Velocity - Range - Wavelength relationships

- Fundamental sampling theorem states that to measure a frequency of f, it is necessary to sample at least at $(2f)$

Sampling rate = PRF $\Rightarrow$ $2f = PRF$

- Doppler theorem states that velocity is related to the frequency shift f by

$$V = -\frac{f\lambda}{2}$$

- Nyquist interval

$$V_{max} = \pm \frac{(PRF)\lambda}{4} = \frac{f\lambda}{2}$$

IF PRF = 10^3 /s ..... S-band (10 cm) $\Rightarrow \pm$ 25 m/s } UNAMBIGUOUS
X-band (3 cm) $\Rightarrow \pm$ 8 m/s }

- Increasing PRF to extend V_{max} decreases R_{max}

$$V_{max} R_{max} = \pm \frac{\lambda c}{8} \quad : \text{CONST.}$$

- Increasing $\lambda \Rightarrow \sigma$ decreases $(\sigma \propto \frac{1}{\lambda^4}) \Rightarrow \bar{P}_r$ decreases $(\bar{P}_r \propto \sigma)$

- S-band can generally detect rain but not cloud droplets
  K-band will detect many cloud droplets even if they not are yielding precipitation