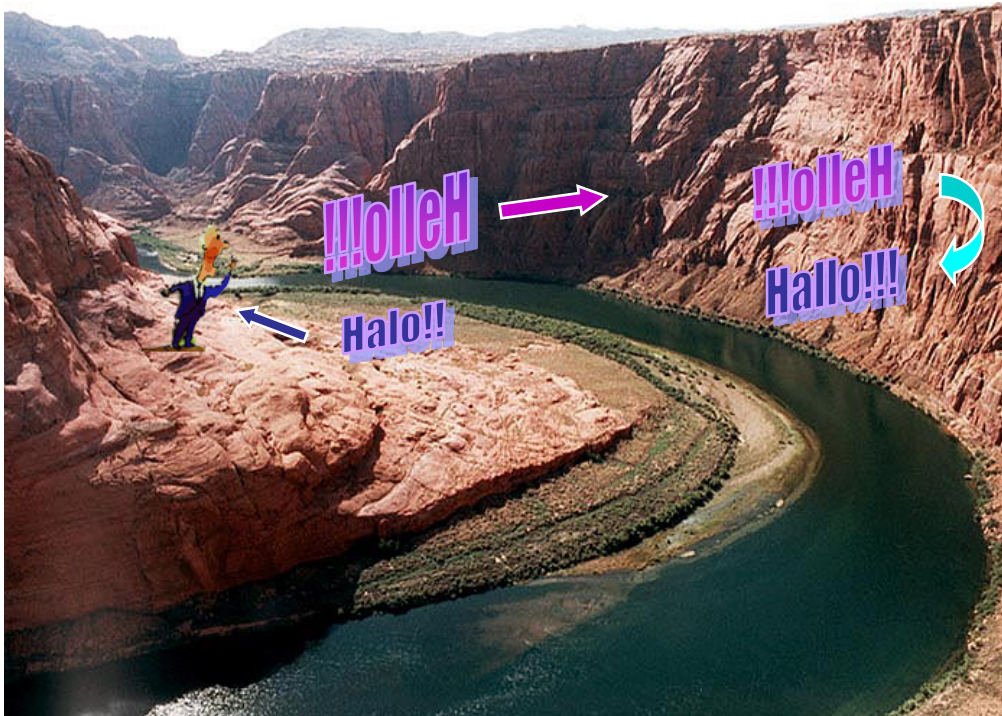
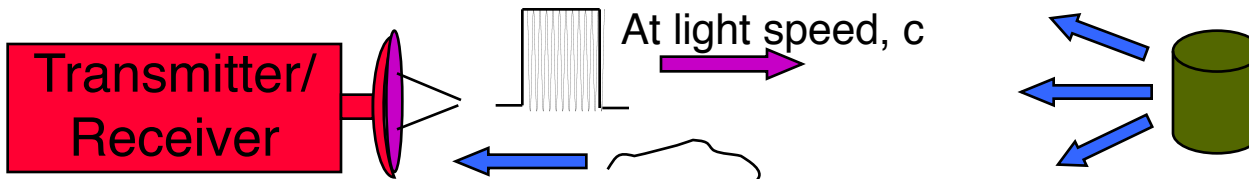
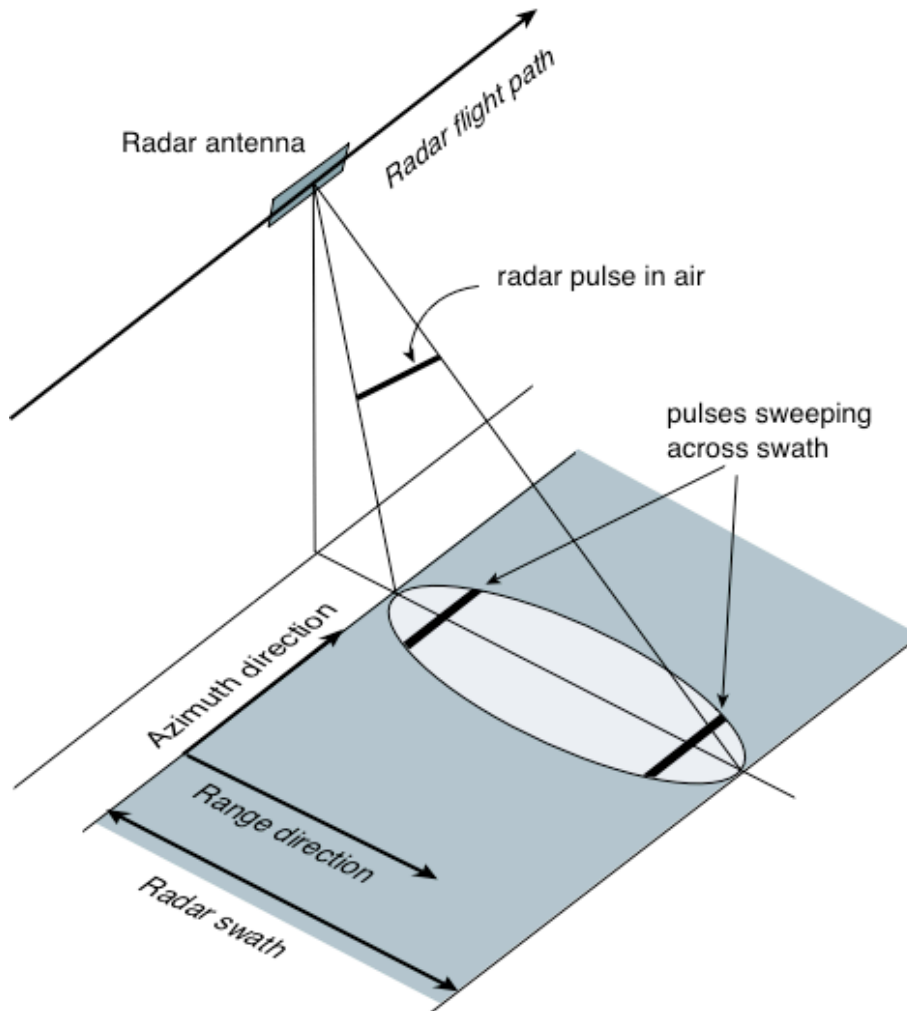


