A Few Words About Checking The Weather

Nick Czernkovich

There is generally no "right way" of checking the weather. Everybody tends to do this differently. There are however a few points that I can make about checking the weather that might help you along. In checking the weather, remember to always collect and use all available information. This could include, but is not limited to: radar, satellite, METARs, PIREPs, TAFs, GFAs, upper level charts (250/500/700/850 mb).

First a foremost, get the "BIG" picture. This is quintessential to understanding the weather. All too often pilots have a tendency to simply read the TAFs, METARs and GFAs. I am strongly opposed to this type of weather analysis because it gives the pilot no understanding of what is really going on. This can lead you down a dark alley with no escape if the forecast goes bust; and I'm sure we all know meteorologists don't get it right 100% of the time (except for maybe one!). Of all of these the GFAs give the most information about the synoptic weather picture, but even these can fall short. In part this is due to the fact that forecasters try to keep it simple, but also because synoptic weather systems often have length (space) scales that are larger than the dimensions of individual forecast regions. Nevertheless, a close look at the GFA can certainly reveal some key information, such as isobaric patterns (indicative of wind), low level jets, synoptic weather system motion, clouds, precipitation, icing and turbulence.

When you start your weather analysis, the first thing to do is find out what is going on right now. This is called diagnosing the weather. There are several ways to get the BIG picture. I used to make a habit of looking at the satellite image before anything else. There is a multitude of information that you can extract just by looking at cloud patterns and relating them to basic weather theory. For example, recall the classic comma-shape cloud pattern associated with a cyclone. By observation of cloud motion (meaning you have to animate the satellite image) you can get a sense of circulation (i.e. where the centre of the low is) and general cloud motion. You can also pick out long bands of cloud which may be associated with cold and warm fronts. With a broad idea of where the "weather" is, you can zoom in and inspect the region of interest, which might include things like bands of cloud, also known as "streamers", coming off the lakes. This can be key to finding regions of lake-effect snow for example. In Southern Ontario the spacing between surface observations (METARs) is so large that it can often miss entirely a band of lake-effect snow. This could ultimately lead you to believe that the sky is clear and blue, when in fact there is a nice juicy streamer located just between the observations.

I mentioned in the last paragraph that "I used to make a habit of looking at the satellite image before anything else." This is not necessary, but it is good practice because it helps you to put weather theory to use, without being predisposed to a meteorologist's diagnosis of the weather. Another way to start would be to look at the surface and upper level charts (SFC/850/700/500/250 mb). For our purposes we don't need to analyze these in depth, but a quick glance at them will help us put the weather picture together. Now whether you do this before or after the satellite is up to you, but start from the top down. Look at the upper level flow. Strong upper flow can mean faster moving systems (unless the system has been "cut-off"). Zonal, or East-West flow, usually tends to push systems along faster whereas high amplitude long-waves move systems more slowly. Also, look for the source region of air. The presence of

the polar vortex over or near Hudson Bay often leads to lake-effect snow in the winter. Strong south-westerly flow from the Gulf of Mexico can advect higher dewpoints which in turn can destabilize air. Recall that an increase in dewpoint by 1 C has a greater effect on destabilizing the air than an increase in temperature of 1 C. Warm air overrunning cold air, such as in the case of a warm front, has the potential to lead to freezing rain. Furthermore, remember that cyclones "tend" to be steered by the 500 mb flow, so this will give you an idea of storm motion. Continue to work your way down to the surface and piece the various levels together. Stronger lows for example will usually be accompanied by an upper-level trough or even a closed low as high as 250 mb. Now you can begin to associate the observed cloud patterns with the diagnosed weather. This is important because every bit of cloud, and every bit of precipitation happens for a reason. You need to understand where and why cloud is occurring.

Once you've got the bigger picture using satellite, you can see if any of the cloud you observed is producing precipitation. One way to achieve this is to check out the radar. Remember though that there are a lot of errors associated with radar and you should always try to validate the radar observations with ground observations. Furthermore, NEVER look at a single radar image! (This goes for satellite too by the way). Ground clutter and anomalous propagation (AP) can lead you to believe that "all hell has broken loose" when in fact you are looking at a false return. Generally speaking, although not always, extremely bright reflectivities which are not moving are usually not real. Also, in convective weather, remember that every thunderstorm starts out as a small cumulus cloud. Beware that convective cloud without the presence of precipitation could be an indicator of a region of developing thunderstorms, especially in the neighbourhood of existing thunderstorms. Furthermore, TCu can be just a turbulent as a CB.

