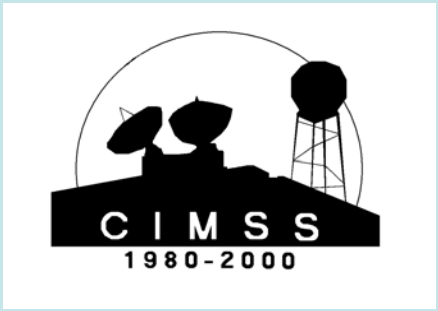
Interrogating MODIS & AIRS data using HYDRA

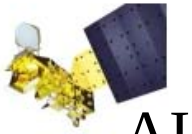


Paul Menzel
NOAA Satellite and Information Services

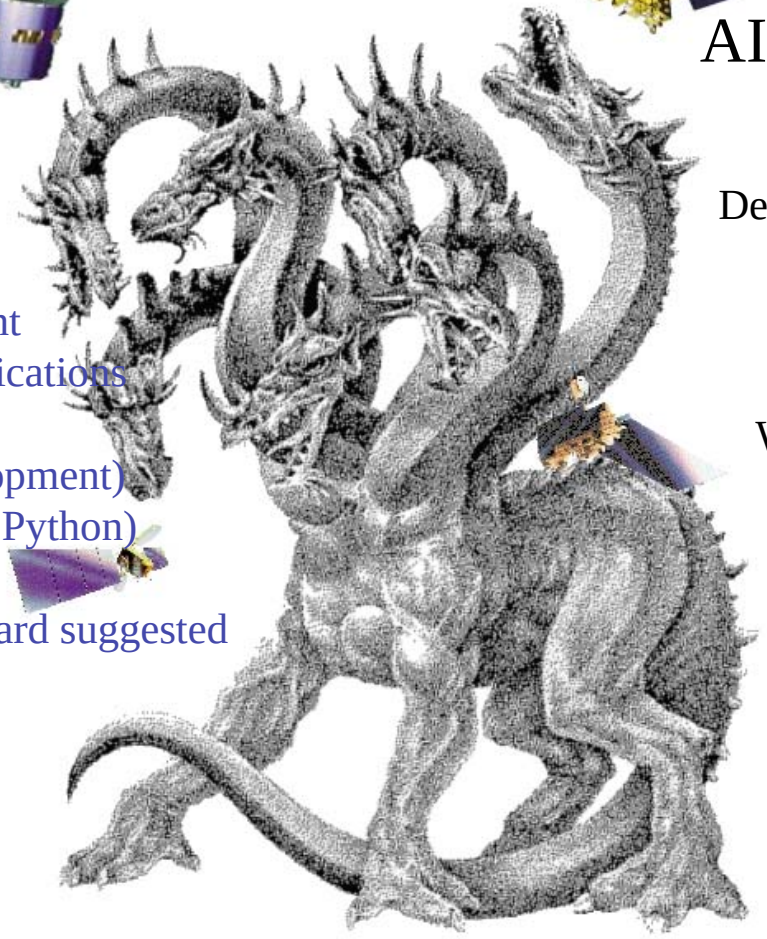
What is HYDRA?
What can it do?
Some examples
How to get it?

HYperspectral viewer for Development of Research Applications - HYDRA

MSG,
GOES



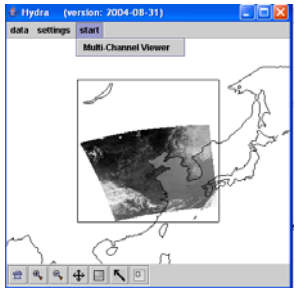
MODIS,
AIRS, CALIPSO



Freely available software
For researchers and educators
Computer platform independent
Extendable to more sensors and applications
Based in VisAD
(Visualization for Algorithm Development)
Uses Jython (Java implementation of Python)
runs on most machines
512MB main memory & 32MB graphics card suggested
on-going development effort

Developed at CIMSS by
Tom Rink
Tom Whittaker
Kevin Baggett

With guidance from
Paolo Antonelli
Liam Gumley
Paul Menzel



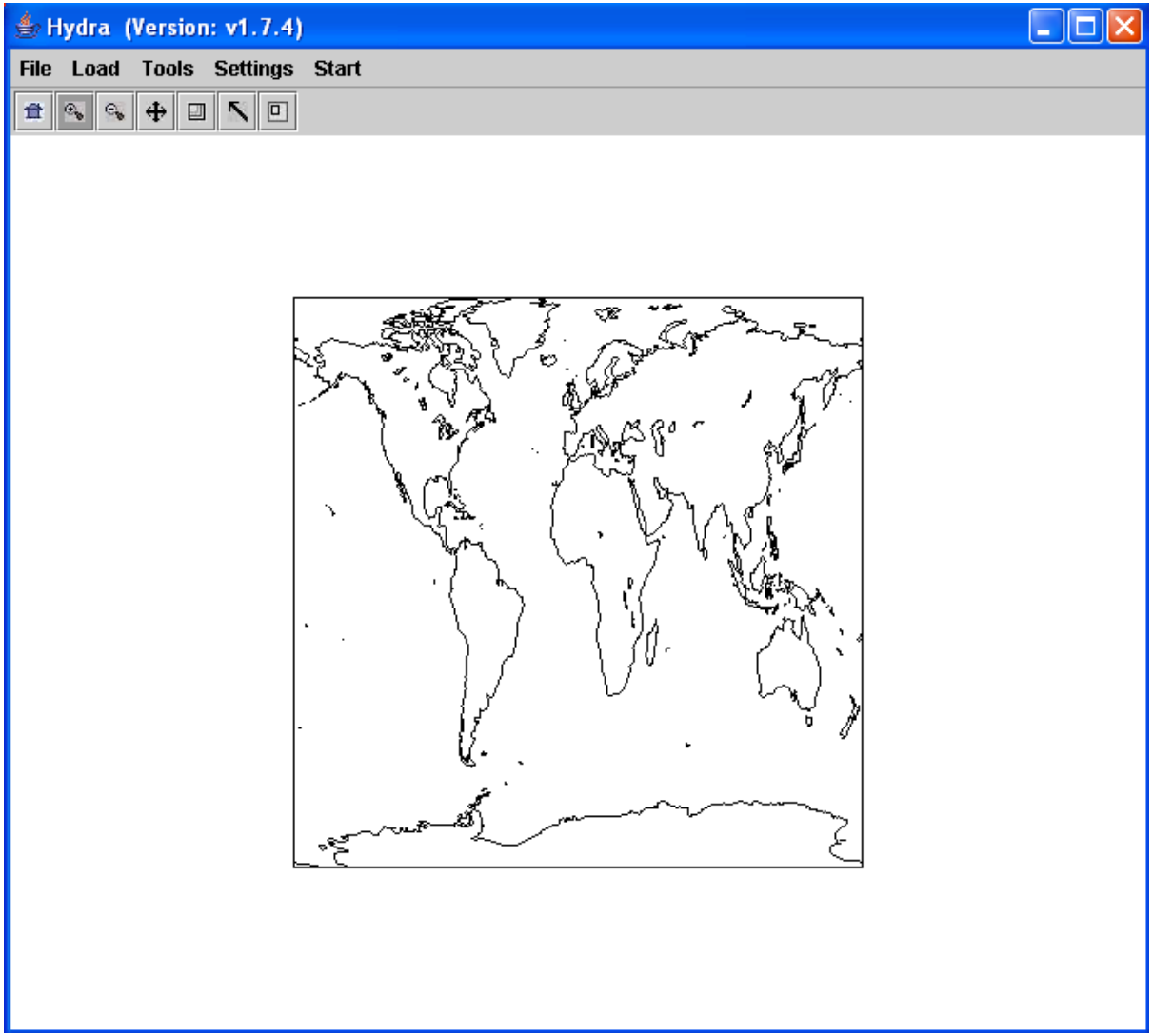
CIMSS

http://www.ssec.wisc.edu/hydra/

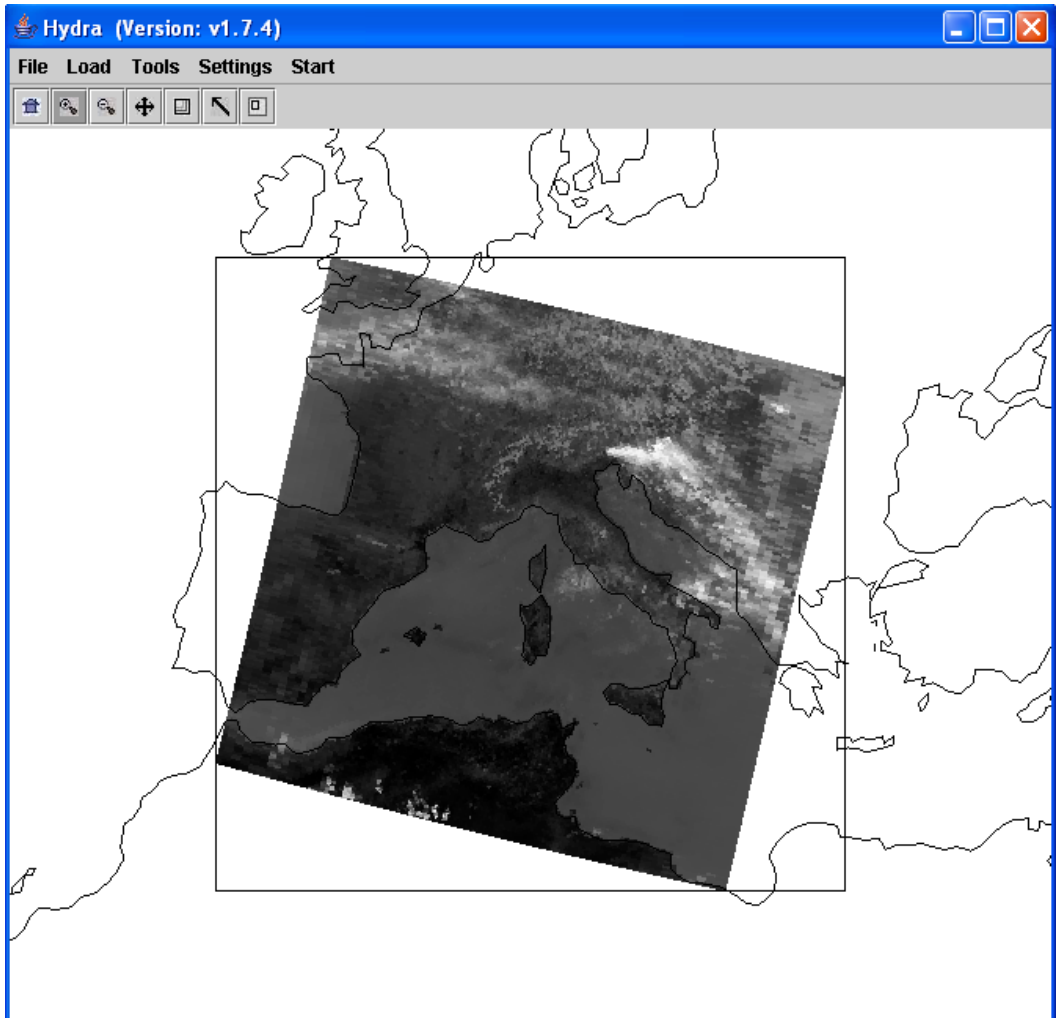
Freely available software
For researchers and educators
Computer platform independent
Extendable to more sensors and applications
Based in VisAD
(Visualization for Algorithm Development)
Uses Jython (Java implementation of Python)
runs on most machines
512MB main memory & 32MB graphics card suggested
on-going development effort