# The Radar Concept



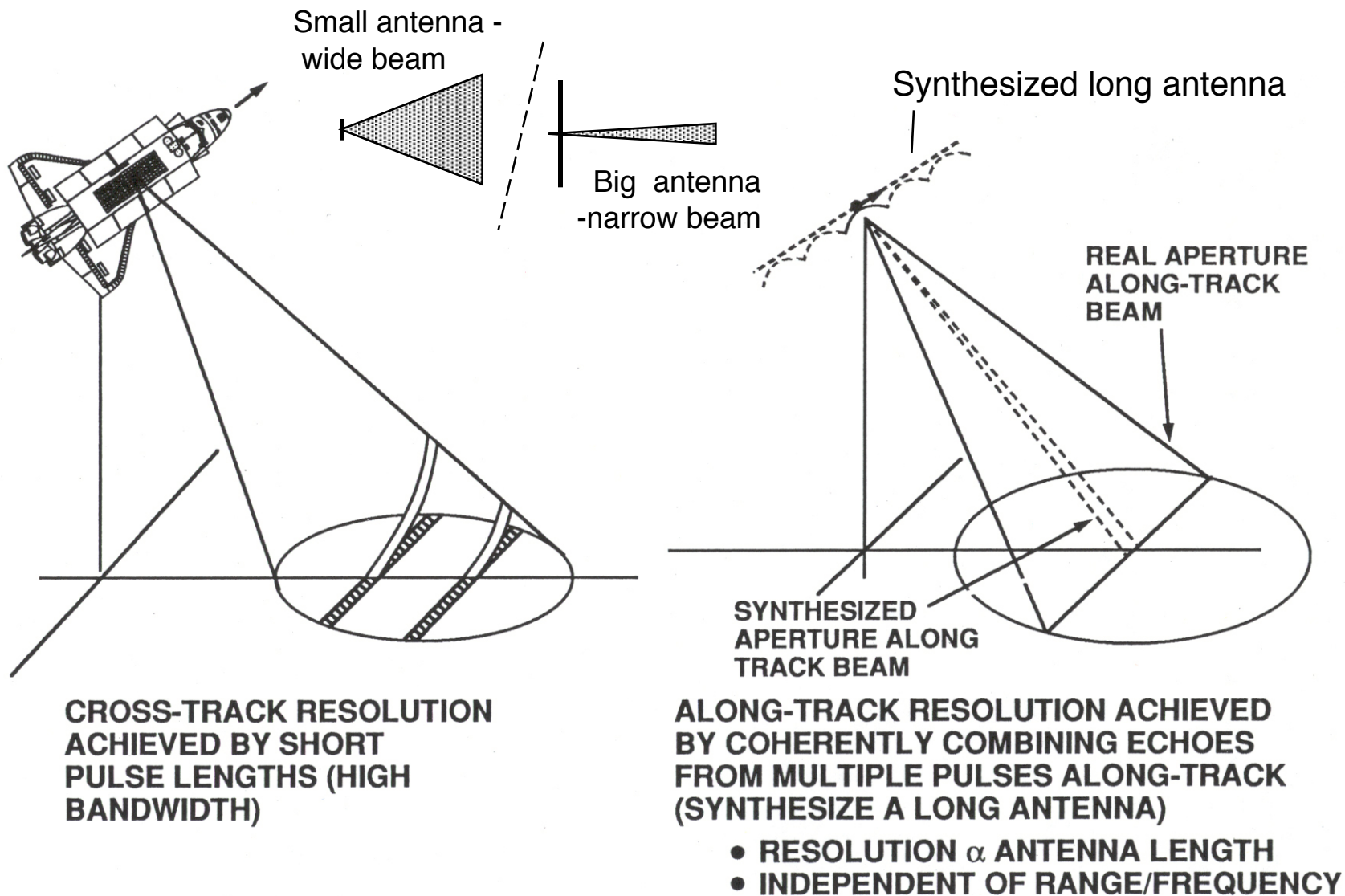
- Much like sound waves, radar waves carry information that echoes from distant objects
- The time delay of the echo measures the distance to the object
- The changes of the message in the echo determines the object characteristics

