



The Front



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Soaring Forecasts: Digging For Data at NWS Web Sites

by Dan Shoemaker, NWS Fort Worth, TX

The National Weather Service (NWS) serves a broad base of aviation users that include soaring pilots. The main sources of information are TAFs, from Weather Forecast Offices “WFOs”, numerous products from the Aviation Weather Center “AWC” and the computer generated guidance from the National Centers for Environmental Prediction “NCEP”.

Specific NWS Forecast for soaring are mainly throughout the southwestern portion of the US. But but we’ll discuss weather products and information that assist making soaring forecast for other locations, as savvy, resourceful soaring pilots, hanggliders, and paragliders enjoy immensely the thrill of letting the atmo-

sphere alone work to keep their refuge from the everyday world aloft.

The soaring community is extensive. One estimate puts the number around 20,000 pilots flying sailplanes, hang gliders, and paragliders. As a group, these pilots have had to hone good meteorological sense to maximize their soaring experience. It’s worth noting that sailplanes have soared past the tropopause, and hang gliders and paragliders have reached altitudes above 18,000 ft. Hang gliders and paragliders routinely make unpowered cross country trips of more than 100 miles. The current hang glider cross country record is over 400 miles. All by tapping the resources of the free air without a powered assist after release.

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Mark Vaughn photography © 2003 Marksp photography@aol.com

Figure 1: Mark Vaughn shows the exhilaration of hang gliding. Obtaining good weather data before each flight will only add to the experience.

The Front

Managing Editor: Michael Graf
Contributing Editor: Craig Sanders
Editor: Melody.Magnus@noaa.gov

Mission Statement

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



Figure 2: Local NWS forecast office locations. Click on the dot to bring up the home page for each office.

Soaring pilots get their lift from two main sources, terrain and instability. Ridge and wave soaring is done in the region downstream from mountains or other prominent terrain. Thermal soaring uses instability in the free, open atmosphere.

Ridge or wave lift relies on wind rising over an obstruction, such as a mountain, and rising over it. In a stable atmosphere these mountain waves can provide lift that goes above the tropopause, as evidenced in Steve Fossett's recent record attempts.

Thermal soaring relies on air parcels released by the sun's heating of the ground. These parcels rise through the unstable lower layers and provide localized lift. This form of soaring usually occurs below cloud base; VFR rules apply.

These two mechanisms can be combined to prolong the flight. A pilot can soar along a ridge while waiting for thermals to develop and provide extra lift for a cross-country flight.

Thermal soaring in the U.S. requires knowledge of two different regions. Dry areas in the west can provide thermal lift above 18,000 feet MSL. Thermals tend to offer higher vertical velocities, and higher cloud bases. Terrain facing the sun will heat up and develop thermals during the morning which supplements the lift providing by air flow toward and up the nearby slopes.

East-facing slopes develop thermal lift first, and west-facing slopes offer better soaring in the afternoon. Soaring pilots must always adjust their techniques to take advantage of these changing conditions.

East of the Mississippi River cloud bases are lower because of the higher dewpoints. Most often the unstable conditions are found below the base of cumulus clouds, which often is around 6,000 feet MSL in the warm season.

Getting into the air requires powered assistance. An aircraft will tow and release a sailplane or paraglider about 2,000 feet above ground level. Ground towing with a vehicle will work to get a glider between 1,500 and 2,000 feet before releasing it.

Before departure, tow pilots need to know the vertical wind profile to select runways and direction of flight. Ground tows need to select roads running in a direction facing the wind. A second concern for tow and sailplane pilots is instability. Will the air be soarable? Does that air temperature decrease with height to provide instability or is a temperature inversion present which will suppress vertical motion? Will thunderstorms be a factor? What is the boundary layer wind speed and direction? Strong boundary layer winds can disrupt the desired vertical column of unstable air and destroy thermal lift. Winds may be too strong to land safely. Will there be cloud cover that will slow down surface heating and thermal development? To make flight