http://www.ssec.wisc.edu/hydra/

The HYDRA Window

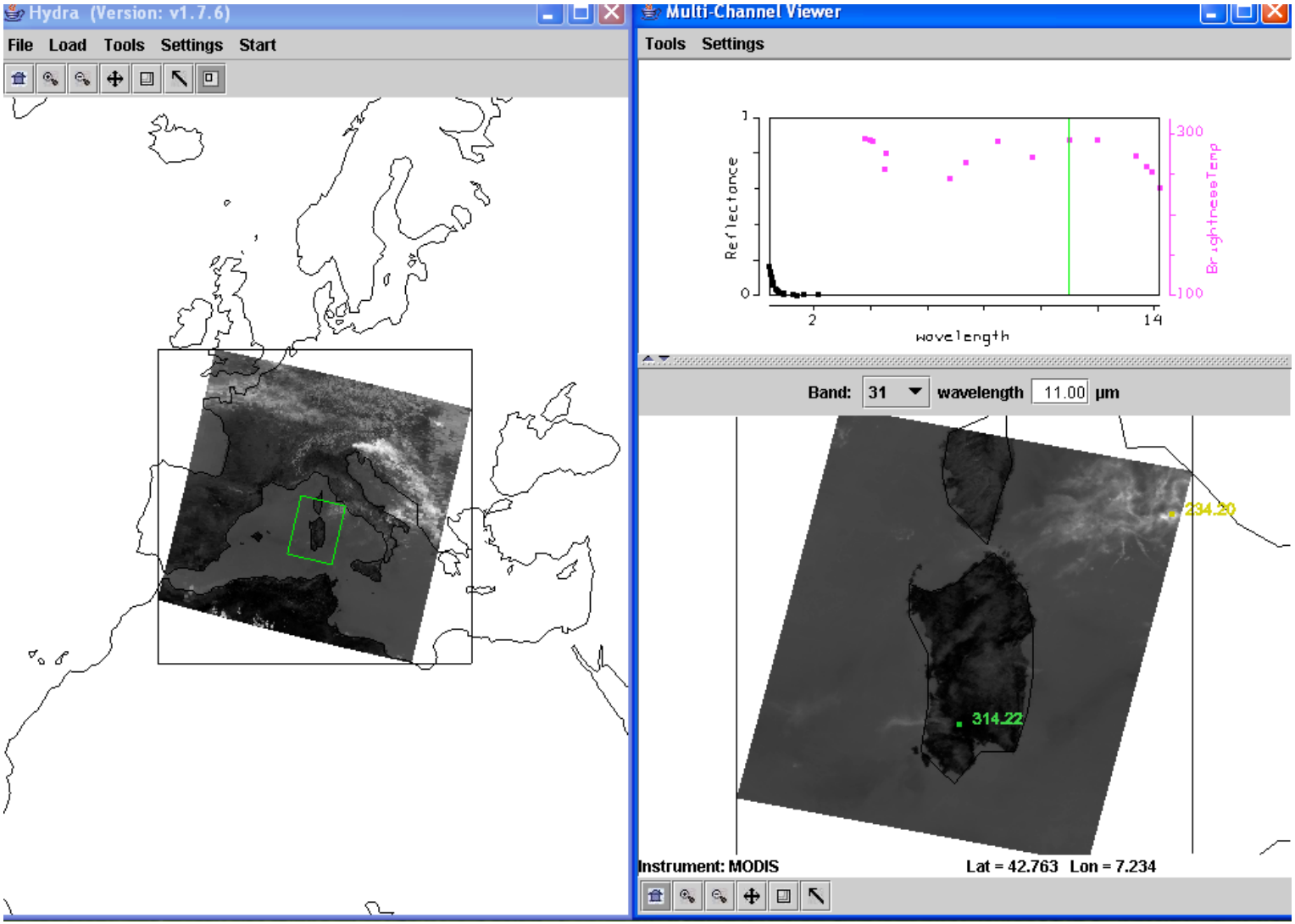


Loading a Granule

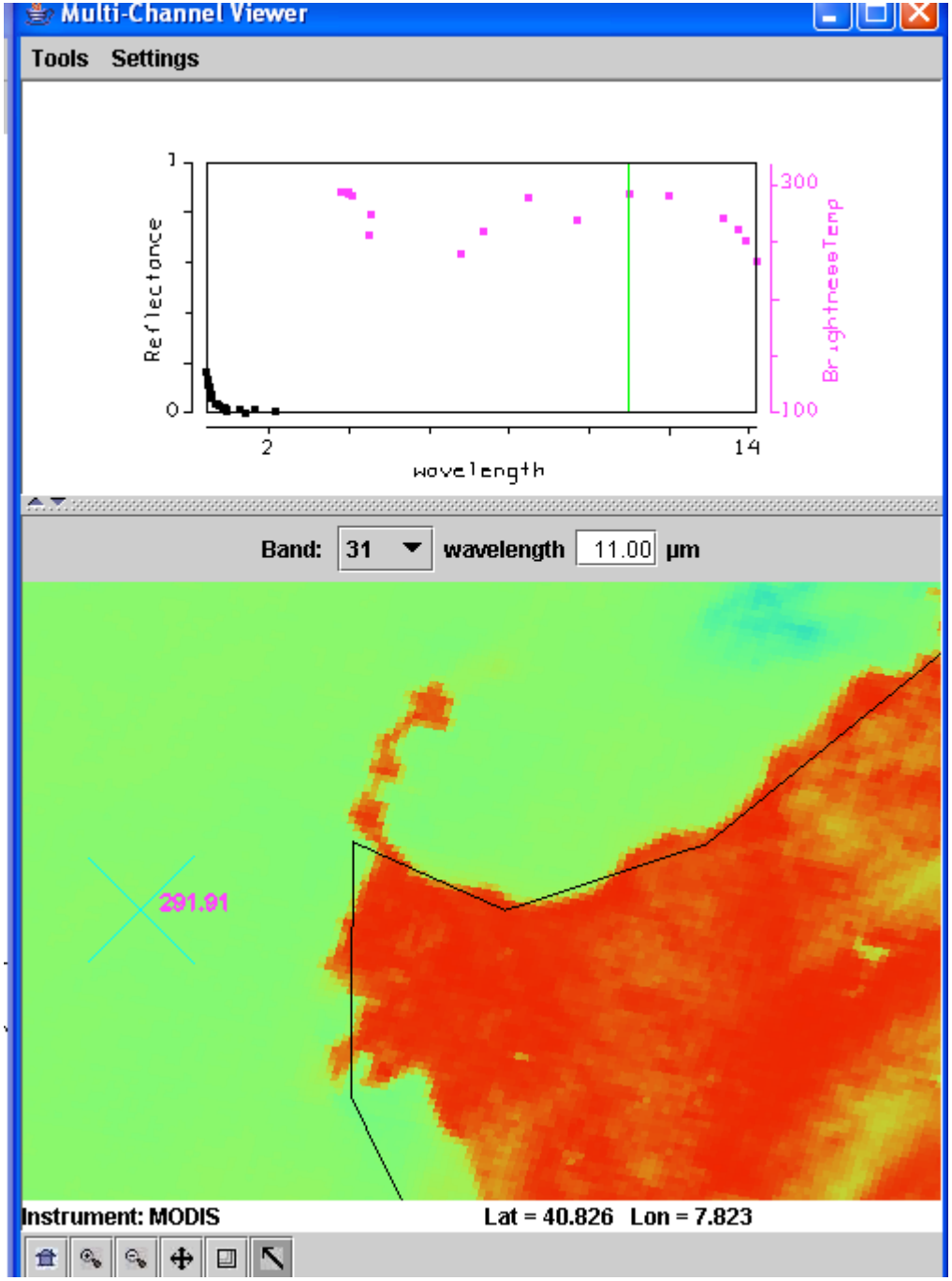


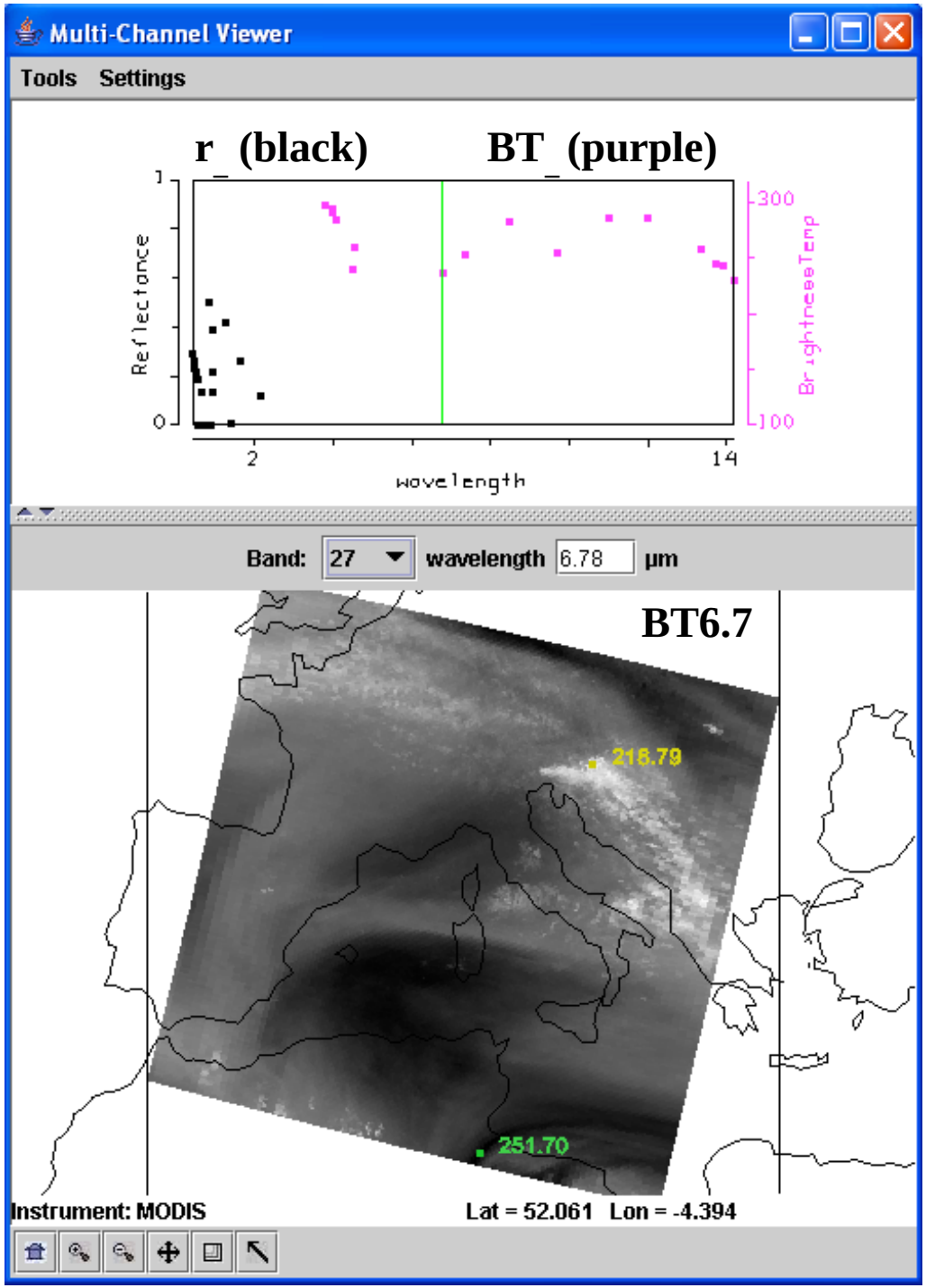
HYDRA IR window with 29 May 2001 MODIS L1B 1KM granule

Select region for full resolution display



Select color
and
Zoom to see
single pixel
resolution





Multichannel Viewer

Under Tools

Linear Combinations opens *Channel Combination Tool* display where you can specify linear combinations of spectral bands a,b,c and d (a +-x / b) +-x / (c +-x / d).

RGB allows you to select a spectral channel for each color in the RGB display

Transect allows you to create a line on the image and see the temperatures or radiances along the transect marked by shift plus right click and drag.

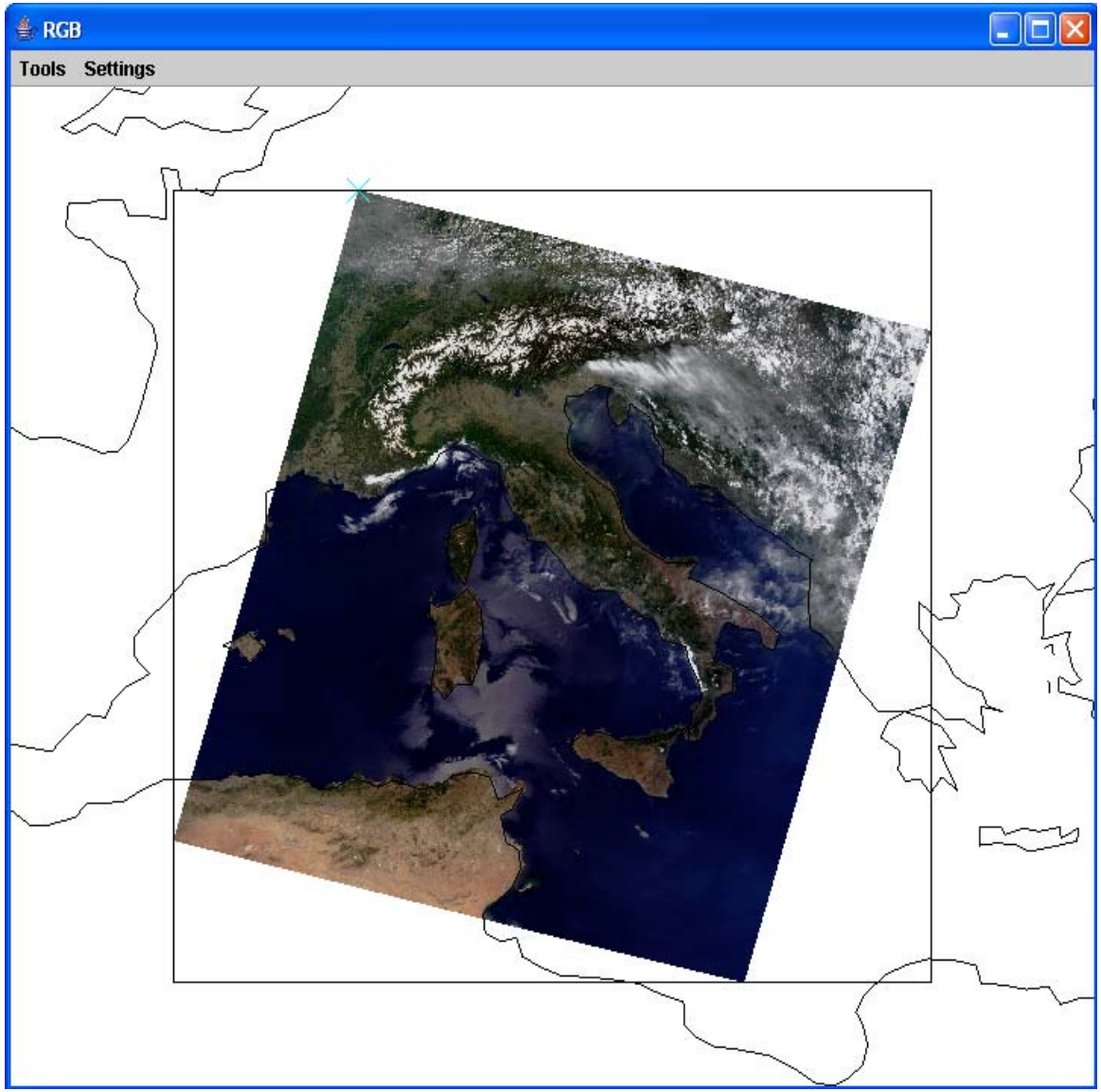
Capture Display allows you to save the image as a jpeg

Statistics displays the min and max values in the image

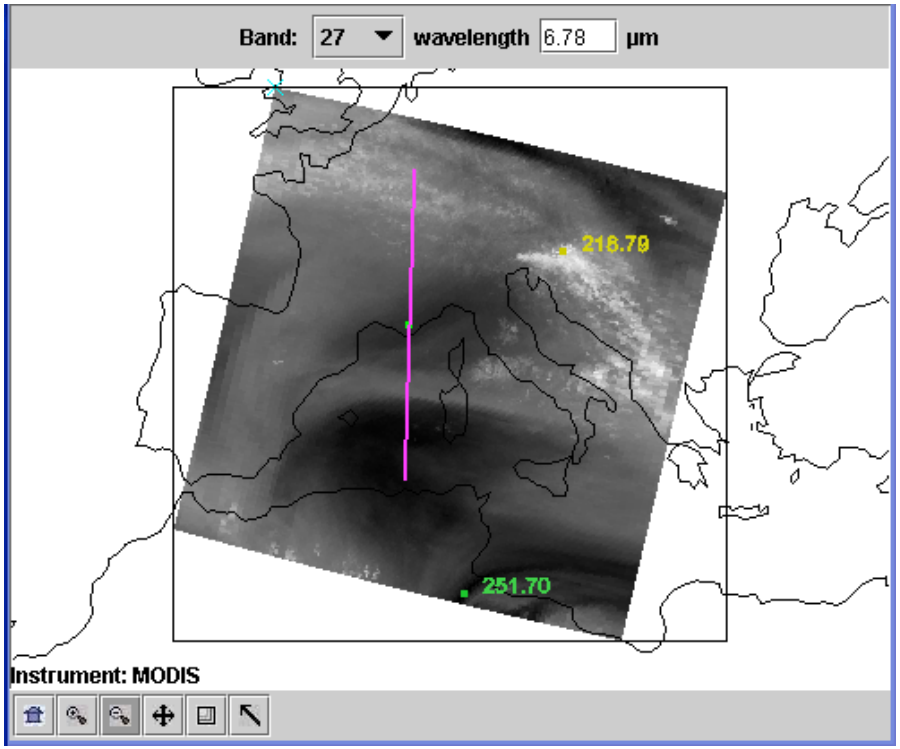
Reference Spectrum allows you to compare spectral measurements from two selected pixels (controlled by the arrows in the bottom toolbar)

