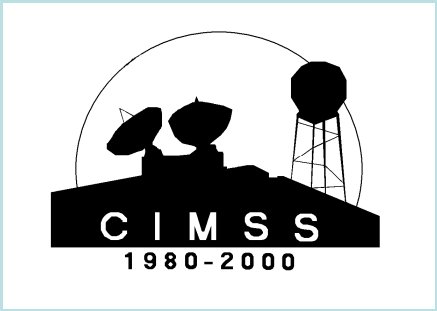
Inspecting multi-spectral and hyper-spectral data using HYDRA



Paul Menzel
University of Wisconsin - Madison

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

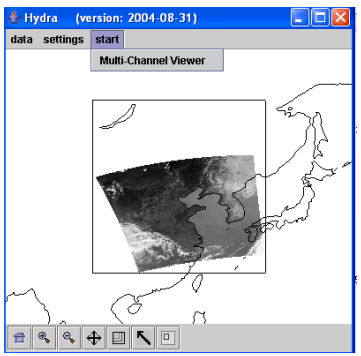
HYperspectral viewer for Development of Research Applications - HYDRA

MSG,
GOES

MODIS,
AIRS, IASI,
AMSU,
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

Rink et al, BAMS 2007



Developed at CIMSS by
Tom Rink
Tom Whittaker
Kevin Baggett

With guidance from
Paolo Antonelli
Liam Gumley
Paul Menzel
Allen Huang

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/

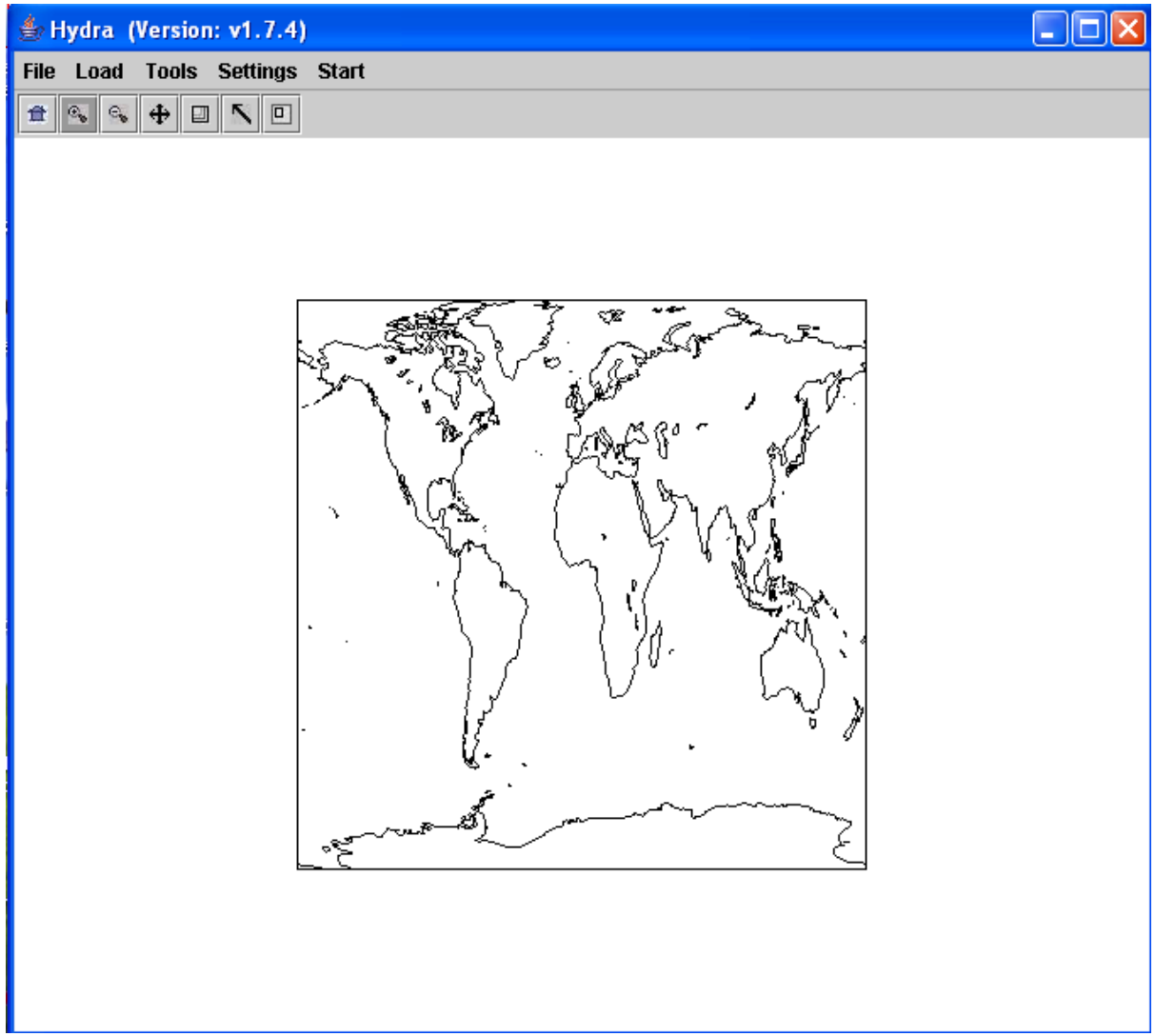
For hydra
http://www.ssec.wisc.edu/hydra/

For MODIS data and quick browse images
http://rapidfire.sci.gsfc.nasa/realtime

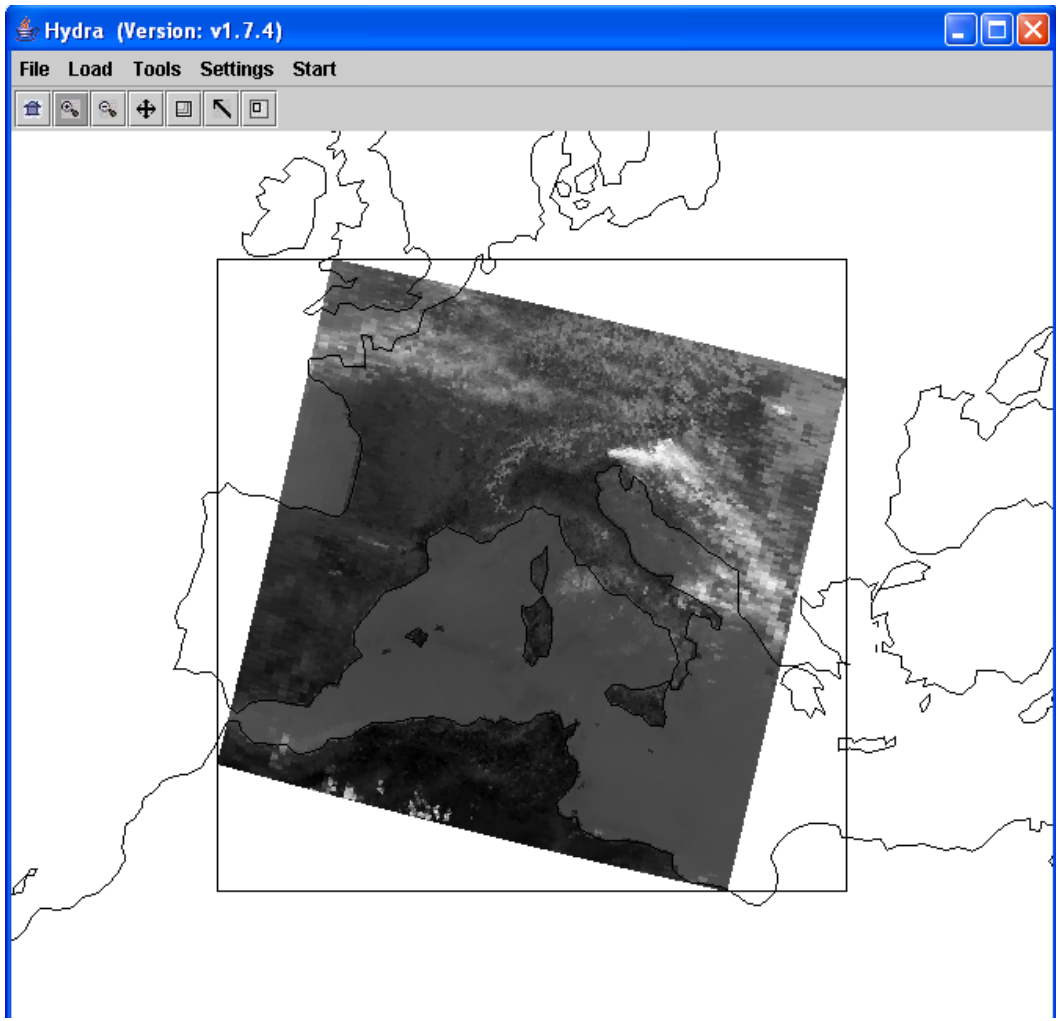
For MODIS data orders
http://ladsweb.nascom.nasa.gov/