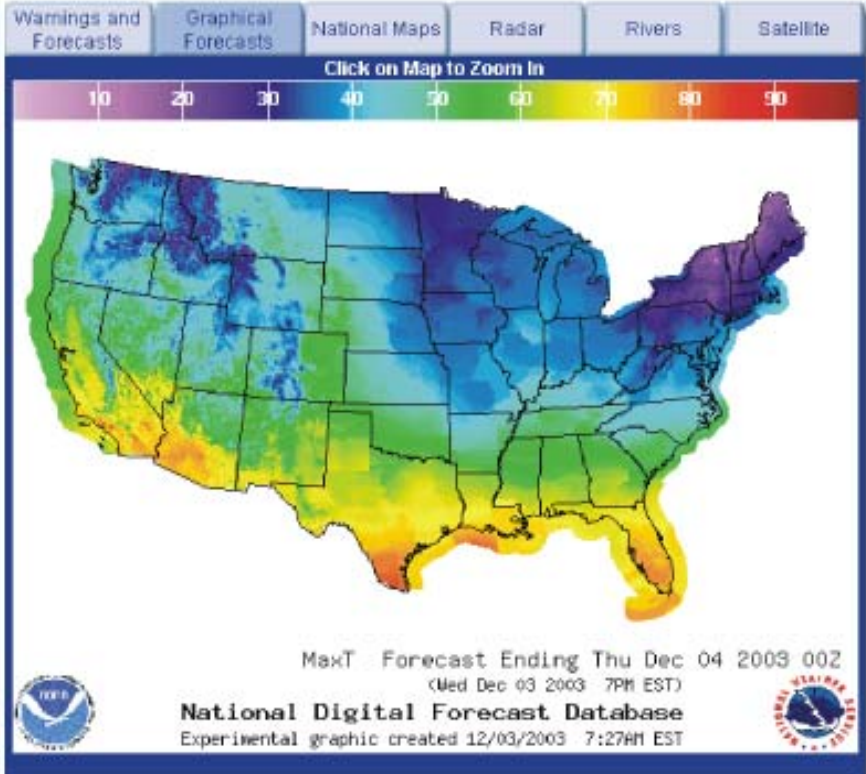


Figure 3: New graphical, digital forecasts are being developed by the NWS to supplement text products.

KDLH	ETA MOS GUIDANCE												12/03/2003 0000 UTC											
DT /DEC	3						/DEC 4						/DEC 5											
HR	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12					
X/N	35						22						32						18					
TMP	10	10	12	22	30	34	29	27	25	26	26	26	29	30	28	25	22	21	20					
DPT	-7	-4	2	10	13	17	19	21	22	23	23	23	25	25	24	22	20	18	17					
CLD	CL	CL	CL	CL	CL	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV	OV					
WDR	14	20	20	19	20	19	15	17	20	21	23	24	25	27	30	31	33	33	33					
WSP	03	03	02	06	07	05	06	07	08	10	09	09	12	10	12	11	12	11	13					
PO6		0	0	0	0	2	6	16	38	20	10													
P12						2	14	48	34															
Q06		0	0	0	0	0	0	0	1	0	0													
Q12						0	0	1	1															
TD6		1/	0	0/	0	0/	0	0/	0	1/	0	1/	0	0/	0	0/	0	0/	0					
T12			1/	0	0/	0	1/	0	1/	0	1/	0												

Figure 4. MOS tables give specifics on temperature, dew point, wind, and other parameters useful for soaring.

decisions, pilots use all the information they can get, and they want it in usable form.

Without specific soaring forecasts for many regions, the Web has become a popular source for weather data. Pilots have to do their homework and search for the data they need. Soaring requires careful planning days in advance.

For outlooks, more than a day or two out, NWS has the text-based zone forecasts out to seven days. These give a quick indication of sky condition, temperature, wind and chances of precipitation. Your local NWS home page has a clickable “Local Forecasts” option on the left hand side. To find your local office, click on the map at: <http://www.wrh.noaa.gov/wrhq/nwspage.html> (Figure 2).

NWS is developing a new graphical tool called the National Digital Forecast Database (NDFD). This may be the main method by which NWS delivers future products.

But for now, it’s experimental. Like the zone forecasts, NDFD maps offer seven days of graphical data for sky cover, winds, temperature, humidity, probability of precipitation

and precipitation type. For a sample, go to <http://www.nws.noaa.gov/forecasts/graphical/> (Figure 3).