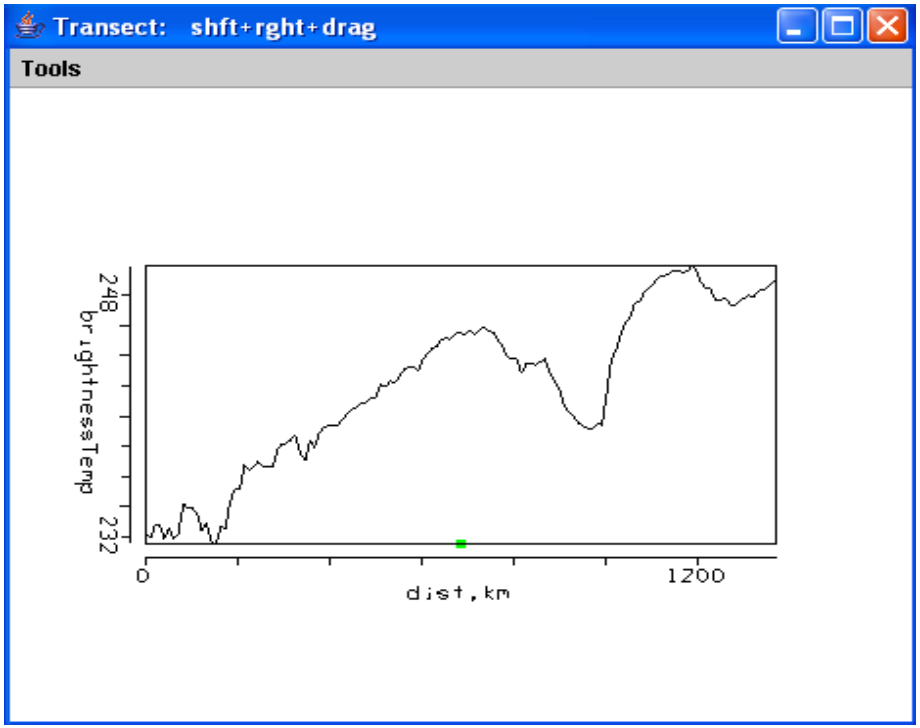
Pseudo RGB Composite Image

Red – ch 1
0.65 _m
Green – ch 4
0.55 _m
Blue – ch 3
0.47 _m

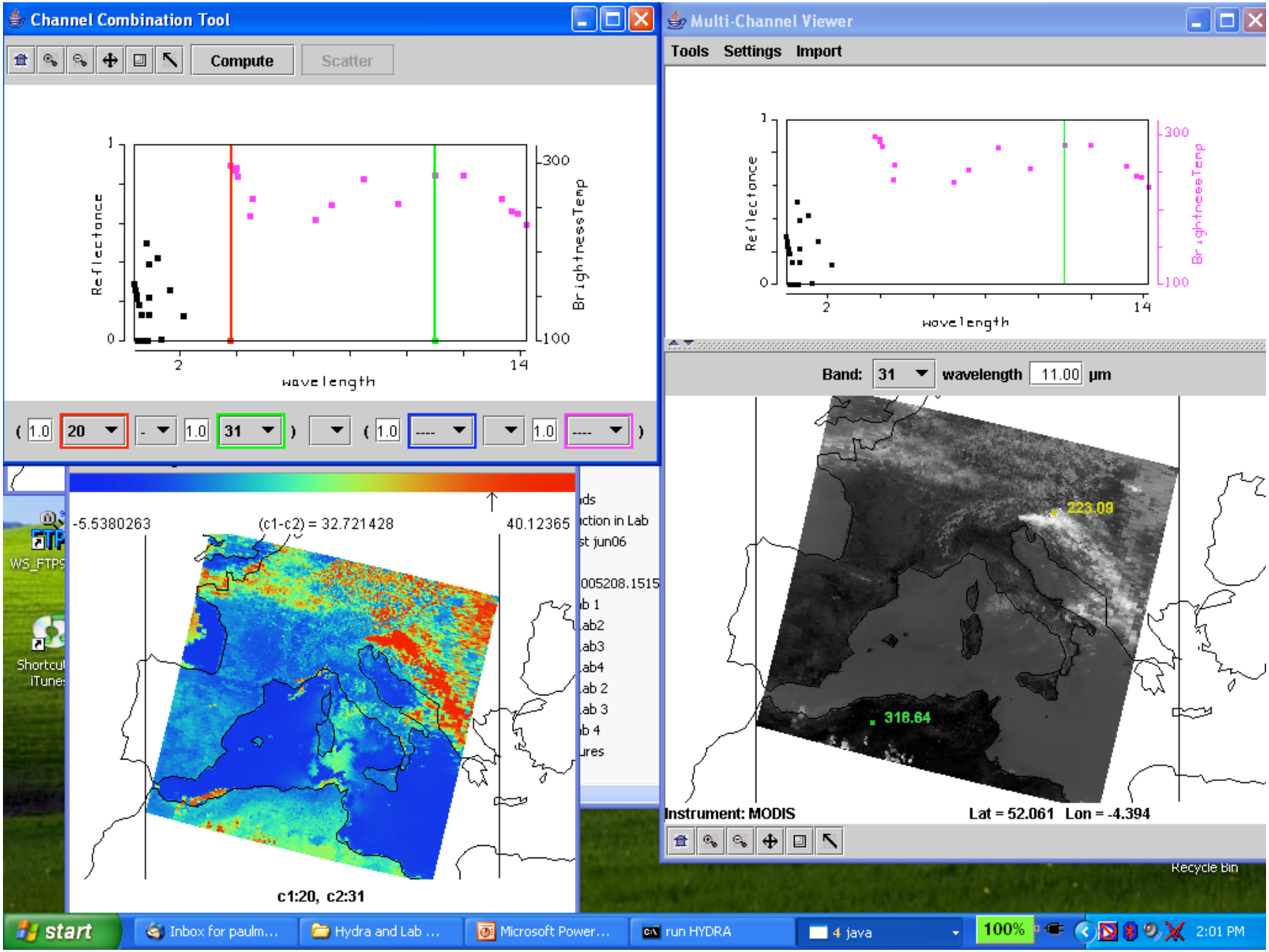


Transect

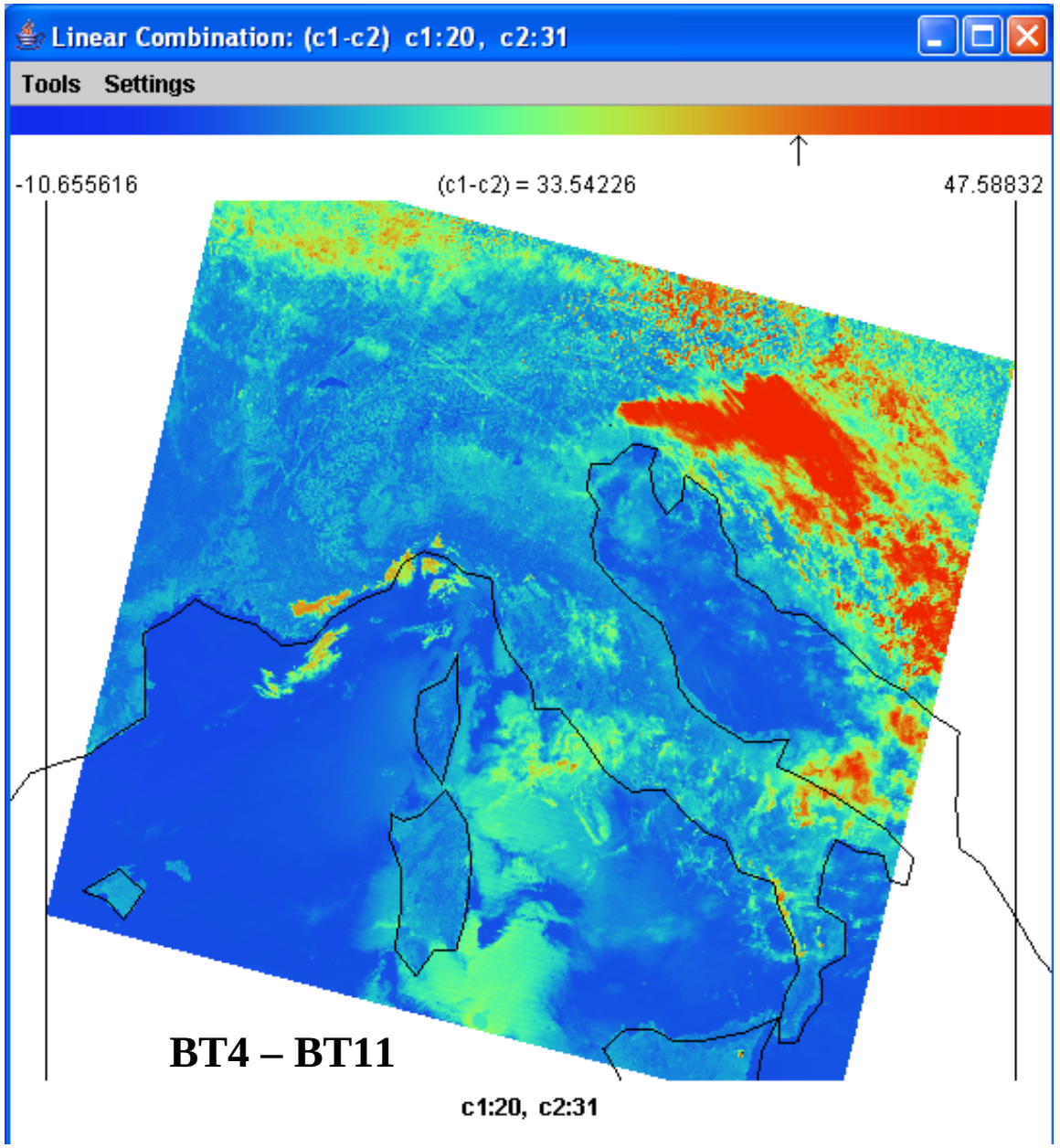

Band: 27 wavelength 6.78 µm
216.79
251.70
Instrument: MODIS


Transect: shft+rght+drag
Tools
248
brightnessTemp
232
0
1200
dist,km

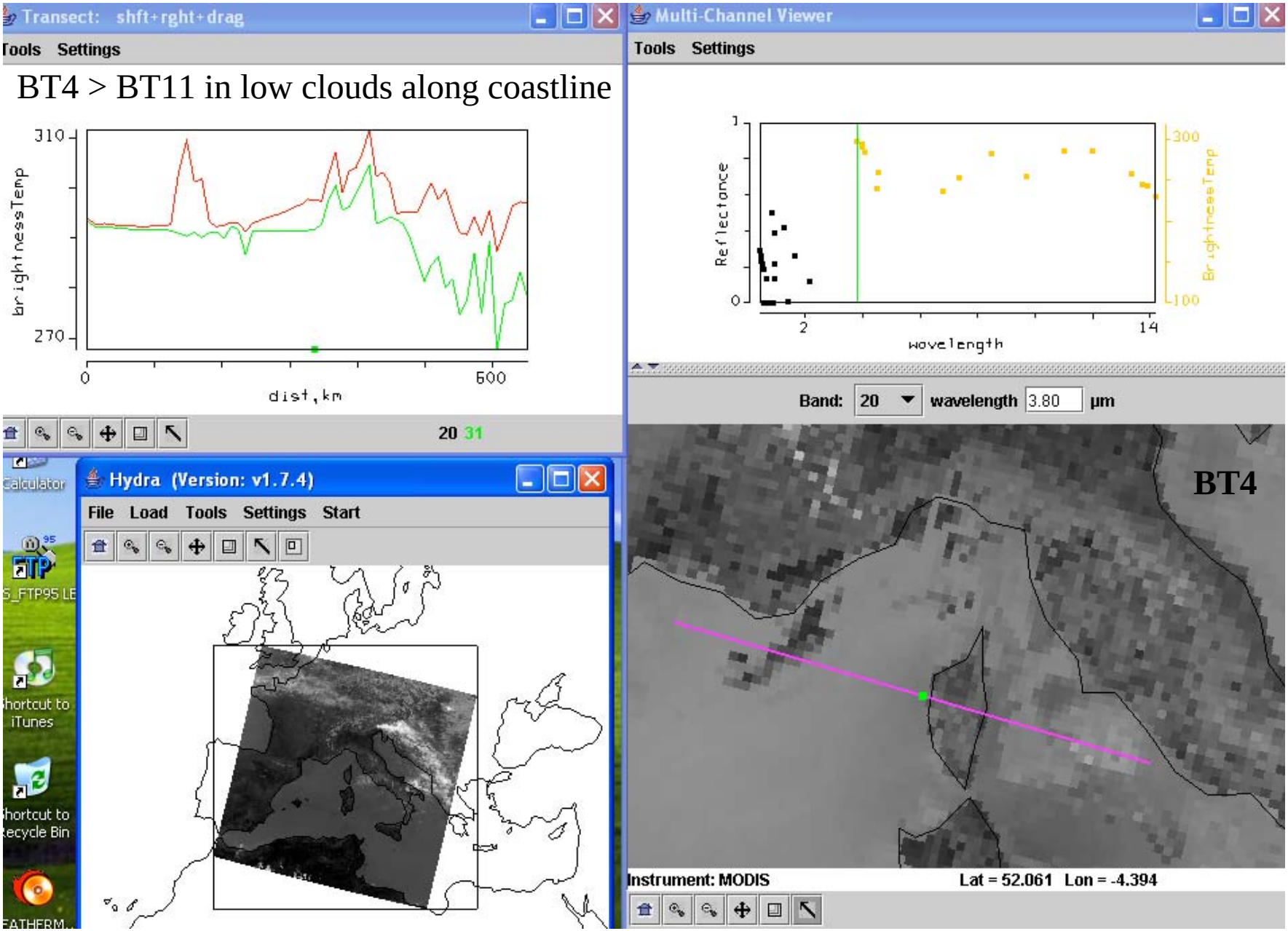
Linear Combination BT4 – BT11



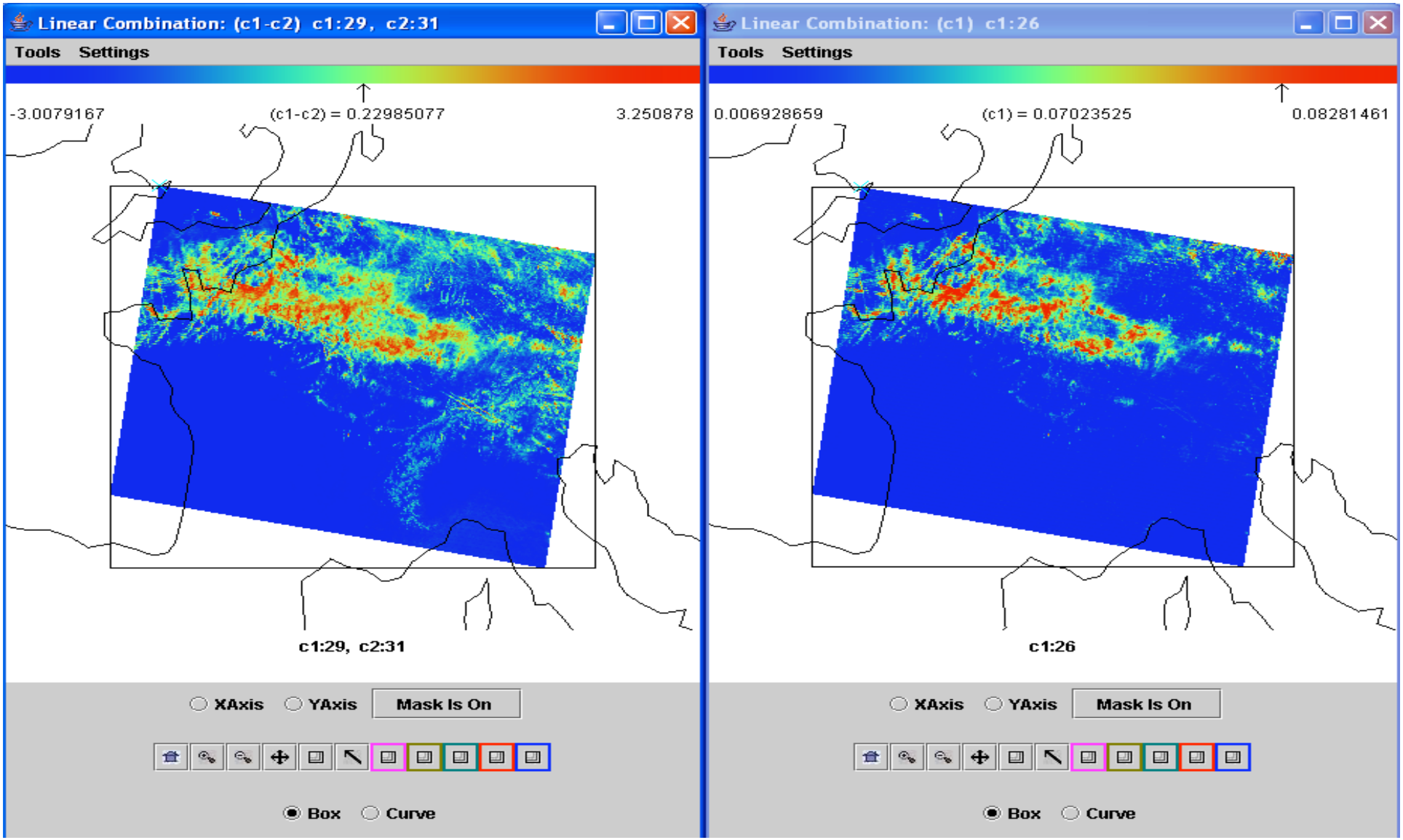
Linear Combination BT4 – BT11



