

Personal weather station

In the twentieth century, an occasional student in the meteorology class kept a personal weather station. It was a lot of work. Readings of the instruments were taken by eye everyday, a few times a day if possible, and recorded in the log. There was not much scope for sharing results. Unless the data was transferred to computer, there was not much scope for numerical and comparative studies. All that has changed since about 2010. Personal weather stations with a range of weather sensors can be purchased with internet connectivity. They also allow results to be recorded on a personal computer and via 'apps' you can see the weather on your phone. 'Automatic' weather stations were available professionally decades earlier but at a cost. The price is now 'reasonable' for the enthusiast, a fraction of the cost of a mobile phone. Free internet sites will display the results, both the current weather and trends over a selected interval of time. The example below shows one version of what can be done at the time of writing (in 2019).

My example is a Froggit WH3000 SE (cost at time of writing about £160). It is described in various places as the most popular of its kind. The instrument cluster senses temperature, humidity, wind speed, wind direction, rainfall, solar radiation and UV, and connects to a base station display by wifi. A range of units is available and the display can be customised, for example to show average values and not instantaneous values. The base station acts as a relay to the local router and hence the data can be transferred either by ftp or via a URL to public sites.



The Froggit display showing time and date, inside temperature and humidity (in red), outside air pressure, temperature, humidity, UV, solar radiation, wind speed and direction and rainfall rate.



The sensors



Facing East



Facing South

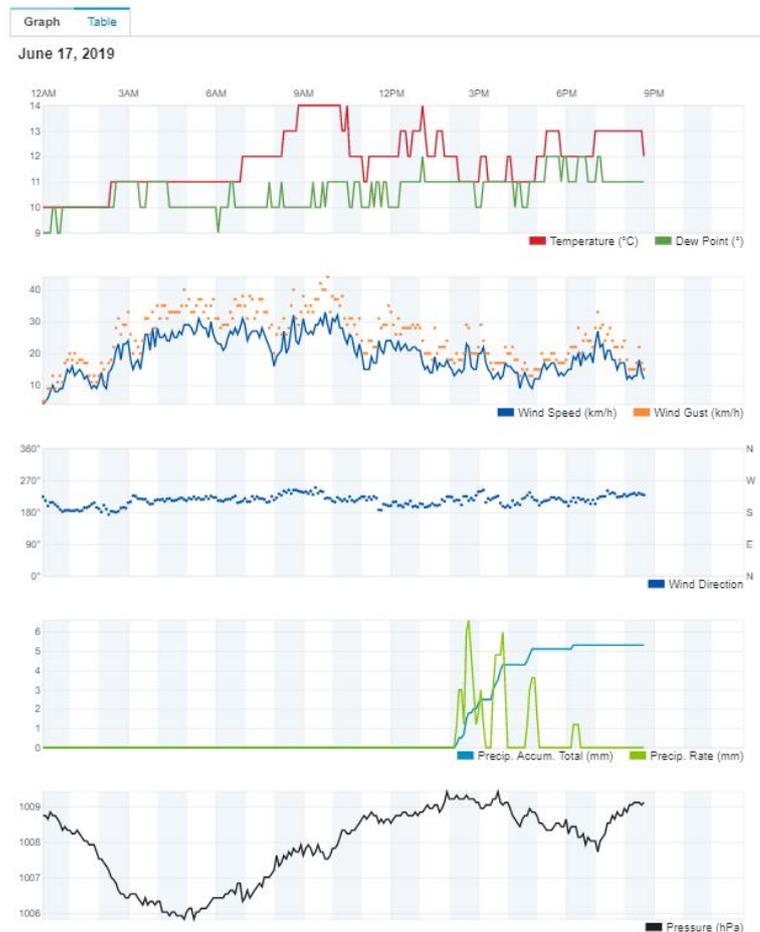
The weather station itself is reasonably compact and in the photos here is seen mounted on a 3 m scaffolding pole cemented into the ground. I chose a galvanised steel pole rather than aluminium or plastic to minimise vibration in the wind. To get accurate wind direction readings, the station must be oriented correctly. I have aligned it with the pole star. Shelter

from any nearby building is an issue. The rule of thumb is to site the station at a distance at least 4 times the height of the nearest obstruction above the station. The further from the house the better but the wifi has a limited range. Notionally it is 100 m in this case but given the signal has to pass through walls, then 50 m is a more realistic limit. Putting the station above the house roof sounds like an option that satisfies this rule of thumb but doing so may well fail the accessibility requirement that the rain-gauge will require periodic cleaning and batteries will need replaced from time to time. A second limit is that the base station must be within range of the router.