For AIRS data orders
http://daac.gsfc.nasa.gov/

The HYDRA Window

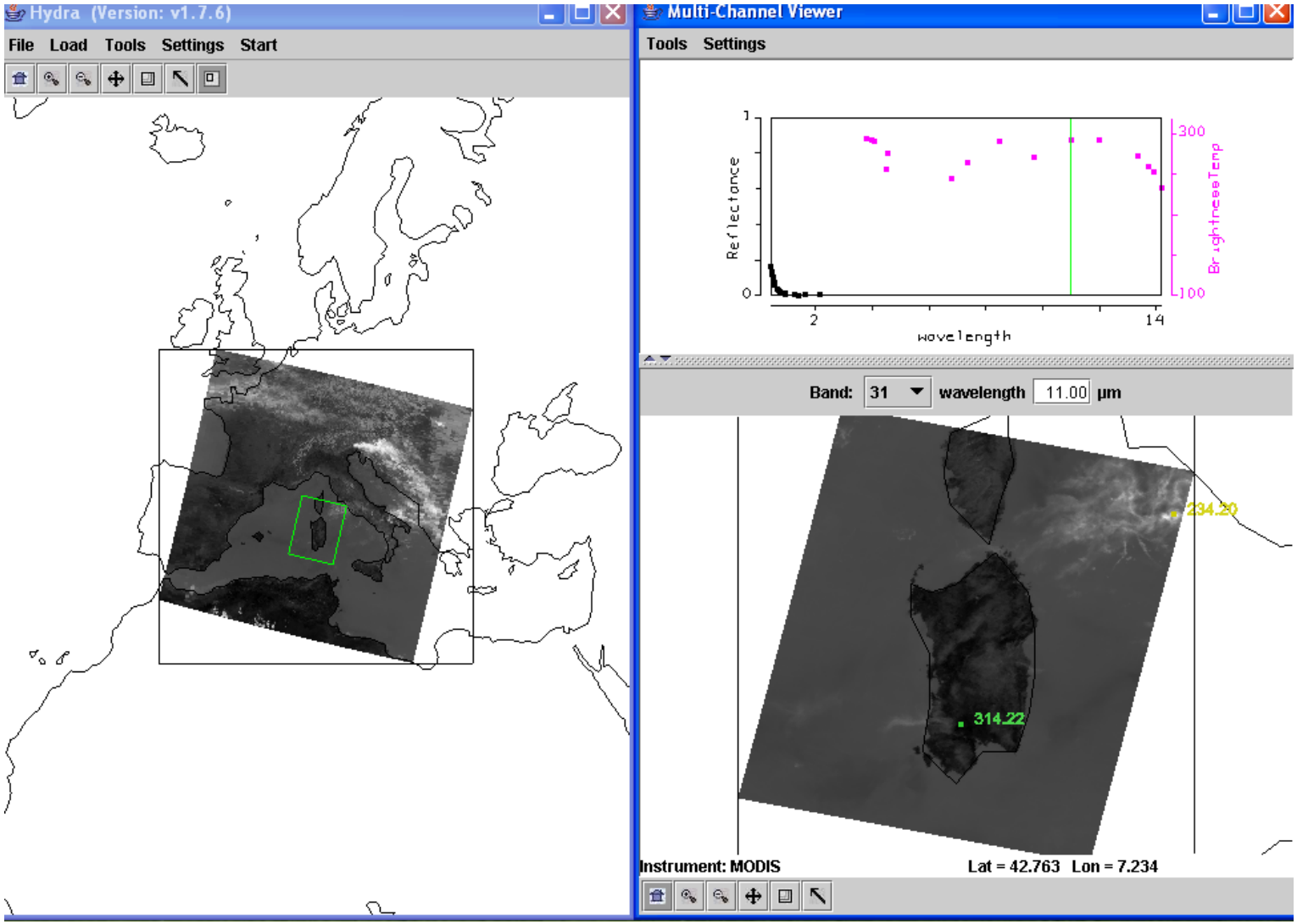


Loading a Granule

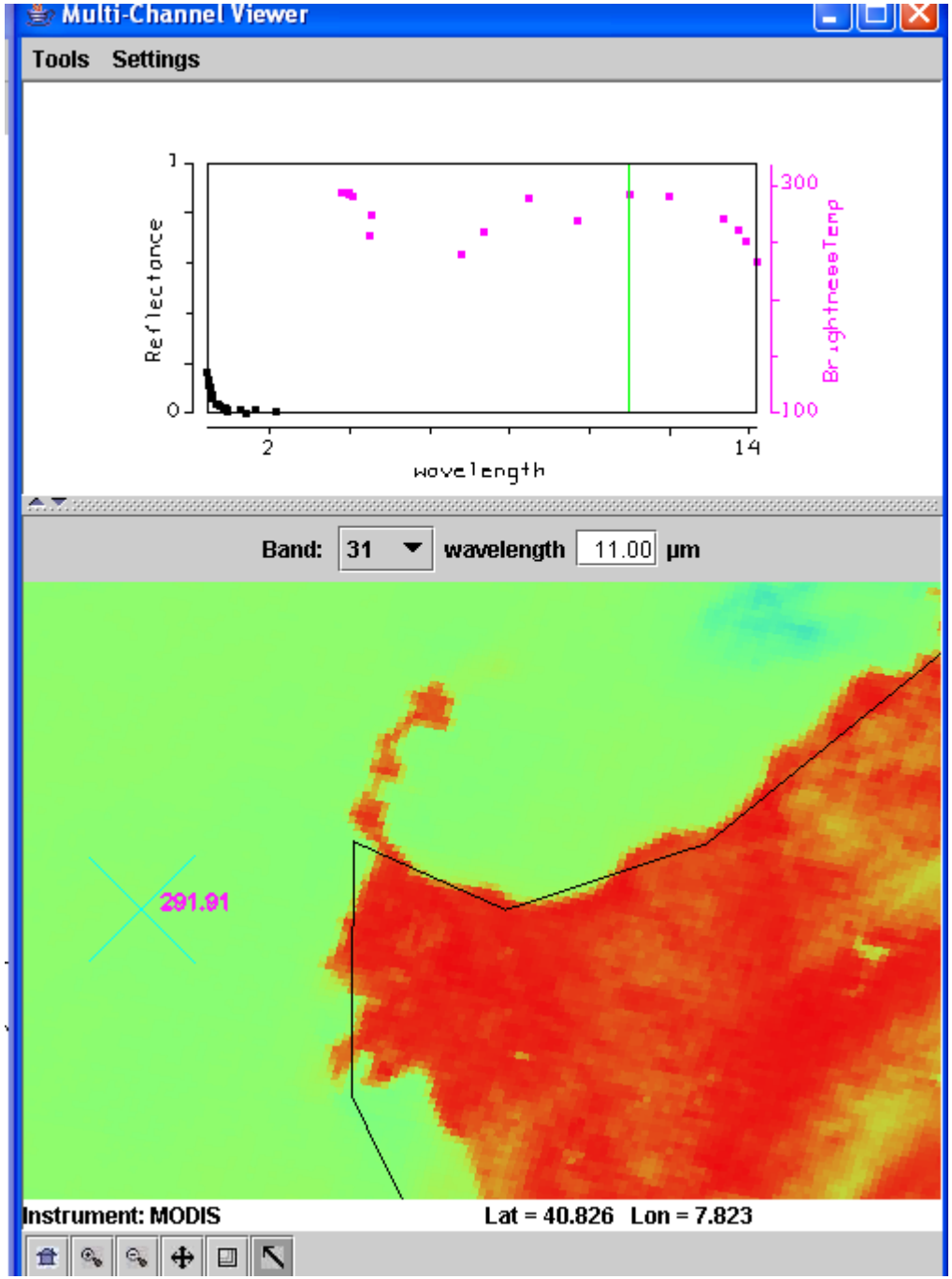


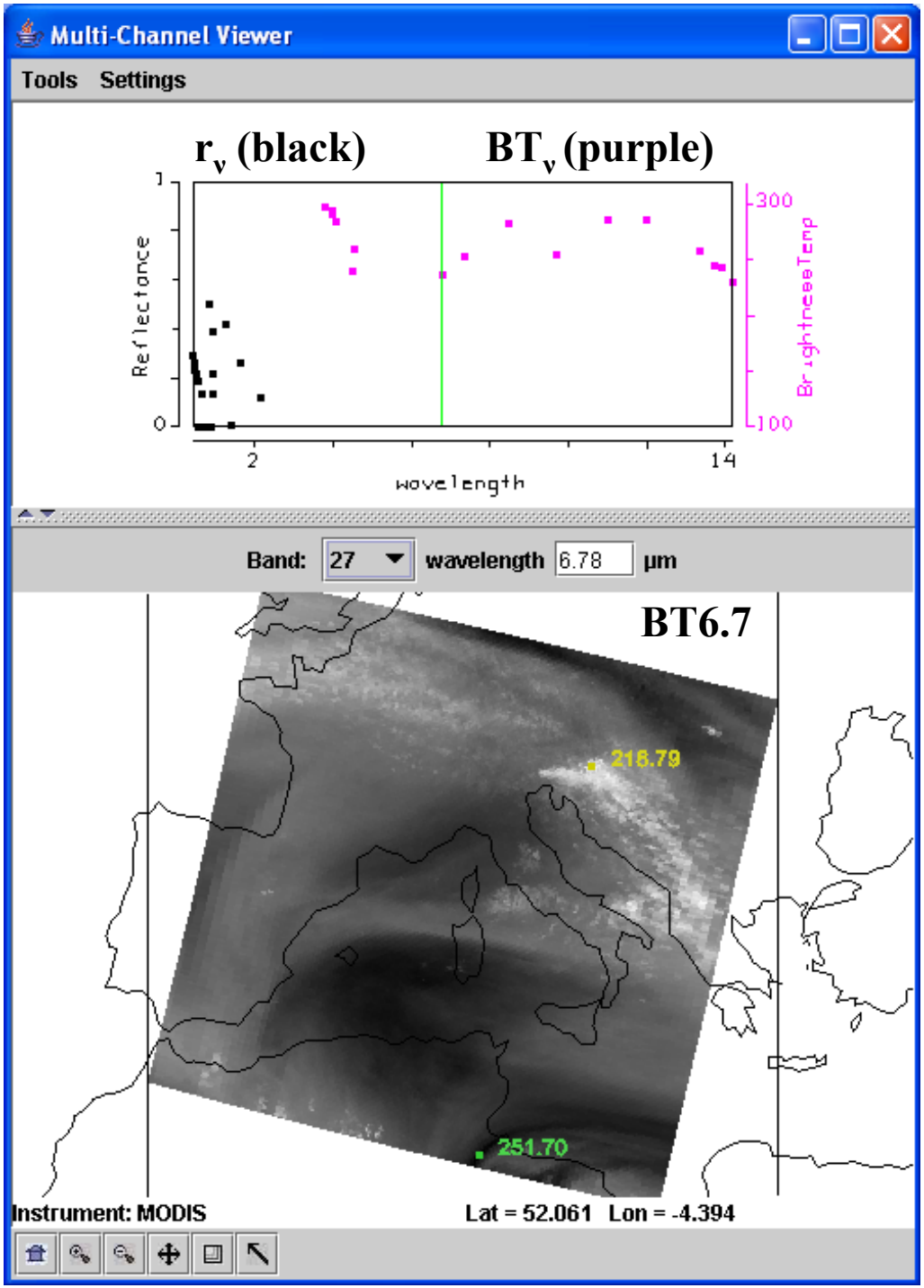
HYDRA IR window with 29 May 2001 MODIS L1B 1KM granule

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.

