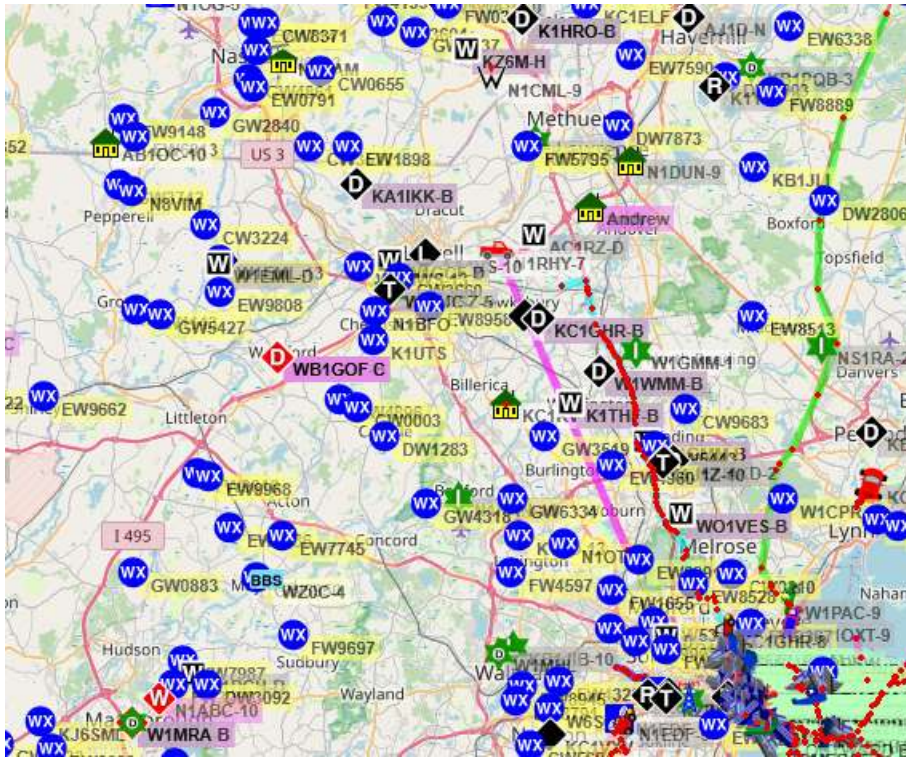# My Notes on Citizen's Weather Observation Program (CWOP)

John Langner WB2OSZ, September 2025

When we look at https://aprs.fi/#!lat=42.00000&lng=-71.00000 we see that the map is dominated by weather stations 🌐 .

The vast majority are not ham radio stations on RF feeding into APRS-IS. Where does this data come from?

Overview: https://www.weather.gov/cle/CWOP

More technical details: http://www.wxqa.com

http://www.wxqa.com/activecwd.html contains an outdated list of the CWOP servers:

3. APRS Internet Service (APRS-IS) servers

These are the servers to use when you send your citizen weather data packets to CWOP. How to change server designations in your local weather program is covered in the set-up pages above. If your program is not listed there, contact the program author.

- **CWOP-1** - - - cwop1.ou.edu - - - Gerry Creager, N5JXS - - - Norman, Oklahoma
- **CWOP-2** - - - cwop.fuller.net - - - Jim Fuller, N7VR - - - Billings, Montana
- **CWOP-3** - - - cwop.tssg.org - - - John Ronan, EI7IG - - - Waterford, Ireland
- **CWOP-4** - - - cwop2.ou.edu - - - Gerry Creager, N5JXS - - - Norman, Oklahoma
- all cwop servers - - - cwop.aprs.net : port 14580 or port 23 - - - this links to all four CWOP servers.

APRS-IS is for ham radio use only.   CWOP uses the same software but a different set of servers. **Cwop.aprs.net** is a round robin address for redundancy, load balancing, and failover.

```
$ dig cwop.aprs.net
…
…
cwop.aprs.net.      7    IN    A    143.244.144.248
cwop.aprs.net.      7    IN    A    44.155.254.4
cwop.aprs.net.      7    IN    A    129.15.108.116
cwop.aprs.net.      7    IN    A    44.235.86.44
cwop.aprs.net.      7    IN    A    85.188.1.27
cwop.aprs.net.      7    IN    A    54.200.219.161
```

When a weather station wants to send a report, it randomly picks one of those addresses. If a server is down, try another.

