

1a. Construct a pseudo image of normalized difference vegetation index (NDVI)  $[(\text{Band } 2 (0.80 \mu\text{m}) - \text{Band } 1 (0.60 \mu\text{m})) / (\text{Band } 2 (0.80 \mu\text{m}) + \text{Band } 1 (0.60 \mu\text{m}))]$ . What are the NDVI values in regions without significant vegetation; what are they in vegetated regions? What values do clouds have in the NDVI? Why?

1b. Create a single band image of band 9 (10.8 micron). Create a scatter diagram of Band 9 on the X-axis and the NDVI image as the Y-axis. Identify the features that you see. Is there a relationship between NDVI and temperature?

2. Close Hydra and then open it again. Load in the MODIS image from 7 August 2006, 11:10 UTC (MOD021KM.A2006219.1110.005.2006220111915.hdf). Select the scene over Northwestern Spain and Northern Portugal as shown in Figure 3. Create an rgb of the scene using band 1 (red), band 4 (green) and band 3 (blue). Create another rgb using band 6 for the red, band 5 for the green and band 7 for the blue. Note where the images differ. Why is the smoke much harder to see in the second rgb combination?

2a. Load the 7 August 2006, 11:15 UTC SEVIRI area (met8\_1234567891011\_2006\_219\_1115.area). Open a new Multi-Channel Viewer and try to select the same region as the MODIS scene, also shown in Figure 3.

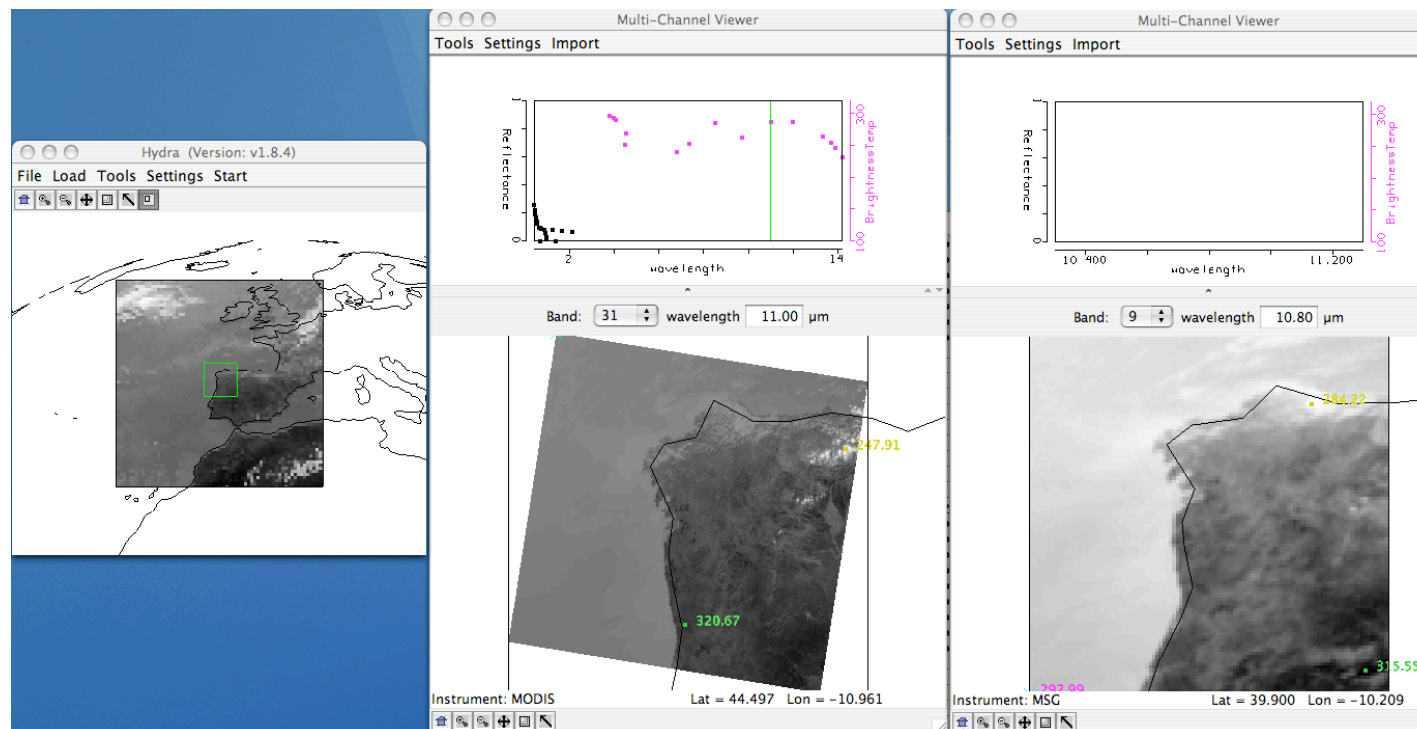


Figure 3. 7 August 2007 11:10 UTC image of Hydra main window (left) and subset from Terra MODIS (center) and SEVIRI (right).

