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THE GOLD and SILVER SPOTTER

Weather Spotter News for Eastern California and Western Nevada

National Weather Service / Reno, Nevada / Winter 2009

In this issue:

Your Reports Needed This Winter!

Hello spotters! Thanks for all your observations and reports this past summer. We look forward to your continued assistance for the upcoming winter months. Even with the extensive tools of modern technology such as satellites, web cameras, and surface observations, there are still wide gaps in information of what is actually happening on the ground. **Your reports are especially needed over the next several months**! As many of you may know, our Doppler Radar suffered catastrophic damage in December and has left us without one of our most important monitoring and verification tools. Your reports directly help in saving life and property; filling in the gap between what we cannot see with our radar out of service, and what is occurring across northeast California and western Nevada. Don't hesitate to call the spotter report number anytime you experience significant weather, even if it is not within reporting criteria. Every report matters!

Spotlight on Forecaster Ray Collins

Jane Hollingsworth, Meteorologist in Charge

Ray Collins has been forecasting weather in Nevada and the Sierra since 1990. Ray served in the Air Force, and came to the National Weather Service (NWS) after finishing his military career. He began his career with the NWS as a Weather Service Specialist in Omaha in 1980, then transferred to Salt Lake City where he worked as a radar operator while earning his degree in Meteorology at the University of Utah. Ray transferred to the Reno forecast office as a General Forecaster in 1990, and was promoted to Lead Forecaster in 2002.

Ray has a wealth of experience that he brings to the forecast desk and shares with the local office staff as well. For the past 8 years or so, he has been the webmaster for the office, so many of the great graphics and materials you see posted on our webpage are due to Ray's outstanding efforts (http://weather.gov/reno).

Ray is known locally for his calm and approachable manner. Even when working overnight (or "mid") shifts, he is cheerful and always willing to help anyone. Ray is a lifelong Vikings fan, and even they have a hard time dampening his positive outlook! Ray is without a doubt the best listener in the office, and many of the staff go to him for a sympathetic ear or advice. As an example of how "universally" popular Ray is, on April 11, 2006, the office held it's first (and possibly last) "Ray Day", to honor Ray and have some fun!

Ray has been married to Un-Mi for 32 years, and they have several small dogs, including "Rusty" and "Shiloh."

Spring & Summer 2008 Top Weather Events

Mark Deutschendorf, Forecaster

1. ***April 14th Strong Winds and Dust Storms:*** A strong cold front following unseasonably warm weather produced high winds with several reports of damage across portions of western Nevada and eastern California. Blowing dust reduced visibility to near zero at times across portions of west-central Nevada.

2. ***Topsy-Turvy Late May with Record Heat then Unseasonably Cool and Wet:*** The second half of May began with a very strong ridge over the region which produced record heat between the 16th and 19th. Temperatures climbed well into the 90s in many western Nevada valleys, with Lovelock reporting its earliest 100°F day in a calendar year on the 17th. Several sites including Lovelock, Carson City, Gerlach, Truckee and South Lake Tahoe set or tied all-time high temperatures for the month of May during the weekend of the 17th and 18th. This heat wave was followed by a powerful cold front on the 20th, which dropped daytime temperatures 40 degrees from the record levels! A large upper level low pressure system remained nearly stationary over the region through the Memorial Day weekend. Rain and embedded thunderstorms prevailed with temperatures remaining in the 50s and 60s across the lower elevations from the 21st through the 28th. Rainfall totals of 0.50" to 1.00" were seen across the region with locally higher amounts up to 2.50" in portions of Pershing, Churchill and Mono Counties, and extreme northwest Nevada.

3. ***June 23rd-Mid July Smoky Skies for Eastern CA and Western NV:*** An extreme dry lightning outbreak over northern California on June 21st sparked over 2000 wildfires which burned nearly 900,000 acres. While most of these fires occurred west of the Sierra Crest, however, west to northwest winds began to push thick plumes of smoke into northeast California and portions of western Nevada by June 23rd. The peak of the smoke occurred on June 25th, when the Air Quality Index in Reno reached the "Very Unhealthful" category for the first time in over 20 years. While some improvement in air quality occurred after June 25th, slow progress in suppressing a large wildfire in the western Sierra foothills resulted in recurring smoke and haze over the Reno and Lake Tahoe region through mid July, with the Air Quality Index occasionally falling into the "Unhealthful" category.

