

Radar assignment parts 10-20

Saturday, February 21, 2026 4:36 PM

National Weather Service Radar.

Weather radar presentation as [powerpoint](#) and as a [pdf document](#) for understanding radar and dbz.

10. What is the name of weather radars used by the National Weather Service?
11. What is the wavelength range used by this radar?
12. Briefly, how does radar work to measure rain?
13. Calculate the size parameter $x = 2\pi \cdot \text{Raindrop Radius} / \text{radar wavelength}$.
14. What 'radiation regime' is the size parameter of question 13? Note that it is the same radiation regime that gives rise to the blue sky on a clear day. Note.
15. What is the basic relationship for radar backscattering in terms of number of raindrops per volume, back scattering strength, droplet diameter D, and radar wavelength lambda? Note.
16. Why must the radar be empirically calibrated for rainfall rate given question 15, and question 6?
17. How does Doppler radar work? What can be detected with it?
18. How does dual polarization radar work, and what can be detected with it?
19. What is the correlation coefficient as used in meteorological radar?
20. What does this correlation coefficient indicate?

From <https://www.patarriott.com/atms360/assignments_ATMS360_2026.htm>

13. Size Parameter = $x = \frac{\pi D}{\lambda}$ $D = 1\text{mm} = 0.1\text{cm}$ $\lambda = 10.7\text{cm}$
 Dimensionless So $x = 3 \times \frac{0.1}{10.7} \approx \frac{3}{100}$

14. Which "Radiation Regime"? \Rightarrow Rayleigh regime $x \ll 1$

15. $N = \frac{\# \text{raindrops}}{\text{Volume}}$ } ingredients

Received = Backscattered microwave power by raindrops

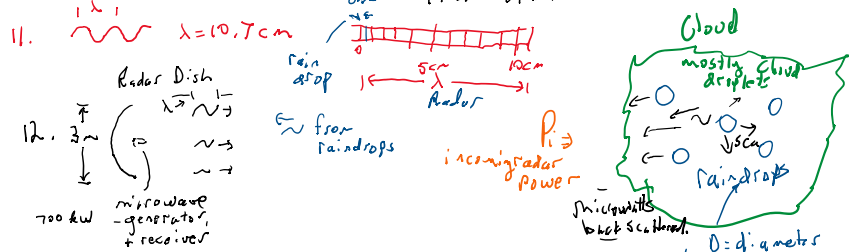
$= \frac{P_r}{\text{range}^2} \eta$

$\eta = \text{radar backscatter by raindrops per } m^3 \text{ of air}$

$\eta = \frac{\pi^5}{\lambda^4} \left| \frac{m^2 - 1}{m^2 + 2} \right| Z$ $Z = ND^6 = \frac{\# \text{raindrops}}{\text{Volume}}$ Sixth Power!

Material Property $M \downarrow$ Air $M \downarrow$ Snow
 $M_{\text{water}} \approx 5 M_{\text{ice}}$

10. Nexrad \rightarrow WSR 88d Weather Surveillance Radar



range = $c \frac{\Delta t}{2}$
 $C = \text{speed of light} = 3 \times 10^8 \text{ m/sec}$
 $\Delta t = \text{time from pulse generation to reception}$

Take Away \Rightarrow Always
 $Z = ND^6$
 Units: $\frac{mm^6}{m^3}$
 $dBZ = 10 \log_{10} \left(Z / 1 \frac{mm^6}{m^3} \right)$ decibel
 $Z = 10^{\left(\frac{dBZ}{10} \right)} \frac{mm^6}{m^3}$

GFS Composite Reflectivity (dBZ) and MSLP (mb; 0.5-degree smoothed)

Init: 12z Feb 23 2026 Forecast Hour: [6] valid at 18z Mon, Feb 23 2026

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