The Front

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Visit NWS at EAA AirVenture

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Are you one of the more than 700,000 aviation enthusiasts planning to attend the EAA AirVenture July 24-30, in Oshkosh, WI? If so, take a few minutes and visit the NWS booth in the Federal Pavilion. EAA Airventure provides a great opportunity for us to interact with *you*, our customers.

Carl Weiss, NWS Aviation Services Branch meteorologist, makes a "tornado" at AirVenture .

NWS staff from our national headquarters in Silver Spring, MD; the Aviation Weather Center in Kansas City; the NOAA Aircraft Operations Center at McDill AFB; and Wisconsin forecast offices will be on hand to show you the latest aviation forecast products, answer your questions, and listen to your feedback.

While we can't provide an official briefing—you can visit the FAA booth for that—we can show you the latest satellite and radar loops, current aviation hazards, and forecast information for your stay in Oshkosh and your trip home.

You can see some of the tools used to measure weather on the ground and in the air, including a weather balloon, wind vane, anemometer, rain gauge, instrument shelter and a barometer. You can also pick up an assortment of safety brochures on topics such as hurricanes, tornadoes, flash floods and NOAA Weather Radio All Hazards. Or enter a drawing to win a rain gauge and other prizes!

NOAA Corps pilot Gregory Glover (left) explains the Aircraft Operations Center's snow survey aircraft.

So make plans to visit the NWS booth at the 2006 EAA AirVenture in Oshkosh this year. See you there! ✈

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When's the Next *Front?*

Would you like an email alert when a new edition of **The Front** *is published? Write melody.magnus@noaa.gov.*

The Front

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Mission Statement

To enhance aviation safety by increasing the pilot's knowledge of weather systems and processes and National Weather Service products and services.

The Flight Instructor's Role in Weather Education

By Michael Moneypenny, Aviation Focal Point, NWS Raleigh, NC
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Weather knowledge/experience varies tremendously with pilots. I see it first hand as an Aviation Focal Point (AFP) meteorologist at the NWS Raleigh, NC, Forecast Office. In this capacity, I give frequent weather presentations directed towards the General Aviation community at FAA workshops, Wings Weekends and other local flight events. I even soloed and was preparing for my cross-country test when I had a bad scare while landing one afternoon in weak convective weather. That landing convinced me I had a markedly better chance of living into old age if my future didn't include the C172 I was planning to purchase. And yes, I do regret that decision at times.

