Upper Air Observations

Radiosondes

For over 60 years, upper air observations have been made by the National Weather Service (NWS) with radiosondes. Radiosondes provide upper-air data that are essential for weather forecasts and research. The radiosonde is a small, expendable instrument package that is suspended below a 2 meter (6 feet) wide balloon filled with hydrogen or helium. The North Platte Weather Service Office uses hydrogen to fill our balloons. As the radiosonde rises at about 300 meters/minute (about 1,000 feet/minute), sensors on the radiosonde measure profiles of pressure, temperature, and relative humidity. These sensors are linked to a battery powered, 300 milliwatt radio transmitter that sends the sensor measurements to a sensitive ground receiver (Master Control Unit). By tracking the position of the radiosonde in flight, information on wind speed and direction aloft is also obtained. Observations where winds aloft are also obtained are called "rawinsonde" observations.

Only about 20 percent of the approximately 75,000 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. If you find a radiosonde, follow the mailing instructions printed on the side of the instrument.

The radiosonde flight can

- last in excess of two hours
- ascend to over 35 km (about 115,000 feet)
- drift more than 200 km (about 125 miles) from the release point

During the flight the radiosonde is exposed to

- temperatures as cold as -90°C (-130°F)
- air pressure only few thousandths of what is found on the Earth's surface

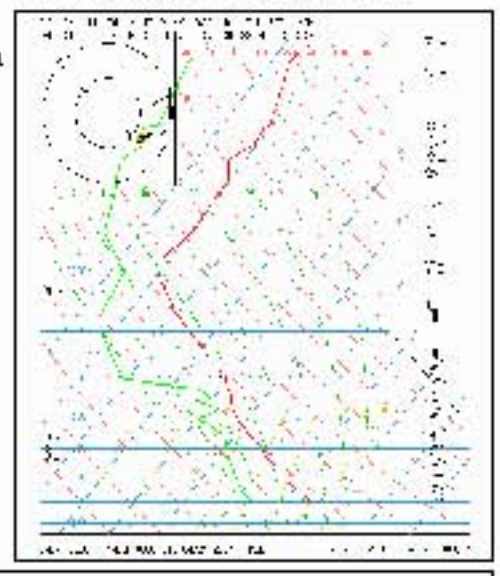
When the balloon has expanded beyond its elastic limit and bursts (about 6 m or 20 feet in diameter), a small parachute slows the descent of the radiosonde, minimizing the danger to lives and property.

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

Radiosonde observations are applied to a broad spectrum of efforts.

Data applications include:

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



Above is a Skew-T diagram that meteorologists frequently use to view the radiosonde data. The red line is the temperature plot and the green line is the dewpoint plot (a measure of the humidity).

Locations and IDs of the Upper Air Sites Nationwide

Worldwide, there are nearly a 900 upper-air observation stations. Most are located in the Northern Hemisphere and all observations are usually taken at the same time each day (00:00 and/or 12:00 UTC), 365 days a year. Observations are made by the NWS at 92 stations - 69 in the conterminous United States, 13 in Alaska, 9 in the Pacific Ocean, and 1 in Puerto Rico. NWS supports the operation of 10 other stations in the Caribbean. Through international agreements data are exchanged between countries.

Wind Profilers

Wind profilers are specifically designed to measure vertical profiles of horizontal wind speed and direction from near the surface to above the tropopause. The NOAA Profiler Network (NPN) was first deployed in 1990-1992 and has operated continuously ever since. Since January of 2000, there are thirty-two 404 MHz profilers in the central United States and three 449 MHz profilers in Alaska. The only wind profiler in the North Platte county warning area is located in Merriman, NE.

Wind NPN profilers are designed to operate reliably and unattended in nearly all weather conditions. To achieve this reliability, they have a minimum number of moving parts; therefore a fixed beam antenna is used. Obtaining wind profiles consistently to the tropopause in nearly all weather conditions requires the use of a relatively long wavelength radar. 404 MHz Wind profilers are relatively low-power, highly sensitive clear-air radars. The radars detect fluctuations in the atmospheric density, caused by turbulent mixing of volumes of air with slightly different temperature and moisture content. The resulting fluctuations of the index of refraction are used as a tracer of the mean wind in the clear air. Although referred to as clear-air radars, wind profilers are capable of operating in the presence of clouds and moderate precipitation.

Merriman Wind Profiler