1 Instructions

Lab 8 is optional. You may attempt as many of the problems as you wish for extra credit. Please save your code for the exercises as an m-file or Jupyter Notebook file and email the file to me (at `m3becker@ucsd.edu`). Download a file called `lab8start.m` (at `http://topex.ucsd.edu/rs/labs2019/lab8/lab8start.m`), which includes some lines of MATLAB code to get you started.

Online you will find two binary SAR image files, `*.SLC`, and two ASCII header files, `*.PRM`. (Download at `http://topex.ucsd.edu/rs/labs2019/lab8/files/`.) This is an ERS-1–ERS-2 tandem image pair from over the Salton Sea, with a perpendicular baseline of 58 m. The `*.PRM` files have been included for your information only and will not be of much use for the exercises below.

This lab is a demonstration of SAR interferometry. You will first look at the phase of the reference image. It will look like random noise. You will then look at the phase of the repeat image. It will also look like noise. Finally, you will examine the phase difference. This will show interferometric fringes across the image related to the curvature of the Earth.

2 Exercises

1) Make the best-looking amplitude image that you can using both images. This could involve low-pass filtering and perhaps averaging the two images. I cannot provide a recipe for doing this, but note that the pixels extend for 16 m in the range direction and only 4 m in the azimuth (top-to-bottom) direction, so the filter should be about four times taller than it is wide. Remember that these are complex numbers. Is it better to construct the amplitude and then filter, or filter the real and imaginary parts and then make the amplitude? When and how should the images be averaged?

2) Make the interferogram and filter it to make the best-looking phase map. Is it better to filter before or after forming the interferogram? Is it better to filter the real and imaginary components or the phase?

3) Do the best that you can to remove the phase ramp across the image. How do you estimate this phase ramp, and what is the best way to remove it?

4) Can you unwrap the phase using MATLAB?