Model Output Statistics (MOS) are tables of numerical data containing specifics every three to six hours from the atmospheric models. You can find these tables at: <http://www.nws.noaa.gov/mdl/synop/products.shtml> (Figure 4). NWS runs a number of atmospheric models daily. Like aircraft that might look the same but perform differently, the atmospheric models, the Eta and GFS, each offer similar but slightly different solutions to an evolving weather situation. The Eta is a respected short term model. The GFS is a good choice for longer range planning. The clickable tabs under each section on the MOS page takes to you pages where you can select site-specific tables of data. Your own investigation of these tables will help you find the products most useful to you.

A map is worth a thousand words, especially a day before a flight. NCEP models produce surface and upper air maps showing weather systems and the winds aloft. Go to <http://www.nws.noaa.gov/>

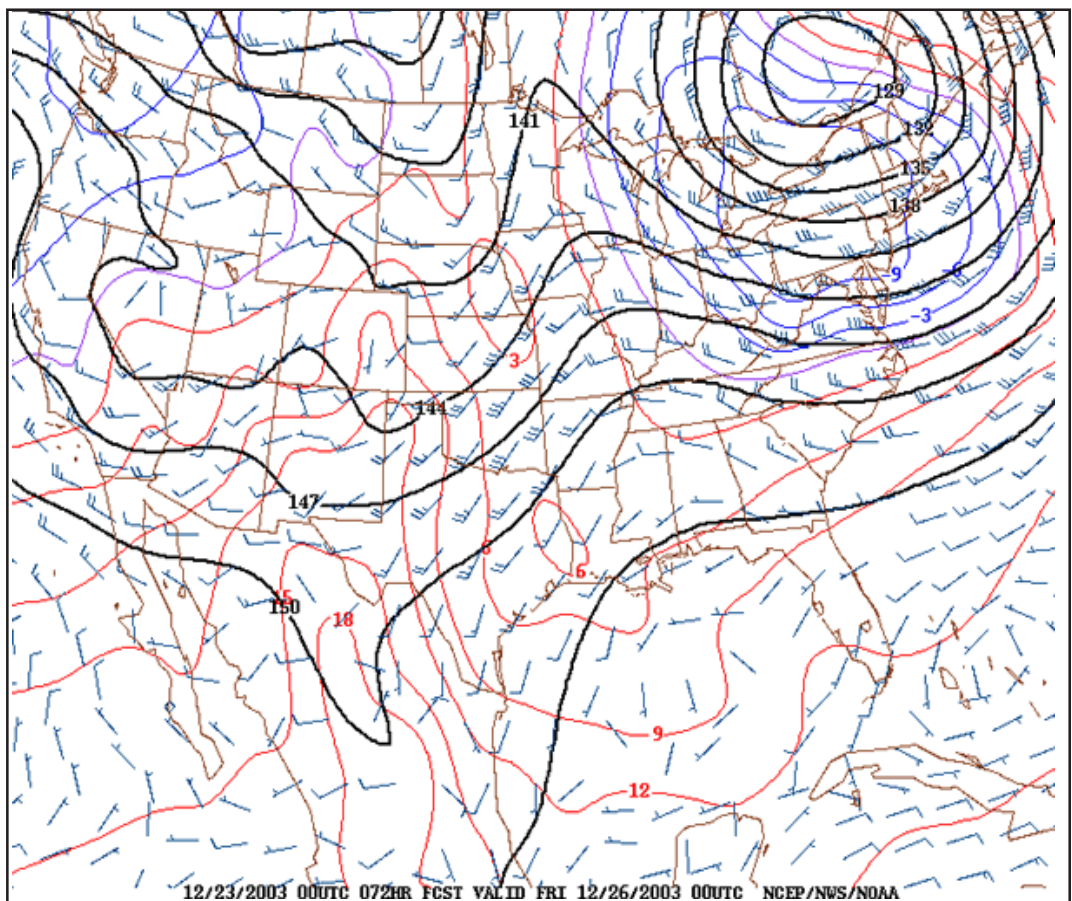


Figure 5. Upper air charts give good visual assessment of winds aloft that soaring pilots will face.

and select “numerical models” to view the Eta and GFS. The RUC, another short-term model on this page, offers maps out to 12 hours based on with real time data.