4. ***July 14th Stead Flash Flood:*** Thunderstorms finally returned to western Nevada after a long dry spell with some storms producing severe weather. The strongest storms produced flash flooding in portions of Stead, which closed streets as mud and water flowed over them. Another severe thunderstorm produced hail and strong winds from Geiger Grade to south Reno.

5. ***July 21st Rare Severe Weather Outbreak with Tornado Warnings in Churchill County:*** Monsoon moisture, instability and strong wind shear aloft ahead of a vigorous upper low produced numerous severe thunderstorms across portions of western Nevada. The strongest storms produced areas of wind damage, hail over 1.00" in diameter and reports of tornadoes in northern Lyon and Churchill Counties from Lahontan Reservoir to Silver Springs and near Fallon. Hail accumulated up to a few inches in some of these storms. Another severe thunderstorm produced flash flooding, hail and strong winds in Palomino Valley. Many storms grew into supercells and lasted for several hours. For the six hour duration of this outbreak, 6 Tornado Warnings, 19 Severe Thunderstorm Warnings, and 2 Flash Flood Warnings were issued. This was the greatest number of convective warnings issued by WFO Reno in several years for a single event.

6. ***July-September Another Hot and Dry Summer:*** While 2008 was not the hottest summer in terms of extreme temperatures (the warmest day in Reno was only 102°F, in comparison to 108°F in 2007), several notable heat-related events still occurred. A 35-day streak of temperatures reaching or exceeding 90 degrees in Reno from July 5th to August 8th equaled the record which was originally set in 2005. August 2008 was the warmest August on record at the Reno Airport, and September 2008 tied the record for the warmest September. Dry conditions also prevailed from late July through the end of September, with only 0.01" of rain falling at the Reno airport during this period. These dry conditions contributed to the rapid spread of a brush fire in a northeast Reno neighborhood on August 18th, which destroyed six homes in nearly the same area which burned four years ago. However, despite this fire and the long period of smoky skies from late June through early July, the overall wildfire activity and number of acres burned was well below the 10-year average for western Nevada and eastern California.

Reno, Nevada's Climate: Summer 2008

Brian O'Hara, Forecaster

Summer conditions in Reno during the first decade of the 21st century continue to be some of the warmest on record for the past 100 years. Summer 2008 was the 4th warmest ever in Reno. The average temperature for the 3-month period of June - August was 74.7° F. Only the summers of 2007 (76.2°F), 2006 (75.3°F), and 2003 (75.0°F) were warmer. In fact, the nine summers from 2000 through 2008 are among the ten warmest on record at Reno! Only the summer of 1994 (9th warmest) is in the top ten.

August 2008 was the warmest August on record at Reno. The average temperature for the month was a very warm 77.0°F. This beat the old record of 76.2°F in August 2007 by almost a full degree! July 2008 was also warm, ending up as the 7th warmest July on record at Reno (the six warmer Julys were from 2002 through 2007).

The average high temperature for the summer of 2008 was 91.5° F. The average nighttime low for the summer was 58.0°F. July and August were especially warm with 35 straight days (July 5th - August 8th) that the daytime temperature topped out at 90°F or greater. This string of 35 consecutive days is tied for the longest occurrence on record at Reno (tied with the period from July 11th - August 14th, 2005).

July and August were also warm at night. The low temperature for each month averaged just over 60°F. People are using their air conditions more, and not just during the daytime, but also at night. The cool nights that long-time residents remember with nighttime temperatures dropping into the upper 40s now seem to be a thing of the past.

Conditions were quite dry during the summer. Only 0.34" of precipitation was recorded at the Reno-Tahoe International Airport during the summer months which was all reported in July. June and August each saw a trace of rainfall. The dry conditions continued into early autumn. From July 21st - September 28th (a period of 70 consecutive days), no measurable precipitation occurred at the Reno airport. This is tied for the 21st longest string of days with only a trace or less of precipitation at Reno since 1906.