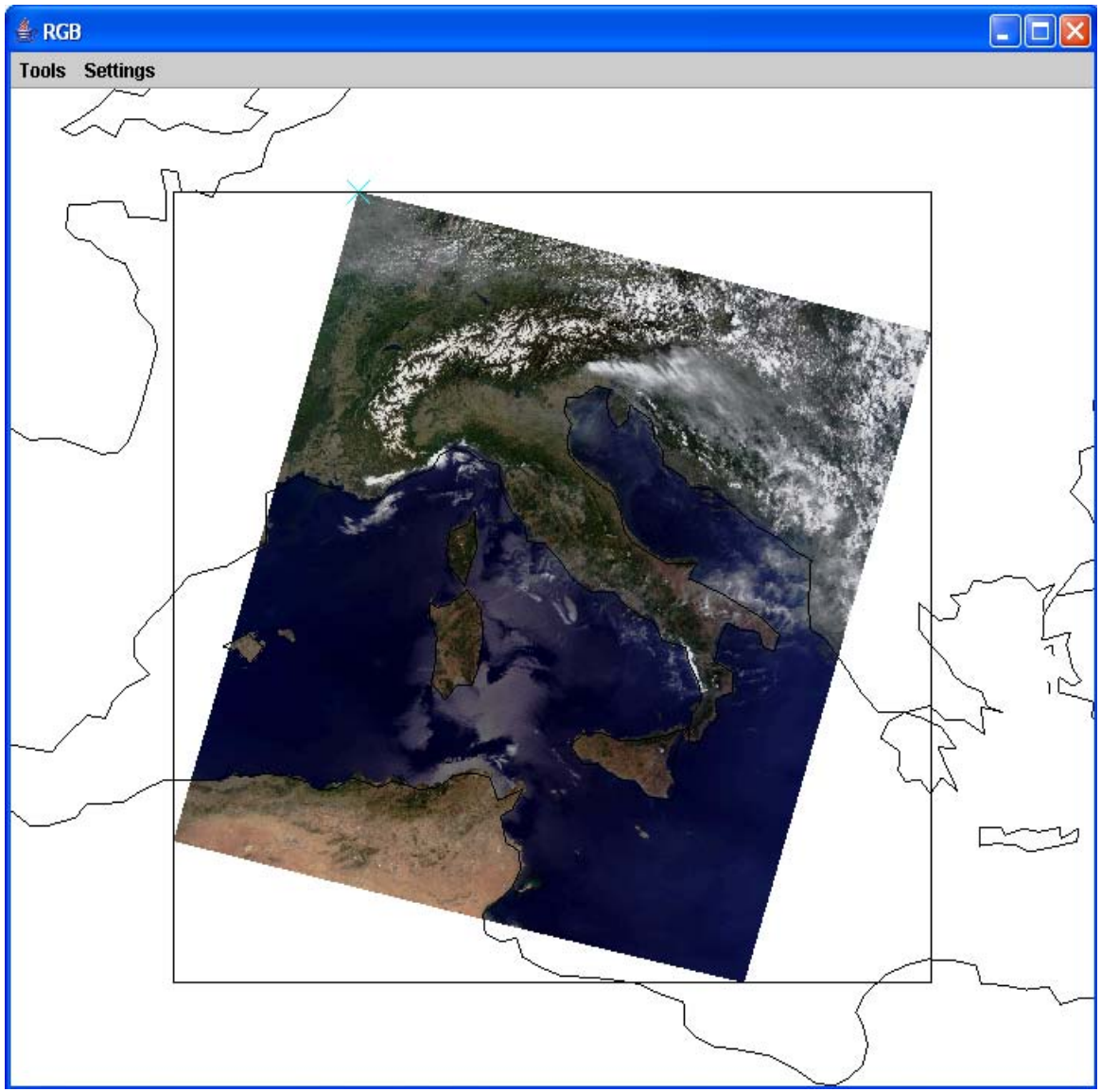
Capture Display allows you to save the image as a jpeg

Statistics displays the min and max values in the image

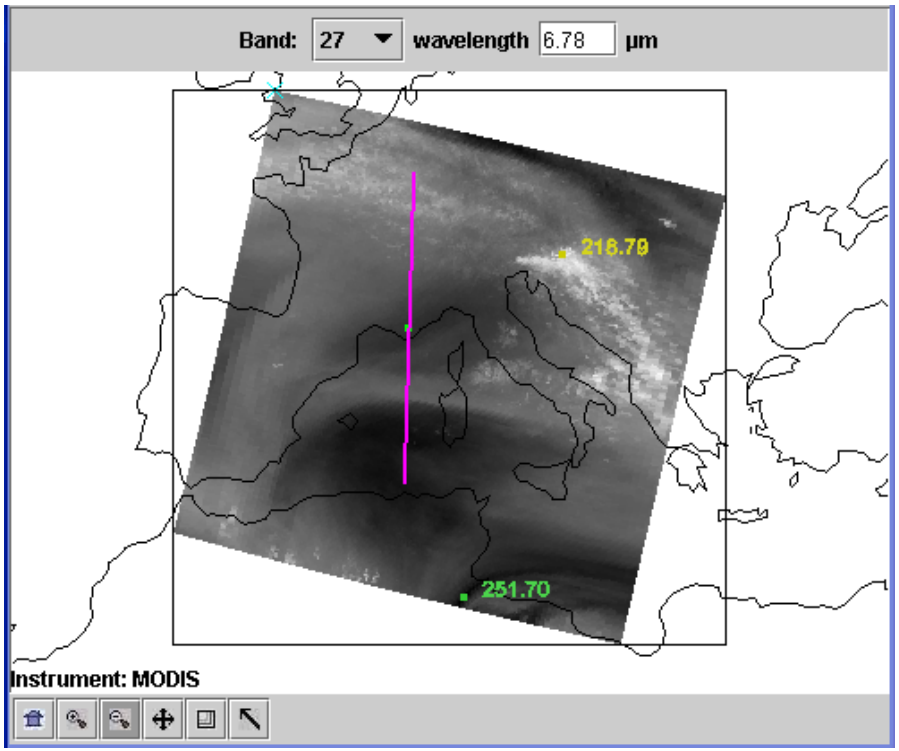
Reference Spectrum allows you to compare spectral measurements from two selected pixels (controlled by the arrows in the bottom toolbar)