The maps show wind direction and speed. Air flow parallel to the lines and wind flags on the map show the direction wind is blowing. The number of barbs or flags indicate speed. Each barb is about 10 knots and each flag represents 50 knots. At least two model runs are made each day at NCEP, 0000 UTC and 1200 UTC. A table is used to select maps.

The numbers represent the hours after the model run was made, i.e., 018 from the 0000 UTC model run table is valid for 1800 UTC the next day. The same 018 choice made for the 1200 UTC run would be valid at about midnight on that night. The valid time of each map is given at the bottom of each chart in UTC time. **Always** check this valid time when studying the maps.

Soaring pilots also study the vertical

structure of the air using soundings, which show whether the air is unstable or if a temperature inversion is present. You can find soundings, as shown in **Figure 5**, at: <http://www-frd.fsl.noaa.gov/mab/soundings/java/>. Once there, enter hours and site, then click java for picture or ASCII for text. Forecast soundings give a more in-depth look at the lower layers and a first guess as to thermal activity as well as winds that would influence decisions on what side of a terrain feature to fly. Also provided is the stability indices such as the lifted index “LI” for the time of flight. For more information on the Stability indices such as lifted index, review the May-June 2002 and July 2003 issues of *The Front*.

On the morning of a flight, I look at METARs, TAFs, satellite and radar images. For that, the Aviation Digital Data Service page is THE place to go: <http://adds.aviationweather.noaa.gov>. Also check short-term soundings at the FSL site.

Finally, some WFOs, mainly in the southwest, issue soaring forecasts. Check <http://www.wrh.noaa.gov/reno/aviation/index.shtml> and click on “Reno soaring forecast” for an explanation of the forecast and terms. To find your local WFO, go to <http://weather.gov/> and select your local area. At the bottom of the WFO site is a “contact us” link where you can ask the WFO about initiating a soaring program.

No single product or Website provides all the data a soaring pilot need might need, but the collective data will help make the best decision. Each flight and the preparation time for it builds on this experience and gives the soaring pilot the very keen sense needed for an extended flight.

Dan Shoemaker is a NWS forecaster at Fort Worth and has been a soaring pilot for 20 years. Dan started flying hang gliders in the early 1980s. He's flown ultralights and sailplanes. He even soared over Guam several years ago. →