Reno, Nevada's Climate: Recent Winters

Brian O'Hara, Forecaster

Recent winters at Reno have not shown the significant warming that summers have shown. The 2007-08 winter was near normal with an average temperature of 35.0°F. This is just 0.3°F below the typical average of 35.3°F for the December through February period. Only five winters in the last ten years have been warmer than normal, but only two of them are among the ten warmest in the last 100 years.

Last winter was wetter than normal with 4.64" of precipitation reported at the Reno-Tahoe International Airport. This is over 50% greater than the normal winter precipitation of 3.00". But as with temperature, winter precipitation amounts at Reno have varied in the last ten years. Amounts have ranged from a wet 6.52" during the winter of 2005-06 (the 10th wettest winter on record) to an extremely dry 0.63" in 2000-01 (the 3rd driest).

Snowfall totals display a similar behavior. The winter of 2007-08 recorded 22.2" of snowfall at Reno. This is among the snowiest 30% of winters. However, during the previous winter (2006-07), only 8.2" of snowfall was reported.

The NOAA/NWS Climate Prediction Center projects near normal temperatures and precipitation in the central Sierra Nevada and western Nevada this winter. This will not do very much to alleviate the dry conditions we have experienced across the region the last couple of years. We will welcome any moisture we get this winter, and an above normal snowpack would certainly help our hydrologic conditions.

January - March 2009 Outlook: ENSO Neutral Conditions Expected to Continue

Kyle Mozley, Intern

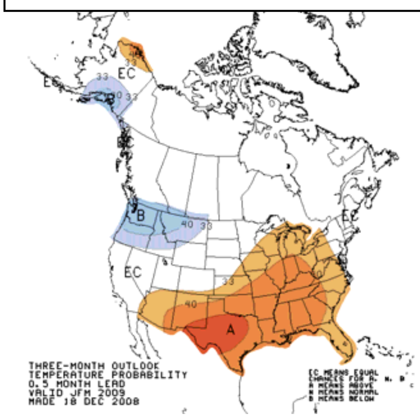
The tropical Pacific remains neutral with respect to El Niño/Southern Oscillation (ENSO), although many atmospheric and oceanic features resemble the cold La Niña phase. Sea surface temperatures are close to the long term averages across most of the equatorial Pacific with some parts of the central Pacific having negative anomalies around 1°C below normal. Subsurface waters have also seen a cooling trend over the past several months with cooler than average water stretching from the central to the eastern Pacific. Trade winds have been persistently stronger than normal for the past few months across the equatorial Pacific reflective of La Niña conditions. Current values of the upper ocean heat anomalies (negative) and the thermocline slope index (positive) are also indicative of the La Niña state of ENSO.

Given the current conditions and recent trends, the development of La Niña during the northern winter cannot be ruled out. Some computer models do forecast this to occur, although the majority of climate model forecasts show neutral conditions with a cooler than normal Pacific. Historically it is unusual for La Niña thresholds to be reached during the northern hemispheric winter, but 1999/2000 is one example where this did occur.

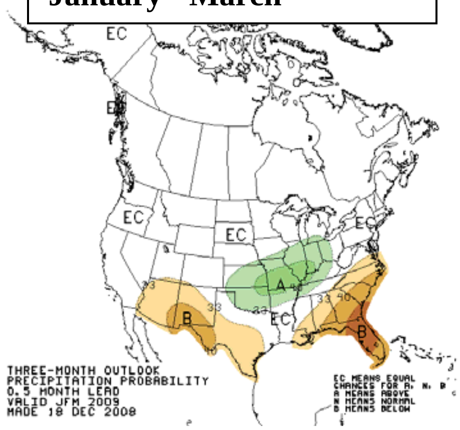
The Madden-Julian Oscillation (MJO) is another large scale cycle that indicates changes to our weather pattern. Convection typically develops over the Indian Ocean and progresses eastward across Indonesia and into the western Pacific. Over the past several months, the MJO has seen a periodicity averaging around 45 days moving steadily into the western Pacific and weakening. In November, the MJO cycle meandered from its steady state with a quick 30 day periodicity before stalling over Indonesia and drifting into the western Pacific. The western U.S. typically sees a pattern change to cooler/wetter conditions when the MJO moves from Indonesia into the west Pacific which occurred during mid and late December.