Rather than downloading data for the entire world, it is possible to select a region with a filter like this:

```
IGFILTER r/42/-71/100
```

That means centered on latitude 42, longitude -71, and within 100 km

 I was able to extract weather reports by using the IGate functionality of direwolf and this configuration file:

```
IGSERVER cwop.aprs.net
IGLOGIN N0CALL 123456
IGFILTER r/42/-72/100
ICHANNEL 15
```

A valid login is only needed for uploading information.   Anyone can download.

The server side filter means select anything within 100 km of the specified latitude and longitude.

One time it happened to connect to CWOP-3 and I got data like this:

N1OTX>APWEE5,TCPIP*,qAC,CWOP-
3:@101550z4227.48N/07111.73W_315/002g005t064r000p000P000b10248h77L207.weewx-
5.1.0-VantageNext

GW4536>APRS,TCPXX*,qAX,CWOP-
3:@101425z4207.27N/07124.61W_061/000g...t061r000p000P001b10180h87L077.weathertrac
ker0311.7.4

GW3101>APRS,TCPXX*,qAX,AMBCWOP-
1:@101550z4155.19N/07210.57W_229/004g005t066r000p000P000h78b10231L618AmbientC
WOP.com

FW5461>APRS,TCPXX*,qAX,CWOP-
3:@101550z4207.85N/07247.58W_018/003g011t067r000p000P000h67b10263L847.DsIP
[

Occasionally we see a ham radio call in there but those are rare. I noticed that it only got packets that
were uploaded to CWOP-3 and AMBCWOP-1.

Another time, the IGate happened to connect to a different server and got packets like this:

KB2UZY>APRS,TCPXX*,qAX,CWOP-
7:@101745z4207.47N/07235.19W_013/003g009t075r000p000P000h58b10214L374.DsIP

GW3723>APRS,TCPXX*,qAX,CWOP-
7:@101745z4139.76N/07205.29W_030/005g015t070r000p000P000h67b10221L....DsWLL

EW3846>APRS,TCPXX*,qAX,CWOP-
7:@101745z4142.05N/07302.11W_048/002g010t066r000p000P000h77b10228L....DsIP

This time it only produced packets that were uploaded to CWOP-7.

My observation: While this behaves a lot like APRS-IS, it seems that there are no core servers linking
these separate servers together.   A query on one server gets results only from that one server.

I checked with a couple experts and my observation is correct. We can't simply download everything in
a single stream.

Extracting the data is little more complicated. The problem we run into is that the servers are all
independent and not linked together to share data. Currently there is not a place where we can a single
stream with all of these merged. It is necessary to query each of them separately and merge the results.

(Keep reading for a better solution.)

FINDU.COM

http://www.wxqa.com/cwop_info.htm#How%20does%20CWOP%20Data%20get%20to%20NOAA?
mentions findu.com. There are plenty of pages showing the information digested and displayed for viewing. e.g.

http://www.findu.com/cgi-bin/wx.cgi?call=CW0351&last=36

http://www.findu.com/cgi-bin/wxnear.cgi?call=cw0351

https://mesowest.utah.edu/cgi-bin/droman/mesomap.cgi?state=MD&rawsflag=1

Various queries are available: http://www.findu.com/cgi.html

The one thing I can't find is a way to download raw data for weather stations within some distance of a given location.

Direwolf 1.8

Direwolf 1.8 has a new enhancement to download from all of the CWOP servers concurrently with a single instance of the application. As this is being written, this feature is in the "dev" branch not the latest release.

This is all you need for the configuration file:

```
CWOPSERVER cwop.aprs.net
IGLOGIN N0CALL 123456
IGFILTER r/42/-72/100
ICHANNEL 15
```

Notice that it uses CWOPSERVER, rather than the usual IGSERVER.

When it starts up, cwop.aprs.net is expanded to all of the corresponding addresses. You should see a message similar to this for each of the addresses:

Now connected to CWOP server cwop.aprs.net (44.235.86.44)
Check server status here http://44.235.86.44:14501

Now connected to CWOP server cwop.aprs.net (54.200.219.161)
Check server status here http://54.200.219.161:14501

Now connected to CWOP server cwop.aprs.net (85.188.1.27)
Check server status here http://85.188.1.27:14501

… etc.