# Radar on a Moving Platform



- Pulses are transmitted from the radar platform as it moves along its flight path
- Each pulse has finite extent in time, illuminating a narrow strip of ground as it sweeps through the antenna beam
- Some of the energy from the ground is scattered back to the radar instrument

# Imaging Radar



# Wavelengths - A Measure of Surface Scale Sizes

Light interacts most strongly with objects on the size of the wavelength

**Forest:** Leaves reflect X-band wavelengths but not L-band

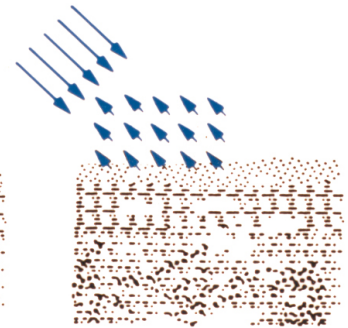
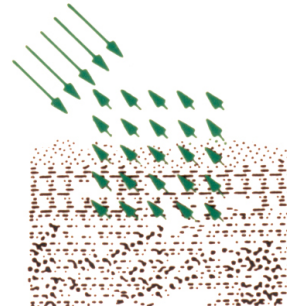
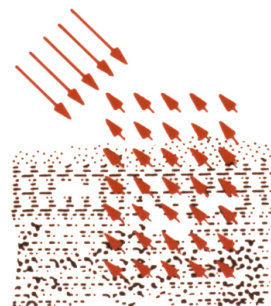
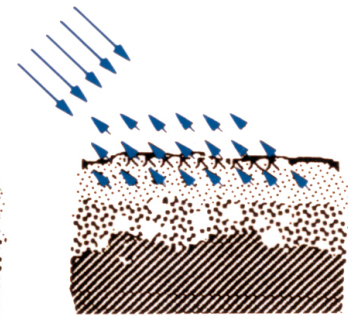
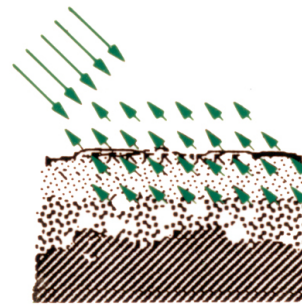
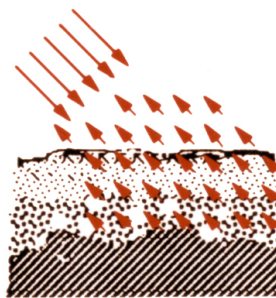
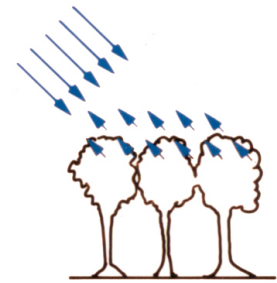
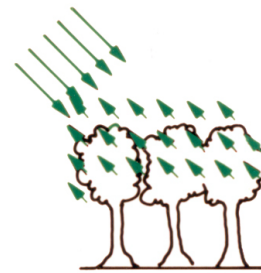
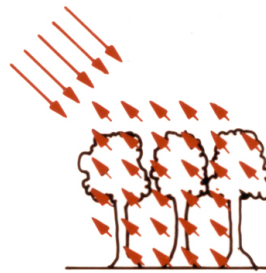
**Dry soils:** Surface looks rough to X-band but not L-band