Typically with a neutral to weak La Niña, northeastern CA and western NV historically see both wet/cool and dry/warmer conditions. The current Climate Prediction Center forecast has our area under an equal chance at seeing above, below or normal precipitation and temperatures. We will also have to monitor the MJO periodicity. A faster periodicity (30 days) would lead to an increased likelihood of seeing above normal precipitation and below normal temperatures, while a slower periodicity (45 days) would lead to below normal precipitation and warmer than normal temperatures. The recent irregular timing between active phases of the MJO in conjunction with its current weaker signal increase uncertainty regarding the timing and nature of the active phases for the next couple of months.

Temperature Outlook
January - March



Precipitation Outlook
January - March



****Check out the CPC home page for updates to the ENSO forecast or other long range forecast information****

http://www.cpc.ncep.noaa.gov/

Lake Effect Snow Does Occur in California and Nevada

Gina McGuire, Forecaster

Lake effect snow is a phenomenon that is most commonly associated with the Great Lakes. However, lake effect snow does occur in northeast California and western Nevada. Lake effect snow has been observed developing off larger area lakes such as Pyramid Lake and Lake Tahoe, and off smaller lakes such as Mono and June Lakes in California, and Walker Lake in Nevada.

The same processes that produce lake effect snow in the Great Lakes also occur in our region. When cold air, relative to warmer water surface temperatures, moves over a body of water, it is heated from below making it more unstable. The air quickly pulls moisture off the lake, saturating the air mass and initiating some type of condensation, either in the form of clouds, fog, or precipitation if enough moisture and atmospheric dynamics are present. See **Figure 1**. Clouds first develop as the air becomes increasingly unstable. As instability and moisture increase, precipitation eventually develops on the downwind side of the lake. See **Figure 2**.

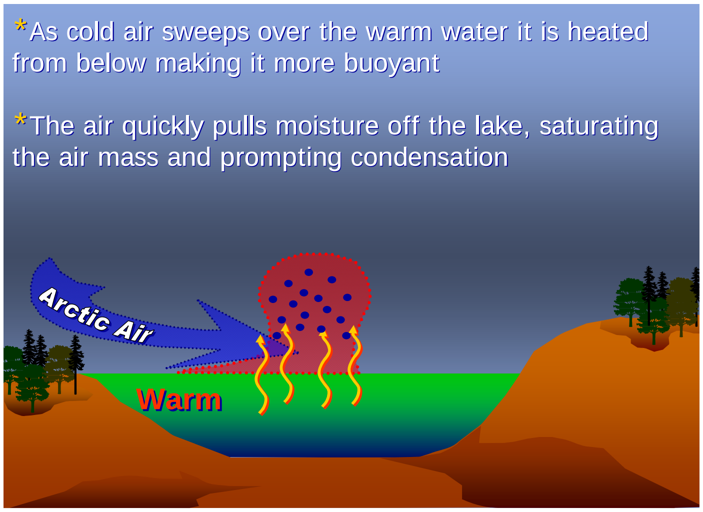


Figure 1: Schematic of how lake effect snow begins to develop.

