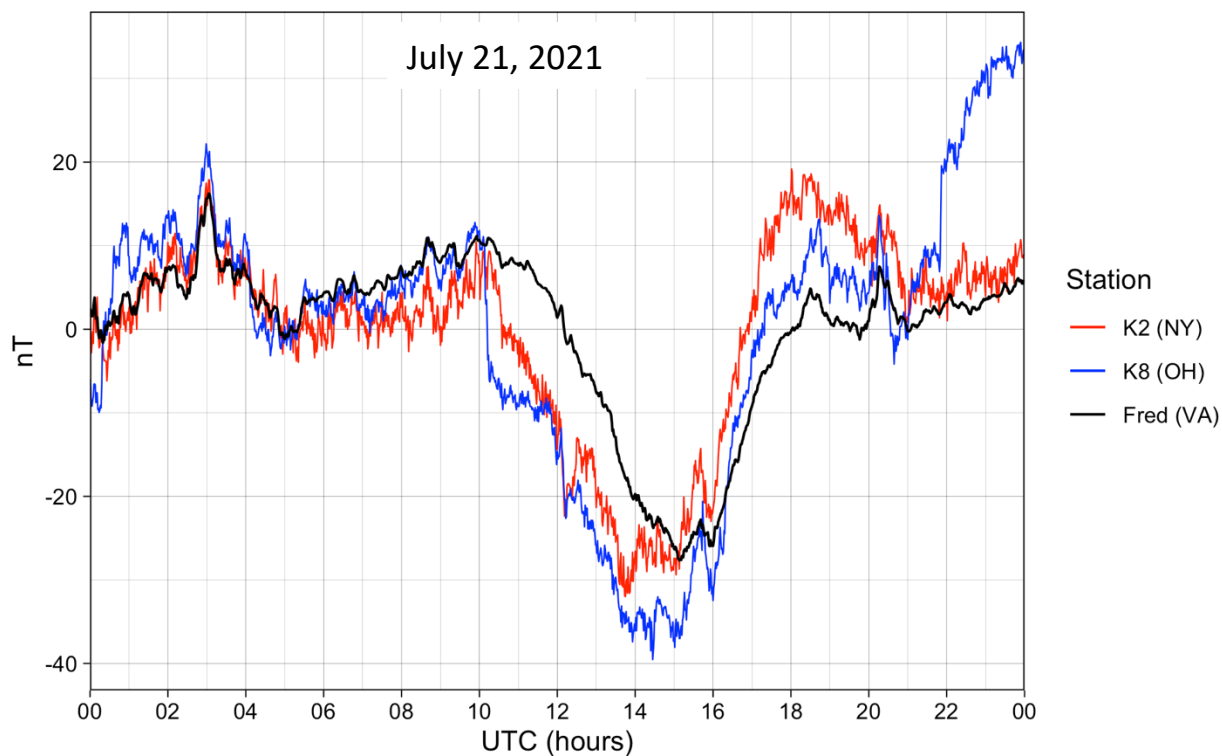

Figure 1- Note just after 10:00UTC there is a sharp drop in my data, I think this is from a car pulling in or out of the driveway.

July 21, 2021

The raw cross correlation table is rather ugly, as this is a distance metric, zero represents time series that are exactly matched.

```
          x_20_K2 x_21_K2      rt x_20_K8 x_21_K8 X_fred_20
x_21_K2    0.0633
rt         0.1025  0.0922
x_20_K8    0.0764  0.0894 0.0746
x_21_K8    0.0835  0.0522 0.0849  0.1167
X_fred_20  0.0803  0.0903 0.0753  0.0748  0.0752
x_fred_21  0.0919  0.0635 0.0829  0.1156  0.0587     0.0681
```

Table 1- K2, Jules station; K8 my station; rt, my "remote temperature"; and fred, Fredericksburg, VA.

The program also made an interesting graph, but it's not easy to read….

	x_20_K2	x_21_K2	rt	x_20_K8	x_21_K8	X_fred_20	x_fred_21
x_20_K2	0	0.06	0.1	0.08	0.08	0.08	0.09
x_21_K2	0.06	0	0.09	0.09	0.05	0.09	0.06
rt	0.1	0.09	0	0.07	0.08	0.08	0.08
x_20_K8	0.08	0.09	0.07	0	0.12	0.07	0.12
x_21_K8	0.08	0.05	0.08	0.12	0	0.08	0.06
X_fred_20	0.08	0.09	0.08	0.07	0.08	0	0.07
x_fred_21	0.09	0.06	0.08	0.12	0.06	0.07	0

Below is a similar graph based on Euclidean distance, and again the smaller numbers (in this case in red) indicate a better match.