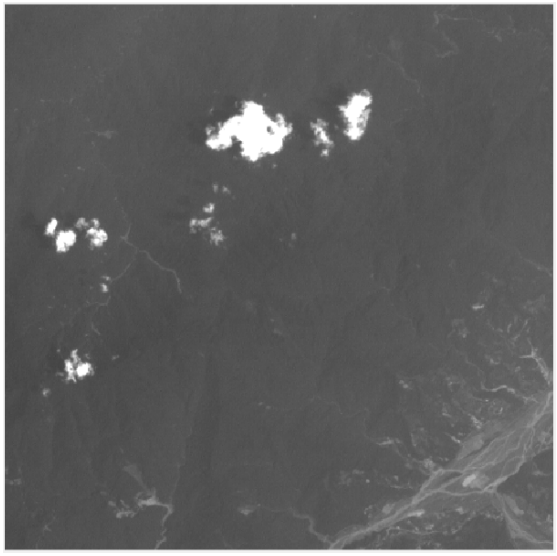
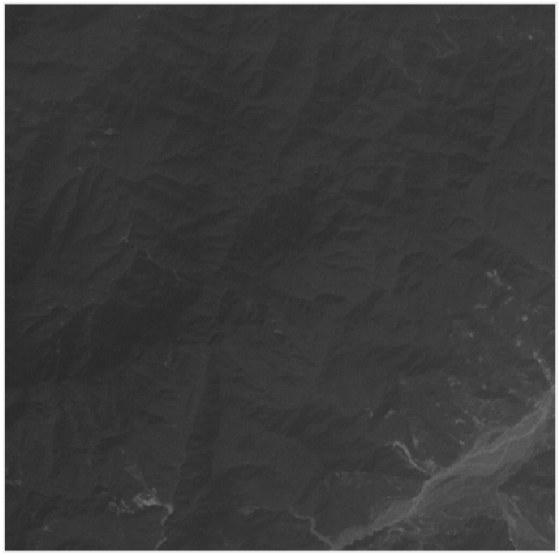
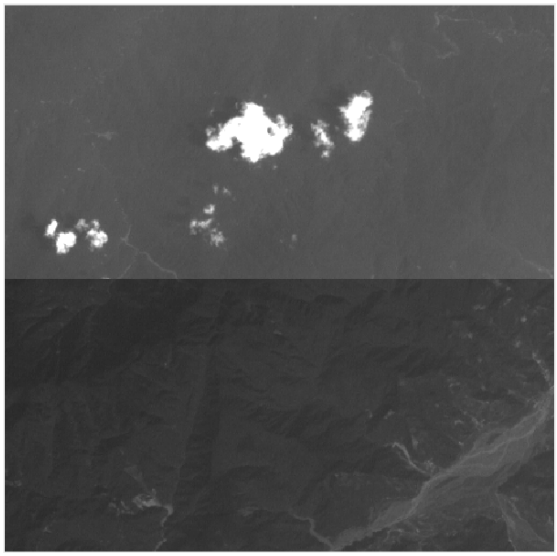
Requirement for the Image Normalization (Assignment 3)

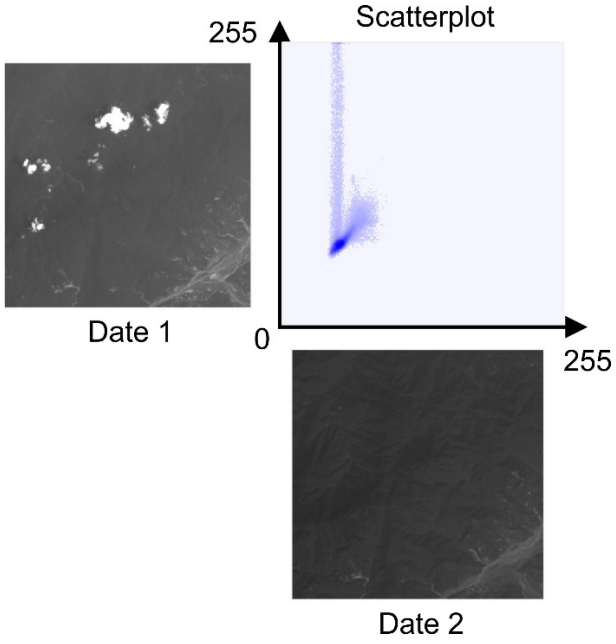
1. Use the image of Landsat 7 provided by TA (Red, Green, or Blue).
2. Date 1(left) as reference image and date 2(right) as subject image.

