Upper Air Observations

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Measuring the Upper Atmosphere

Every day weather stations around the globe launch weather balloons with instruments tied to them known as "radiosondes" to measure the atmosphere from the surface up into the lower stratosphere. In the US and its territories, radiosonde measurements (also known as a "sounding") are taken at 92 stations (69 in the contiguous US). Worldwide, there are over 800 upper air observation stations, and through international agreements data are shared between countries.

The National Weather Service (NWS) began taking soundings in the mid 1930s. Today, approximately 75,000 radiosondes are released by the NWS each year, with observations taken simultaneously by all sites every day at 00 and 12 UTC. When severe weather is expected, additional soundings may be taken at key times in affected areas.

About Radiosondes

The radiosonde itself is a small, expendable instrument package that is suspended below a latex balloon filled with hydrogen or helium. As the balloon rises, it expands due to decreasing atmospheric pressure. When it has expanded beyond its elastic limit, the balloon bursts and a small parachute deploys to slow the descent of the radiosonde. If found, the instrument can be returned in a postage-paid bag for reconditioning and reuse.

As the balloon rises, the radiosonde measures pressure, temperature, and relative humidity. Wind speeds and the direction of the wind at different levels of the atmosphere are calculated by tracking the position of the radiosonde during flight using GPS tracking. The sensors are linked to a battery powered, 300 milliwatt radio transmitter that sends the data to a sensitive ground receiver on a radio frequency between 1668.4 and 1700.0 MHz.

Uses of Data

Radiosonde data is critical for understanding and accurately predicting changes in the weather, as it is the only direct means of measuring the upper atmosphere. Radiosonde observations are applied to a broad range of efforts including weather prediction and air pollution models, severe storm, winter, aviation, and marine forecasts, climate change research, and verification of satellite data.

Flight Facts

- ✓ Balloons rise at about 300 meters/minute (or just over 11 mph).
- ✓ Flights last about two hours.
- ✓ It costs about $200 for each balloon flight.
- ✓ Radiosondes typically reach altitudes from 29 to 33 km (18-21 miles).
- ✓ The radiosonde can drift more than 300 km (about 180 miles) from the release point.
- ✓ During a flight, balloons expand from 6 feet to 25 feet in diameter.
- ✓ Less than 20% of radiosondes are currently returned for reuse.

On the web:

NWS Upper Air Program ..... www.ua.nws.noaa.gov
National Weather Service ..... www.weather.gov