Getting the most from ForeFlight radar layers

Learn how our radar layers are built and when to use them to help choose the most accurate view for your flight needs.

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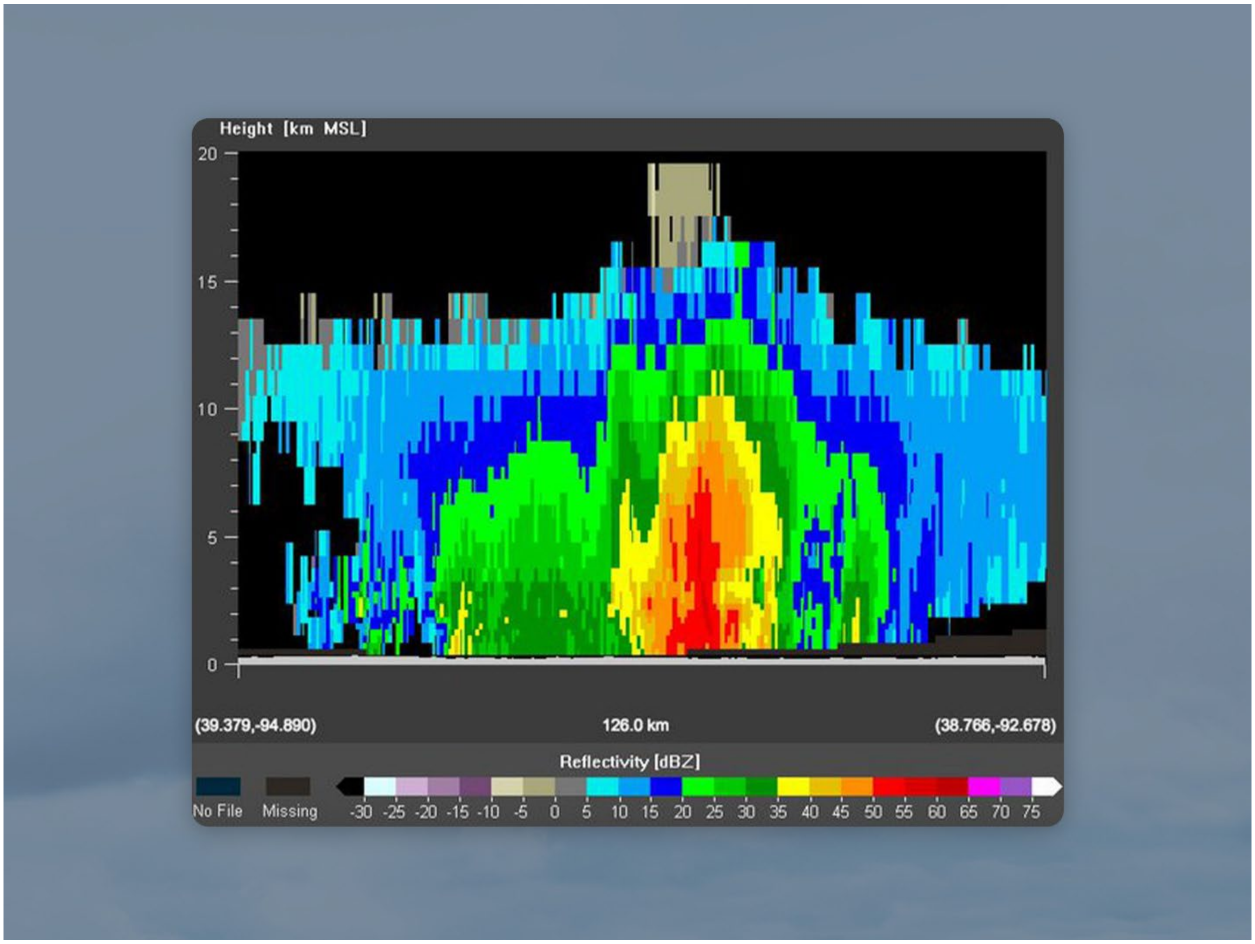
Now that ForeFlight Mobile 7.7 introduced a second radar layer to the app, what are the practical advantages of each? The composite reflectivity and lowest tilt radar layers both provide a high glance value to the pilot to highlight the location and movement of the truly nasty adverse weather. But I think you'll find that these two layers are more often similar than they are different.