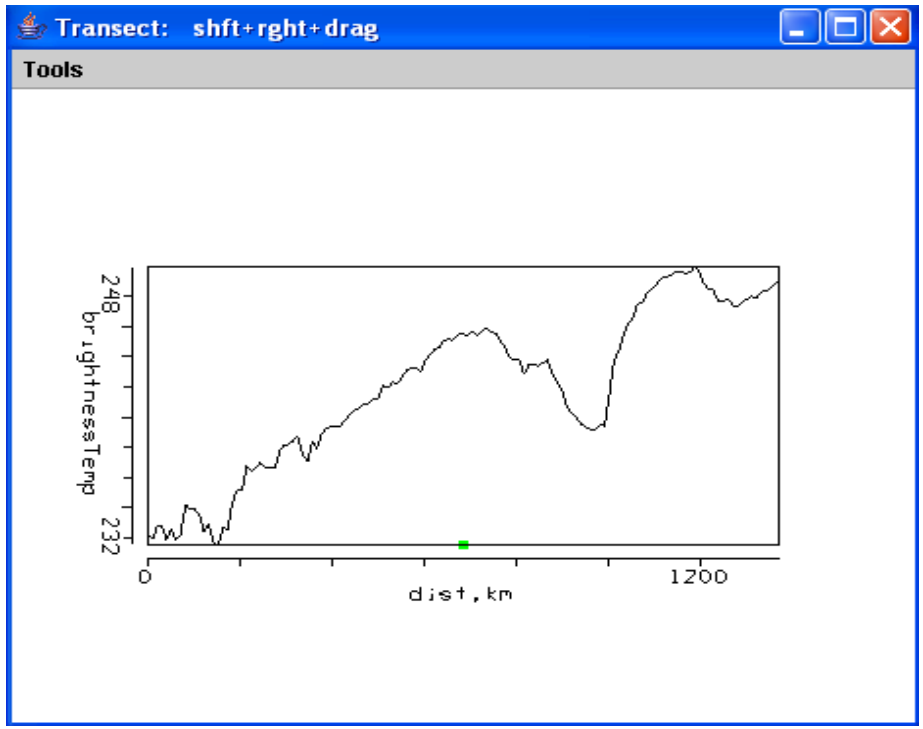
Pseudo RGB Composite Image

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

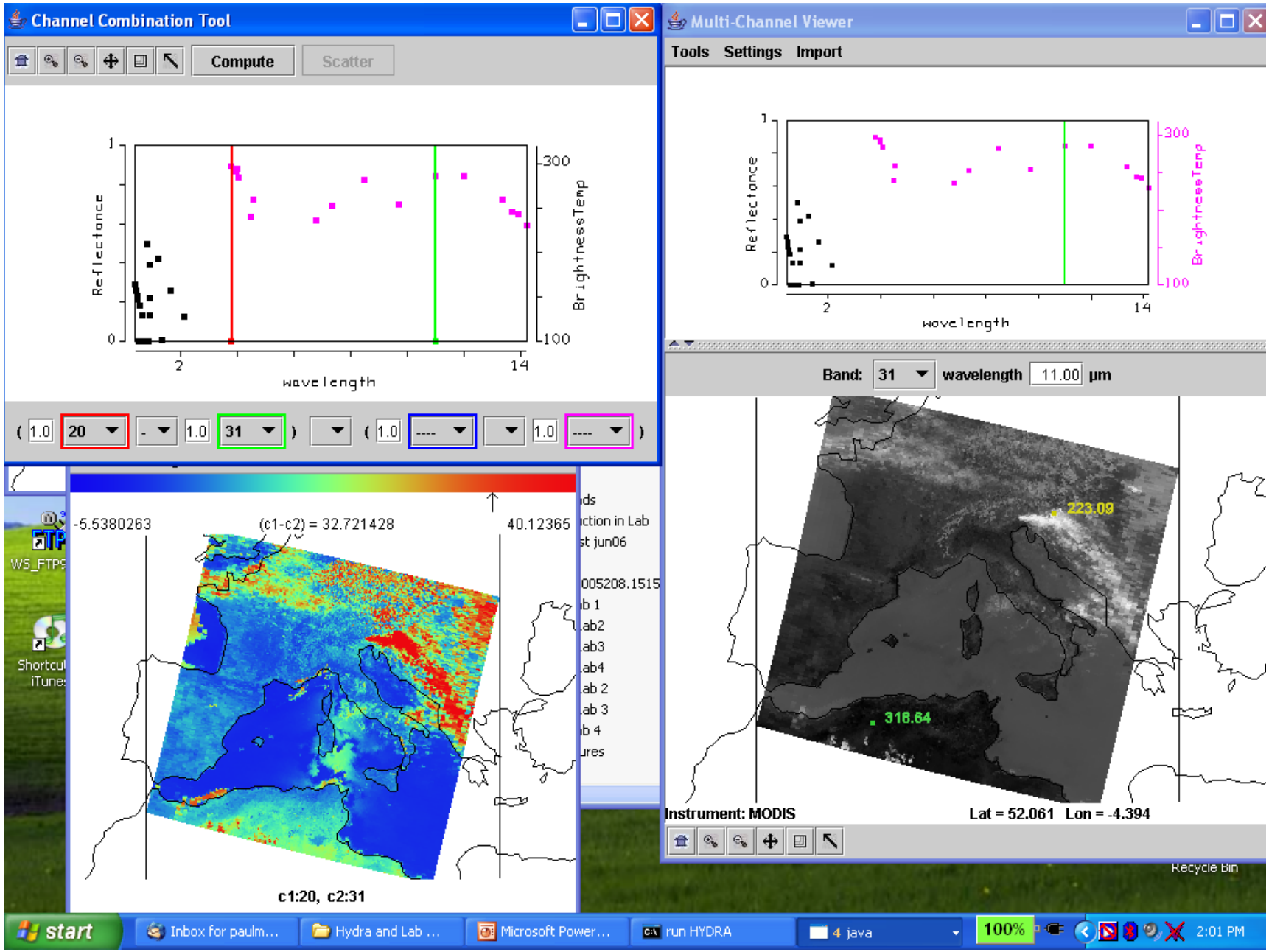


Transect

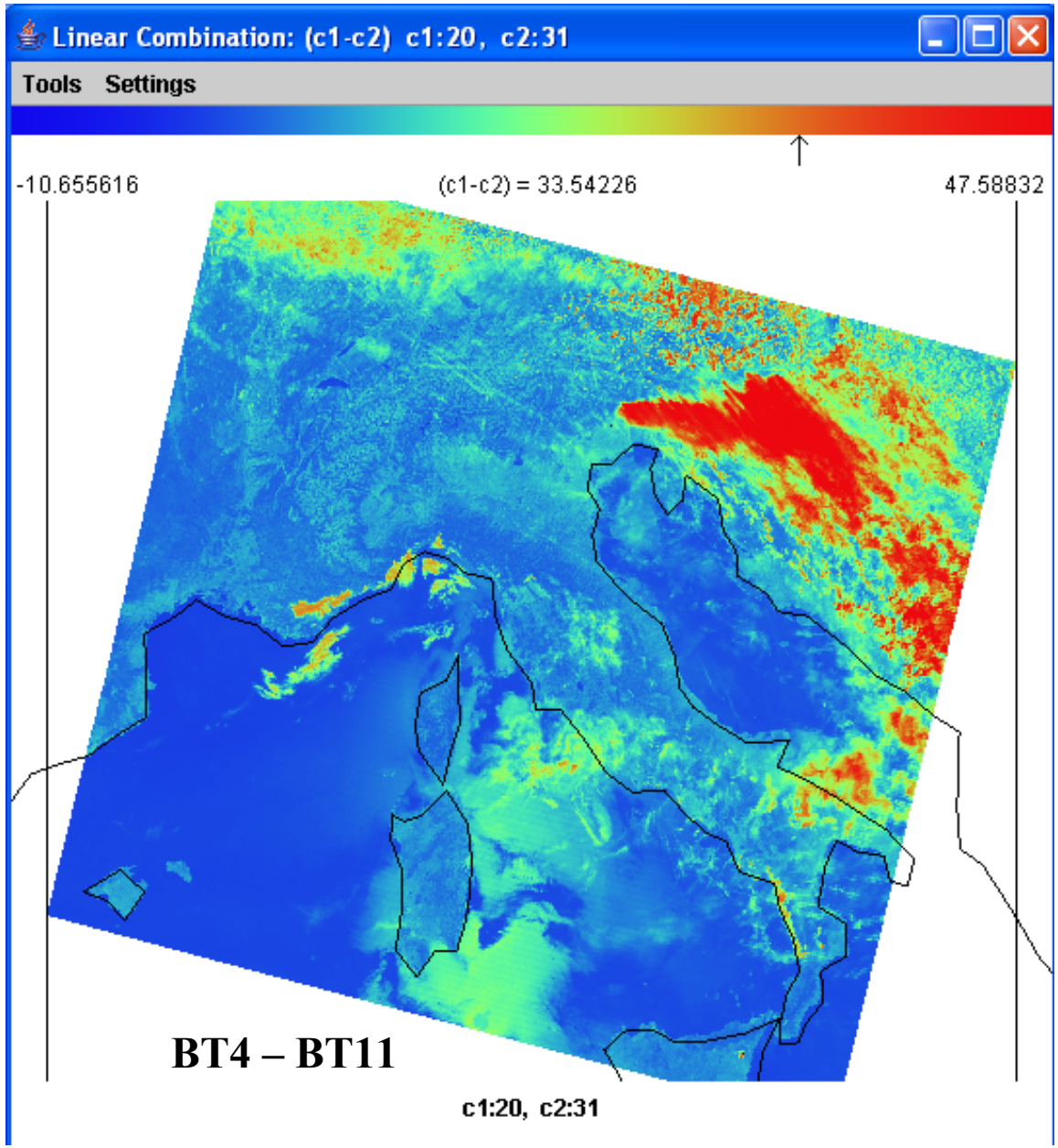

Band: 27 wavelength 6.78 µm
218.79
251.70
Instrument: MODIS


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

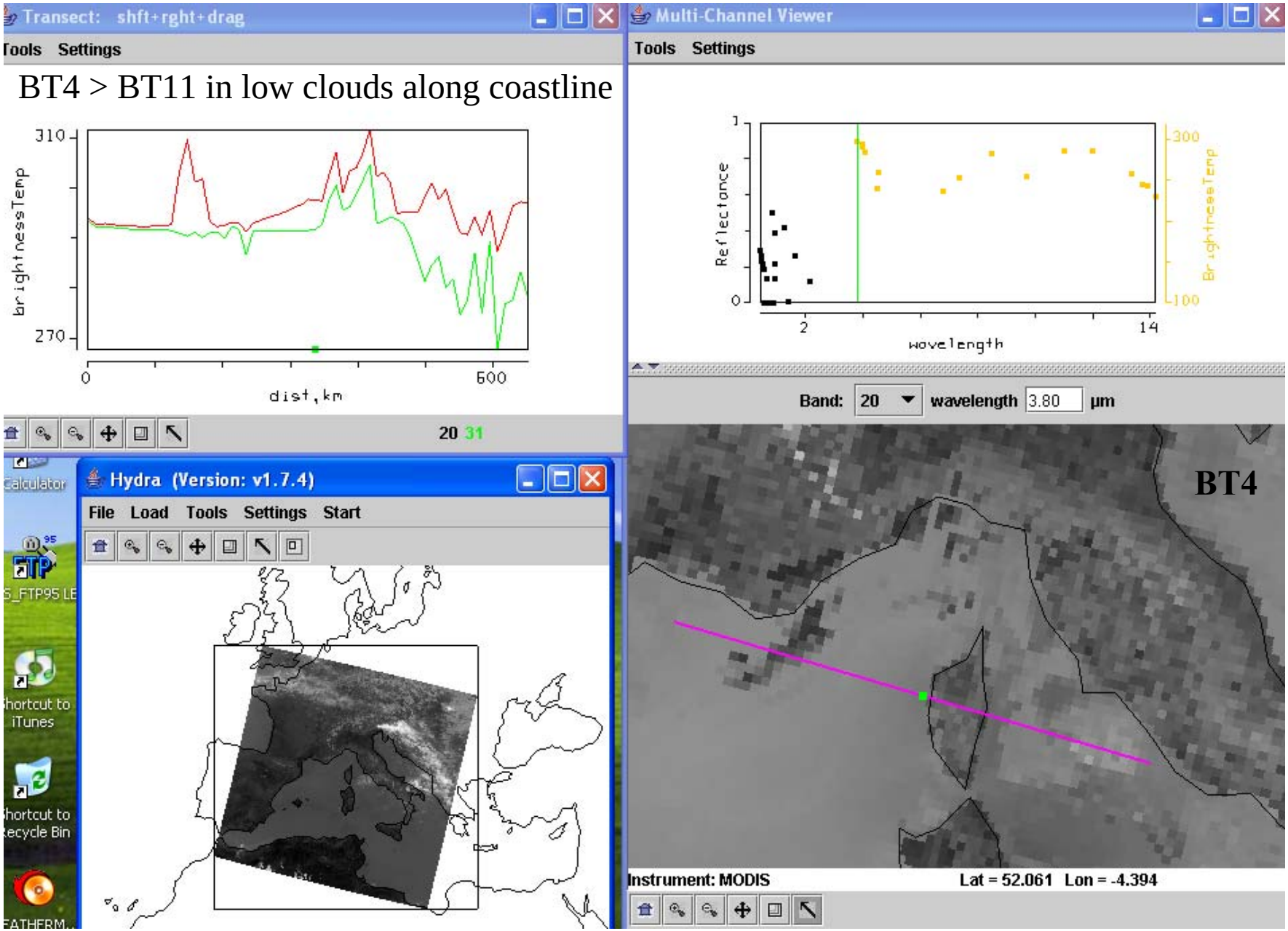
Linear Combination BT4 – BT11



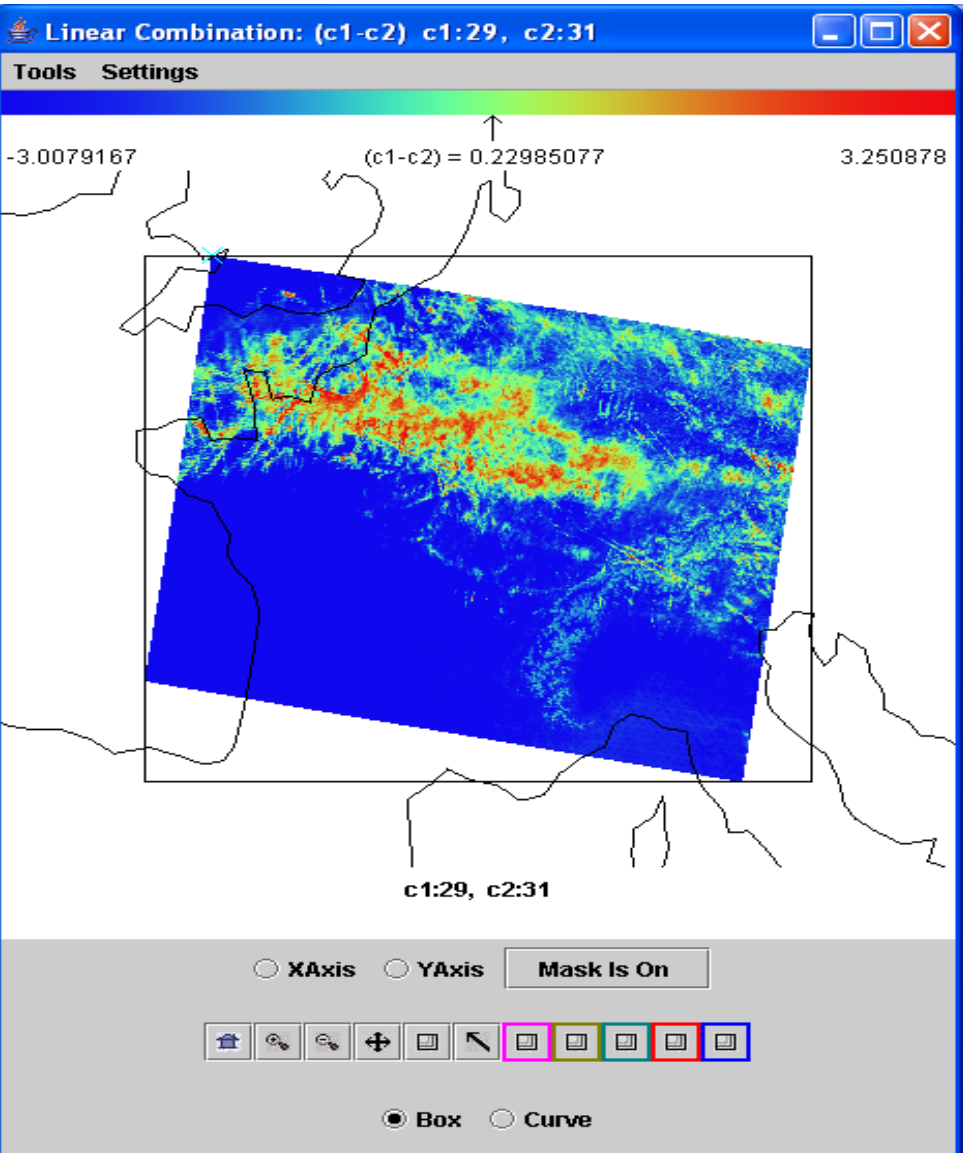