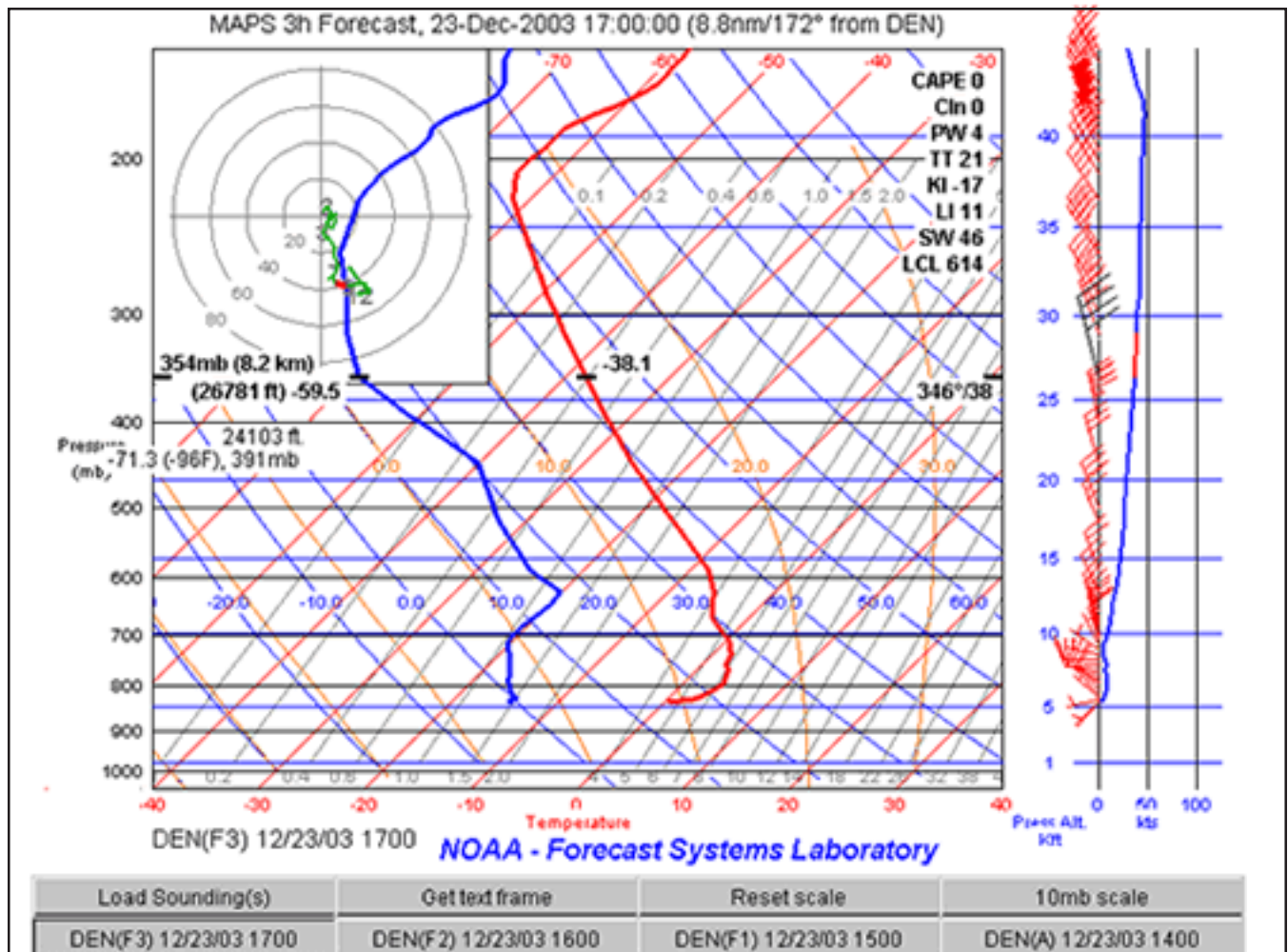


Figure 6. Upper air soundings offer a wealth of information about the stability of the air and wind directions at many levels.

Volcanic Ash: Significant Aviation Hazard

by Dan Gregoria, Forecaster, NWS San Juan, Puerto Rico

Volcanoes are awesome displays of power that throw gritty ash miles into the atmosphere.

this isn't even close to the kind of ash you might find in your fireplace or campfire. Volcanic ash is a destructive substance com-



Figure 1. Looking as though a nuclear bomb exploded, the Alaska's Redoubt Volcano erupts.

Volcanic ash suspended in the atmosphere presents a significant hazard to the aviation community. Even in thin concentrations, ash poses a subtle threat to aircraft engines. See **Figure 1**.

Several agencies work together to alert pilots to this hazard. The Anchorage Volcanic Ash Advisory Center (VAAC) is one of nine units in a worldwide monitoring network and is also a part of the Alaska Aviation Weather Unit. Another VAAC in Washington, D.C., covers the remainder of the continental U.S., the Caribbean and the northern portion of South America.

The Aviation Weather Center in Kansas City, MO, provides SIGMETs for volcanic ash in the continental U.S. based on Volcanic Ash Advisories from the VAACs. Center Weather Service Units (CWSUs), Flight Service Stations (FSSs), and the local Weather Forecast Office (WFO) near an active volcano all play their part in this awareness activity.

Why all the fuss about volcanic ash? The term ash sounds pretty innocent, but

posed of fine pulverized rock and a number of gases converted into droplets of sulphuric acid and hydrochloric acid.

This composition can significantly damage an aircraft engine. The ash may melt in the hot sections of the engine and fuse into a thin coating on components farther back, creating the potential for complete engine failure. Although piston-powered aircraft are less likely to lose power when encountering volcanic ash, no aircraft is immune to its danger. See **Figure 2**.

There have been several major aircraft encounters with volcanic ash. In June 1982, a British Airways 747 lost power in all four engines and suffered severe damage when it ingested ash from Mt. Galunggung in Indonesia. After losing power, the plane fell to 12,000 feet before the crew was able to restart the engines. The plane made an emergency landing in Jakarta.

Another major incident occurred near Anchorage, AK, in 1989 when a wide-body passenger jet encountered a volcanic ash cloud. All four engines failed, putting the plane in a free fall from 25,000 feet to 13,000 feet before the pilots were finally able to restart the engines. The mountain tops in the area where this plane descended reach



Figure 2. Damage to this jet turbine resulted from ingesting volcanic ash. The ash melted and formed an acidic glass-like coating on the engine.