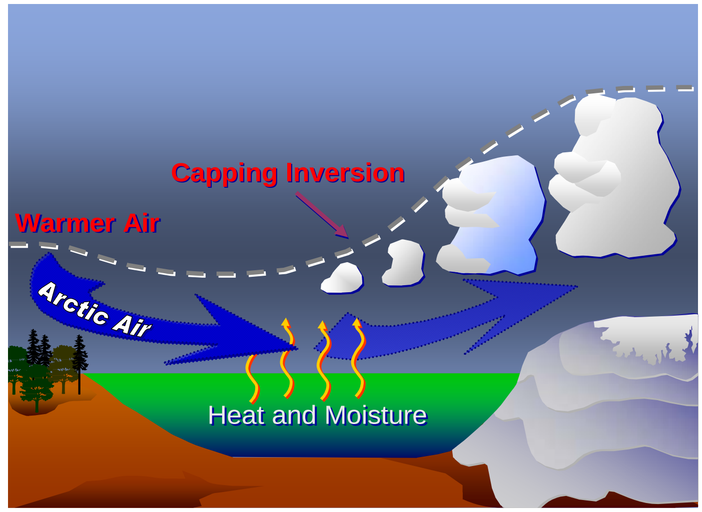


Figure 2: Lake effect clouds and snow develop, depositing snow on the downwind side of the lake.

There are certain elements that are very important in order for lake effect snow to develop off of lakes in northeast California and western Nevada.

- **Instability**
  - To determine if there will be enough instability for lake effect snow to develop, forecasters compare temperatures about 5,000 ft above the lake surface to the lake water surface temperature. This temperature difference must be large enough (around 17°C) in order to generate enough instability for precipitation to develop.
- **Moisture**
  - Without a saturated air mass, cloud development and precipitation initiation is inhibited. Therefore, a drier air mass requires a longer time where favorable air flow and instability exist over the body of water to become saturated.
- **Lift/Topography**
  - Rougher surfaces (such as mountainous terrain) produce greater friction enhancing low level convergence and lift to help generate precipitation.
  - Upper level disturbances also bring additional instability and lift that enhances lake effect precipitation.
- **Wind Shear (**the difference in wind speed and direction with height in the atmosphere):
  - The type of wind shear in the atmosphere above the lake will determine the type of snow bands that develop (strong/well organized bands, weaker/multiple bands or nothing/flurries), and how far downstream the lake effect snow will travel.
- **Fetch**
  - Fetch is the distance air travels over water. The greater the distance the wind travels over the warm water, the more instability and moisture the air will pick up, and the greater likelihood of lake effect snow.
    - For example, the most favorable fetch for lake effect snow to develop in South Lake Tahoe is a north to north-northeast wind over the lake, while the most favorable conditions for lake effect snow to develop over northern areas of Lake Tahoe (i.e. Incline Village, Kings Beach, Truckee) is a south to south-southwest fetch. These trajectories occur over the longest portion of the lake and have the best potential for generating lake effect snow.
    - Even though the most favorable fetch is along the longest trajectory of a lake, lake effect snow does occur over shorter stretches of a lake if conditions are ideal.

Since conditions must be ideal for lake effect snow to develop, lake effect snow does not happen very often, or at all times of the year. Sufficiently cold air must move over a relatively warm body of water. Therefore, we normally see lake effect snow develop in the fall and late spring when the lake waters are relatively warm, and yet it is late/early enough in the year to have cold systems drop south across the area. As we get into the dead of winter, lake waters are cooler making the temperature difference between the water and the air above it less than what is needed for lake effect snow to occur.

The most recent lake effect snow event that occurred in our region was October 10th, 2008. A low pressure system dropped south and brought very cold air aloft over the area. Lake effect snow developed off the southwest side of Lake Tahoe, but was most significant southwest of Pyramid Lake in western Nevada. **Figure 3** shows the radar imagery on October 10th. Pyramid Lake is outlined near the center of the rings in the image. A lake effect snow plume can be observed extending to the southwest of Pyramid Lake.