Transect

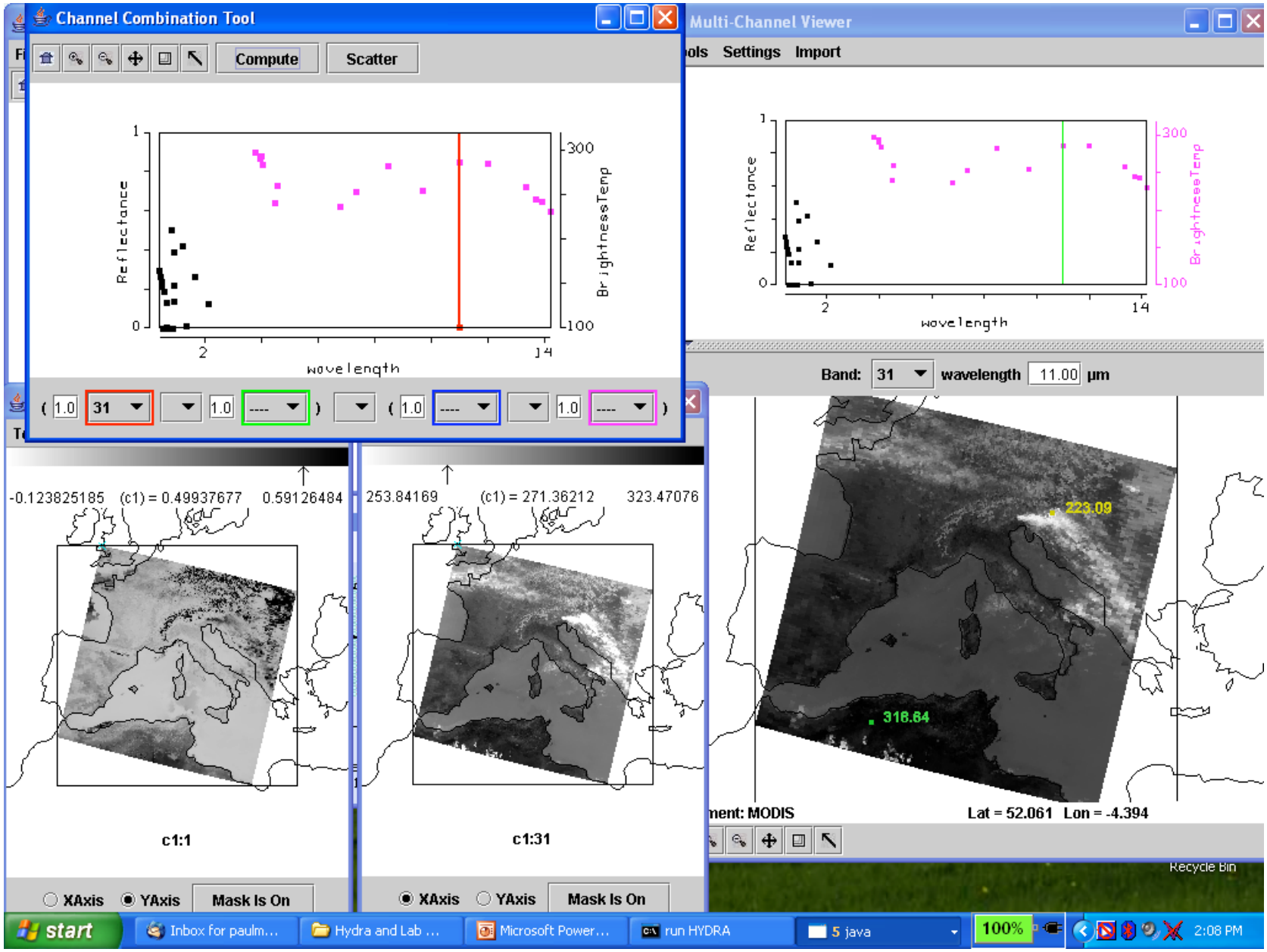

Transect: shft+rght+drag
Tools Settings
BT4 > BT11 in low clouds along coastline
310
270
brightnessTemp
0
500
dist,km
20 31
Hydra (Version: v1.7.4)
File Load Tools Settings Start
Multi-Channel Viewer
Tools Settings
Reflectance
wavelength
Band: 20 wavelength 3.80 µm
BT4
Instrument: MODIS
Lat = 52.061 Lon = -4.394

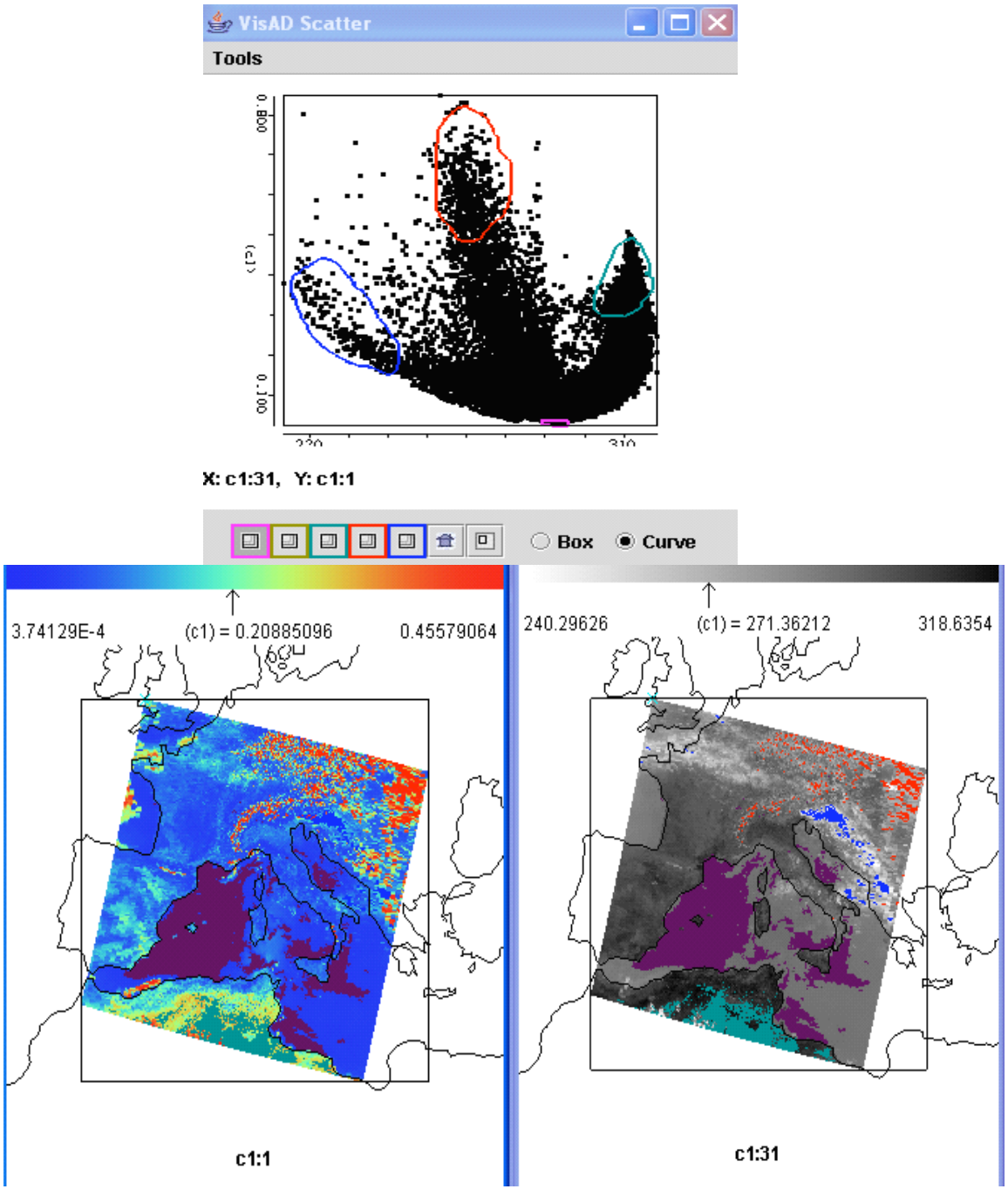
Comparing IR to NIR Cloud Detection



Thin cirrus show up in BT8.6-BT11 (left) as well as r1.38 (right)

