Weather Forecasting for Amateur Astronomers

Making sense of conflicting weather predictions

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Where weather data comes from. Image source: Australian Bureau of Meteorology

Like all amateur astronomers I want to know if the atmospheric conditions over the next few days will provide a good opportunity to plan an observing session.

When setting up at home, it's somewhat handy to know if clouds will appear. When packing the car to travel to a remote location, it is vital!

So, what information is at our disposal here in Australia?

The Bureau of Meteorology

BOM has all the information to be very accurate when it comes to predicting imminent and severe weather conditions but it's written day to day forecasts can also be agonisingly vague. They are not published with astronomers in mind.

Telling us it will be a sunny day is unsatisfactory for working out if the stars will be shining that evening and weather by icon does simply does not cut it for astronomy.

Often they will tell us, for example, that there is a 20% chance of rain or an 80% chance of a thunderstorm. What does this mean?

Is there a 20% chance of rain at your specific location or is there a 20% chance of some rain falling somewhere in the region? Does it mean that 20% of the region will get rain and 80% of it will not? Perhaps it means that 20% of the computer models are predicting rain and 80% are not.

I've often pondered the reasons for the vagueness from BOM and perhaps cynically I would put it down to either lack of human resources or not wanting to be proved wrong. Lately I've come to a third conclusion: that with so many computer models available, the difficulty they have is drawing a definitive conclusion from the output of so many models, which may be contradictory.

More about models later but bear in mind that the principle computer model used by BOM is a global model for capital cities and is very specific to the Australian region. However, BOM also compares various other global models from meteorological agencies around the world.

Will I use BOM?

> *Yes. Whatever you may think of it, the BOM is the principal authority on Australian weather. Their forecasts are often vague but when seeking an overview of current weather conditions, BOM should always be checked – but not exclusively.*
>
> *Read on...*

General Weather Websites and Phone Apps

There are a number of websites and apps which can be useful for deciding whether to go on a picnic or if you need to take a brolly when you leave for work in the morning, in case it rains on your way home.

These websites are popular because they provide detailed graphics, including a couple of things which astronomers find most useful: hourly predictions of cloud cover and humidity.

More detail? Good graphics? Sounds great! These apps are great for astronomy must be better than BOM, right? Well, not necessarily.

It comes down to models again. Websites like these come with all the impressive coloured graphics and hourly details, temperature graphs, humidity, cloud % etc. but they almost certainly come from only one computer model. They probably don't even reveal which one but because these apps are available for use wherever you are in the world, it infers that the information must be generated from one of the global models and disregards Australian regional models.

So whilst BOM publishes less intricate written forecasts (such as *"50% chance of rain"*) using the insight of local data and many other different computer models, general weather apps publish highly detailed information but from only one computer model.

Neither solution is really very satisfactory for astronomy purposes.

Would I use these general apps and websites?

> *No, because I don't know which model they use to make predictions and that makes it hard to compare with other similar sites. If you choose one of these sites exclusively, because you like the graphics, then you you are not getting the benefit of alternate models.*

Astronomy Weather Apps

There are a number of astronomy weather apps which are fairly similar to the general weather apps which I described above but their output may be more suitably presented for astronomers and thus more appealing. Like the general weather apps, their output is detailed but it is likely generated from only one computer model.

Some of these sites give useful output about upper atmosphereic wind speeds, seeing conditions and sky brightness etc. which can be very interesting to astronomers.

Would I use these astronomy apps and websites?

> *Not really, no. Perhaps if I am seeking to check up on seeing conditions and upper atmosphere stability, whilst remembering that, once again, the output likely comes from a single unidentified model. If it is a clear and moonless sky, the likelihood is that I will set up my telescope regardless of any prediction about upper atmospheric conditions.*

Computer Models

So, if you've got this far, you will have some inkling that:

- I will never rely on general weather prediction apps or websites.;
- I will base my observing sessions on the output of more than one computer model;
- I want to know which models they are; and
- One or more of those models should be specific to the Australian region.

Computer weather models, also known as '*numerical weather prediction*' models, are the main tools forecasters use. They each use super-computers to calculate for billions of points within the atmosphere around the Earth, taking the past and current weather observations of the atmosphere and ocean as the starting point, before calculating the weather into the near future.

What are all these models?

ACCESS (Australian Climate Community Earth Systems Simulator), is BOMs own global numerical weather prediction model – and it is specific to our region. When comparing weather models, it is surely important to look at the local models first. Your favourite weather app is unlikely to use ACCESS.

The ACCESS-G model covers the entire country, while the ACCESS-C model is a more detailed model which is scaled to cover capital cities in finer detail.

ECMWF is a global prediction model produced by a collaboration of over 30 European nations.

GFS (Global Forecast System) is a global weather prediction model run by the United States' National Weather Service.

UKMO is a global weather prediction model run by the British Meteorological Office.

GEM is the Global Environmental Multiscale model run by Canada.

ICON is the German weather prediction model.

All of these models extend to global weather predictions and include Australia.

There are more models. Here is a list of some of them:
https://en.wikipedia.org/wiki/Atmospheric_model#Domains

Why should I consider a European or North American weather model when I can use the Australian Access models?

Because sometimes the global models get it right and the Australian models get it wrong….

….and vice versa!

How Do I Compare Models?

I can recommend two handy sites which allow comparisons between models. These are *Cloud Free Night* and *Meteologix.*

Cloud Free Night

This site is designed for use by Australian astronomers. It provides a direct comparison with two Australian ACCESS models and one global model - the US global model, GFS.

Here is a link to the site: *https://www.cloudfreenight.com/index.html*. Select the meteogram icon and choose your location.

When using *Cloud Free Night*, do not rely on one model alone to base your decision on. It is essential (and simple) to compare the meteograms for each model. Sometimes they are identical but often they are at variance. This provides you with three (sometimes varying) scenarios to make your own judgement.

Meteologix

This is not a site designed specifically for astronomers but unlike most other general weather websites, it provides the ability to switch between eight *numerical weather prediction* models, (two of which are duplicated in *Cloud Free Night*) and publishes cloud coverage predictions for each model.

Here is a link to the Campbelltown page of the site: *https://meteologix.com/au/forecast/2172586-campbelltown/meteogram/aus*

Conclusion

Your “favourite” website or app only tells you part of the story. Go closer to the source and compare as many computer models as you can. Your app will likely be sourcing from only one of these models.

Observing the differences between some of the world’s largest super-computer *numerical weather prediction* models allows you to make the best decision. At the time of writing, the two websites: *Cloud Free Night* and *Meteologix* publish nine super-computer prediction models and the outputs will not be identical.

My observation is that they are all capable of being accurate – but none more so than the others. The weather can be very unpredictable and sometimes nature triumphs over processing power. Only by comparing the available models are you giving yourself the best chance of making an informed decision about setting up your gear.

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