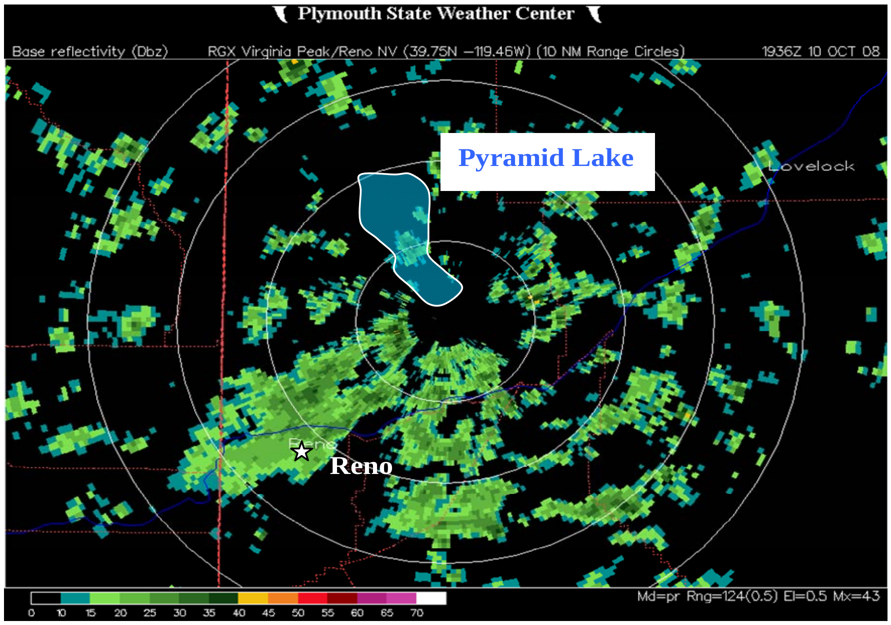


Figure 3: Radar image of lake effect snow at 12:36 pm on October 10, 2008.

Figures 4 and **5** are pictures taken at the National Weather Service Forecast Office on the north side of Reno during this lake effect snow event. **Figure 5** is a picnic table covered with snow overlooking the Reno-Tahoe International Airport.

Figure 4: NWS Reno During Lake Effect Snow Event

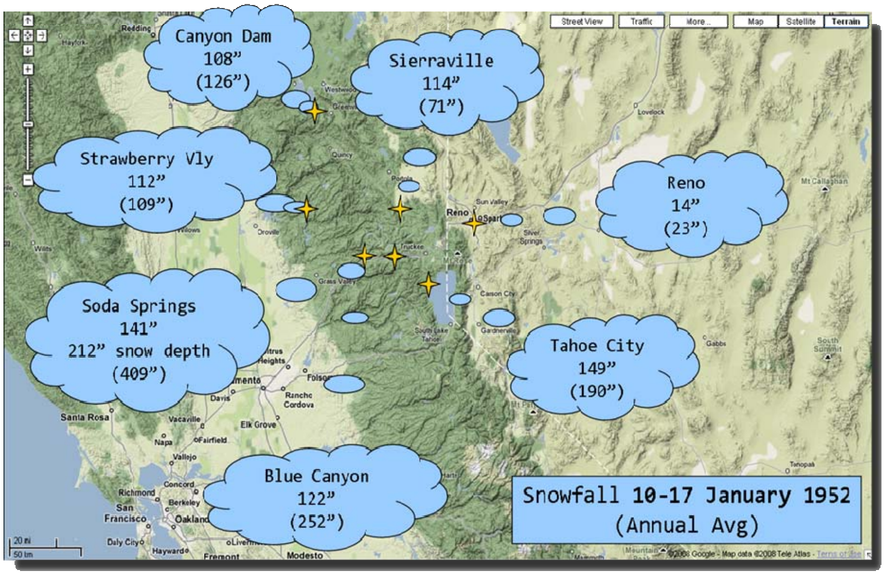
Figure 5: Overlooking the Reno Airport from NWS Reno

This lake effect snow event lasted several hours, and produced anywhere from a trace of snow to 3 inches in areas from Palomino Valley and Spanish Springs southwest to Reno. Lake effect snow is a very localized phenomenon, making it very difficult to forecast with respect to exactly what areas will see heavier snow bands, and how much snow will fall within the heavy bands. Forecasters recognized that a lake effect snow event was likely, and issued Lake Effect Snow Advisories and Winter Weather Advisories 12-18 hours ahead of time. Many spotter reports were received and were very helpful in narrowing down where the heaviest snow bands occurred, and how much snow accumulated on the ground.

