WEATHER:

FLYING THE SOUTH-EAST WEATHER MAP

Think strategically about general patterns as you plan flying for summer into fall.

BY SCOTT DENNSTAEDT

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FLYING IN THE SOUTHEAST, including the southern Appalachian Mountains and the Tennessee Valley during the warm season, carries with it different weather challenges than what you would experience in the spring. The good news is that on any given day, airframe icing is much less common given the freezing level is often hanging around the mid-to-upper teens at this time. Supercooled liquid water and the threat of airframe icing still exists, but it is most often associated with deep, moist convection and thunderstorms, which we diligently try to avoid anyway.

Another benefit of summertime in this region is that frontal system passages are few and far between as the fast-flowing jet stream has been steadily migrating north into Canada throughout the spring and early summer. That leaves behind light westerly winds aloft or what meteorologists call zonal flow. Consequently, mountain wave activity takes a back seat in the southern and central Appalachians as instability near the surface ushers in thermal turbulence that most pilots must endure during the afternoon and early evening hours.

It is also common for a stagnant high-pressure ridge to develop over much of the southeastern U.S. The result is sinking air that compresses and warms the lower atmosphere. This creates a subsidence inversion aloft that can trap moisture and pollutants and beckons the call for hazy, hot, and humid conditions.

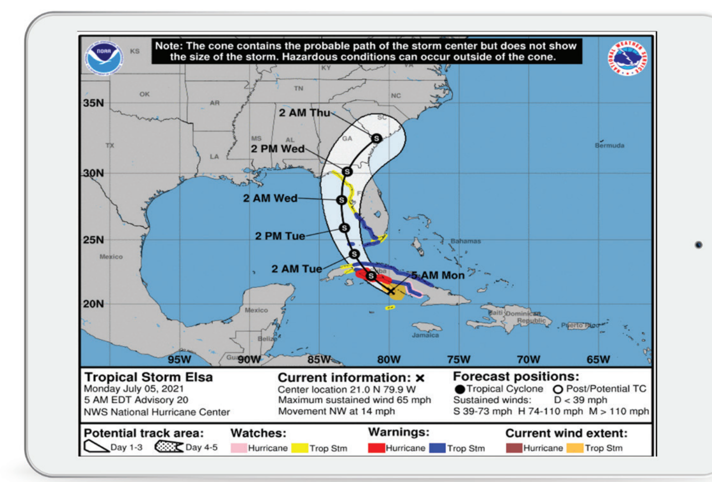
While the sky may be free of any significant clouds, these stagnant conditions engender light surface winds and reduced visibility at many airports, especially in the early morning hours. This persists until daytime heating dissipates some of that low-level moisture and improves the ground visibility in the late morning and early afternoon. The Great Smoky Mountains are aptly named as these hazy conditions make it difficult to visually navigate the southern Appalachians when flying VFR into mountain airports, especially aerodromes in valleys where rivers provide much of the surface-based moisture. And density altitude also becomes an issue at higher elevation airports on these days as the temperature soars into the upper 80s and 90s.

HURRICANE SEASON

One of the wild cards during this time of year that is difficult to predict with any certainty is activity in the tropics. Hurricane season started on June 1, and based on estimates by scientists at Colorado State University, there's "an above-average probability for major hurricanes making landfall" this 2022 season. Tropical systems can wreak havoc even with the best of plans, and forecasting them can be tricky once they have made landfall.

Tropical systems are indeed convective monsters, but this is not your garden variety convective threat. It's probably not a surprise to hear that a healthy squall line moving through the lower Mississippi Valley or Midwest during the spring or fall can generate lightning at a rate of more than one stroke per second for an extended period. You'd likely be astonished to learn that, on average, a hurricane rarely produces more than a single lightning stroke every 10 minutes, according to Robert Black, a research meteorologist with the Hurricane Research Division of the National Oceanic and Atmospheric Administration (NOAA).

Even if you're not planning a coastal destination this year, hurricanes and tropical storms make landfall, weaken, and move inland as tropical depressions, creating the threat of torrential rain, flash flooding, and severe convection that may include small tornadoes. In fact, as the system decays and moves over land, it is not unusual to see tornado watches and warnings issued on the eastern side, long after the storm's center has moved away from the point it made landfall.



Hurricanes and tropical storms greatly influence weather in the Southeast in the summer and fall.

SQUALL LINES AND PULSES

Once again, the convection in a dissipating tropical system may not be dominated by lightning like that springtime squall line. Even if your datalink radar mosaic looks benign, don't be fooled; the vertical wind shear in the remnants of these systems can be deadly to small aircraft flying through them. It is important to keep your distance from widespread areas of precipitation generated by these tropical systems, especially in the rain bands that circulate outward from the dissipating low pressure center. They still carry a lot of wind and convective energy despite being in their dissipating stage.