**Ice:** Surface and layering look rough to X-band but not L-band

L (24 cm)

C (6 cm)

X (3 cm)



# Radar Images in Different Bands

**X-band**



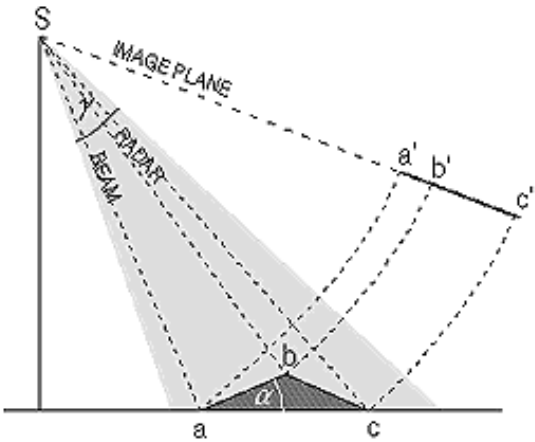
**L-band**



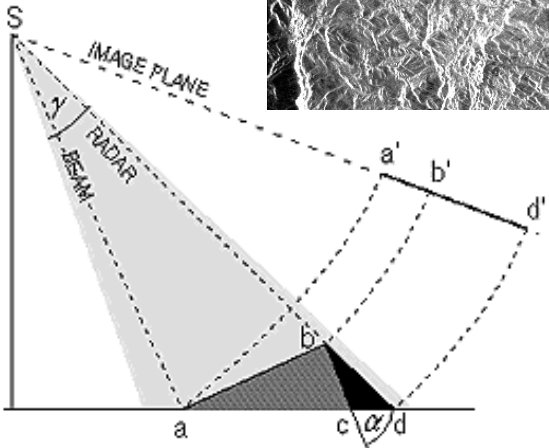
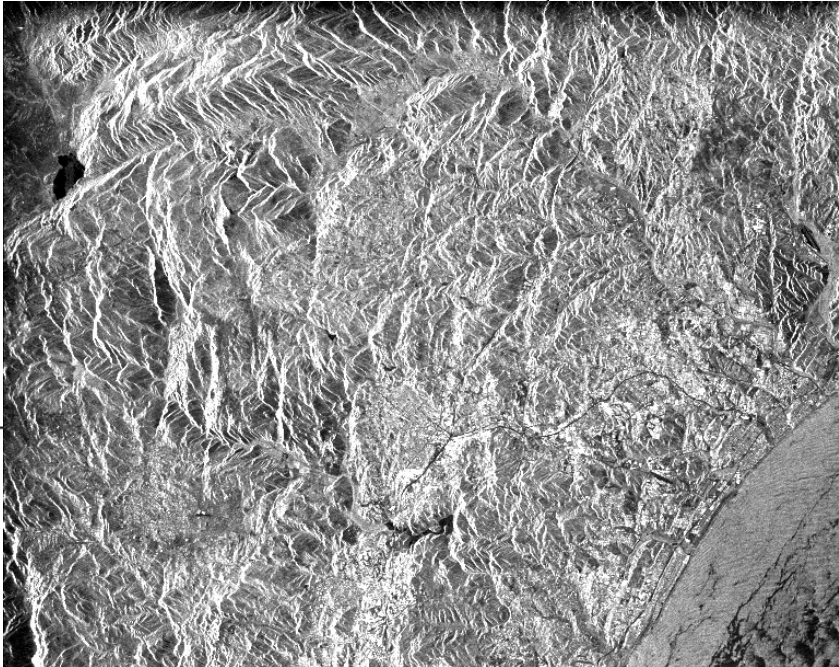
**P-band**