Snowstorm of Record for the Sierra Nevada: January 1952

Chris Smallcomb, Science & Operations Officer

We've had plenty of humongous snowstorms in the Sierra Nevada Mountains, most recently the January 4-5, 2008 event with up to 11 feet of snow. However, to look for the "snowstorm of record" one would have to time travel back to January 1952 to see the mother of all Sierra snowstorms. This event, lasting close to a week from January 10th through the 17th and consisting of two massive back to back low pressure areas, clobbered the Sierra with up to an estimated 12-14 feet of snowfall. The map below shows snowfall for selected locations along with the annual average in parentheses.



Aside from the torrential snowfall, the most significant impact was the stranding of the *City of San Francisco* passenger train for nearly four days close to Donner Pass. Below is a photo taken of an actual *Sacramento Bee* newspaper relating the story of the passenger rescue.


THE SACRAMENTO BEE

Warren Warns GOP It Must Be Progressive

Damage And Suffering Ride In With Storm

Drama Marks Rescues In Snow Areas

222 Rescued Train Passengers Are Cheerful Despite Ordeal

Two Women Are Taken To Hospitals Here

Carlsen Gets Welcome In New York

From the Hawthorne Ordnance Museum (Hawthorne, NV)

To wrap this short story up, the winter of 1951-52 was the worst in recorded history overall for the Sierra Nevada, primarily due to this one week of storms in January. Research by meteorologist Brian O'Hara at the National Weather Service in

Reno showed the average snowfall in the central Sierra for this winter was a whopping 475 inches (39.6 feet)! The runner-up winter was 1994-95 with 400 inches (33.3 feet). Compare this to an annual average snowfall of 218 inches (18.1 feet)!

Radiosondes: What Are They and What to Do if You Find One

Jessica Kielhorn, Hydrometeorological Technician

Understanding and accurately predicting changes in weather requires adequate observation of the upper atmosphere. Radiosonde observations are a primary source of upper-air data and will remain so into the foreseeable future.

Since the late 1930s, upper air observations have been made by the National Weather Service (NWS) with radiosondes. Worldwide, there are over 800 upper-air observation stations and through international agreements, data are exchanged between countries. All observations are usually taken at the same time each day (0000 and 1200 UTC), 365 days a year.

The radiosonde is a small, expendable instrument package that is suspended below a 6 ft wide balloon filled with hydrogen or helium. Launched from the ground, radiosondes constantly measure and transmit atmospheric temperature, humidity, pressure, wind speed and wind direction throughout the atmosphere.

The radiosonde flight can last in excess of two hours, ascending to altitudes over 100,000 ft and drift more than 180 miles from the release point. During the flight, the radiosonde is exposed to temperatures as cold as -90°C and an air pressure only a few thousandths of what is found on the Earth's surface. If the radiosonde enters a strong jet stream, it can travel at speeds exceeding 250 mph. When the balloon has expanded beyond its elastic limit, it bursts and a small parachute slows the descent of the radiosonde as it falls back to the earth, minimizing the danger to lives and property.

If you find a NWS radiosonde, it poses no danger to you and is safe to handle. Plus, the radiosonde, balloon, and parachute are made of materials that are benign in the natural environment. Less than 20% of the radiosondes released by the NWS each year are found and returned to the NWS for reconditioning. These rebuilt radiosondes are used again, saving the NWS the cost of a new instrument.

To return the radiosonde, cut the string to the burst balloon; remove and discard the battery inside the instrument. Note: The instrument is powered by a water-soaked battery that uses a chemical containing sulfur. If the battery is still active when you find the radiosonde, it may be warm to the touch and give off a strong odor for several hours. Wait until the battery has cooled before removing it. Next, remove the plastic mailbag enclosed in the radiosonde and place the instrument inside the bag. Hand the package to your postal carrier. Postage is prepaid. These instructions are also found on the radiosonde cover.

How is radiosonde data used?

- Input into computer-based weather prediction models
- Local severe storm, aviation, and marine forecasting
- Weather and climate change research
- Input into air pollution models
- Ground truth for satellite data

Spotter Reports: Crucial to the National Weather Service Mission

Shane Snyder, Forecaster

You might ask yourself, "Where do my spotter reports go?" and "How are my reports used?". Well, I hope by the end of this article you know how we use your reports and just how important they are to the National Weather Service's mission to protect life and property.