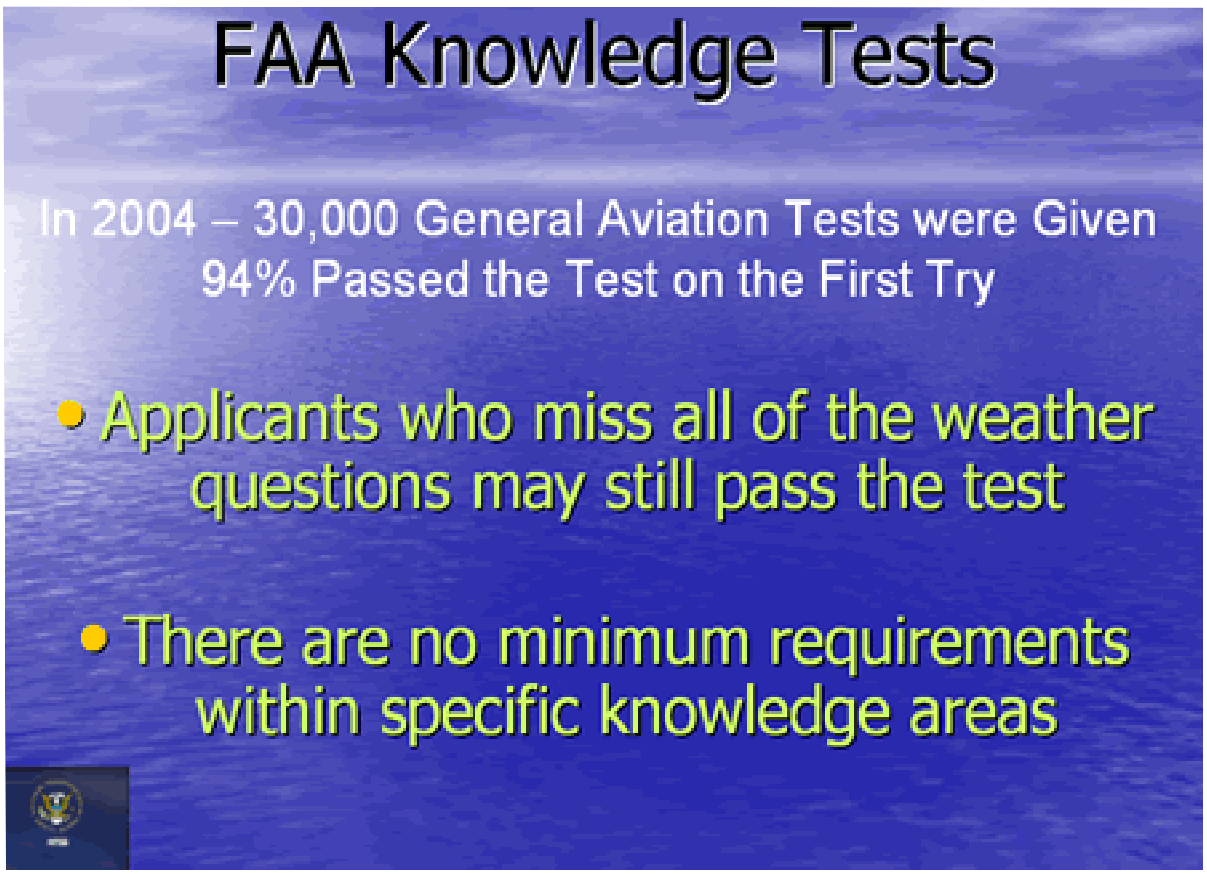

Figure 1

But back to the heart of this article: what knowledge are would-be pilots required to have before they are certified to fly? I ran across the facts in Figure 1 on a National Transportation and Safety Board Website. The answer is that a student pilot can pass their knowledge test without answering even ONE weather question correctly! Now that's scary! I reflected back on the weather training I had received in ground school and from my Certified Flight Instructor (CFI). With my background in aviation meteorology, I already knew the lingo and how to interpret the products, so I breezed through the weather sections without a thought; however what if I didn't know weather? I might be struggling to decode a TAF, or understand parcel theory in ground school. Maybe I'm going to need some encouragement and supplemental weather instruction.

The FAA's Training Philosophy

The FAA places the full responsibility for student training on the CFI. In addition to flight training lessons, the CFI must teach the standards required for certification in an ever-changing operating environment. Ideally, after each flight, the instructor reviews the day's lesson and clears up any questions while the subject is still fresh. This one-on-one training offers the opportunity to develop a strong relationship. More importantly, especially from an aviation safety standpoint, the instructor has the time to diagnose and correct a student's academic and operational faults.

While the basic curriculum and standards for pilot training are written and specific, the training is largely conducted in an informal setting. I noted during my flight training that this lack of formality, while providing a comfortable atmosphere, tended in my case to foster a less-than-rigid academic mindset. For example, flexibility in scheduling lessons is a great advantage for the individual

> *It's better to be on the ground wishing you were in the air than in the air wishing you were on the ground. Your safe flight depends on your ability to discern the weather hazards that may lie on your route and at your destination."*
>
> *An Anonymous CFI*

with a job and family to balance, such as I had. But there were times when I had only one lesson scheduled in a week. Consequently, when it was time for my lesson, I was raring to fly, not sit and discuss some questions I might have come up with while studying during the week. I'd tell myself that I would ask those questions later—when it was raining—if I remembered.

Thus from my own experience, it's easy to envision how a student's weather academics might be neglected on those "perfect-weather-to-fly" days or times when other commitments limit lessons. Ideally, these days when a lesson plan is skipped happen infrequently, and the instructor notes their occurrence. The CFI then ensures that any material missed is covered thoroughly in subsequent lessons.

Different Personalities, Abilities and Goals

The one-on-one teaching ratio gives the CFI an opportunity to assess the students' capabilities. The key point of the previous statement is that the instructor has the *opportunity* to assess the student's capabilities.

In the early stage of flight training, this is analogous to gathering background information. A number of elements determine how much weather training an individual needs: personality, level of knowledge and interest in weather education, and their aviation goals. This assessment should begin with the first lesson.