Linear Combination BT4 – BT11

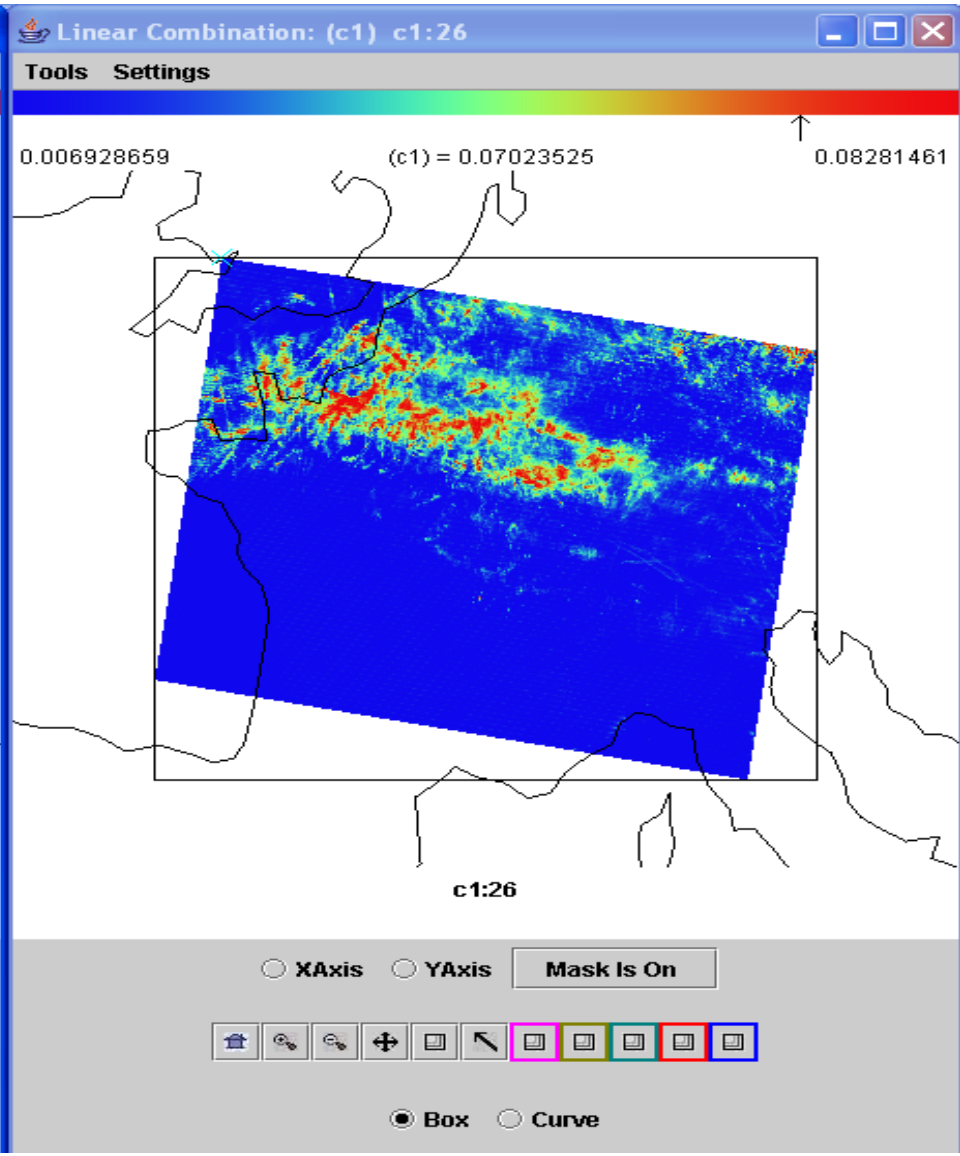


Transect


Transect: shft+rght+drag
Tools Settings
BT4 > BT11 in low clouds along coastline
310
270
brightnessTemp
0
500
dist,km
20 31
Multi-Channel Viewer
Tools Settings
Reflectance
1
0
2
14
wavelength
300
100
BrightnessTemp
Band: 20 wavelength 3.80 µm
BT4
Instrument: MODIS
Lat = 52.061 Lon = -4.394
Hydra (Version: v1.7.4)
File Load Tools Settings Start