# Geometric Distortion

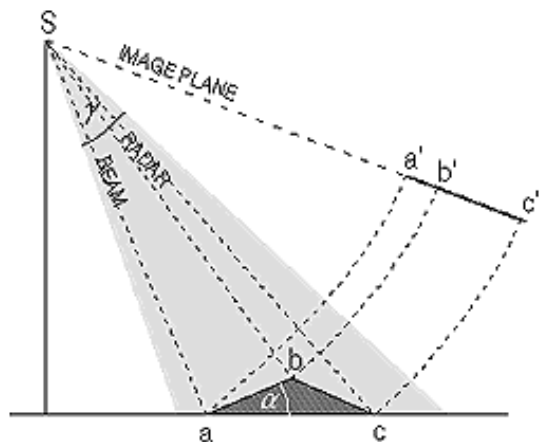


**Foreshortening**

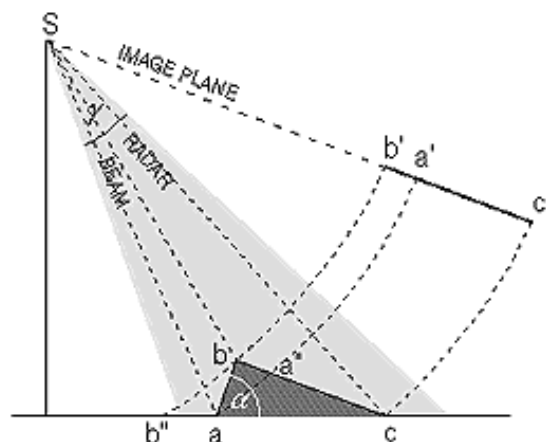


**Shadowing**

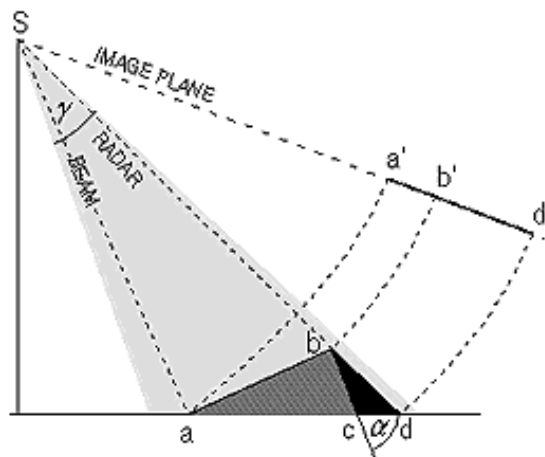
### Geometric Distortion



**Foreshortening**



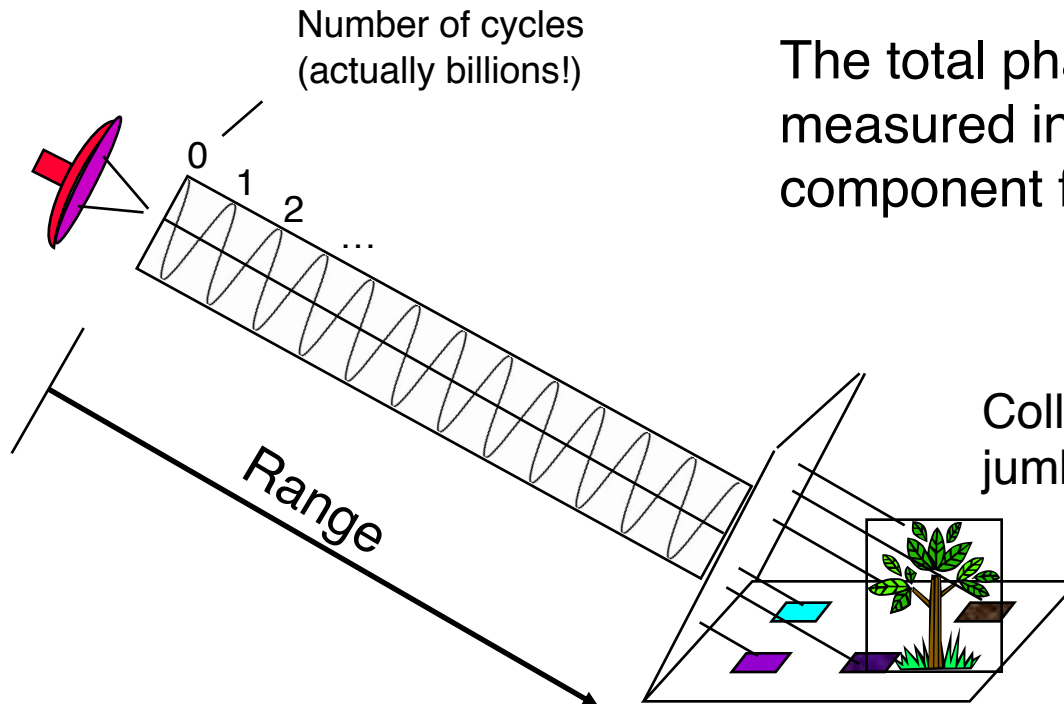
**Layover**



**Shadowing**

# Phase - A Measure of the Range and Surface Complexity

The phase of the radar signal is the number of *cycles of oscillation* that the wave executes between the radar and the surface and back again.



The total phase is two-way range measured in wave cycles + random component from the surface

Only *interferometry* can sort it out!