There are many aspects to personality, most of which will not be a factor in the individual's ability to learn. One exception is the know-it-all, who will likely claim a "Darwin Award" sometime in their future since he won't live long enough to pass on this attitude. Less obvious is the more average student's unwillingness to ask questions. My CFI told me that he much preferred female students, because on average, they were much more likely to ask a question if something was unclear. Some students are afraid they will appear stupid if they ask questions, especially when they know the topic should be familiar, such as TAF codes to a recent graduate from ground school.

A good CFI always reminds students that there are no dumb questions. Growing familiarity between the instructor and student should also ease the student's fear of asking a question more than once; CFIs need to be aware that a student's willingness to ask questions must be encouraged in other facets of the flight training. Here is my list of key areas:

- **Radio transmissions and FSS weather briefings.** It's beneficial for CFIs to monitor weather briefings from the FSS with their students. CFIs would then know what the students have heard, and could suggest questions that might be appropriate.
- **Current level of weather knowledge.** Before diving into meteorological training, the instructor needs to review the student's current weather knowledge. Ask a few weather theory questions and have the student interpret basic maps and decode TAFs and METARs. Such skills diminish quickly after ground school ends unless the student has an interest in meteorology. It is quite likely that many students need refresher training on these topics areas.
- A**bility to interpret the weather briefing.** The weather briefing is vital to flight instruction. There are almost too many sources of weather information available to the General Aviation pilot. Figure 2, from a recent pilot survey, shows the many choices out there. This wide range of resources allow for a variety of different training methods and philosophies, based largely on the instructor's preference and level of expertise. Three key points to emphasize here:
    - Individual CFI's preference
    - Need to remain current on information available
    - How to use the information.

Early in the training regimen, CFIs keep weather training focused on interpreting basic weather depiction maps and text forecast and observation formats in the student's home airspace. At this point, the student is gaining familiarity with the FSS weather briefing format. As the student progresses and begins preparing for the cross country, the weather briefing becomes much more difficult and time consuming, involving larger spatial and temporal scales.

The CFI's individual style of gathering weather information for a flight becomes more critical as the student nears certification. Many students mimic their instructor's methods so you must be particularly thorough in fine-tuning a student's ability to locate, select, organize and properly interpret weather data. It's also obvious that a CFI's weather skills *must* be up-to-date, as the latest graphical weather products and the services available are far-removed from the standard radar summary and general weather depiction charts that served for many years.

Every flight student has goals, whether it's to grab an occasional "hundred dollar hamburger" at the beach or to fly cross country to the next Super Bowl. Weather savvy becomes increasingly important as goals grow loftier. There's no need to vastly exceed the depth of weather knowledge the student needs to reach short-term goals. The instructor should, however, encourage a student's interest in meteorology, as acquiring this knowledge is an ongoing process.

The state of the science, and the means by which weather is displayed graphically, is rapidly evolving. Pilots need to continually refresh their knowledge to ensure they are using the latest and