Go to any pilot gathering discussing weather and you'll likely discover a majority of pilots genuinely swear by the composite reflectivity mosaic. In fact, you may even hear a few so-called "experts" stand up in front of an audience and attempt to convince them that you should only ever use composite reflectivity. Depending on your particular flying habits and aircraft capabilities, you may find that the base reflectivity from the lowest tilt is actually more useful and accurate. However, before we get into the pertinent differences, let's examine how each mosaic is built.

The nuts and bolts of NEXRAD

Every NEXRAD radar site throughout the U.S. scans the sky with multiple 360-degree sweeps at increasing elevation angles. It starts the process (called a volume coverage pattern) at 0.5 degrees and finishes at 19.5 degrees assuming the radar is in precipitation mode. The base reflectivity from the lowest elevation angle (called the lowest tilt) is most representative of precipitation, if any, that is falling out of the base of the cloud and reaching the surface. So the lowest tilt is what interests most of the general public so that's what you are likely to see on various websites that depict weather radar.

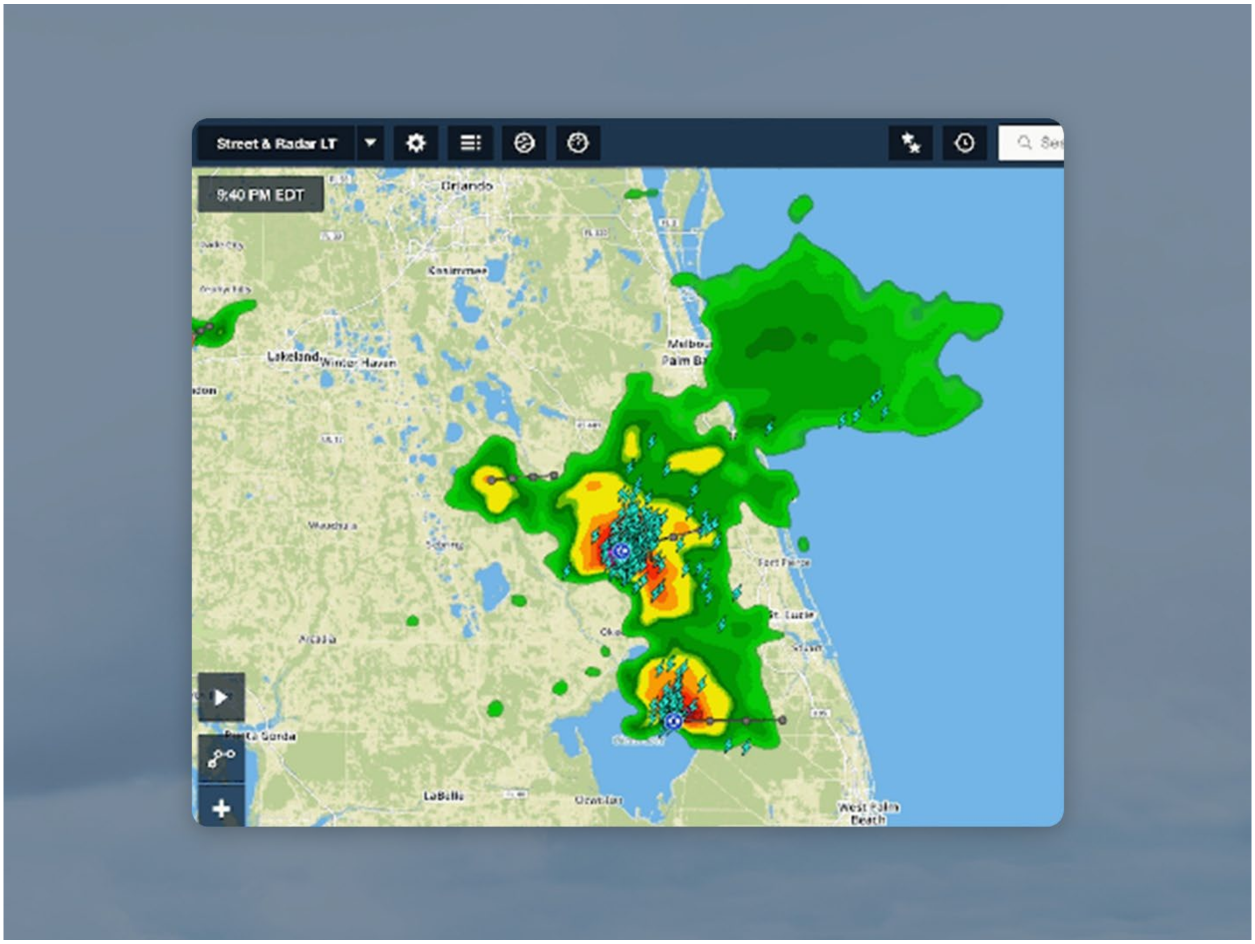
The composite reflectivity, on the other hand, includes the base reflectivity from every elevation scan. Depending on the scanning strategy of the particular radar site, this could be up to 14 different elevations. The highest base reflectivity value from each of these elevations is what's included in the composite reflectivity mosaic. Consequently, you don't know if the reflectivity depicted is near the base of the cloud, somewhere in the middle or near the top simply by looking at the mosaic.