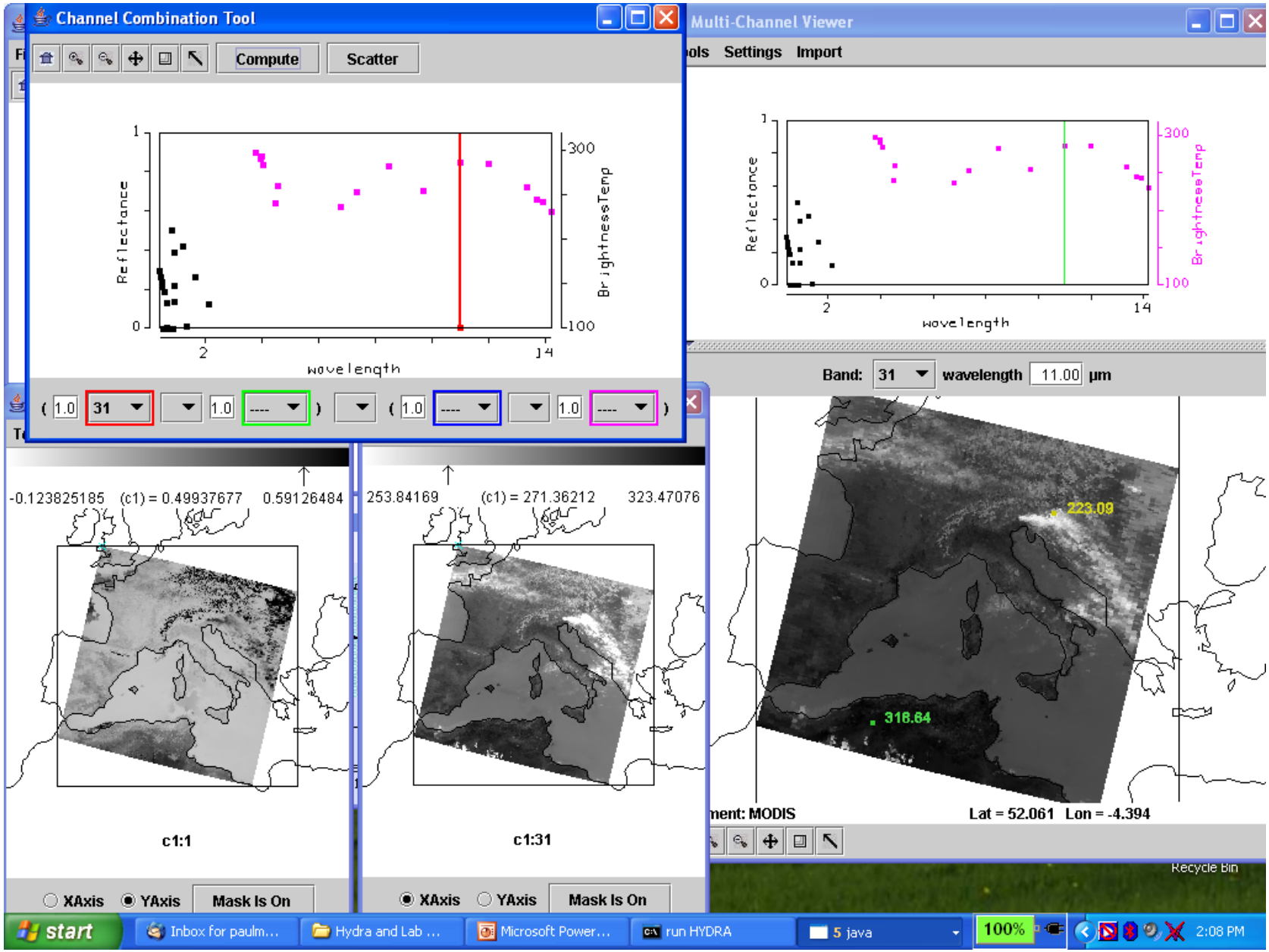
Comparing IR to NIR Cloud Detection

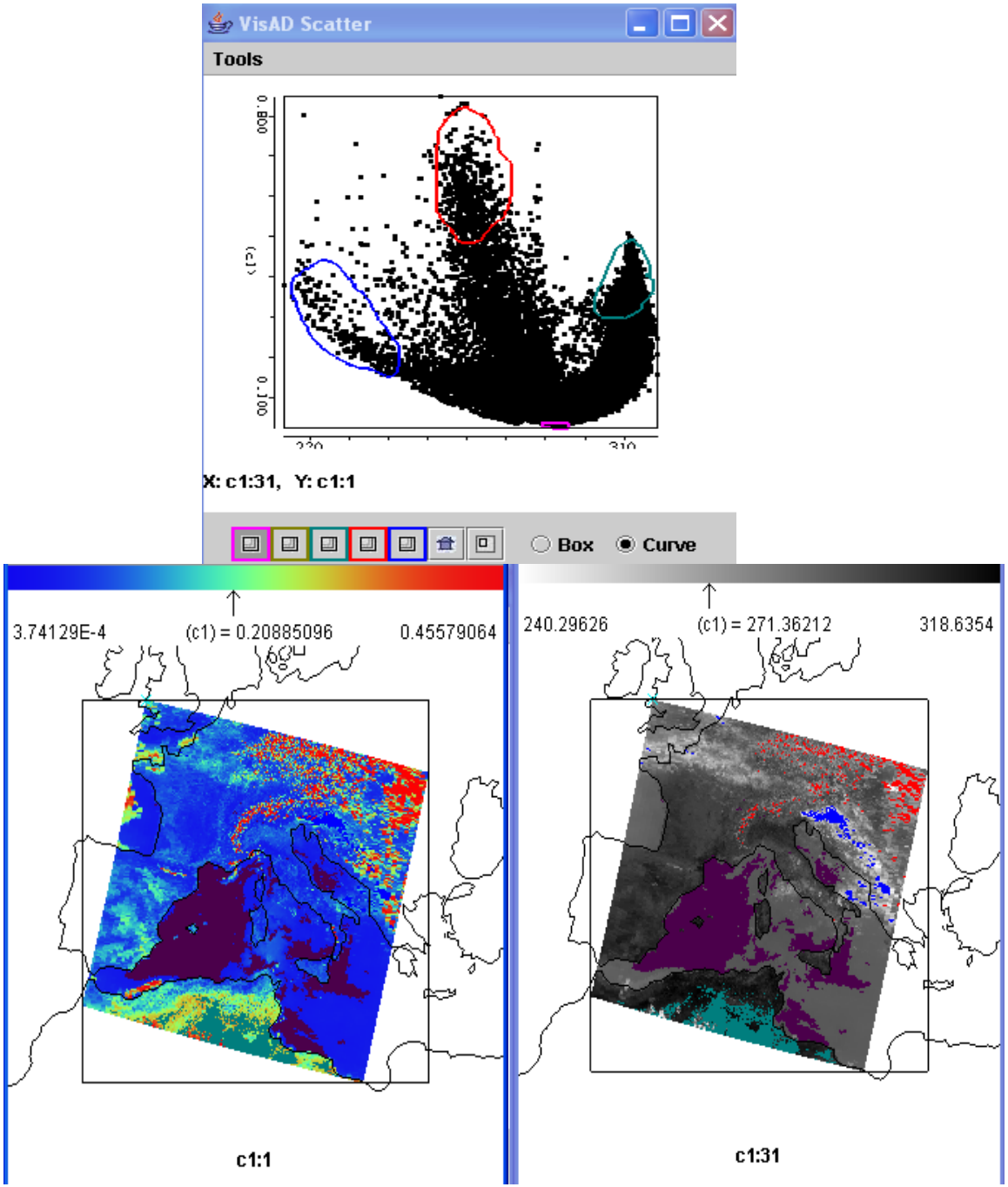




Thin cirrus show up in BT8.6-BT11 (left) as well as r1.38 (right)

