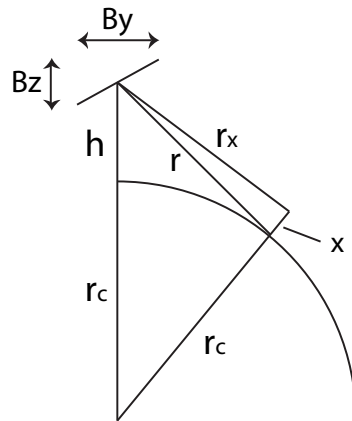


This week's assignment consists of removing the topographic phase pattern from an interferogram and revealing a deformation signature. We will begin with two single look complex (slc) files, then form the interferogram, and make the phase correction. For each answer, please create an image file such as a .jpg or .tif file and submit. In this way you can avoid submitting large files that might not fit on the submissions disk.

For computing the topo phase term, you may find the following construction useful:



In this figure,  $r_c$  represents the local Earth radius of curvature,  $h$  is the satellite height,  $x$  is the topographic elevation at a point,  $r$  is the range to the reference sphere at the point,  $r_x$  is the range to the point at elevation, and  $B_y$  and  $B_z$  are the components of the baseline vector  $B$ . The parameters for the files we will use are:

Image width, pixels: 6144  
 Image length, lines: 12000  
 Radius of curvature: 6343837.13 m  
 Satellite height: 700000 m  
 Range to first pixel: 741489 m  
 Range sample rate: 32 MHz, complex samples  
 Wavelength: 0.236057

1. Download files slc1.dat and slc2.dat from class web area under homework 9. These images have been processed using a motion compensation processor that removes the flat-Earth term automatically, and produces coregistered images. Cross multiply the two images (you should not have to resample) and form the interferogram, take 4 looks in range and 16 in azimuth, and submit an image. Your interferogram should resemble topography of Hawaii with the flat (curved)

Earth term removed.

2. Now download the slc.dem and slc.baseline files from the web site. The dem file is a floating point array with the elevation of each point in meters, and every location corresponds to the slc1.dat and slc2.dat files. The slc.baseline file is a text file with 12000 lines, one for each line in the radar images. Each entry consists of three numbers, the line number, the length of the baseline vector in the y direction, and the length of the baseline vector in the z direction.
3. Compute the topographic phase term as follows. Referring to the figure above, calculate the unit look vectors to both the elevated point at each pixel location and also to the same pixel location but at zero elevation. (Hint: you will find it most accurate to use the curved-Earth geometry in your construction.) The two unit vectors will be almost the same, but slightly different. Simulate the radar phase measurement by deriving the component of the baseline vector for each line in the line-of-sight direction to each pixel using the two unit vectors you just created. You will have two phases, one for the elevated pixel and one for the pixel at ground level. The difference of these is the topographic phase. Submit an image of the simulated topo phase.
4. Using the simulated phase, correct the phase of each point in the interferogram for topography. This should yield a map of deformation. Submit this image.
5. Now examine the deformation signature. Using the measured phases estimate the size of the deformation at several points where significant deformation is occurring. How much deformation in cm is occurring over the time of this interferogram? Is it related to features seen in the image?