A cross section of this mesoscale convective system (MCS) provides a better indication of the altitude of the highest reflectivity in the storm. In this case the precipitation core is below 6 km or 20,000 feet.

More is not always better

One of the chief issues with the composite reflectivity mosaic is that it often has a very large footprint when compared to the lowest tilt. It tends to exaggerate the areal impact of the precipitation event making it challenging to determine where it's safe to fly. Shown below is a two image animation over the southeastern Florida peninsula that toggles between the composite reflectivity and lowest tilt. Notice on the composite reflectivity mosaic at least one-half of the area depicts returns that are not likely to be actual precipitation falling from the sky. Most of the green contours to the northeast of Lake Okeechobee are low dB*Z*returns from ice crystals in the thunderstorm's anvil and are not likely a threat to pilots flying at lower altitudes 10 or more miles from the storm, but below the anvil.



High ice water content

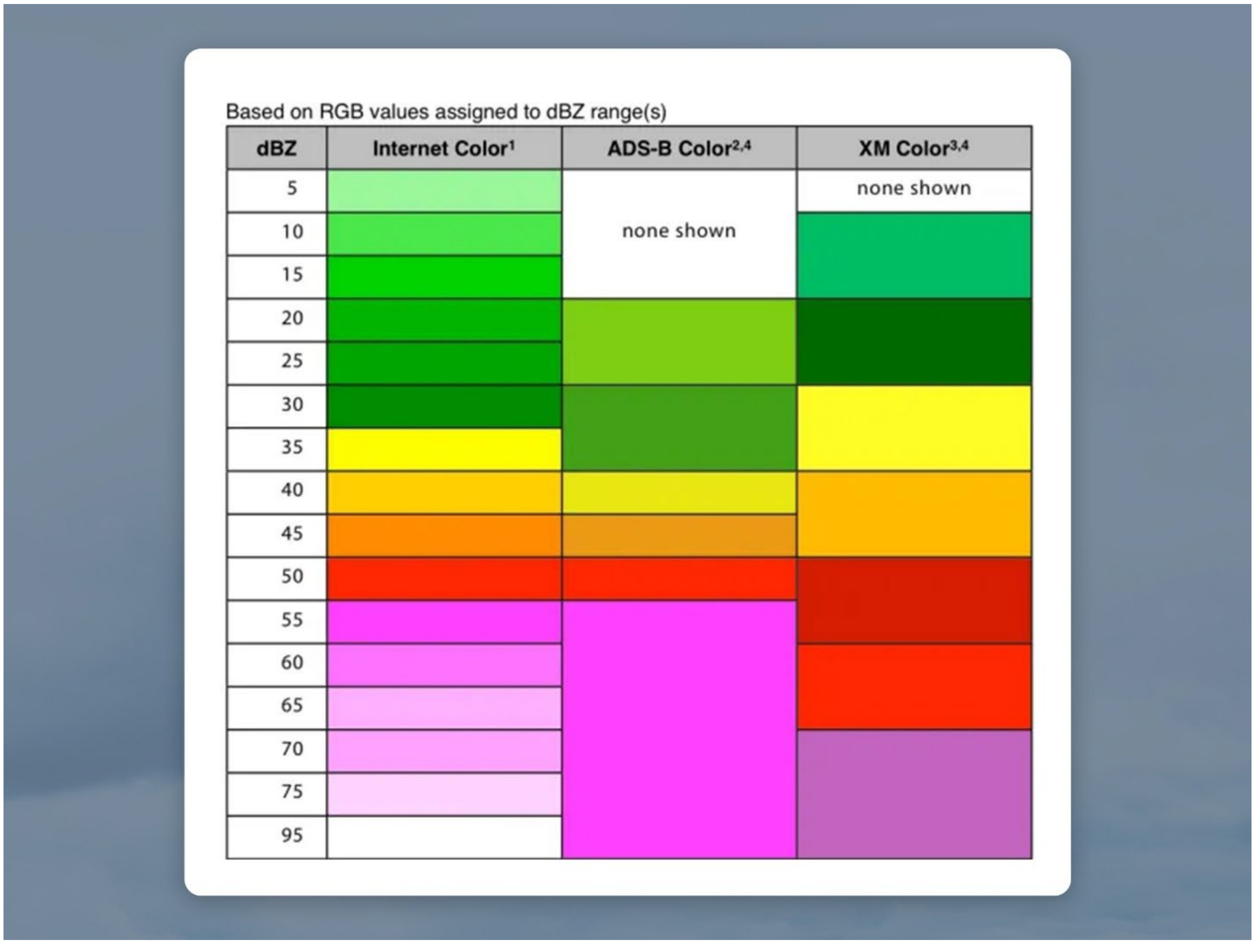
If you fly a turbojet aircraft in the upper flight levels, the composite reflectivity mosaic can be quite important to examine. The thunderstorm anvil like the one shown above can contain a high enough concentration of ice crystals (called high ice water content) to be a problem. These ice crystals can be ingested into jet engines causing power-loss or damage within the engine core. Engine instability such as surge, stall, flameout, rollback and damage of compressor blades due to ice shedding have been reported in these conditions. So if you are a pilot circumnavigating deep, moist convection in a turbojet aircraft, the composite reflectivity mosaic provides some indication of where the high ice water content may be located.

Down low and below