Setting up for scatter plot of BT11 vs r0.66

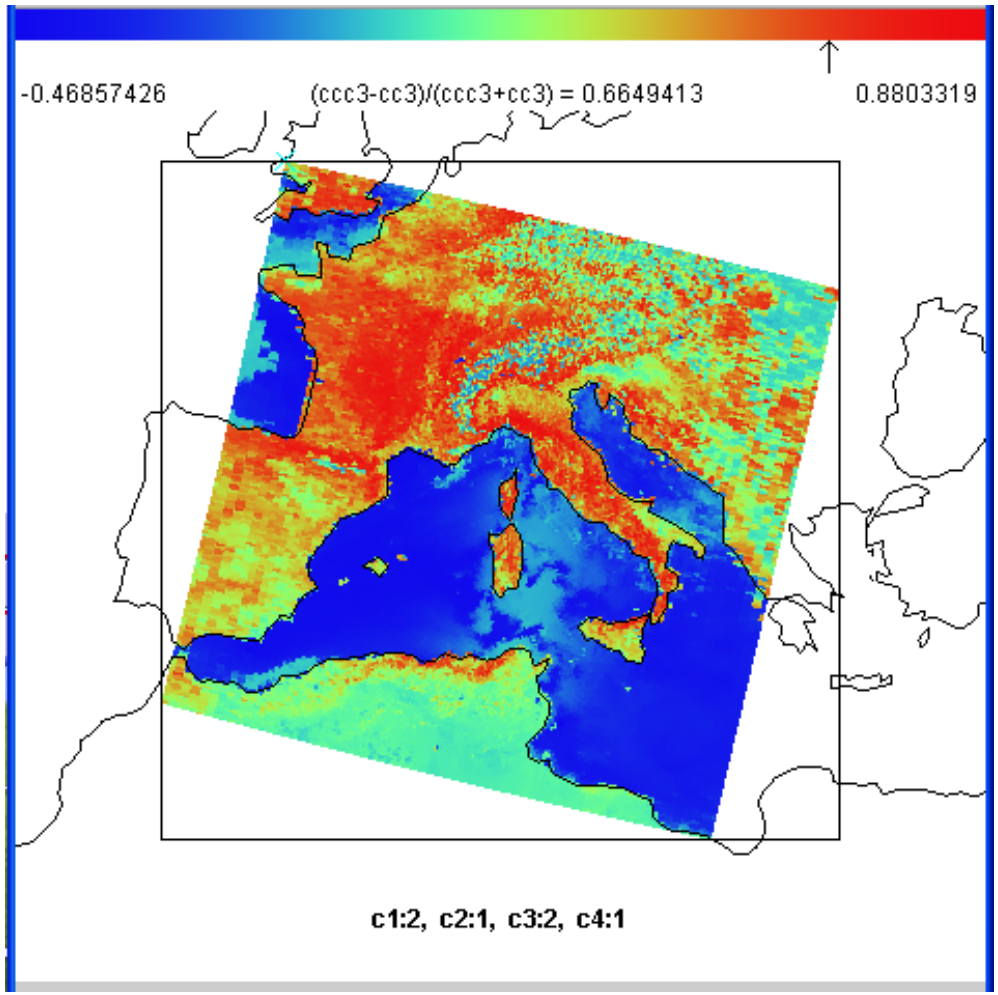




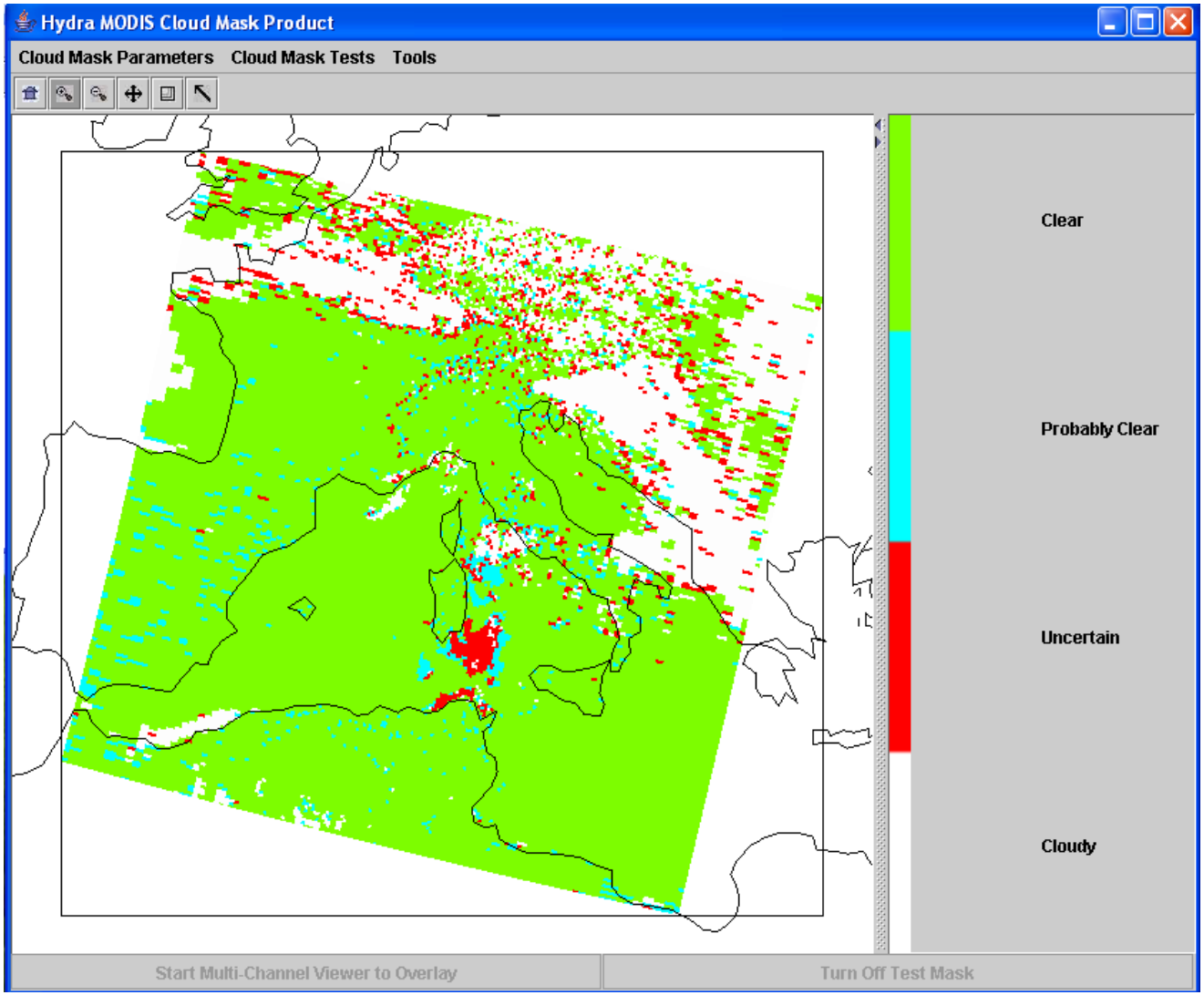
Scatter Plot of r_{vis} vs BT_{11}

with colors highlighting locations of pixels in plot on images

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

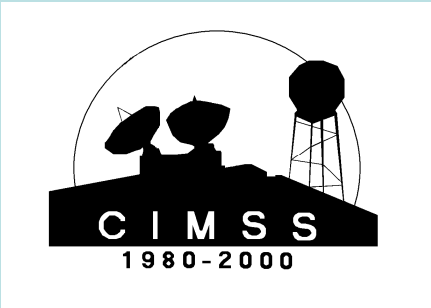


MODIS level 2 cloud mask display