For timing, forecasts, and evolution of these tropical systems, the official word is the National Hurricane Center (NHC) at nhc.noaa.gov. Once the hurricane makes landfall, the Weather Prediction Center (WPC) at wpc.ncep.noaa.gov and Storm Prediction Center (SPC) at spc.noaa.gov will be your best resources.

Even if there's not a tropical system to ruin your vacation, those pesky diurnal thunderstorms are ubiquitous this time of year, particularly in the Appalachian Mountains and along coastal regions as sea breezes lead to afternoon convection. In stagnant situations where there's no significant change in air mass (e.g., frontal boundary), every day's heating is usually sufficient to get a new round of thunderstorms going by the middle of the day. In fact, yesterday's thunderstorms often lay down outflow boundaries that can help initiate today's afternoon thunderstorms. It's extremely difficult, if not fundamentally impossible, to predict where those storms will develop with enough accuracy to satisfy the unrealistic needs of some pilots.

These pulse-type thunderstorms, colloquially known as air mass thunderstorms, may not always reach convective SIGMET criteria because of their scattered or isolated nature. In the southern and central Appalachian Mountains, they develop along the ridgelines in the early to midafternoon. Owing to weak upper-level flow aloft, they do not have a significant vertical tilt like you might see with pre-frontal convection or supercell thunderstorms that are commanded by strong upper-level prevailing winds. Consequently, pulse-type thunderstorms typically don't move very fast and will last an hour or less as the precipitation core in these cells falls through its own updraft to literally rain itself out.

A LITTLE PLANNING

For convective planning, tyou can try to use the available weather guidance to estimate broadly where and when storms are most likely to occur, a probabilistic approach to be sure. This is because forecasting convective weather isn't black and white, but shades of gray. A forecaster must quantify their uncertainty and communicate that to the pilot. How that is accomplished can be quite difficult for the average pilot to fully appreciate.

For example, pilots tend to see a forecast for rain showers (SHRA) or showers in the vicinity (VCSH) in a terminal forecast (TAF) and do not think twice about it. After all, there's no cumulonimbus (CBs) in the cloud group forecast, so this is just a few harmless rain showers, correct? According to the National Severe Storms Laboratory (NSSL), a thunderstorm is "a rain shower where you hear thunder. Since thunder comes from lightning, all thunderstorms have lightning." This definition doesn't sound very profound, but it's quite important to acknowledge that all thunderstorms start as rain showers. Moreover, not all rain showers grow up to be mature thunderstorms. In other words, a little rain shower is the beginning of the convective process.

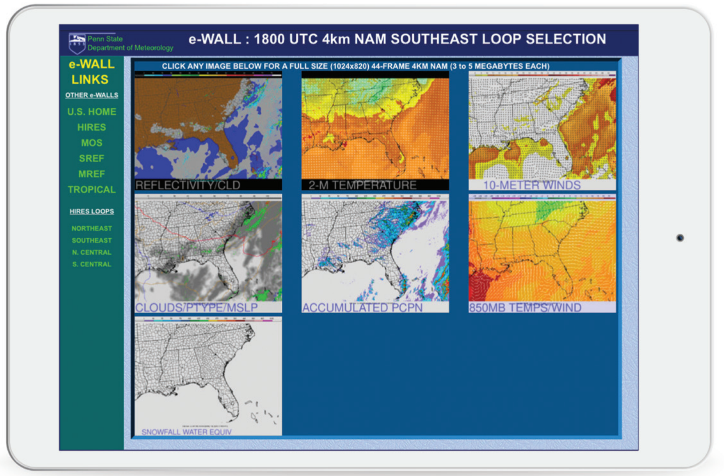
During the spring and fall when there's convection associated with a strong cold front, the certainty of thunderstorms is often quite high. On the other hand, when the National Weather Service (NWS) forecaster is uncertain about a convective event, as they often are during the summer months with isolated or scattered pulse-type thunderstorms, they will often place a forecast for showers in the TAF, like the one you see below for Asheville Regional Airport, North Carolina (KAVL). It's important to recognize that the terminal area is the region 5 sm from the center of the airport's runway complex. This is incredibly tiny, which drives up the uncertainty—especially as it relates to isolated or scattered pulse-type convection.