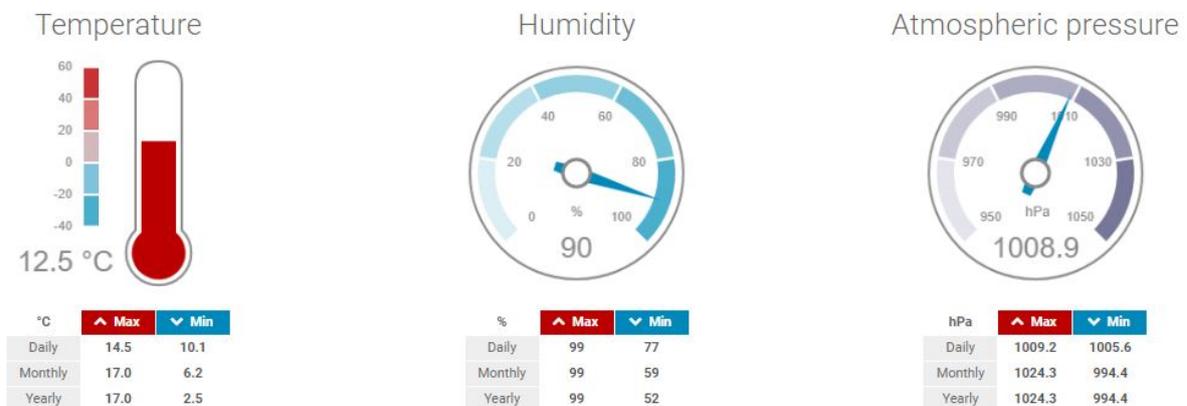
Accessing the data

A downside of transferring the weather data to one’s own PC is that the PC must be always on, which consumes energy and may not be what one wants when out of the house. There are several world-wide weather sites that accept data, usually directly by ftp (file transfer protocol) or via a URL. The examples to follow show **Wunderground**, **Weathercloud** and **WOW** (Weather on the Web, the UK Met. Office site).

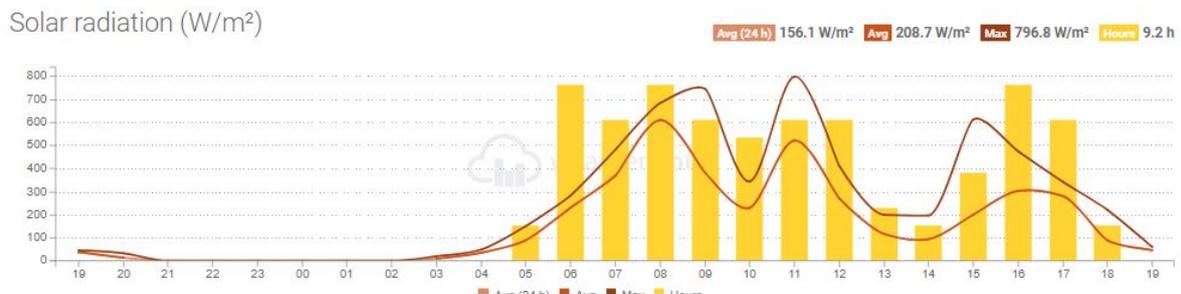
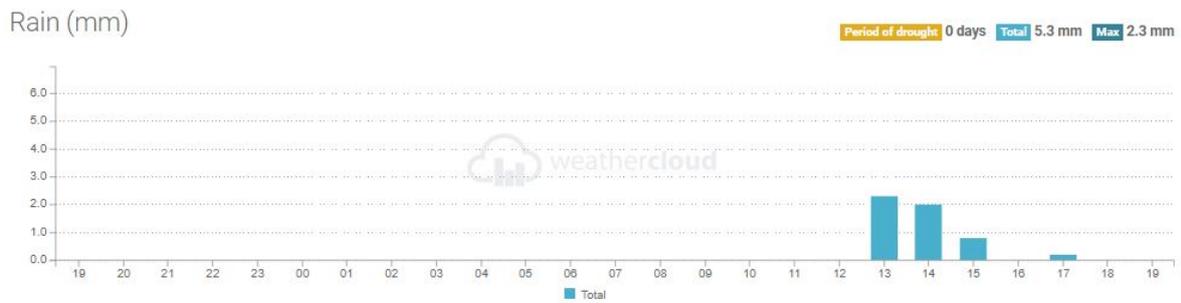
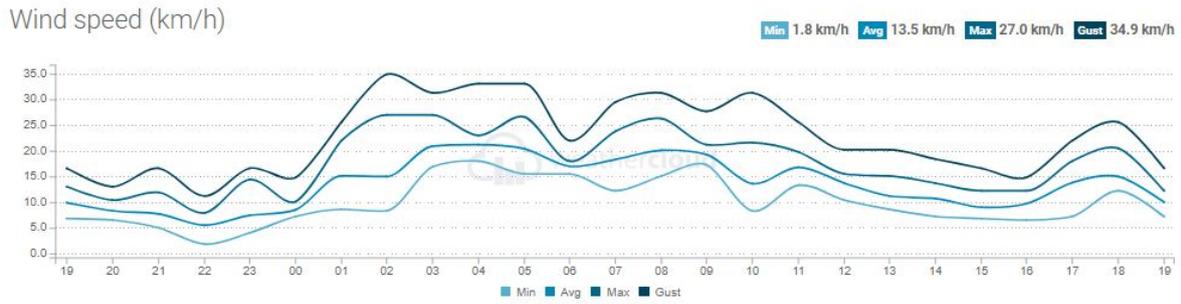
The <https://www.wunderground.com> page gives a station summary with a map showing the station location, current conditions, and further down the page weather history and graphs showing changing conditions for the day since midnight. Wunderground allows the user to choose from a range of unit.