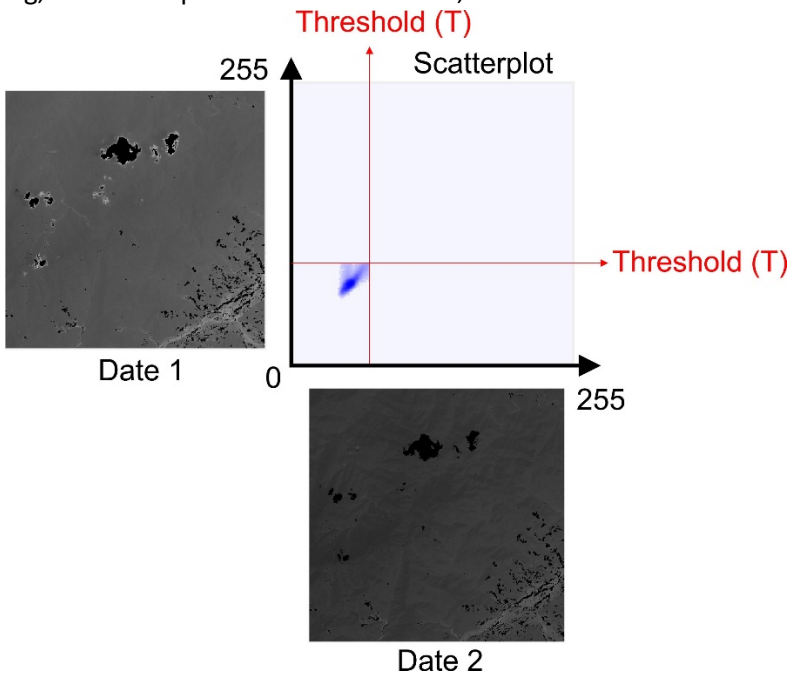
3. The example of the mosaic Image before normalization, (up) date 1, (bottom) date 2. It has the straight horizontal lines between image date 1 and date 2.
   (The students don't need to implement it)



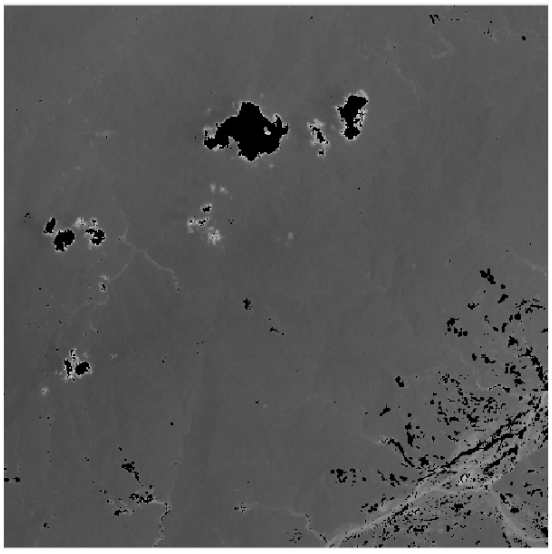
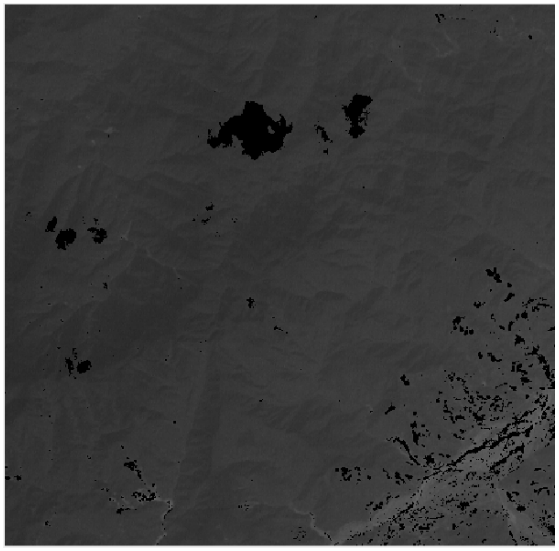
4. Define two images from different date required (Reference image and Subject Image). Use Date 1 as Reference Image, Date 2 as Subject Image.