During the warm season when thunderstorms are the most common, the lowest tilt depiction is one that is useful to pilots that like to fly down in the bumpy air below the cloud deck. Typically the footprint of the areas of precipitation will be less giving pilots a cleaner image leaving behind just the cellular structure that's most important when flying within a convective environment. Even so, it's still important to keep your distance. Bear in mind that nasty convective wind shear often occurs below building convection or when flying near mature thunderstorms. Gust fronts from thunderstorm outflow as well as microbursts are the biggest threats especially with high-base convection.

What about the radar from my Stratus?

At the moment, the base reflectivity from the lowest elevation angle isn't part of the ADS-B broadcast. So while en route you will only have the regional and national composite reflectivity mosaic available. The current provider of ADS-B radar does a good job removing most non-precipitation returns, however, they don't broadcast any returns below 20 dB*Z* which is typically what you'd see in areas with a thunderstorm anvil.



Based on RGB values assigned to dBZ range(s)

dBZ	Internet Color[1]	ADS-B Color[2,4]	XM Color[3,4]
5		none shown	none shown
10			
15			
20			
25			
30			
35			
40			
45			
50			
55			
60			
65			
70			
75			
95			

Here is the ForeFlight mapping of colors to dBZ levels found in the Pilot's Guide. Notice that the first shade of green under ADS-B doesn't start until 20 dBZ whereas the Internet scheme starts as low as 5 dBZ

In the end, when both depictions are available as they are in ForeFlight Mobile, each radar should be given its due time during your preflight analysis.

About the Author

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Tim Bernas is a Senior Product Manager at ForeFlight. With over 20 years of experience in product management and through his unique perspective as a meteorologist, Tim helps teams turn complex data into easy-to-use products across web and mobile platforms. A longtime aviation enthusiast, Tim's work spans consumer weather apps and interactive features used by millions at The Weather Channel to aviation tools at ForeFlight.