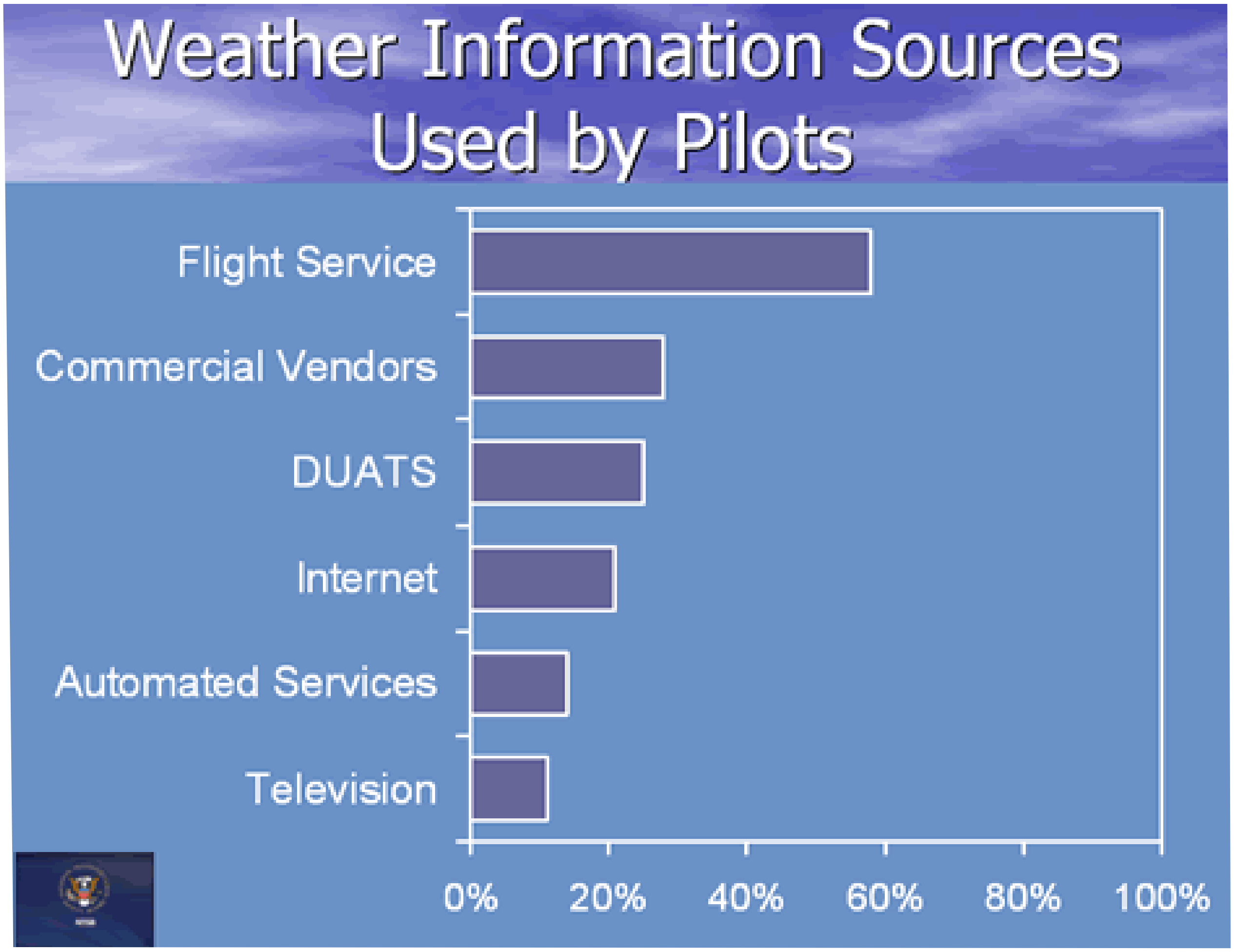

Figure 2

most accurate weather information available. We might consider and then slightly revise the old saying, "Knowledge is Power," to read "Knowledge is Safety."

Conclusions

According to the FAA's training philosophy, the CFI alone is responsible for ensuring their students are trained to proficiently acquire and interpret weather data. There are human factors that will determine the instructor's success in this training. Each student has a personality, as well as specific personal interests in weather. These specifics may be tied to the student's ultimate goals in the General Aviation or commercial community.

Examine these factors to determine the level of weather expertise a student should attain early in this training. Stay abreast of latest technological advances in weather forecasting. Students will be using these more sophisticated and accurate forecasts and weather depiction graphics now or in the near future.

Remember, aviation safety is enhanced both by a CFI's weather knowledge, and the student's ability to use and understand today's weather briefing tools in future flight planning. ✈

Aviation Weather for Western Hot Air Balloonists

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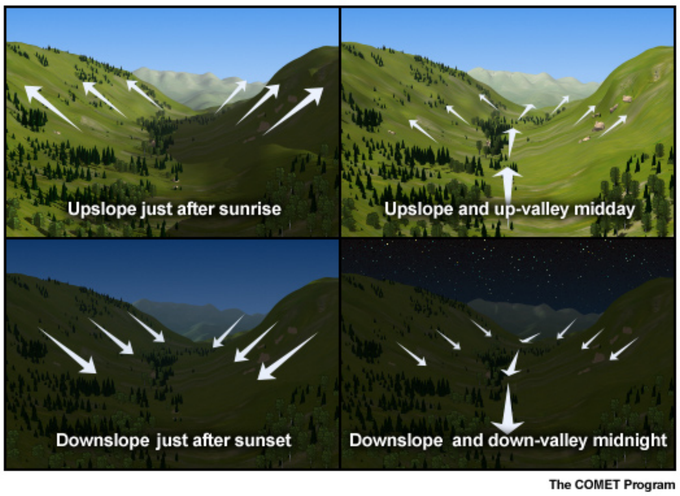
Hot air ballooning is a favorite outdoor activity in the West, particularly in New Mexico and Arizona. The dry climate in this region is particularly favorable for winter ballooning. Morning temperatures are cool enough to significantly reduce fuel use, precipitation is infrequent and skies are almost always VFR. Complex temperature profiles allow light but highly variable wind conditions to develop over short distances, both horizontally and vertically. When the occasional winter storm affects the region, the "no-fly" period usually lasts only a day or two. The storm is usually followed by high pressure, allowing the complex low level temperature and wind profiles to redevelop.