Part of a daily Wunderground set of graphs



The beginning of weathercloud’s current conditions page



A section of weathercloud's 24 hour evolution graphs

<https://app.weathercloud.net> shows data in both analogue and digital form. The 'Profile' tab gives an overview of the station, including its location. 'Current' displays current conditions; 'Wind', wind speed (current, average and gusts) and direction; 'Evolution', graphs past readings for 24 hours, a week or a month as chosen. Weathercloud's wind speeds are in km/h. 'Current conditions' includes a figure for wind chill and heat index but the Froggit doesn't report these so they simply repeat the temperature reading.

Latest Weather Observation information at **Findon Moor**

12.3 Temperature °C	10.2 Dew Point °C	87.0 Humidity %	8.0 Wind Speed km
1009.3 Pressure (at station height) hPa	9.9 Wind Gust Speed km	5.3 Rainfall Amount mm	0.00 Rainfall Rate mm/hr

Map showing location: Findon Moor (134b34fc-9a7c-4911-00e7-0003f99009d)

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Photos

Met Office WOW dashboard display

<https://wow.metoffice.gov.uk/> brings up a map with local weather stations on the network marked. At present there are fewer stations here than on the two networks mentioned above. Clicking on a circle brings up a summary beside the map with an option to see full observations. The Met Office like to use UT (GMT) and quote wind speed in knots. Tabs allow further navigation to tabulated data, graphs and webcam. One feature on the website allows a time-lapse set of frames at 15-minute intervals to be viewed at just faster than 1 frame per second, showing the evolution of the weather.

All these sites seem to be in a state of development so there may be differences from the results suggested above by the time you look in the future. At times some features fail to work.

Weathercam

One of the developments riding on the ‘internet of things’ has been the rise of cheapish IP (Internet Protocol) cameras, notably driven by the security market. These can be made to record only when motion is detected, they can record audio too, send e-mails to you when a recording starts, etc. None of this sophistication is needed for a weathercam but the internet protocol ability is and the ability to ftp a still image. The weather sites above all claim to allow a weathercam display but the facility is not working for them all. The general requirement is either to ftp a fixed name .jpg file or to supply a URL on which the current weathercam image appears.

There was one advantage of the ‘old fashioned’ weather station: the observer could record ‘observations’ that were not instrumental, such as cloud height, cloud coverage, visibility, lightning, etc. A weathercam at least shows an observer’s view over a fairly wide angle, probably at least 100° depending on the camera. Images can be recorded, though not as succinctly as in an observer’s log book.



Late evening weathercam image showing a clearing sky after rain

Issues

The WH3000 SE doesn't store data itself. If there is an internet dropout then the data is lost. Likewise if the batteries fail, though they are supposed to last for a few years and the manufacturers recommend using lithium batteries. The base station runs off the mains but has battery back-up in case of a power failure (though my router doesn't, so the web-page readings will in fact be lost).

My only operational issue so far has been the loss of the rain gauge funnel for some days before I could replace it. No funnel, no rain recording. It was likely loosened by the wind shaking the station, for the funnel does not click into place. Hopefully they will come up with a better design of fitting.

Weather stations won't last for ever. I've just taken down my previous station. It didn't have web connectivity. The anemometer had seized and the battery terminals had become corroded. Your personal weather station is likely to be located in the most exposed location you have. The Froggit hasn't yet experienced the worst of our winter storms so I can't vouch for its longevity but it will give up, I expect after a few years. Its replacement will be a product of the 2020s.

It's a wrap

A personal weather station on the web is now achievable for many people. Yourself, friends, family and others interested can see the weather at your home location, particularly if supplemented by a weathercam. You can contribute data such as rainfall to special interest groups or provide data in newsworthy times. With the spread of personal weather stations, you may well be able to see the weather in places you intend to visit.

JSR