Weather data from all of the servers are merged into a single stream.   Direwolf displays its usual interpretation of the weather packet:

[15.is] X>X:}CW0104>APN000,TCPXX*,qAX,CWOP-6:@191701z4214.60N/0711
1.87W_299/000g008t078r000p000P000b10127h55L069eMB54
Weather Report, WEATHER Station (blue), UNKNOWN vendor/model
N 42 14.6000, W 071 11.8700
wind 0.0 mph, direction 299, gust 8, temperature 78, rain 0.00 in last hour, rai
n 0.00 in last 24 hours, rain 0.00 since midnight, barometer 29.91, humidity 55,
 69 watts/m^2, "eMB54"

This is good for troubleshooting but not so good if you want to feed weather data into some sort of automated process. Just the data can be extracted by using the "kissutil" application.

[15] X>X:}EW6187>APRS,TCPXX*,qAX,CWOP-
6:@131712z4141.73N/07243.55W_196/002g003t076r000p000P000b10187h64L933.WD 31

[15] X>X:}GW2867>APRS,TCPXX*,qAX,CWOP-
6:@131712z4217.40N/07244.38W_138/001g002t072r000p000P000b10172h73.WD 10

[15] X>X:}EW8754>APN000,TCPXX*,qAX,CWOP-
6:@131712z4212.97N/07130.48W_203/002g005t073r000p000P000b10170h62L788eMB62

[15] X>X:}EW0420>APRS,TCPXX*,qAX,AMBCWOP-
1:@131712z4205.53N/07152.43W_271/001g003t074r000p000P000h69b10265L265AmbientC
WOP.com

[15] X>X:}KB1LTW-13>APWEE5,TCPIP*,qAC,CWOP-
5:@131712z4154.83N/07253.60W_143/001g002t071r000p000P000b10218h69L093.weewx-
5.1.0-Interceptor

[15] X>X:}W1MWS-13>APRS,TCPIP*,qAC,CWOP-
3:@131712z4238.00N/07122.24W_.../004g005t081r000p000P000b10187h60.weewx-4.10.2-
AcuRite

[15] X>X:}GW5618>APRS,TCPXX*,qAX,AMBCWOP-
1:@131712z4209.43N/07049.35W_168/002g003t073r000p000P000h61b10203L806AmbientC
WOP.com

[15] X>X:}DW2428>APRS,TCPXX*,qAX,CWOP-
3:@131712z4127.42N/07239.98W_328/002g008t073r000p000P000h73b10201.DsVP

[15] X>X:}GW0883>APRS,TCPXX*,qAX,CWOP-
6:/131712z4226.35N/07133.92W_222/000g002t072r000p000P000h74b10217RainwiseNet-
MKIII

[15] X>X:}CW9455>APN000,TCPXX*,qAX,CWOP-
4:@131712z4108.23N/07217.67W_256/005g010t073r000p000P000b10186h55L784eMB62

[15] X>X:}FW5974>APRS,TCPXX*,qAX,CWOP-
5:/131712z4248.76N/07150.32W_225/000g000t071r000p000P000h65b10960RainwiseNet-
MKIII

[15] X>X:}GW0203>APRS,TCPXX*,qAX,AMBCWOP-
1:@131712z4142.71N/07115.77W_231/006g007t074r000p000P000h65b10181L483AmbientC
WOP.com

[15] X>X:}N1UEC>APRS,TCPXX*,qAX,CWOP-
4:@131713z4206.50N/07117.10W_070/002g005t073r000p000P000h62b10208.DsVP

[15] X>X:}FW9998>APRS,TCPXX*,qAX,AMBCWOP-
1:@131712z4223.78N/07108.04W_121/002g002t077r000p000P000h53b10213L651AmbientC
WOP.com

[15] X>X:}N1EDZ>APREST,TCPXX*,qAX,CWOP-
7:@131711z4216.24N/07215.33W_154/002g003t072r000P000h71b10190L572eREST

What does it mean? Let's break this down into parts.

[15] X>X:}
Ignore this part.

Next is that station name. CW, DW, EW, FW, GW prefixes are non-ham stations.
N1EDZ is an example of a ham radio station.

APRS, APREST, APWEE5, etc. should be the identifier for the type of device or software app that
generated the packet.
If there is an issue, we can trace it back to the problematic software.
If it says APRS, the software author is either ignorant or lazy.

TCPXX*,qAX
Ignore this.

Next is the name of the server that accepted the weather report from the client. Notice how it changes because we are combining data from all of them.

Finally, we have an APRS Position Report. When the symbol table is / and the symbol is _ it is a special case meaning weather report.

Here is an introduction to understanding the format of APRS Packets:

https://github.com/wb2osz/aprsspec/raw/main/Understanding-APRS-Packets.pdf