**KAVL 221140Z 2212/2312 260008KT P6SM SCT040
FM221900 25011G18KT P6SM VCSH BKN035
BKN060 FM230000 35006KT P6SM SKC=**

When a forecaster adds showery precipitation to a TAF, it could simply be their way of quantifying and communicating their uncertainty to you. But most pilots really don't understand this subtle hint. Once convection does eventually develop and is determined by the forecaster that it will most likely impact the airport's terminal area or its vicinity, forecasters will amend the TAF and remove the forecast for showers and add TSRA or VCTS, respectively, in its place. One of the reasons forecasters use showers as a placeholder is attributed to outside pressure by commercial air carriers. Airlines prefer not to see thunderstorms to avoid the need to file an alternate and carry extra fuel.

AREA FORECASTS

To help understand what the forecaster is expecting, pilots should also be reading the area forecast discussions (AFDs) available within most of the heavyweight apps or from weather.gov. No, these are not discussions about the retired aviation area forecast (FA), but those that are issued by the local NWS offices throughout the U.S. The forecasters that write the plain English AFDs are the same local forecasters who issue the TAFs. The discussion is meant to describe the expected weather within the forecast office's county warning area (CWA). For example, the Greenville-Spartanburg forecast office (GSP) in Greer, South Carolina, is responsible for issuing the Asheville TAF, but to gain a better perspective of the forecaster's uncertainty, they will often document this in the AFD. For example, here's the aviation section of the AFD for a similar convective event. Notice they are using showers in the vicinity as a placeholder:



This Penn State University website shows the North American Mesoscale (NAM) model on a regional loop.

**"AVIATION /12Z TUESDAY THROUGH SATURDAY/...
At most terminals...little change from 06 UTC package as a west wind less than 8 kts under mostly clear skies will continue thru mid-morning. Expect increasing WSW winds with low amplitude gust potential by midday and perhaps periods of VFR CIGS through the afternoon. Scattered showers and perhaps a thunderstorm...are expected from the afternoon until early evening and will carry VCSH for now to cover that threat. Deep convective activity will diminish by midevening when a wind shift to NW is expected."**

It is also beneficial to examine the convective outlooks from the SPC, which will help to narrow the timing of these storms to a four-hour period. You can find those high temporal resolution outlooks on the SPC website at spc.noaa.gov/products/exper/enhtstm/. Finally, to help visualize how the precipitation will evolve, look at the simulated reflectivity forecasts, also known as forecast radar. Penn State University has a great website for the Southeast. It shows the loop for the 0600Z run of the high resolution North American Mesoscale (NAM) model, which is the perfect timing to plan your day. You can interpret this just like any Nexrad mosaic, but it's a forecast for what might happen over the next 48 hours.

As the summer weather wanes, the upper-level winds will begin to strengthen and mountain-induced turbulence will start to rear its ugly head again. You'll notice that most of those convective SIGMETs that blanketed the area during the afternoon and evening hours will morph into advisories for airframe icing as the freezing levels start a downward trend throughout the Ohio and Tennessee Valleys and even into the Southeast. In the highest elevations in the southern Appalachians, it's not unusual to see an early mountain snowfall as Halloween approaches and temperatures allow for artificial snowmaking to begin in the North Carolina mountain ski resorts.

As waters in the Atlantic cool during the late fall, this sets the stage for the first cold air damming event east of the Appalachian Mountains. This evolves as a cold Canadian high pressure system takes root over northern New England with clockwise flow pulling in cold, moist air off the Atlantic that gets wedged up against the central and southern Appalachian Mountains. With this cold, dense air locked in at the surface, a vigorous early season low pressure traverses from the Deep South and moves northeast up the spine of the Appalachian Mountains. Warm air from the south that overruns the cold, dense air wedged against the mountains creates the potential for a nasty freezing rain event in the Piedmont Mountains of the Carolinas and central Georgia.

If your journey takes you to an airport in the Southeast this summer, aim to be on the ground before noon to beat the afternoon convection. A week before your departure, keep a close watch on the tropics to map out the potential for any landfalling tropical systems along your route. If flying during the early morning hours, be careful of hazy conditions that reduce flight visibility, especially in the mountains. Last but not least, avoid the secret killer, density altitude. Be sure to check the performance numbers before landing at or departing from high-elevation airports, especially during the mid to late afternoon when the density altitude is the highest. Then relax and enjoy the beauty this area has to offer. ●

SCOTT DENNSTAEDT, PH.D., resides in Charlotte, North Carolina, and flies regularly throughout the Mid-Atlantic and Southeast U.S. He is a CFI and former NWS meteorologist. Scott is the co-author of *Pilot Weather: From Solo to the Airlines* and the founder of EZWxBrief.