2b. Load the 3.9 micron bands and into both the SEVIRI and MODIS Multi-Channel Viewer windows (use SEVIRI band 4 and MODIS band 22). Compare the temperatures in the scene. Consider reasons why the values are different.

2c. Create a transect across some of the darkest pixels in the MODIS band 22 scene as shown in Figure 4. What range of values do you observe in the transect? Do you notice anything that looks strange to you? Grab the transect point locator by right clicking and holding down the mouse button on the green point located at the bottom of the transect window X-axis. Move the

position to the location along the transect where there seems to be missing data. Why do you think the values are missing?

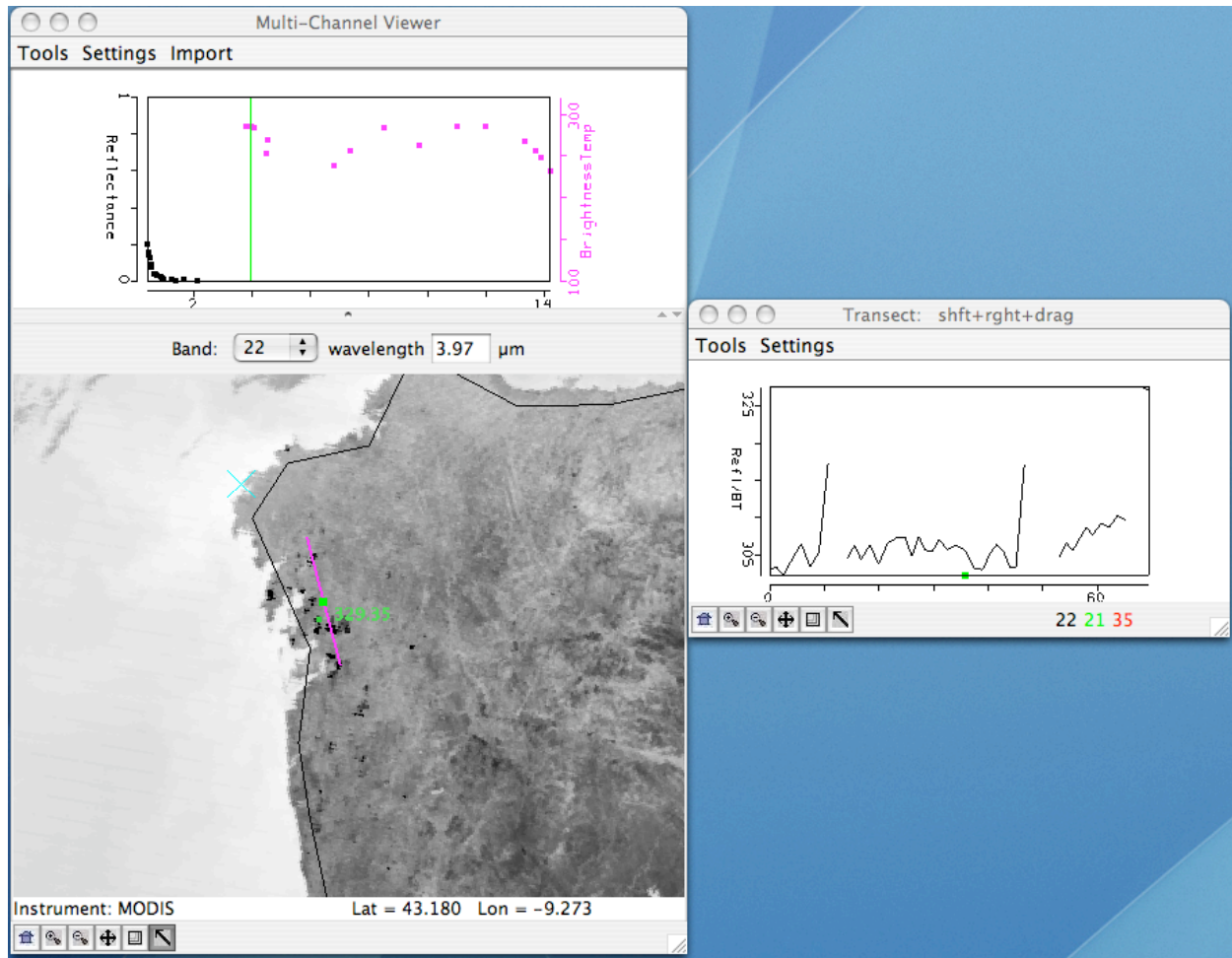


Figure 4. Transect of MODIS data from the 7 August 2007 scene.