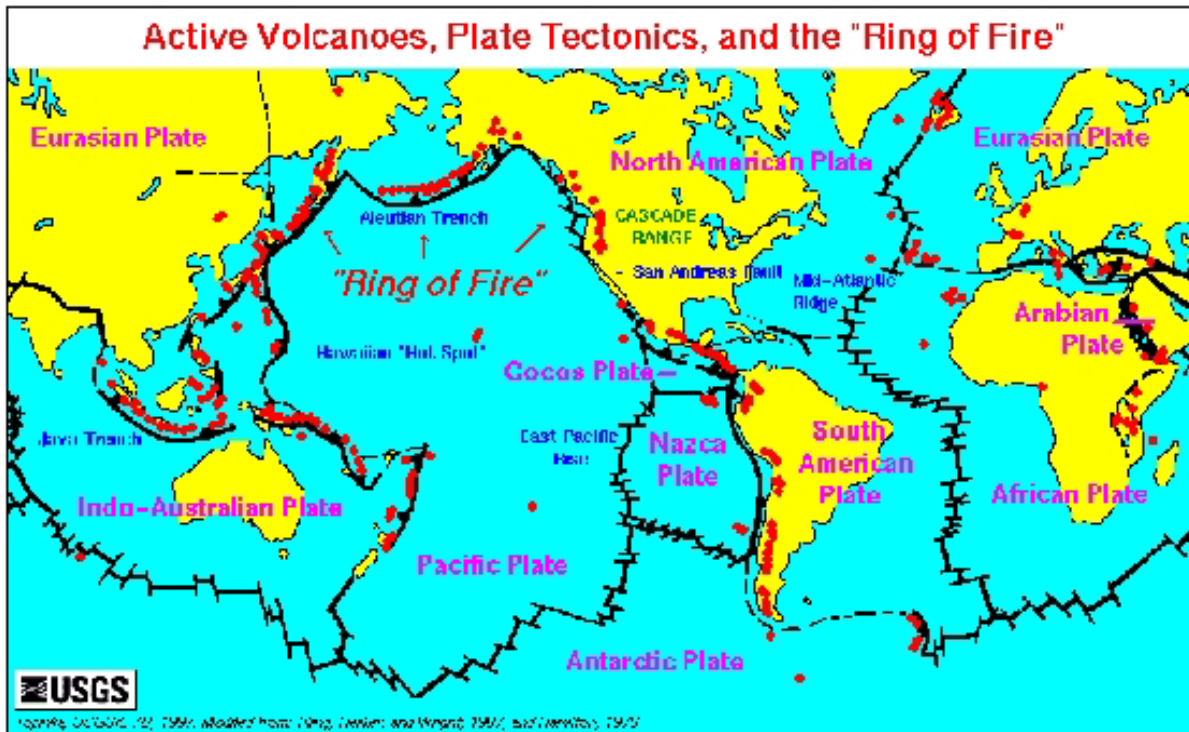


Figure 3. Tectonic plates are interlocking sections of the earth where seismic activity and volcanos are found.

nearly 11,000 feet, making this incident an extremely close call.

So where are pilots most likely to encounter volcanic ash? Volcanoes concentrate around the periphery of the earth's tectonic plates, interlocking sections of continental land-masses. Plate movement has resulted in slowly drifting continents and changes in the shape and size of both ocean basins and continents. Where two or more plates meet, earthquakes and volcanoes are likely. **Figure 3** depicts these interlocking plates.

The highest density of active volcanoes, extending from eastern Asia to Alaska, is known as "The Ring of Fire" for good reasons. It is important for pilots to realize that ash can travel hundreds and even thousands of miles from an active site. During one major eruption of the Redoubt Volcano in Alaska, the ash traveled all the way into



Figure 4. Satellites can track volcanic ash. This view is from Alaska. Note that it looks like smoke from a forest fire or thin cirrus clouds, but this hazard is far more dangerous than either one of those.

northern parts of the continental United States. Eruptions in remote areas are no guarantee that region you fly in will be free of ash-related hazards.