Before explaining how your reports are directly used to support our mission, I would like to discuss the kind of information we are looking for in a spotter report. Every spotter report is examined with the concept of product verification. Therefore, although it is not always possible, it is best if you can include data related to verification criteria. For snowfall, information such as the time it took to accumulate to warning or advisory criteria (listed on page 10) or the start and stop times of snow greatly aid in verification of National Weather Service products. Please refer to your spotter reference guide for all the details of product warning and advisory criteria.

Now to answer the questions, "Where do my spotter reports go?" and "How are my reports used?"…

Your reports go into a Local Storm Report (available on our webpage), which then go into a national database used to both verify our products as well as to serve as historical information for weather studies. As far as the verification side, your reports help us to validate the effectiveness of our mission and teach us how we might improve our forecasting in the future to better serve the public. *Without knowing how our forecasts turned out, we cannot improve our skills!* As far as the historical information that your reports provide, there are large gaps in surface data in the West. You help to fill in the gaps that allow forecasters and the scientific community to study and learn about the weather patterns that generate significant severe weather and winter storm events.

****For more on snowfall measuring, go to http://www.nws.noaa.gov/om/coop/snowguid.htm ****
*****For a local spotter guide, go to http://www.wrh.noaa.gov/rev/spotter/Reno_spotterguide.pdf *****

Changes to Winter Related Warnings and Advisories Now in Effect

Discontinued	Replaced By
Heavy Snow Warning Heavy Sleet Warning	Winter Storm Warning
Snow Advisory Blowing Snow Advisory Snow and Blowing Snow Advisory Sleet Advisory	Winter Weather Advisory
Lake Effect Snow and Blowing Snow Advisory	Lake Effect Snow Advisory

The primary weather threats associated with the warning/advisory will be included in the first paragraph of the warning/advisory text, as shown in this example:

…WINTER WEATHER ADVISORY IN EFFECT UNTIL 4 AM PST TUESDAY…

THE NATIONAL WEATHER SERVICE IN RENO HAS ISSUED A WINTER WEATHER ADVISORY **FOR BLOWING SNOW**…WHICH IS IN EFFECT UNTIL 4 AM PST TUESDAY…

Spotter Reporting Criteria – Winter Season

What to report	Where to report it	When to report it
Snowfall**	All Areas	-Accumulating at 2 inches or more per hour. -Accumulations of 1 inch or more with only flurries or no snow in the forecast. -Snow levels 1000 feet higher/lower than forecasted.
	The Sierra Nevada in Eastern Plumas and Eastern Lassen Counties	-*7000 ft and below*: 8" or more in 12 hrs. or 12" or more in 24 hrs. -*Above 7000 ft*: 12" or more in 12 hrs. or 18" or more in 24 hrs.
	All Other Areas	-*Valley areas*: 4" or more in 12 hours or 6" or more in 24 hrs. -*Mountains 7000 ft and below*: 6" or more in 12 hrs. or 10" or more in 24 hrs. -*Mountains above 7000 ft*: 8" or more in 12 hrs or 12" or more in 24 hrs.
Rain	All Areas	Report periods of heavy rain greater than: 0.25 inch or more in less than 1 hour. 0.50 inch or more within 6 hours. 1.00 inch or more within 12 hours. 2.00 inches or more within 24 hours.
Freezing Rain/Fog	All Areas	All occurrences – When freezing rain/fog began and when it ended.
Wind	All Areas	Sustained 40 mph or greater (Twigs begin breaking off trees) or Gusts 50 mph or greater (Roof shingles come loose)
Visibility	All Areas	-Less than ¼ mile due to Dense Fog. -Near zero in blowing/drifting snow - blizzard / whiteout conditions.
River Flooding	All Areas	When the river: -is abnormally high; overflows its banks; -appears to have crested (is no longer rising); appears to be subsiding; -returns to its natural banks.
Damage/Deaths	All Areas	Caused by high winds, heavy snow, flood, or any other weather phenomenon.