2d. Now look at the values in the SEVIRI image by selecting Tools->Transect in the SEVIRI Multi-Channel Viewer and very carefully try to match the transect in the MODIS image. If you are successful, the transect will appear in the same window with the MODIS values. Compare the values. Are there missing values in the SEVIRI data? Change the bands to 11 micron for each instrument (MODIS band 31 and SEVIRI band 9). How do these brightness temperatures compare? What are reasons for differences between the instrument bands? Now change the MODIS band to 21 (the fire channel). Are there missing values now? Why not?

2e. From the MODIS Multi-Channel Viewer, open the Linear Combinations Window and make a single image of Band 21 (3.99 μm) and a combination window of BTDIF4-11 (Band 21(3.99 μm) – Band 31(11 μm)) as shown in Figure 5. Choose the band 21 image as the X-axis and the BTDIF4-11 image as the Y-axis, and create a scatter diagram. Save the scatter diagram by using the Tools->Capture Display option in the scatter diagram window. Identify the regions that have:

- i) Temperatures less than 300K and small brightness temperatures differences
- ii) Temperatures ~310-320 K and small brightness temperature differences
- iii) Temperatures ~300K with large brightness temperature differences

and in each case explain why they exhibit these characteristics.

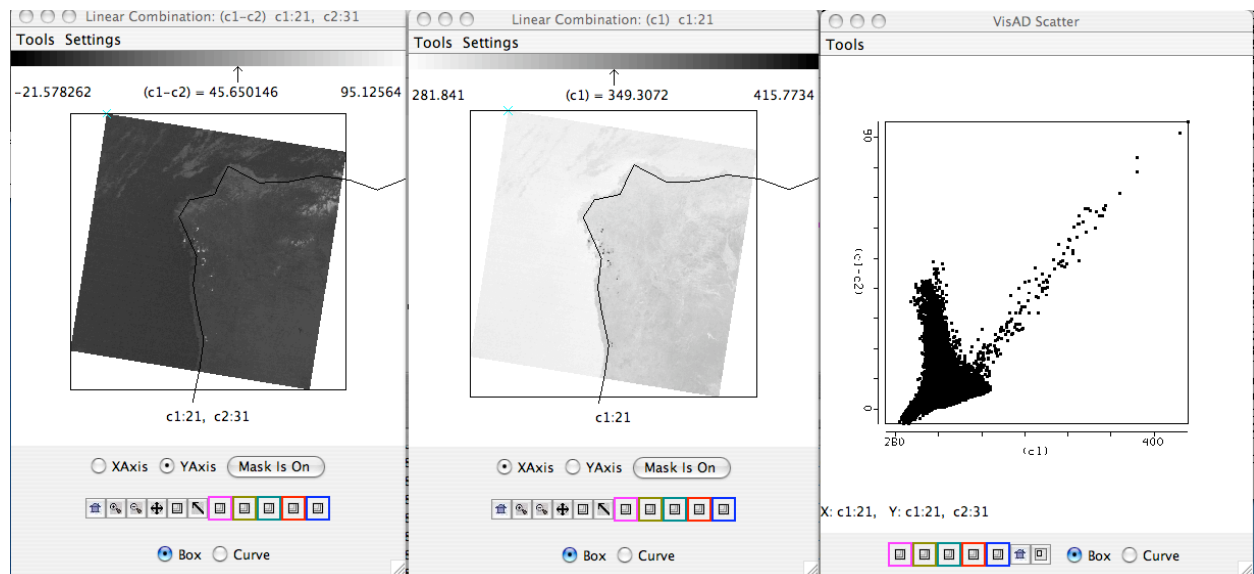


Figure 5. Scatter diagram of pixels from 7 August 2007 MODIS scene (right panel) over Spain and Portugal. The scatter diagram was made from the 3.99 micron band (center panel) and the 3.99-11 micron brightness temperature differences (left panel).

2f. Fire detection algorithms often use a series of tests to determine if a pixel contains a fire. Determine where the fire pixels lie on the scatter diagram. If you were to create a fire detection technique for MODIS, what thresholds would you use for an:

- i). 3.99 micron brightness temperature test
- ii). 11-4 micron brightness temperature test

2g. Why are the brightness temperatures of fire pixels so different between the 4 and 11 micron windows?

2h. Now close the Linear Combinations window. Make sure you have the SEVIRI window units set to brightness temperatures and open up a new Linear Combinations window from the SEVIRI Multi-Channel Viewer. Create a scatter diagram of the 4 micron band on the X-Axis and 4-11 micron brightness temperatures differences on the Y-Axis. Do you recognize the patterns that you saw in the MODIS scatter diagram? You may wish to display the MODIS scatter diagram that you saved. How are these patterns the same? How are they different?

2i. Now apply the fire detection threshold tests that you created in exercise 2f using your MODIS thresholds. Describe your results.

2j. How do MODIS and SEVIR instruments compliment each other in detecting fires?