5. To select threshold, use ones of the spectral values (Red, Green, Blue).
6. Make sure the clouds are removed. Hints: select pixels <100 for band 1 (Blue band)
7. After thresholding, the scatterplot should be look like;



8. Make the same zeros thresholding between image date 1 and image date 2. ((left)Date 1 and (right)Date 2)

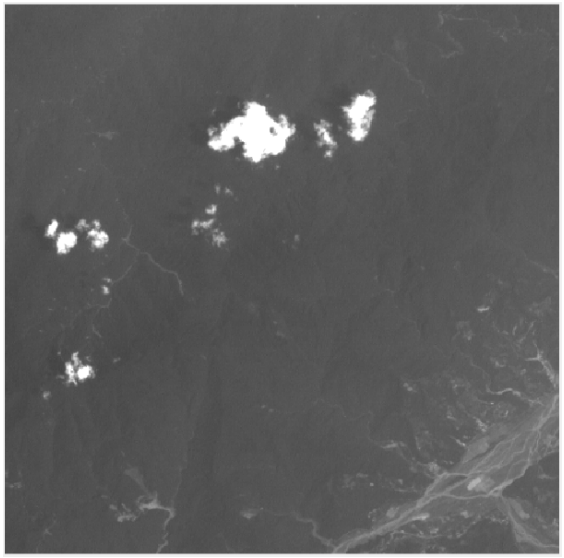
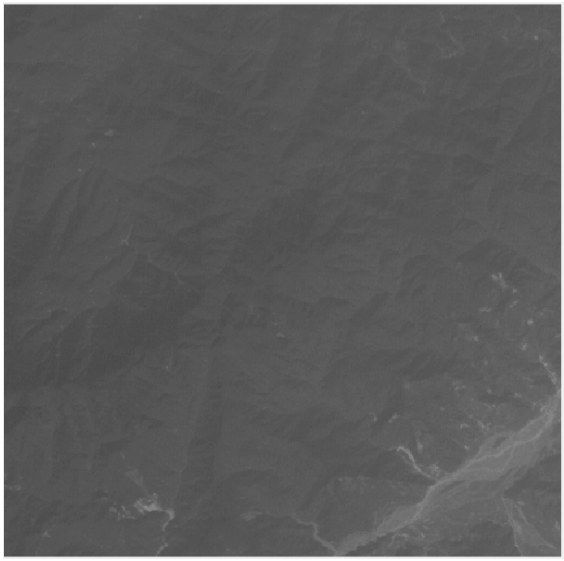



9. The normalization uses Ordinary Least Square (OLS).
   The normalization uses OLS as $y = ax + b$. To obtain the Intercept (b) and the slope (a), define the Dependent variable as x, and Independent variable as y. The input values are the image after thresholding decision, removes all zero values.

$$A = \begin{bmatrix} x_1 & 1 \\ x_2 & 1 \\ x_n & 1 \end{bmatrix} \; and \; Y = \begin{bmatrix} y_1 \\ y_2 \\ y_n \end{bmatrix}$$

$$X = [A^T A]^{-1} A^T Y$$

10. (left) Date 1 reference, (right) Date 2 subject image (Normalized image).

11. The example of image normalization. Image normalization using Ordinary Least Square. (up) Date 1 and (down) Date 2 after normalization. The horizontal line is almost can't be seen. (The students don't need to implement it)