1/31/2018 Dan Carver carver.dan1@gmail.com

Notes taken from ARSET webinar section 1 link to first training

General information

Radar is an active sensor that uses electromagnet radiation from the microwave range microwaves are not effected by day/night or clouds

Advantages

- very sensitive to dielectric properties and structure of the feature

disadvantages

- topography alters the radar and it needs to be accounted for

how it works

Imaging radar systems are all side looking. They function by measuring the difference in time between when the signal is sent and when the signal to returns to the sensor.

The intensity of the signal is measured as backscatter. The actual values range across orders of magnitudes which needs to be accounted when conducting certain statistics or comparisons Return time is measured to calculate distance.

The resolution is determine based on the size of the antenna. Because large antennas are difficult to maintain in space they use the movement of the senor to synthetically increase the size of the antenna. Hence Synthetic Aperture Radar (SAR)

Radar measures amplitude and phase. amplitude is the strength of the signal know as backscatter coefficient.

All SAR data contains information about - Structure of the feature - dielectric properties of the feature

Three instrument parameters effect the return signal 1. Wavelength; distance between peaks of a wave different wavelengths interact with the surfaces differently longer wavelength have greater penetration. if the wavelength is bout the same size as the object backscatter will occur. If the wavelength is smaller then the object the surface will appear smooth(low backscatter).

C Band is used on sentinel 1 C-Band is recommended for identifying structure of agricultural products L-band is ideal in detecting inundated vegetation;

2. Polarization polarization defines the orientation of the wavelength. common notation 1st letter refers to the transmitted orientation, 2nd is received orientation HH: HV: VH: VV: HH and VV are co-polarized HV and VH are cross polarized
3. Incidence Angle The angle between the sensor and Earth's surface plane larger angles will be more sensitive to surface roughness backscatter decreases with the lowering of incident angle

Radar Backscatter

The amount of energy returned to the sensor is influenced by the three parameters above The brightness of the image from radar is dependent on the intensity of the Backscatter The higher the backscatter the brighter the image

surface Roughness - the average height variation of the features on the surface. - if average height is much smaller then wavelength the feature will appear smooth - size and orientation influences the scattering - different polarization combinations can detect differ structures

dielectric constant is a measure of conductivity - presence of absence of moisture drives the dielectric constant - water has a very high effect on the dielectric content - reflectively increases with increase moisture content

Reflection

- smooth water often appears as dark due to spectral reflectance
- volume scattering is indicative of vegetation
- double bounce; often show inundated vegetation.

Geometric and Radiometric distortion

- slant range resolution will vary across the image. Edges are compressed relative to the actual ground This must be corrected if distance measurements are to be made with the image
- relief displacement foreshortening: energy reaches the bottom of a slope before the top. This changes the slope of the object, it looks compressed layover; energy reaches the top of a tall feature before it reaches the base. So the top is display before the base, hence layover. relief displacement can be correct using a DEM
- radar shadowing if energy can not reach areas, data gaps will be generated
- antenna pattern the strength of a signal is more significant closer to the center of the swath this can be correct to average out the values across the image.

Speckel

grainy images are cause by random variability in reflectance from sub pixel objects. This variation results in a variance in backscatter between cells across a similar surface.

The amount of speckle can be reduce with - multilook; split the beam into multiple features and average all the features. comes at the cost of decreases resolution - spatial filtering Moving window to average out value from that window. This smooth's the image

SAR Processing and Data Analysis

pdf of slides

objectives

1. using sentinel-1
2. performing image preprocessing

3. analyze SAR imagery to classify water

sentinel1 background

both sentinel 1-A and 1-B have the same sensor characteristics; 6 day repeat this goes over using snap for data processing seem like snap has a good interface link to snap

This is really a step by step for the preprocessing tools. it looks like a great interface. in the end they run an thresholding classification based on histograms to bin water and not water.

If you need to do Sentinal1 preprocessing this is a perfect resource