Setting up for scatter plot of BT11 vs r0.66

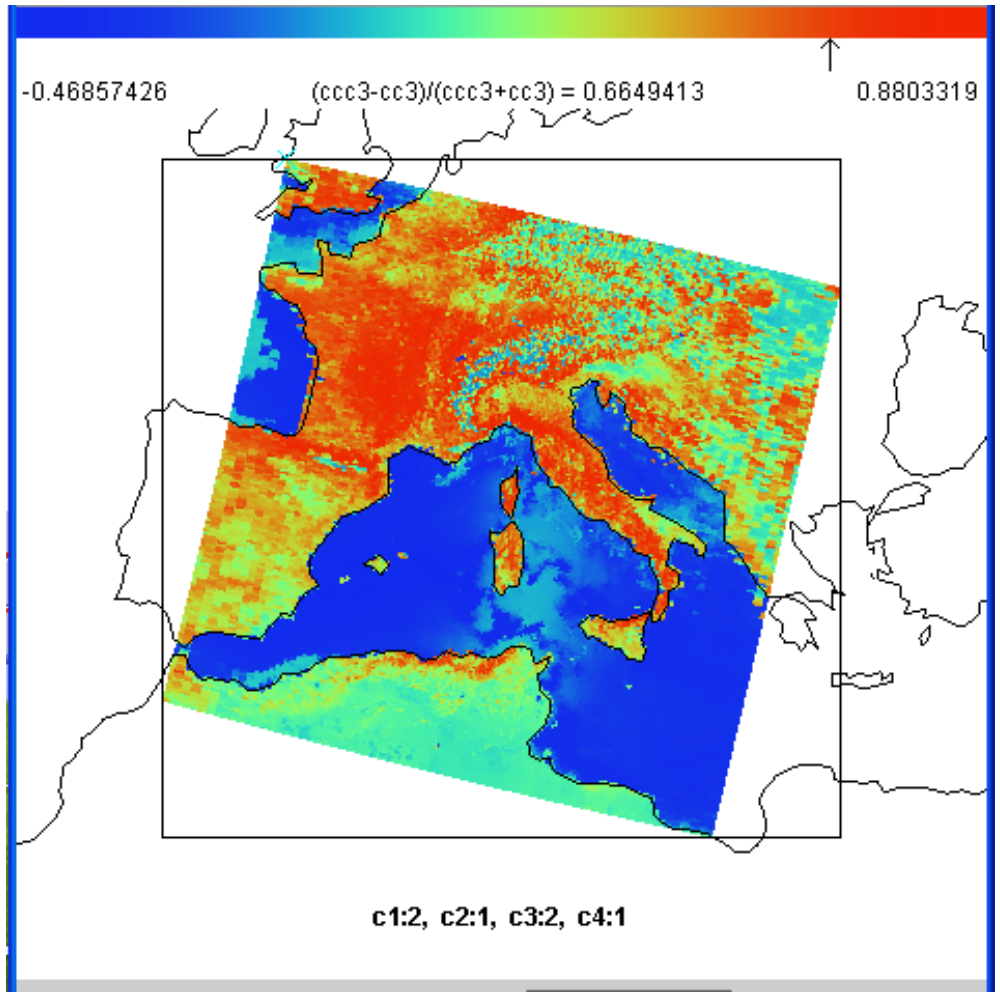




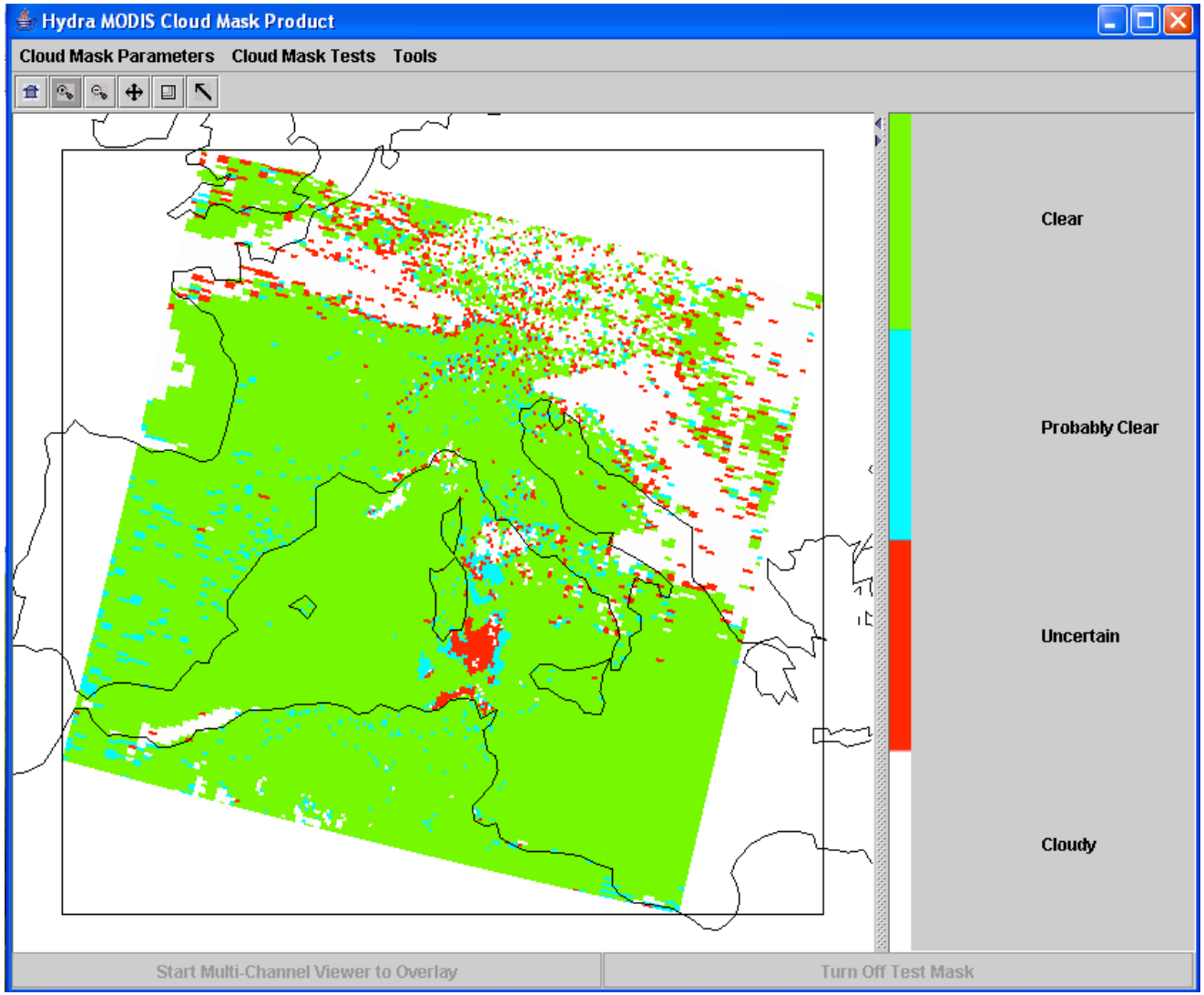
Scatter Plot of r_{vis} vs BT_{11}

with colors highlighting locations of pixels in plot on images

Linear Combinations Pseudo Image of Normalized Vegetation Index $[(r_2 - r_1)/(r_2 + r_1)]$

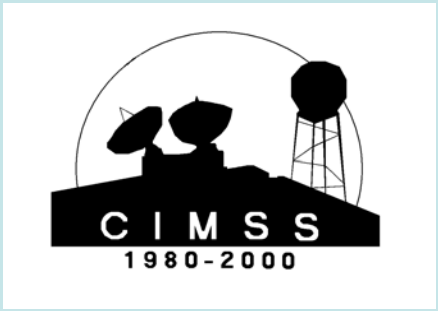


MODIS level 2 cloud mask display



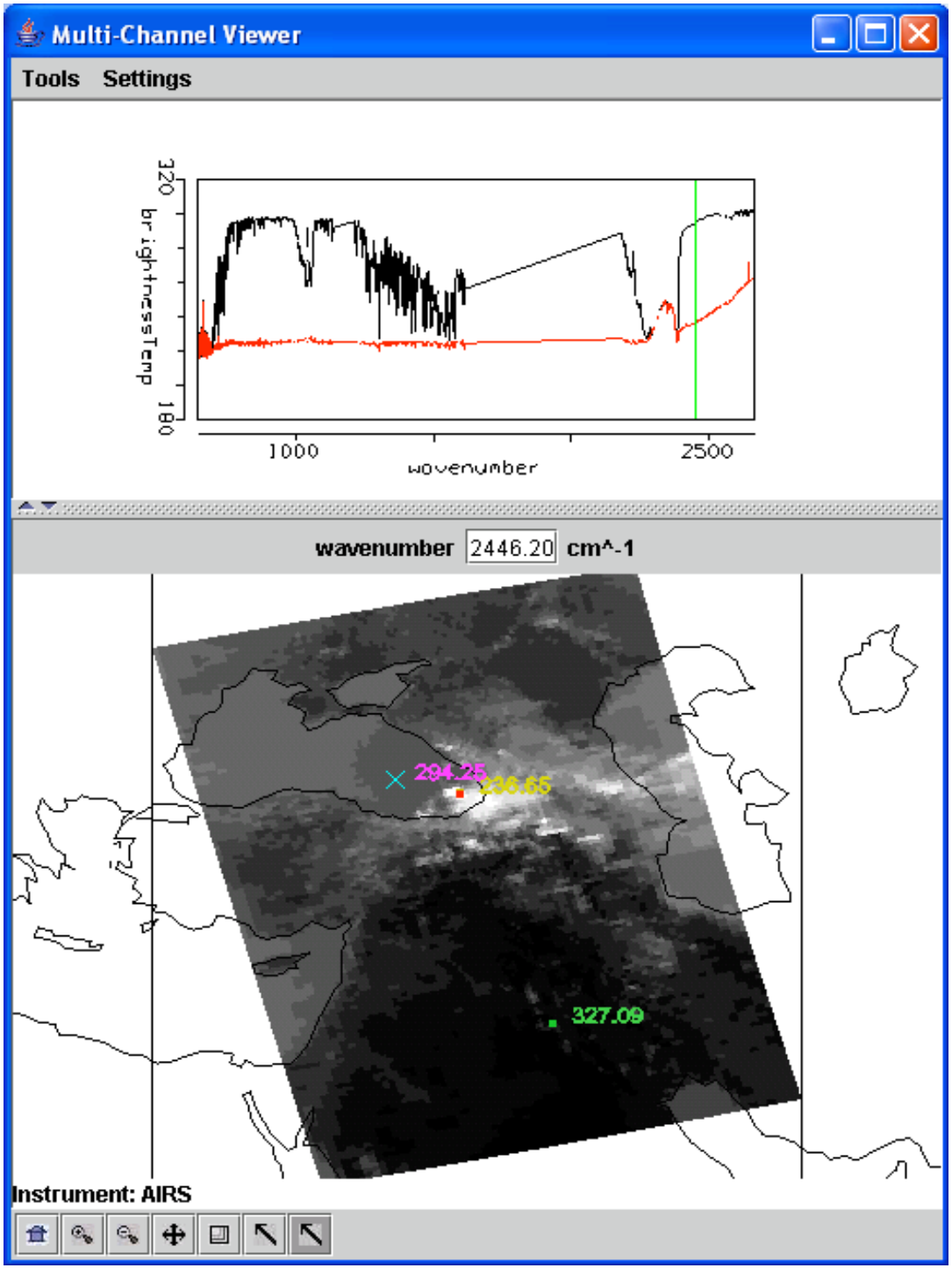
clear =green
probably clear (95% certain) = turquoise
uncertain = red
cloudy = white

Interrogating MODIS & AIRS data using HYDRA



Paul Menzel
NOAA Satellite and Information Services

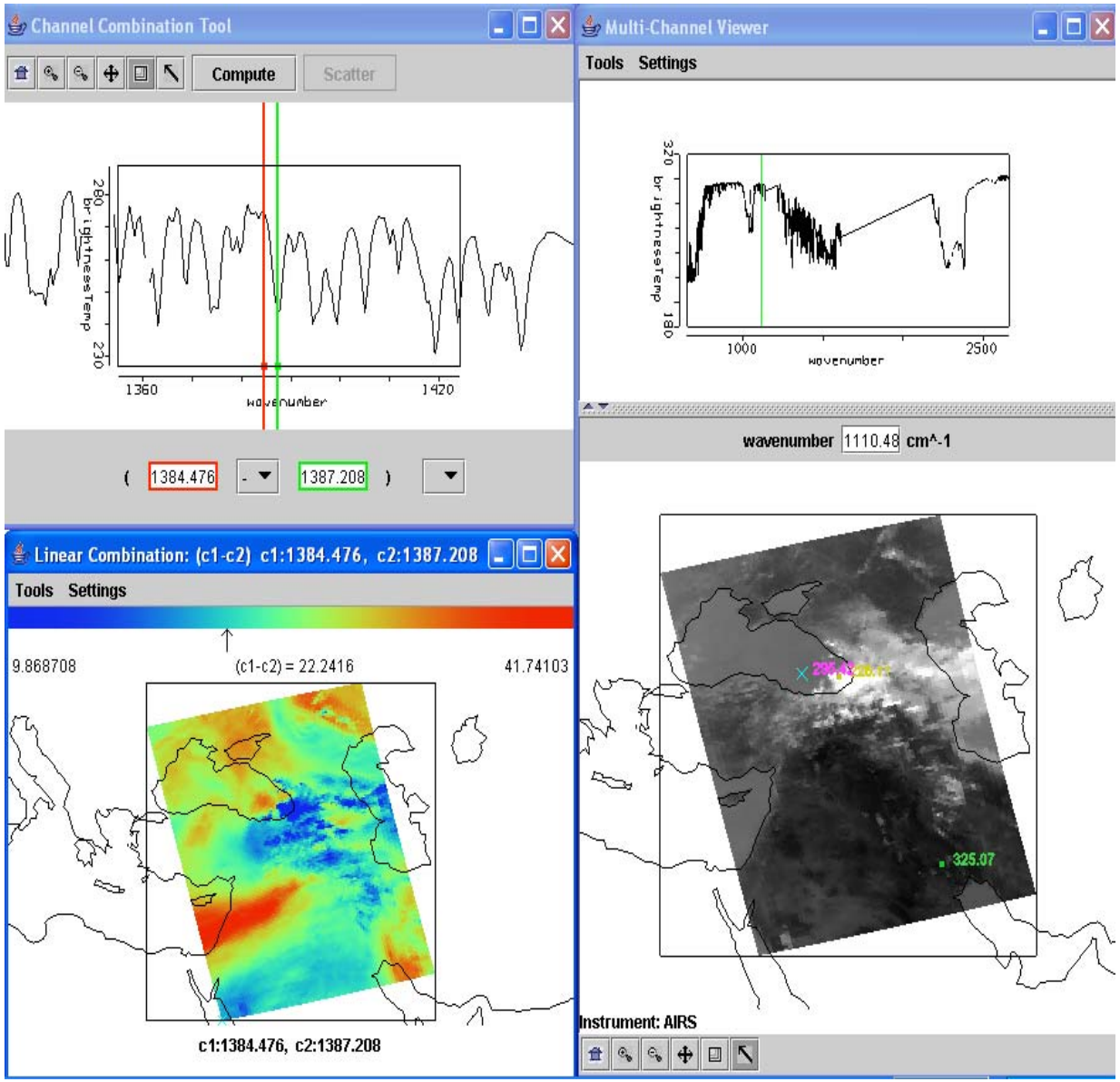
What is HYDRA?
What can it do?
Some examples with AIRS
How to get it?