Upslope and downslope wind illustration from UCAR/COMET.

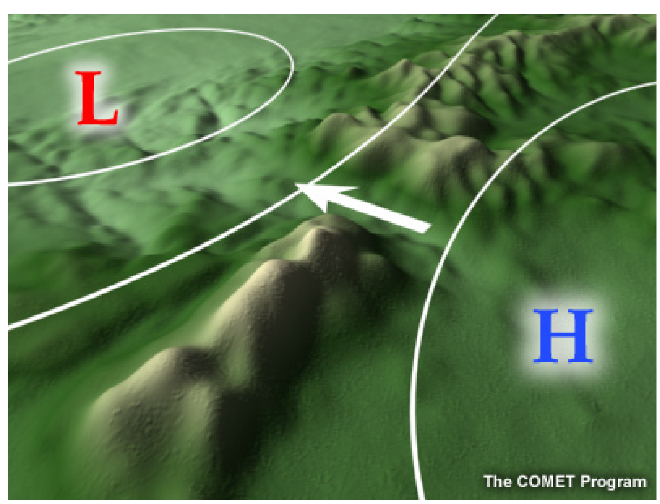
Other than precipitation, wind is perhaps the most important weather element to consider when planning safe balloon flights. A 10kt wind is usually trivial for fixed wing aircraft, but that same wind is often a "no-go" forecast for balloonists. Even less wind may ground an inexperienced pilot, an inexperienced ground crew or a multi-passenger flight. Wind changes of just a knot or two or 10 to 20 degrees can mean the difference between a safe landing in an open field, and an unsafe landing near busy highways, power lines or unwelcoming landowners.

Hot air ballooning in mountainous regions presents more challenges, even on clear and seemingly calm days. Foremost, wind direction and speed can vary over minute distances, particularly for popular morning flights. In the absence of a strong pressure gradient, morning winds tend to blow down mountain slopes and valleys as cooler night time air sinks toward lower elevation.

This trend creates complex "steer" currents, allowing the balloon pilot to navigate by changing elevation above, below or even within a nocturnal temperature inversion. This ability can make hot air ballooning particularly exciting. These wind currents are usually predictable because they depend simply on terrain orientation.

A much larger safety issue arises when these terrain-driven winds are enhanced. There are several mechanisms that can increase normally gentle morning winds to unsafe levels. Many are accompanied by rather obvious synoptic patterns, such as increased winds at the surface and aloft, and other no-go weather conditions like low clouds and precipitation. In those situations, the pilot's no-go decision is easy.

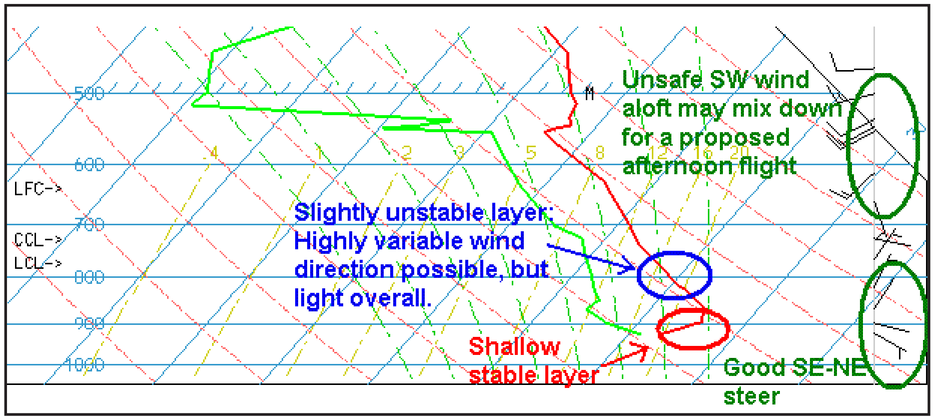
In the desert Southwest, however, despite clear, calm conditions at a launch site, winds near mountain gaps and in deep valleys can be much stronger just



Gap wind illustration from UCAR/COMET.

a few hundred feet above the surface. These enhanced downslope winds are most likely to occur when a high pressure system strengthens over the Great Basin or slides down the Front Range of the New Mexico Rockies. The cold, dense airmass associated with the high pressure is then either forced through mountain gaps or accelerates from higher elevation to lower elevation.