In July 2001, the Soufriere Hills Volcano on the island of Montserrat in the Caribbean erupted and quickly sent ash over the U.S. Virgin Islands and Puerto Rico. The San Juan, P.R. International Airport was forced to close due to the volcanic ash.

The ash actually covered the ground of Eastern Puerto Rico, some 300 miles from the volcano itself. A volcanic event similar to the one in 2001 occurred in 1996 and for the first time was detected by the recently installed Doppler radar at WFO San Juan.

What Can You Do?

How can a pilot know when volcanic ash is present even if no SIGMET is valid at the time? The Volcanic Ash Advisory Center routinely issues Volcanic Ash Advisory Statements whenever ash is present in the atmosphere. These statements provide an outline of the location of the volcanic ash along with its movement.

Volcanic ash is one of the criteria for SIGMETs issued by the Aviation Weather Center, in addition to the more familiar SIGMETs for severe turbulence and icing.

The ash hazard and its movement are depicted the same way as other hazards. CWSUs along FSS communicate this information to the pilots. NWS Forecast Offices such as San Juan include "VA" in a TAF when volcanic ash is expected to be present at a terminal site.

A number of aviation products warning of this hazard are issued for aviation users. Volcanic Ash Advisories use a format all their own. They provide location and dispersion data not found in other types of SIGMETs. Pilots may find these products useful for monitoring. You can find this information at: <http://www.ssd.noaa.gov/VAAC/messages.html>.

Figure 5 shows a recent example of an advisory. This particular product has a graphic to show the location.

Volcanoes can be small pinpoint sources or huge disasters, like Mount St.

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FVXX21 KWBC 190127
VOLCANIC ASH ADVISORY
ISSUED: 2003NOV19/0130Z VAAC: WASHINGTON

VOLCANO: COLIMA 1401-04
LOCATION: N1931W10337 AREA: MEXICO

SUMMIT ELEVATION: 13451 FT (4100 M)

ADVISORY NUMBER: 2003/59

INFORMATION SOURCE: GOES-12 IMAGERY. MEXICO CITY MWO.
GFS
MODEL WINDS FORECAST. PILOT REPORT.

ERUPTION DETAILS: EXHALATION ABOUT 19/0000Z.

OBS ASH DATE/TIME: 19/0045

OBS ASH CLOUD: SFC/FL180 5 NM WIDE LINE EXTENDING BE-
TWEEN
N1931W10337 N1941W10327. ASH IS MOVING NE 5-10 KNOTS.

FCST ASH CLOUD +6H: SEE SIGMETS

REMARKS: THE MEXICO CITY METEOROLOGICAL WATCH OFFICE
REPORTED A POSSIBLE ASH PLUME FROM A PILOT REPORT THEY
RECEIVED. A VERY SUBTLE EXHALATION CAN BE SEEN ON THE
LAST
VISIBLE IMAGES AND SUBSEQUENT MULTI-SPECTRAL IMAGERY
SHOWED
A SMALL AREA OF ENHANCEMENT THAT WOULD CORRESPOND WITH
WIND
INFORMATION AND OTHER REPORTS. APPROXIMATED THE HEIGHT
TO BE
ABOUT FL180.
.
NEXT ADVISORY: WILL BE ISSUED BY 2003NOV19/0730Z.

NNNN"Attached Graphic Map Depicting Ash Only"

A SIGMET for Volcanic Ash in Puerto Rico a short time
ago looked like this:

SIGMET BRAVO 4 VALID 200100/200500 KPCI-
SAN JUAN FIR VA WI AREA BOUNDED BY 1690N6283W 1753N6365W
1727N6412W 1675N6338W. VA BLO FL080. MOV NW 10KT. BASED
ON SAT OBS.
```

Figure 5. Recent example of a Volcanic Ash Advisory.

Helen's. Finding these events is made easier with high-resolution NOAA satellites and trained scientists who monitor volcanic ash worldwide. Some examples of events in 2003 are available at NOAA's Operational Significant Event Imagery Website at: <http://www.osei.noaa.gov/>.

This resource also shows imagery for events such as severe weather, icebergs, forest fires and other hazards.

Clearly, volcanic ash is a danger to any pilot. Monitoring the latest advisories and SIGMETs for volcanic ash will keep you aware and safe when you fly. ➔