AIRS data

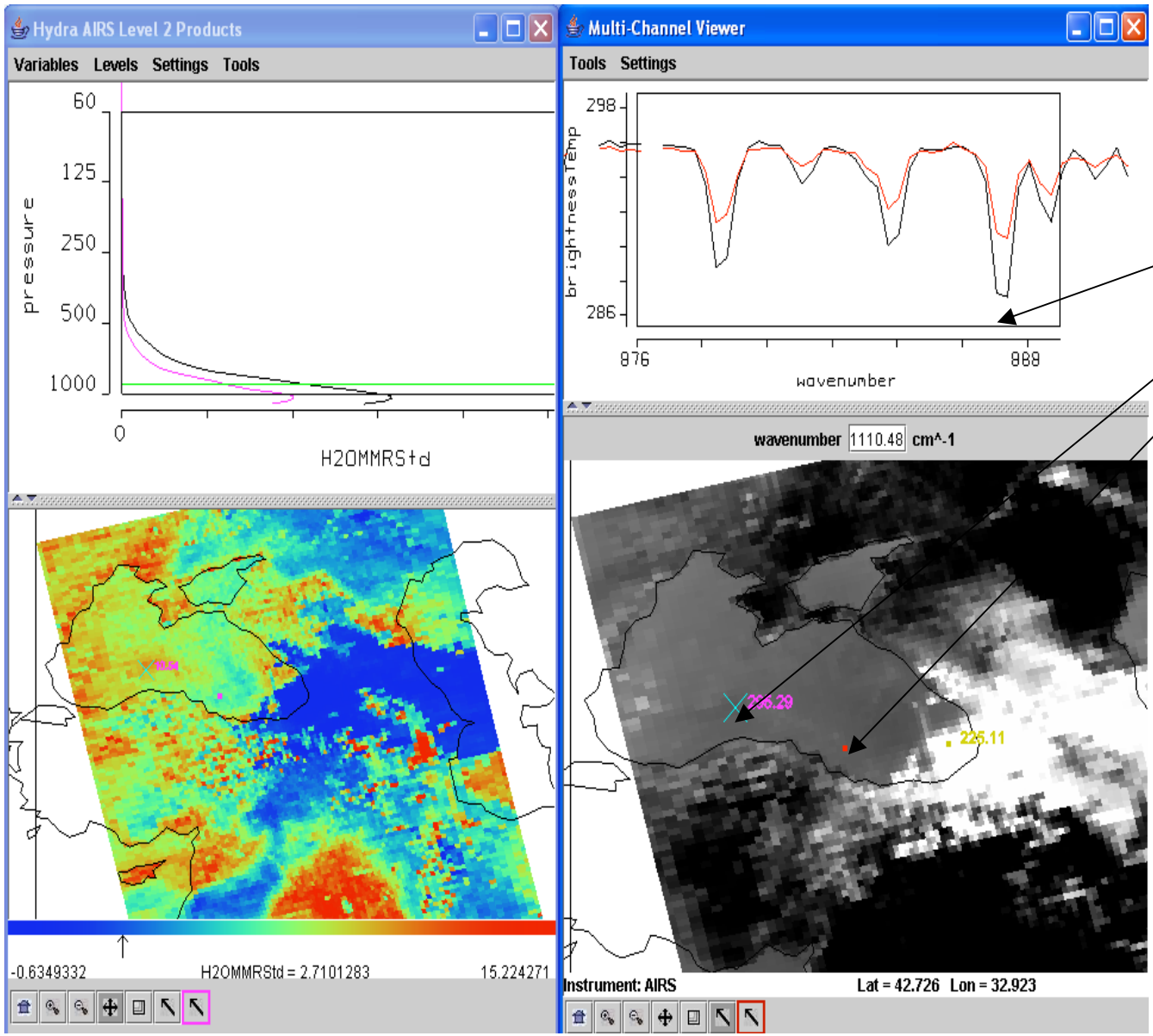
over
Black & Caspian Seas
28 August 2005

BT1384.5 minus BT1387.2



BT differences of more than 40 K are seen in clear regions and less than 1 K in opaque high cloudy regions

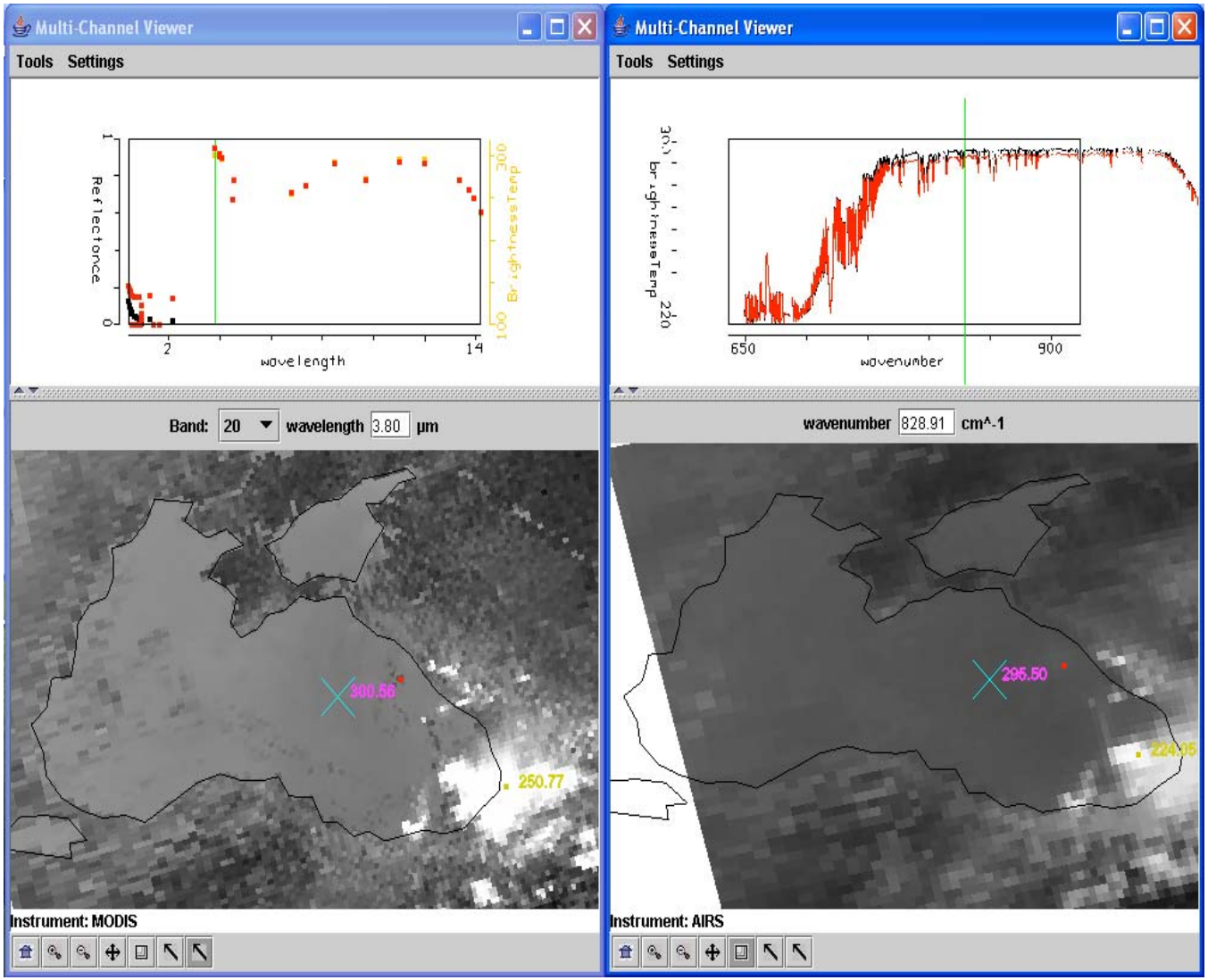
Investigating AIRS Retrievals



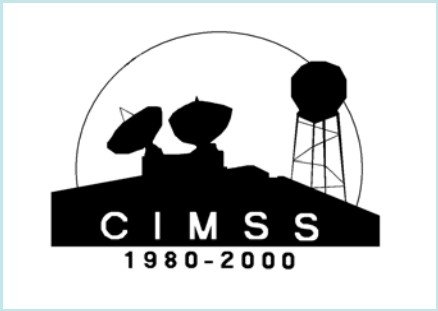
On-line off-line BT difference is greater in western (blue x) than eastern (red dot) location of Black Sea; x has more low level moisture than dot.

This is confirmed by moisture profiles (upper left); 900 hPa retrieved moisture image (lower left) shows moisture gradients