Now compare regions of cloud and apparent precipitation with surface observations. Make sure to check cloud bases, types, wind shifts, temperatures and dewpoints. All of these data will help you to finalize your weather picture. Confirm locations of fronts by looking for wind shifts, temperature and dewpoint changes. Look at the weather and how the wind changes as the front passes. This can be vital information if you are expecting the front to pass through your destination airport around the time of your anticipated arrival. Note the dewpoints. I can't emphasize this enough! High dewpoints mean more water available for condensation. This means in the very least heavier precipitation, but also the potential for more vigorous weather. The temperature-dewpoint spread will give you an idea of how close the air is to saturation, which can help in assessing convective cloud bases, fog, etc.

Finally, check the PIREPs. This will give you an idea of the type of weather that others have encounters. Be sure to note what type of airplane has filed the PIREP though because things like turbulence and icing can vary greatly from airplane to airplane.

At this point you should have a clear mental picture of exactly what is happening right now. This means clouds, precipitation, turbulence, icing, winds, etc. You should know where all the IFR/VFR conditions are and most importantly you should know WHY the particular weather elements are occurring. Again, all weather happens for a reason and knowing why will go a long way to helping you get the most out of your weather forecasts.

Now you can begin examining the GFAs. Start by looking at the GFA for the present time period. See if the forecast matches the observations. If not, can you guess what I'm going to say? That's right, "understand why!" Continue on by looking at the GFAs for the future time periods to see how the weather is expected to evolve. Once again, have a clear idea of why the weather is expected to evolve the way it is.

With this information in mind we can now move onto the TAF. The TAFs should be your final source of information. In fact, by the time you get to the TAF you should already have a good idea of what it is going to say. Check TAFs along the route of flight as well and validate present time periods within the TAFs with current observations to make sure the forecast is holding.

Checking the weather can be done in any number of ways, but there are two key elements to remember: use all available information and understand why. The latter can be accomplished by knowing the big picture. You may have noticed that we worked our way down from the synoptic scale, using national weather maps and satellite, to the regional scale, using radar, METARs and GFAs, to the local scale, using TAFs and METARs. I chose to do it this way because of the "lifetimes" associated with each scale. Essentially, bigger systems last longer and there is a cascade of energy (or a cascade of "weather" if you will) from the larger scales to the smaller scales. What this means is that small scale weather is almost always associated with large scale weather. Furthermore, large scale weather is more predictable, so it is best to get a handle on what we are "pretty sure of" first.

A final note on checking the weather is to look at the history of the system. Often for example, if fog was present the night before in association with a system, it will be present the next night as well (all things being equal). You can sometimes push the region of fog forward with the system. Also, organized clusters of thunderstorms, such as squall lines, will exhibit a diurnal cycle. Therefore, you might anticipate that if it intensified midday yesterday, it will do so again today.

The process I have described is by no means the only way of checking the weather. It is up to you to find a way to check that you feel most comfortable with. And as always, practice makes perfect, so do it everyday even if you are not flying!

Safe flying and happy landings!

Any questions? Feel free to email me at nick@aerosafety.ca

Weather Websites of Interest

Aero Safety – www.aerosafety.ca
- Downloads of a number of seminars and papers I done

Nav Canada – www.navcanada.ca
- The first place to check for weather information

Aviation Digital Data Service - http://adds.aviationweather.gov/
- U.S. weather information for pilots
- Pilot reports
- Forecasts
- Metars (Including Java script)
- U.S. Radars and Satellite

Environment Canada - http://weatheroffice.ec.gc.ca/canada_e.html
- More up to date radar information
- Public weather
- Watches and Warnings
    - Gives an excellent synopsis of imminent or expect severe weather
- Special Weather Statements
    - Often gives a more general story of what is expected, with more detailed information and discussion
    - Also provides reviews of recent severe weather such as snowfall amounts. This allows for a better picture of the weather at your destination

Storm Prediction Center - http://www.spc.noaa.gov/
- U.S. Watches and Warnings with detailed discussion
- Mesoscale Discussions
    - An overview of the weather picture and how it relates to expected or occurring severe weather
    - Oriented more toward meteorological users, some of the wording may be complex and difficult to decode, but it can help to identify the threat level of severe weather
- Convective Outlooks
    - Expected convective weather over the next few days
    - Locations of interest
    - Synoptic and mesoscale explanations of weather
- NOTE: Some products contain a paragraph at the bottom of the discussion which says "Aviation Users…" and often gives storm motion and speed. This can be very helpful, but caution…several storms can move in slightly varying directions

Hydrometeorological Prediction Center - http://www.hpc.ncep.noaa.gov/
- Good U.S. surface analysis
- Precipitation discussions
    - Again, this will help form a good mental picture of the weather you are going to face

Research Applications Program - http://www.rap.ucar.edu/weather/
- Excellent source for meteorological data
- Products include:
    - Satellite
    - Radar (National/Regional/Local)
    - Java Metar tool