How Weather Radar Works, and When It Lies

By the rock. August 6, 2026. Grounded in National Weather Service definitions.

THE SHORT VERSION

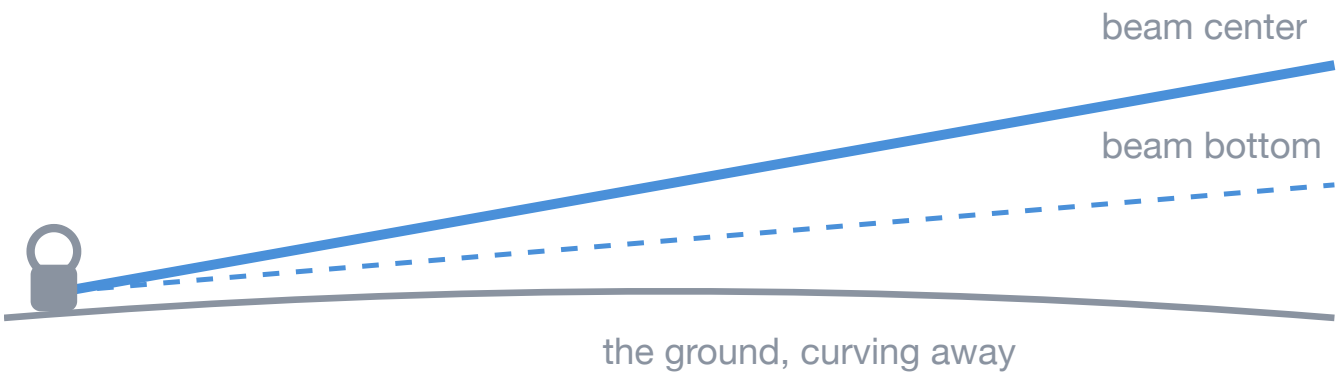
Radar sends microwave pulses and times the echoes that bounce back off precipitation. It measures what is falling through the air, not what is reaching your shoes: the beam rises with distance, so far from the radar it can only see rain a mile or more overhead. Most radar illusions, like dry ground under a colorful blob, come from that gap between the beam and the ground.

Pulses, echoes, and colors

A weather radar spins slowly, sending out pulses of microwave energy and listening. When a pulse hits raindrops, snowflakes, or hail, part of the energy reflects home. Distance comes from the delay; intensity comes from how much energy returns. Big drops and hailstones reflect ferociously, which is why the colors climb from green through yellow to red as precipitation gets heavier.

The beam looks up

The lowest radar scan is tilted about half a degree above level, and the Earth curves away beneath it. Both effects lift the beam higher above the ground the farther it travels. Close to the radar it samples air a few hundred feet up; a hundred miles out, it is sampling weather more than a mile and a half overhead. Everything below the beam is invisible to it.



The beam and the ground part company with distance. The gap between them is where radar's lies are born.

The classic lies

- **Virga.** Rain paints the screen but evaporates in dry air on the way down. The radar honestly saw rain; the rain simply never finished the trip.
- **The leading edge.** An approaching storm slings rain forward aloft. Radar paints your neighborhood minutes before the first drop lands, which is why the map can disagree with your dry driveway while thunder is already audible.
- **Ground clutter.** Near the radar, the beam clips buildings, ridges, even flocks of birds, and draws them as weather. Modern filters catch most of it.
- **Under the beam.** Far from the radar, shallow drizzle or snow can slide beneath the beam entirely: dry screen, wet ground. The opposite lie.

Reading radar like the rock does

Treat radar as testimony about the air, not a verdict about the ground. Animate it: motion tells you whether that blob is a threat or a memory. Check intensity trends rather than single frames. And when the map and your window disagree, believe the window. The rock has held this position for roughly a billion years and sees no reason to soften it.

Check your understanding

1. Radar shows heavy rain over your house, but your street is dry and thunder is getting closer. Most likely explanation?

- □ A. The radar is broken
- □ B. Rain aloft on the storm's leading edge has not reached the ground yet
- □ C. It rained earlier and the map is old

2. Why does radar miss shallow drizzle far from the radar site?

- □ A. Drizzle does not reflect microwaves
- □ B. The beam has risen above the shallow precipitation
- □ C. Drizzle moves too slowly to detect

3. What does the color on a radar map represent?

- □ A. Temperature of the rain
- □ B. How much energy echoed back, a proxy for intensity
- □ C. Wind speed inside the storm

4. Which situation does radar tend to UNDER report?

- □ A. An approaching squall line
- □ B. Shallow drizzle far from the radar, sliding beneath the beam
- □ C. A hail core overhead

5. How old is the newest frame on a typical public radar map?

- □ A. Live to the second
- □ B. Usually two to eight minutes
- □ C. About an hour

Answer key

1. Radar shows heavy rain over your house, but your street is dry and thunder is getting closer. Most likely explanation?

B. Rain aloft on the storm's leading edge has not reached the ground yet — Approaching storms sling precipitation forward aloft. The beam sees it minutes before your driveway does.

2. Why does radar miss shallow drizzle far from the radar site?

B. The beam has risen above the shallow precipitation — With distance, the beam climbs. Precipitation hugging the ground slides underneath it.

3. What does the color on a radar map represent?

B. How much energy echoed back, a proxy for intensity — Stronger echoes mean bigger or more numerous drops, drawn as hotter colors.

4. Which situation does radar tend to UNDER report?

B. Shallow drizzle far from the radar, sliding beneath the beam — Far out, the beam has climbed; precipitation hugging the ground can pass underneath it entirely.

5. How old is the newest frame on a typical public radar map?

B. Usually two to eight minutes — Mosaics update every few minutes. Fast storms can travel a mile or two inside that window, so animate and extrapolate.

Questions people actually ask

Is the radar on weather apps live?

Nearly. Public radar mosaics update every few minutes, so the newest frame is typically two to eight minutes old. Fast storms can move a mile or two in that window.

Why does the radar show a blob that never rains on anyone?

Usually virga: precipitation evaporating in dry air below the cloud. The radar reports what it honestly saw aloft.

Can radar see fog or clouds?

Not meaningfully. Cloud droplets are far too small to return usable echoes; radar is tuned for precipitation sized particles.

What are the circles or spikes that sometimes appear near the radar site?

Ground clutter and other non weather echoes: terrain, buildings, birds, even insect swarms. Filters remove most, not all.