AIRS (right) and MODIS (left) co-located display of spectra



Interrogating MODIS & AIRS data using HYDRA



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What is HYDRA?
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Some examples with CALIPSO
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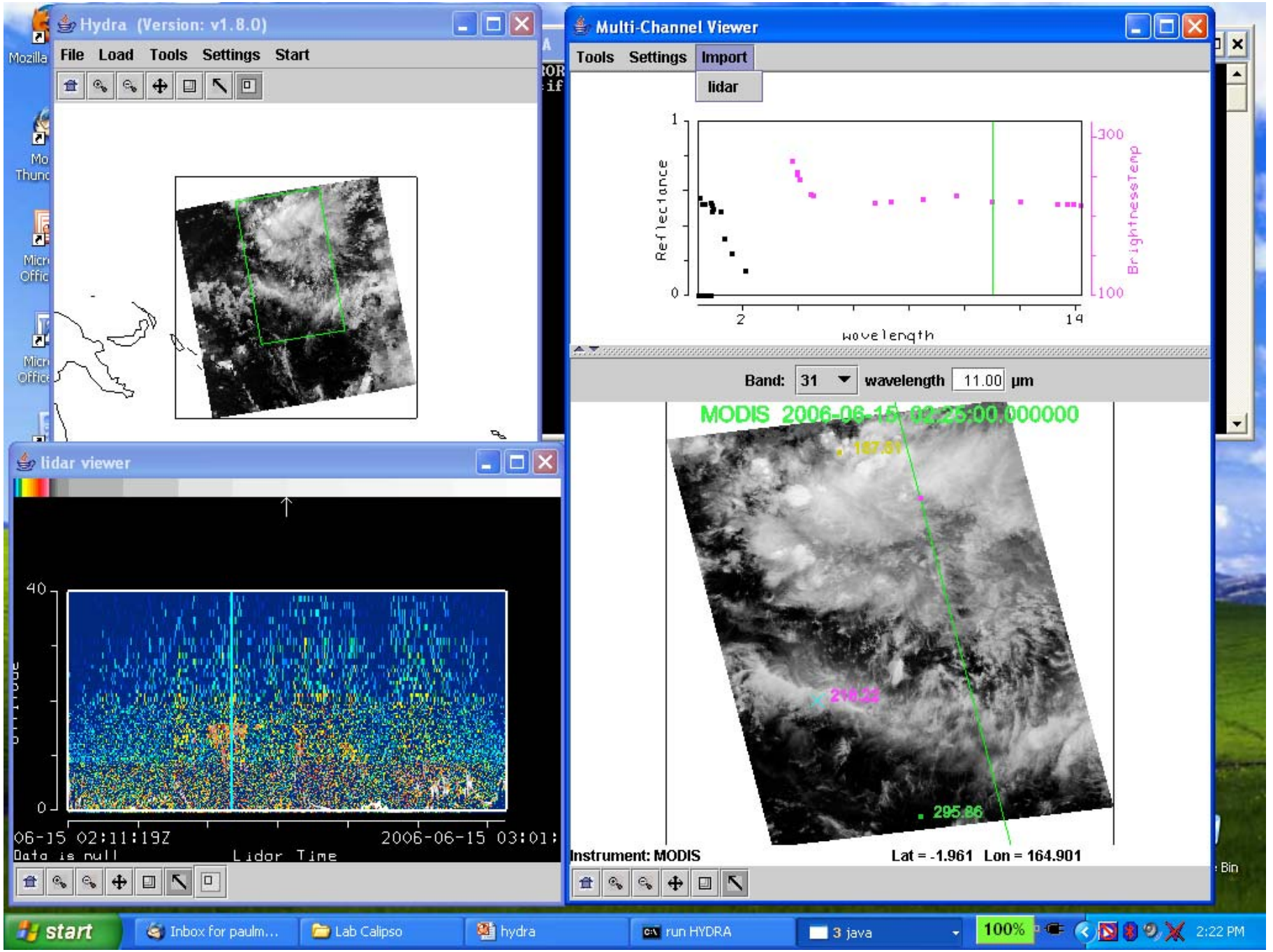
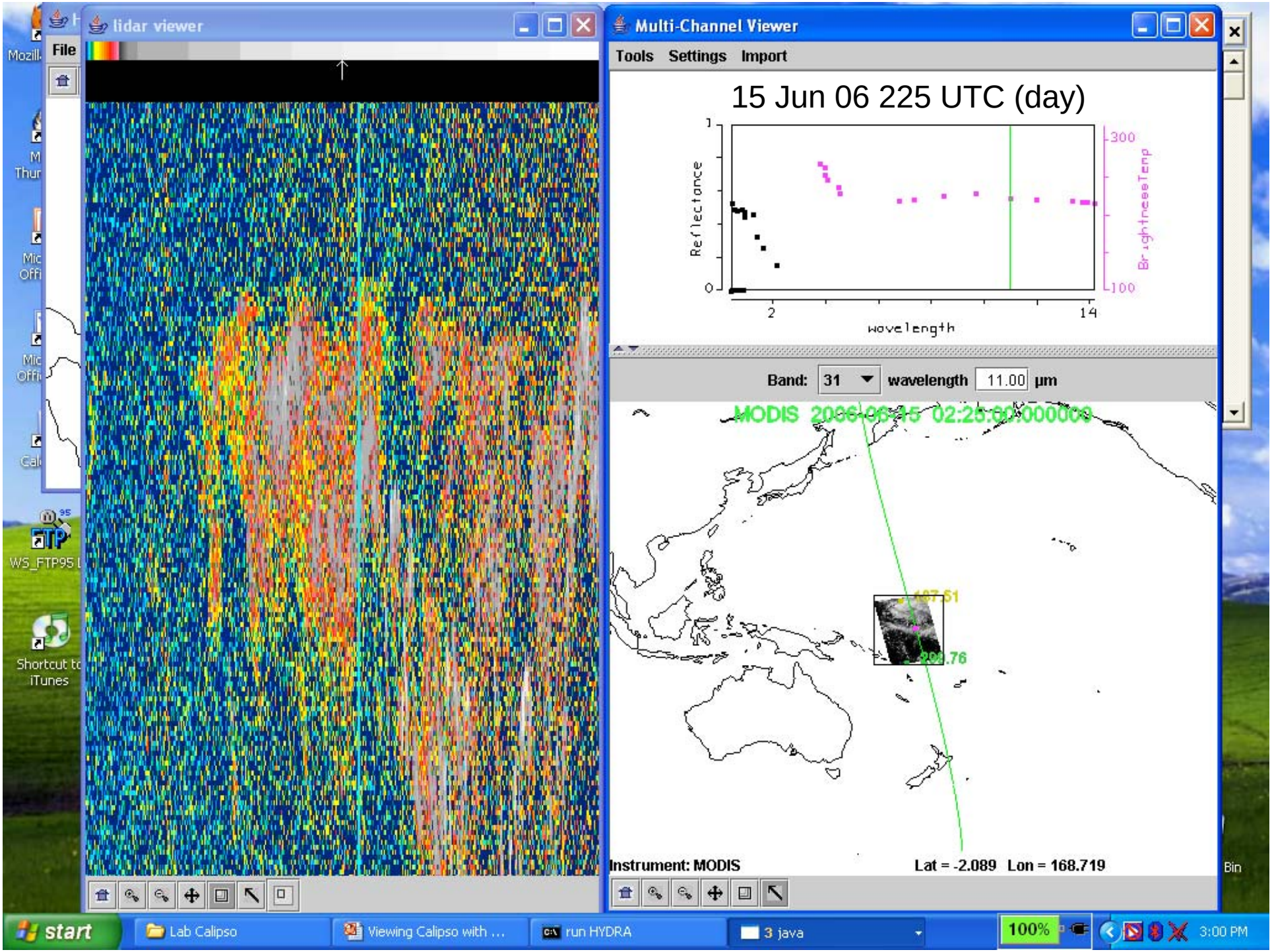
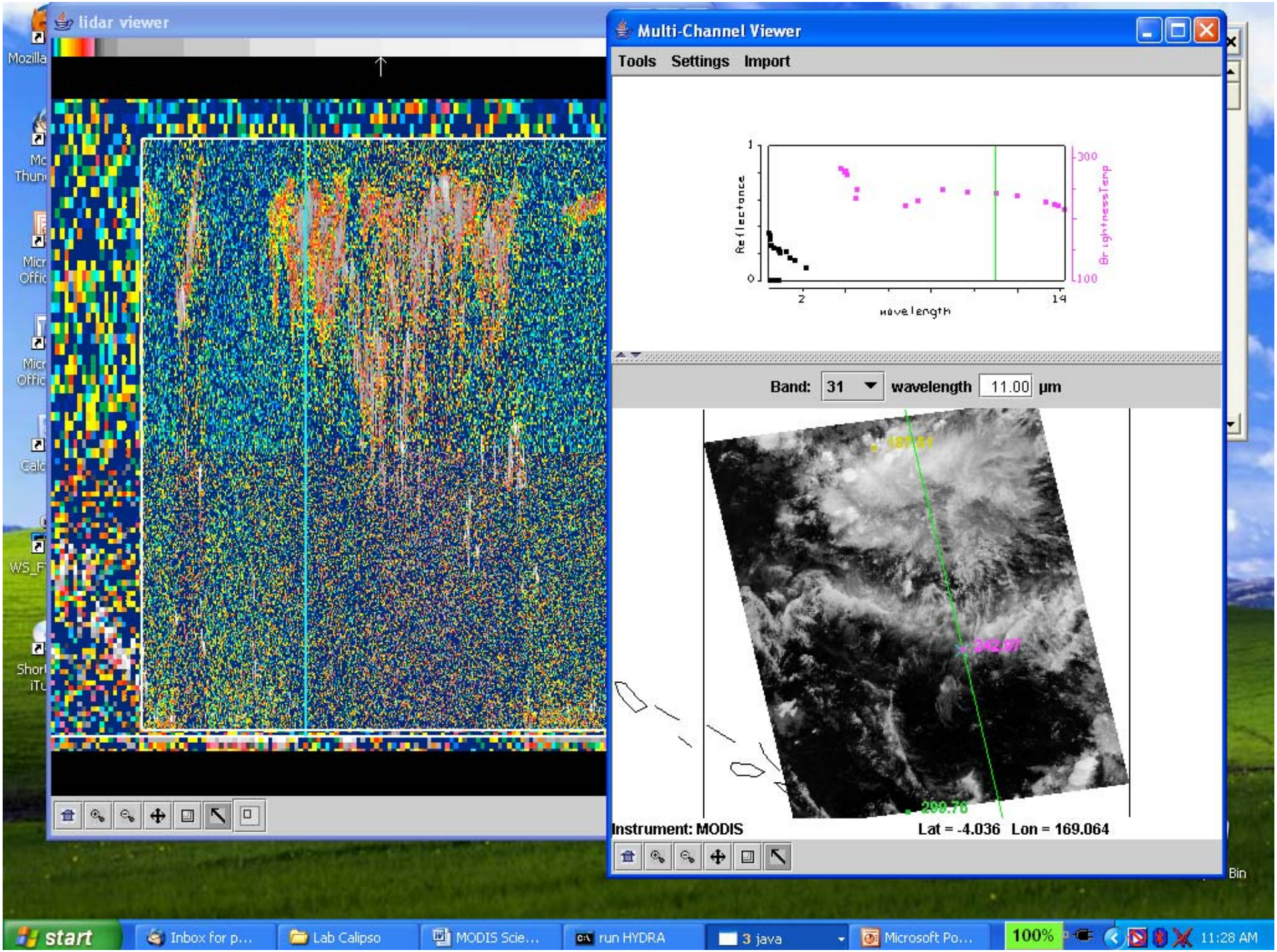
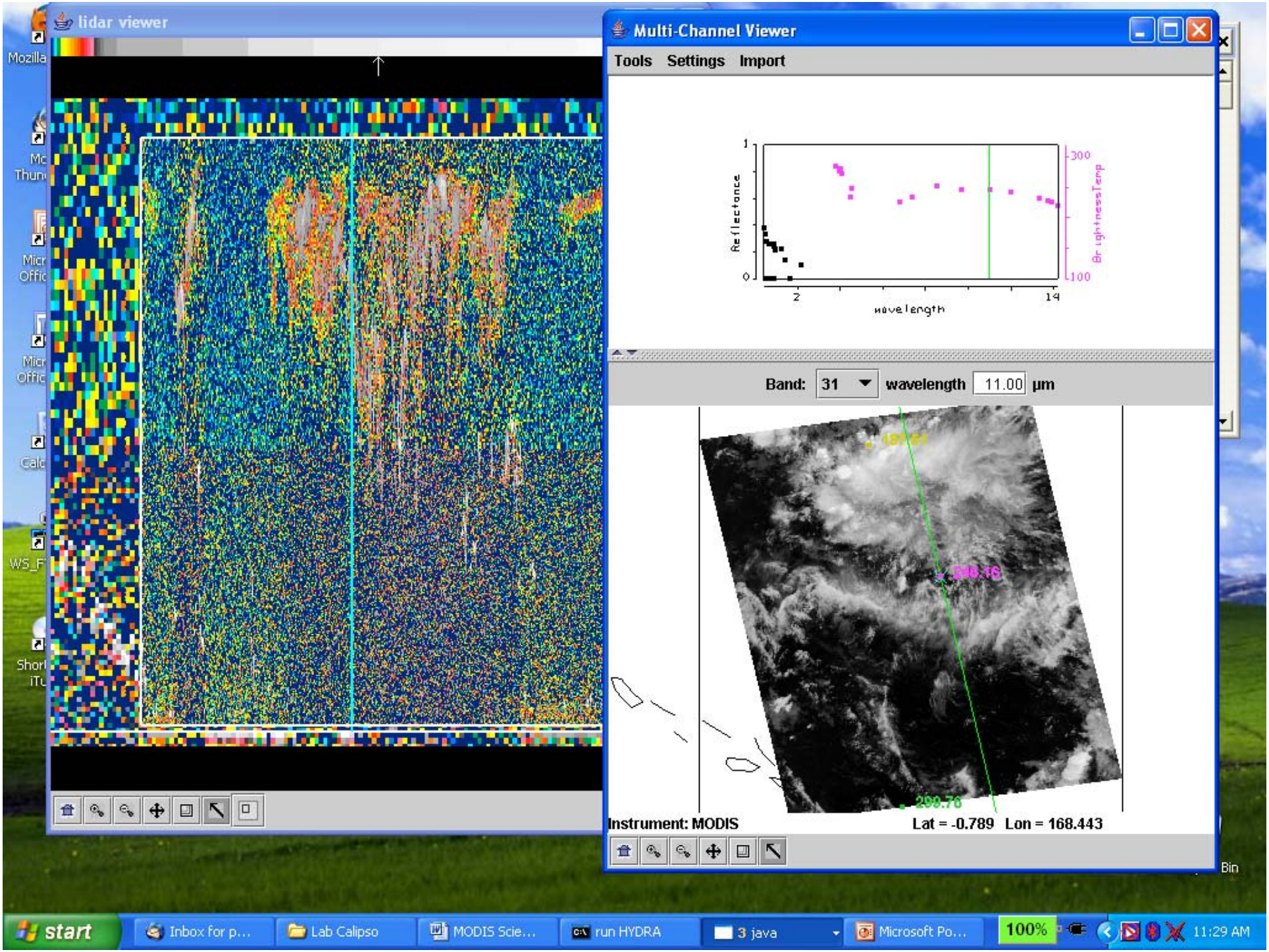
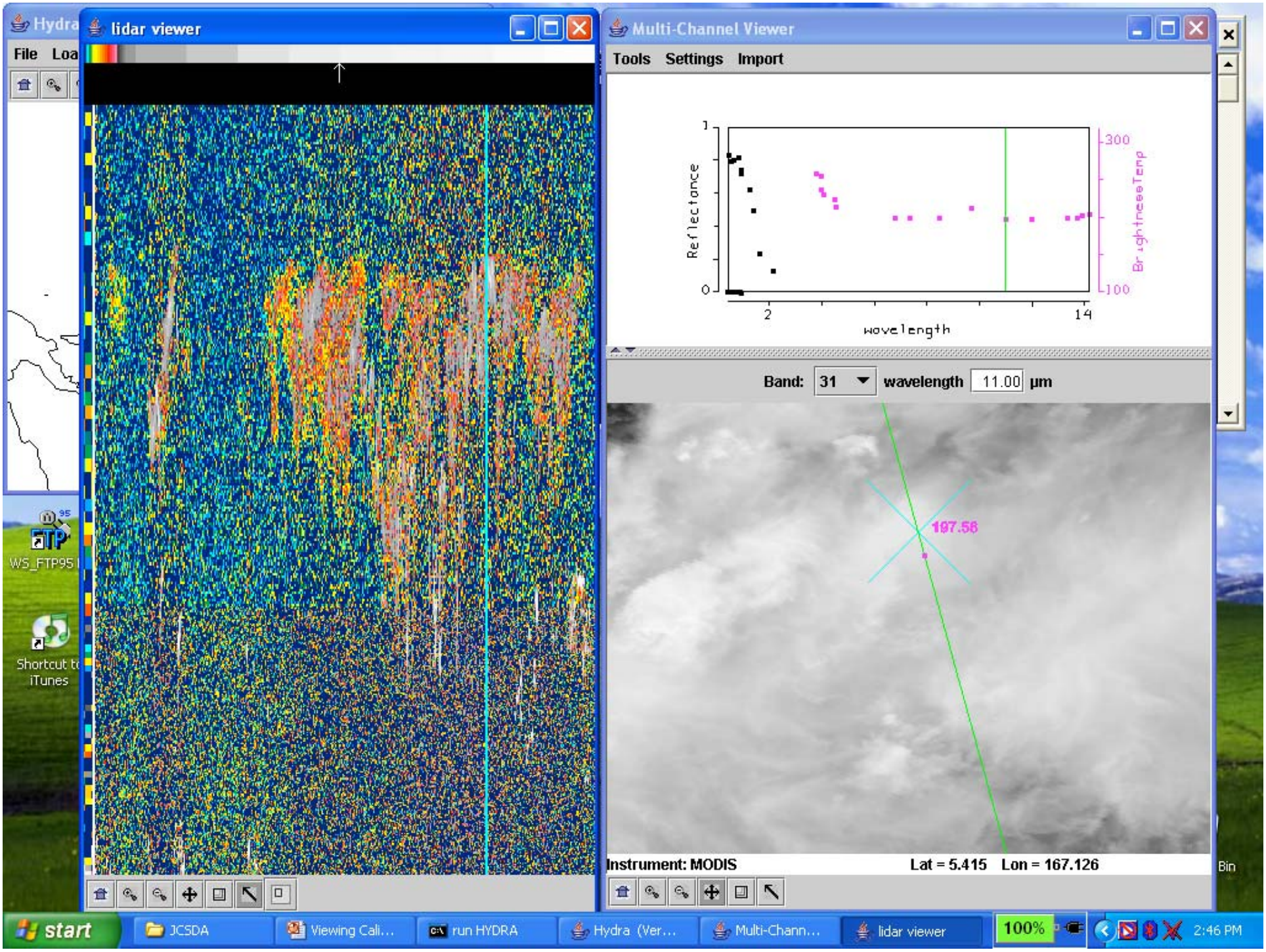
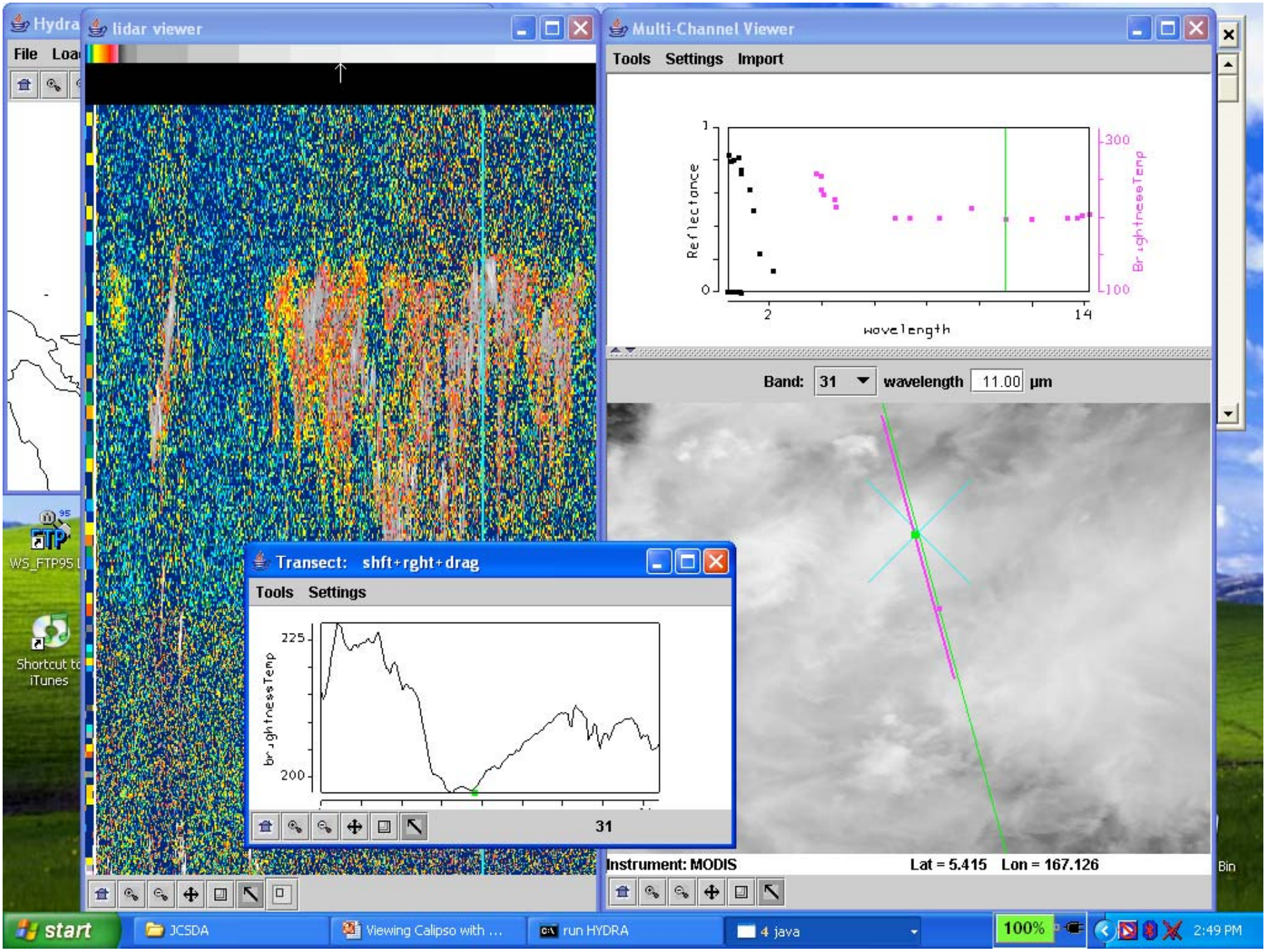