These localized winds are enhanced depending on the exact orientation of the high pressure center, the orientation of the gaps relative to the flow, and even the presence and height of one or more temperature inversions.



Example of simple sounding interpretation for a balloonist. For more information, go to http://rucsoundings.noaa.gov/. For a related article, go to http://aviationweather.gov/general/pubs/front/docs/feb-04.pdf.

The Santa Ana winds of California, or Chinook winds on the Front Range, are the most notorious examples of this pattern; however, even a weak downslope or gap wind enhancement can occur anywhere near mountainous terrain. It does not take much wind to pose a hazard to a balloonist.

The main danger for balloonists is that these winds may not be detectable at launch. Eye-level winds in a deeper valley may be only 1-2 kts, while just above the morning temperature inversion, winds can be blowing at 10-20 kts. Once airborne, a balloonist will try to lower the balloon to avoid stronger winds aloft; however, as these winds mix to the surface after sunrise, the landing can rapidly become difficult, and in some cases, dangerous.

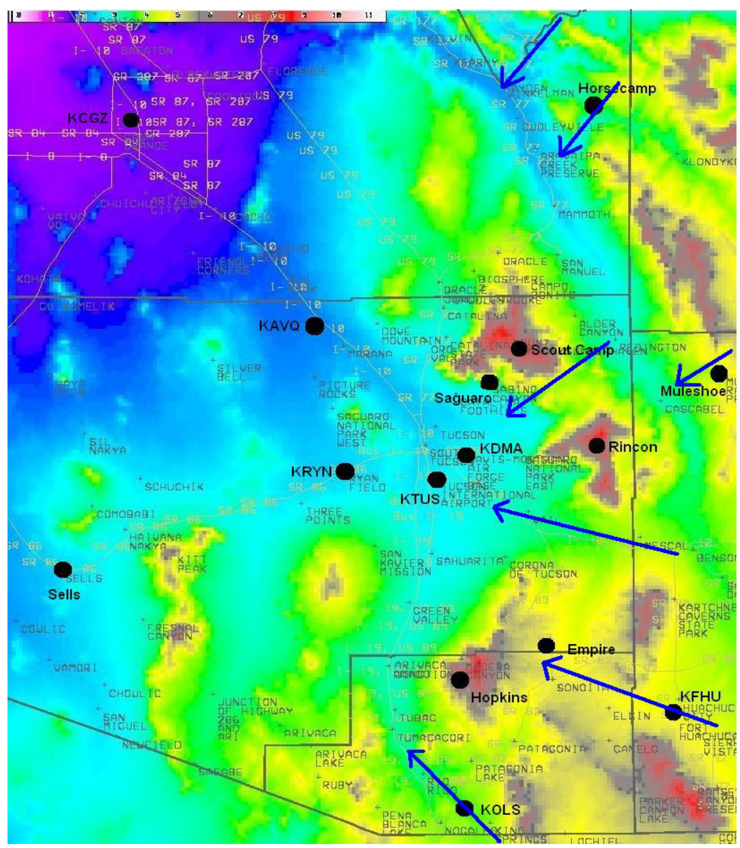
The best defense for a hot air balloonist is information. Surface aviation observations are an obvious choice; however, you can get key wind information from sources a typical fixed-wing pilot may not need to consider.

Portable Pilot Balloon (PIBAL) Wind Observations units have gained great popularity, are easier to use, and have come down in price in recent years, but they are still expensive. Fortunately for balloonists in the West, the U.S. Forest Service has deployed numerous Remote Automated Weather Systems (RAWS) at many different elevations and in some mountain passes.

Balloonists can also use amateur radio- or Web-based wind data for planning, provided the data quality and sensor calibration is good.

The goal when looking at alternate wind data sources is to detect downslope enhancement or gap winds before they surface in the deeper, colder and deceptively calm valleys.

Basic pattern recognition, and even basic education on how to read rawinsonde data from nearby upper air sites, can also assist the pilot on making safe go/no-go decisions on otherwise clear, sunny mornings. ✈



Known gap wind areas around Tucson and some of the many wind observation sites that can detect them before they "surface."