Hydra (Version: v1.8.0)
File Load Tools Settings Start
Multi-Channel Viewer
Tools Settings Import
lidar
Reflectance
BrightnessTemp
Wavelength
Band: 31 wavelength 11.00 µm
MODIS 2006-06-15 02:25:00.000000
Instrument: MODIS
Lat = -1.961 Lon = 164.901
lidar viewer
Data is null
Lidar Time
2006-06-15 03:01:
start
Inbox for paulm...
Lab Calipso
hydra
run HYDRA
3 java
100%
2:22 PM

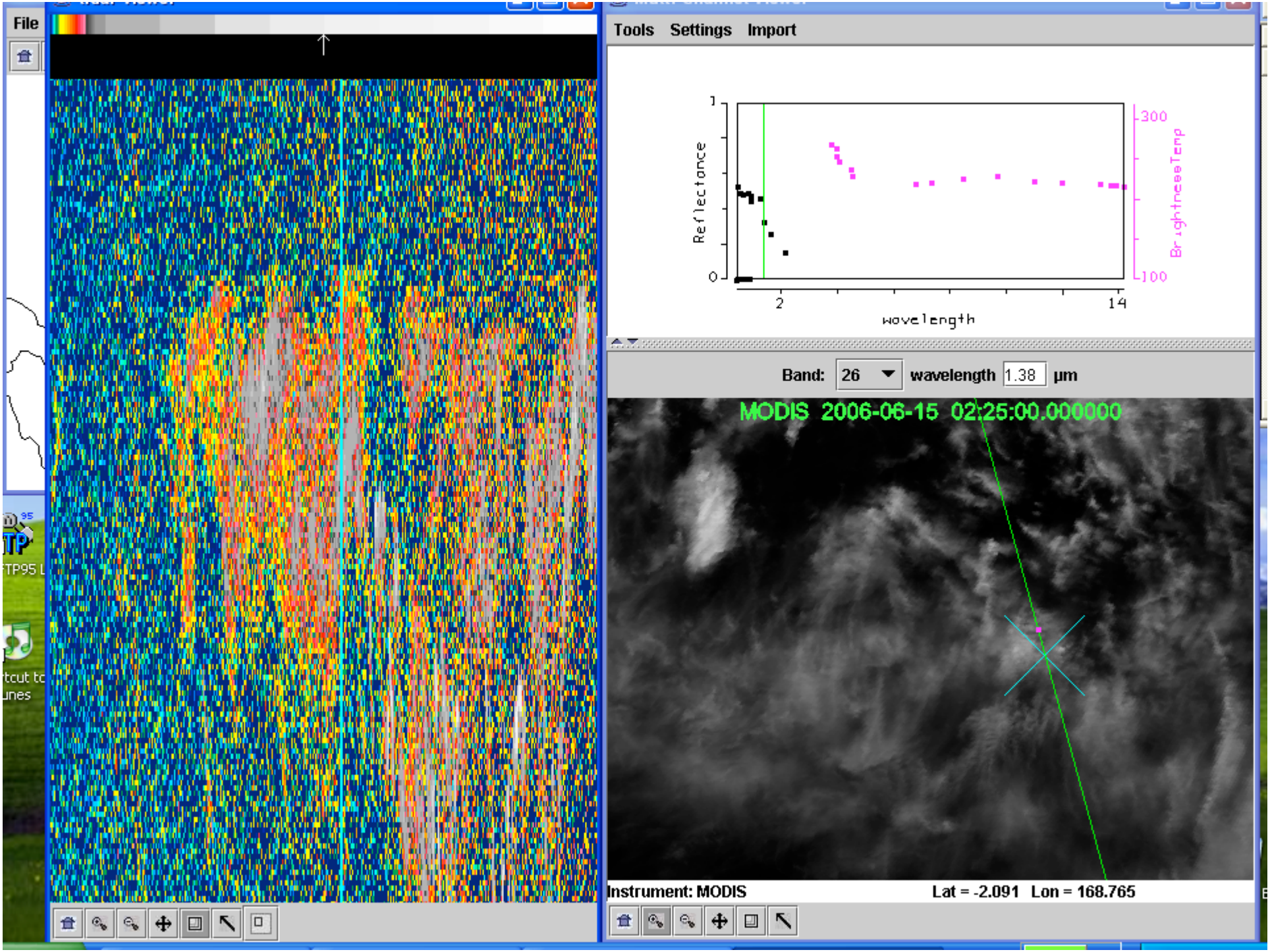

lidar viewer
File
Multi-Channel Viewer
Tools Settings Import
15 Jun 06 225 UTC (day)
Reflectance
Brightness Temp
wavelength
Band: 31 wavelength 11.00 µm
MODIS
Instrument: MODIS
Lat = -2.089 Lon = 168.719
start
Lab Calipso
Viewing Calipso with ...
run HYDRA
3 java
100%
3:00 PM


lidar viewer
Multi-Channel Viewer
Tools
Settings
Import
Reflectance
BrightnessTemp
wavelength
Band:
31
wavelength
11.00
μm
Instrument: MODIS
Lat = -4.036 Lon = 169.064
start
Inbox for p...
Lab Calipso
MODIS Scie...
run HYDRA
3 java
Microsoft Po...
100%
11:28 AM

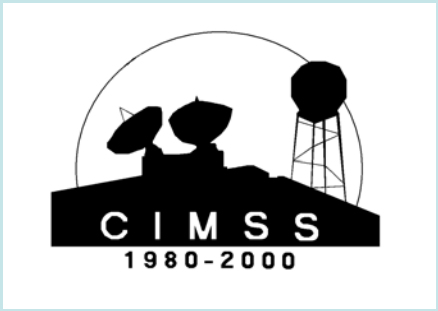

lidar viewer
Multi-Channel Viewer
Tools
Settings
Import
Reflectance
BrightnessTemp
wavelength
Band:
31
wavelength
11.00
μm
Instrument: MODIS
Lat = -0.789 Lon = 168.443
start
Inbox for p...
Lab Calipso
MODIS Scie...
run HYDRA
3 java
Microsoft Po...
100%
11:29 AM


Hydra
File Loa
lidar viewer
Multi-Channel Viewer
Tools Settings Import
Reflectance
1
0
2
14
wavelength
300
100
BrightnessTemp
Band: 31 wavelength 11.00 µm
197.56
Instrument: MODIS
Lat = 5.415 Lon = 167.126
WS_FTP95
Shortcut to
iTunes
start
JCSDA
Viewing Cali...
run HYDRA
Hydra (Ver...
Multi-Chann...
lidar viewer
100%
2:46 PM
Bin


Hydra
File Loa
lidar viewer
Multi-Channel Viewer
Tools Settings Import
Reflectance
1
0
2
14
wavelength
300
100
BrightnessTemp
Band: 31 wavelength 11.00 µm
Transect: shft+rght+drag
Tools Settings
225
200
brightnessTemp
31
Instrument: MODIS
Lat = 5.415 Lon = 167.126
WS_FTP95
Shortcut to iTunes
start
JCSDA
Viewing Calipso with ...
run HYDRA
4 java
100%
2:49 PM


File
Tools
Settings
Import
Reflectance
1
0
2
14
wavelength
300
100
BrightnessTemp
Band:
26
wavelength
1.38
μm
MODIS 2006-06-15 02:25:00.000000
Instrument: MODIS
Lat = -2.091 Lon = 168.765

Interrogating MODIS & AIRS data using HYDRA



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HYDRA - Hyperspectrl Viewer for Development of Research Applications - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Go to www.ssec.wisc.edu/hydra/

Back Search Favorites

Address http://www.ssec.wisc.edu/hydra/ Go Links

- The HYDRA Team
- Tutorial on HYDRA (AIRS data)
- Links to OpenDAP MODIS & AIRS servers
- Download HYDRA
- Notes on using OpenADDE for local GOES & MSG files

HYperspectral-viewer for Development of Research Applications

If you would like to send comments and be notified of updates, please join the HYDRA email list, by sending a note to: **hydra-subscribe@ssec.wisc.edu**. You will receive a confirmation email that you will also need to respond to in order to verify your email address.

Done Internet

start Search Results hydra VZAccess Manager Inbox for paulm... HYDRA - Hypers... 100% 10:51 AM

http://www.ssec.wisc.edu/hydra/download.html - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://www.ssec.wisc.edu/hydra/download.html
Go Links
Updated 3 March 2005
Downloading and Installing HYDRA
For Windows Users
Important note: before installing this version, be sure to uninstall the previous one! using: Start->Control Panel->Add/Remove Programs.
Download the installer file from this location to a temporary directory. When the transfer is complete, just run this file and follow the instructions. We recommend just using the default options presented.
For Linux Users
Download the tar-gz file from this location. When the transer is complete, then 'cd' to the parent directory and unpack the archive. This will create its own hydra subdirectory as a child.
For Mac OS-X Users
Download the tar-gz file from this location. When the transer is complete, then 'cd' to the parent directory and unpack the archive. This will create its own hydra subdirectory as a child. You must have Java and Java3D installed in order to use HYDRA.
Running the HYDRA application
To startup the Hydra application, either click on the menu item (Windows) or type the command runhydra.bat. On Linux, you will likely just type in the command runhydra. Please see the on-line tutorial for more details.
Done
Internet
start
Search Results
hydra
VZAccess Manager
Inbox for paulm...
http://www.sse...
100%
10:53 AM

2005/102 - 04/12/05 - MODIS Rapid Response System - Microsoft Internet Explorer

File Edit View Favorites Tools Help

http://rapidfire.sci.gsfc.nasa/realtime

Back Search Favorites

Address http://rapidfire.sci.gsfc.nasa.gov/realtime/2005102/ Go Links

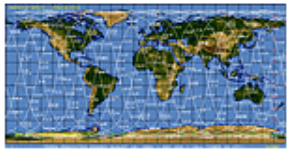
MODIS Rapid Response System

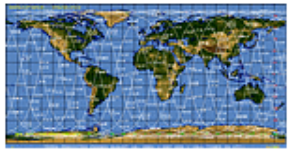
Home | Gallery | Real-Time | FAQ | Status

Near-Real-Time Level-2 Browse

Date: 2005/102 - 04/12/05

prev next


Terra Orbit Tracks


Aqua Orbit Tracks

Display true-color and false-color

Access other dates from the archive

Terra/MODIS

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2km	2km	2km	2km	2km	2km	2km
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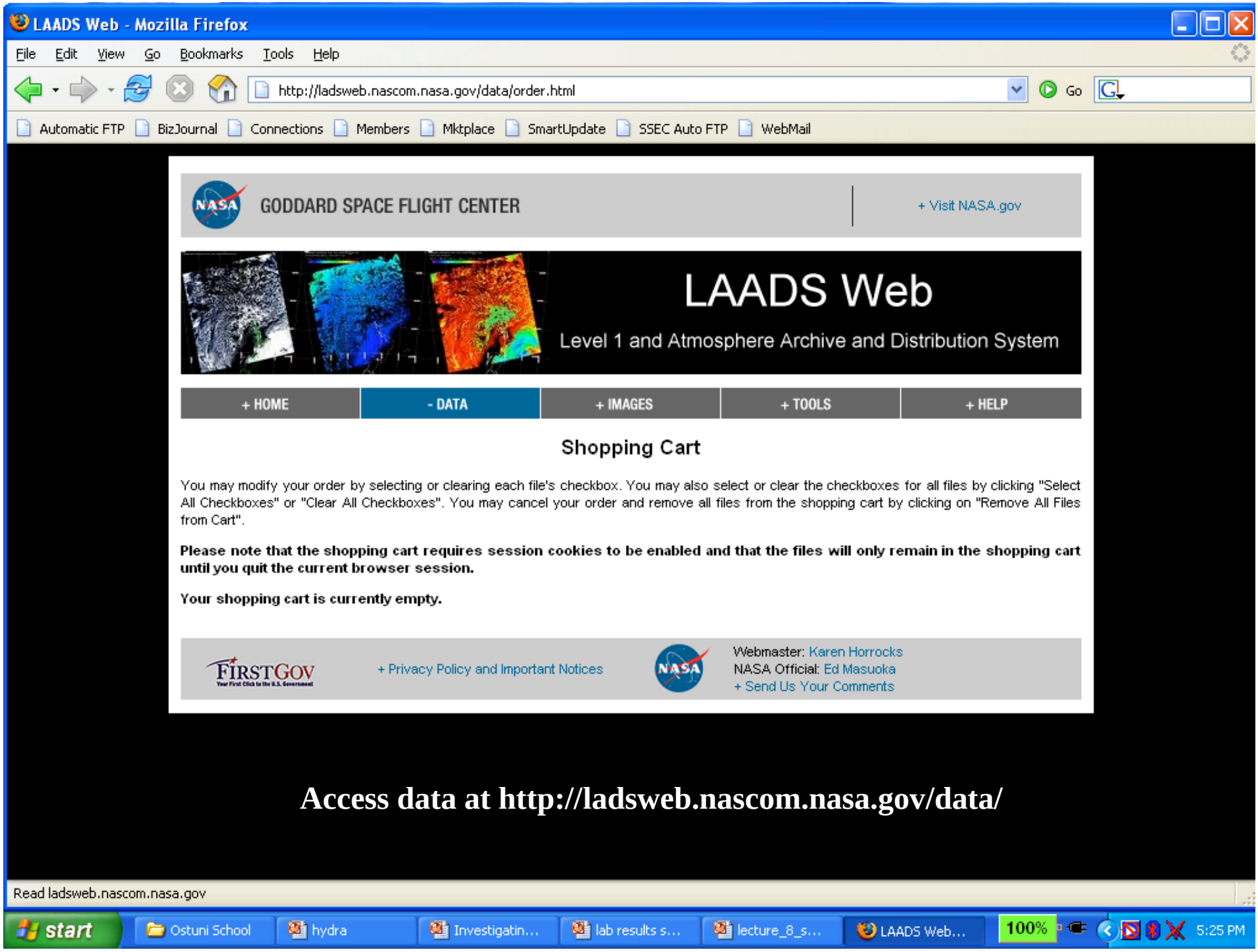
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HYDRA has been part of an effort for Environmental Literacy, Outreach, and Education

Schools on remote sensing have been held in
Bologna, Italy (Sep 01),
Rome, Italy (Jun 02),
Maratea, Italy (May 03),
Bertinoro, Italy (Jul 04),
Cape Town, South Africa (Apr 06),
Krakow, Poland (May 06),
Ostuni, Italy (Jun 06)