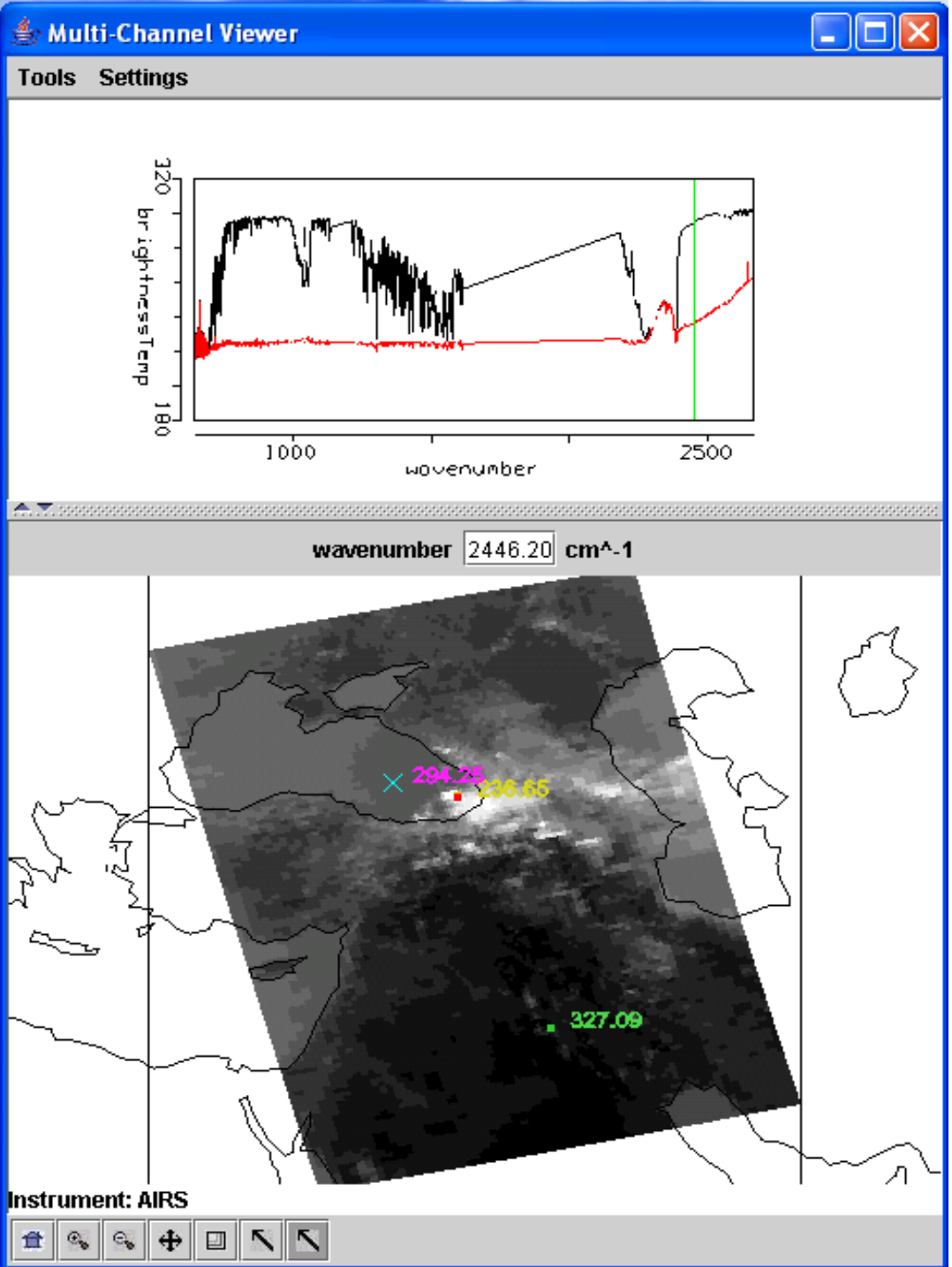
clear =green
probably clear (95% certain) = turquoise
uncertain = red
cloudy = white

Inspecting multi-spectral and hyper-spectral data using HYDRA



Paul Menzel
University of Wisconsin - Madison

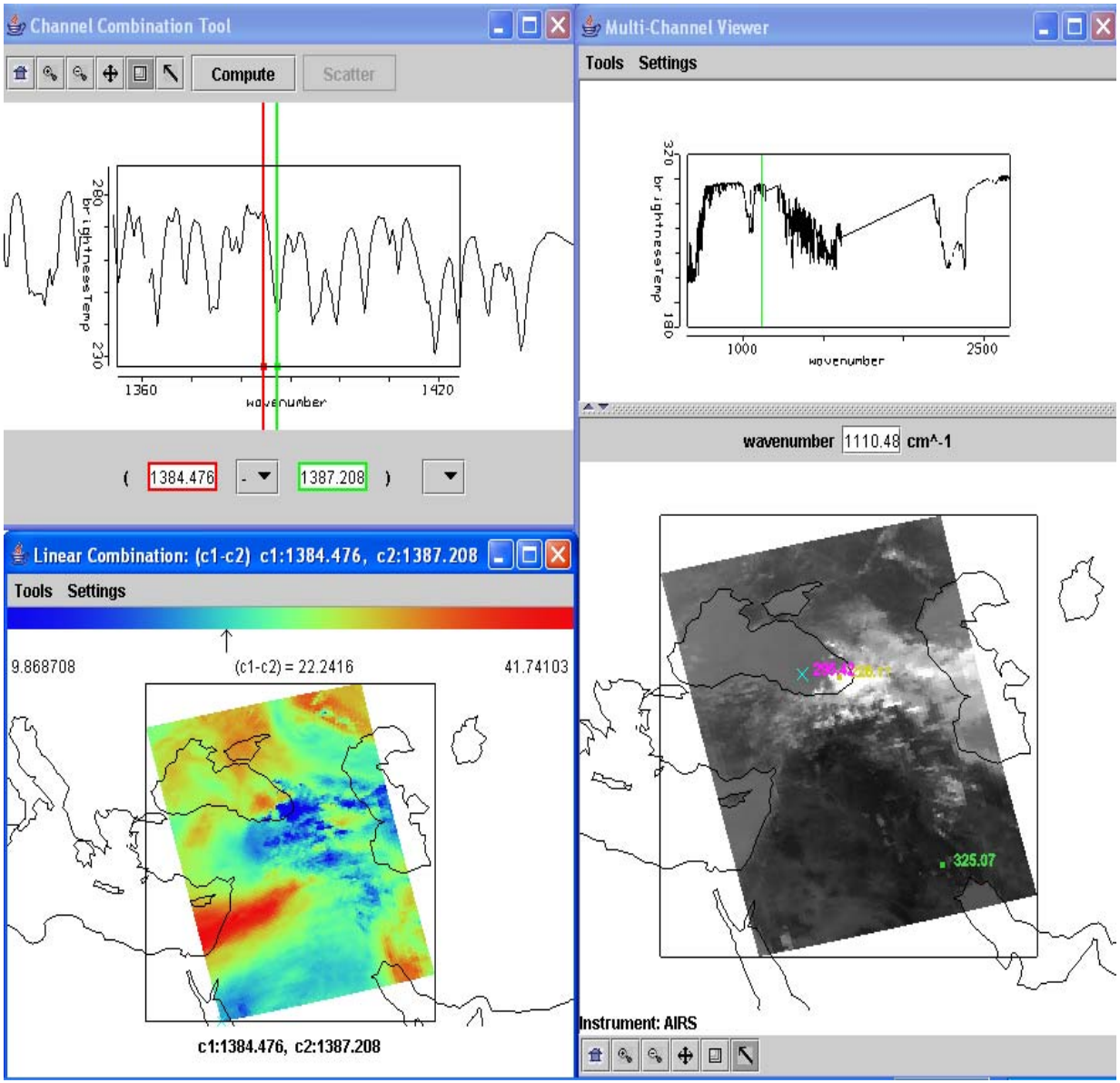
What is HYDRA?
What can it do?
→ Some examples with AIRS
How to get it?



AIRS data

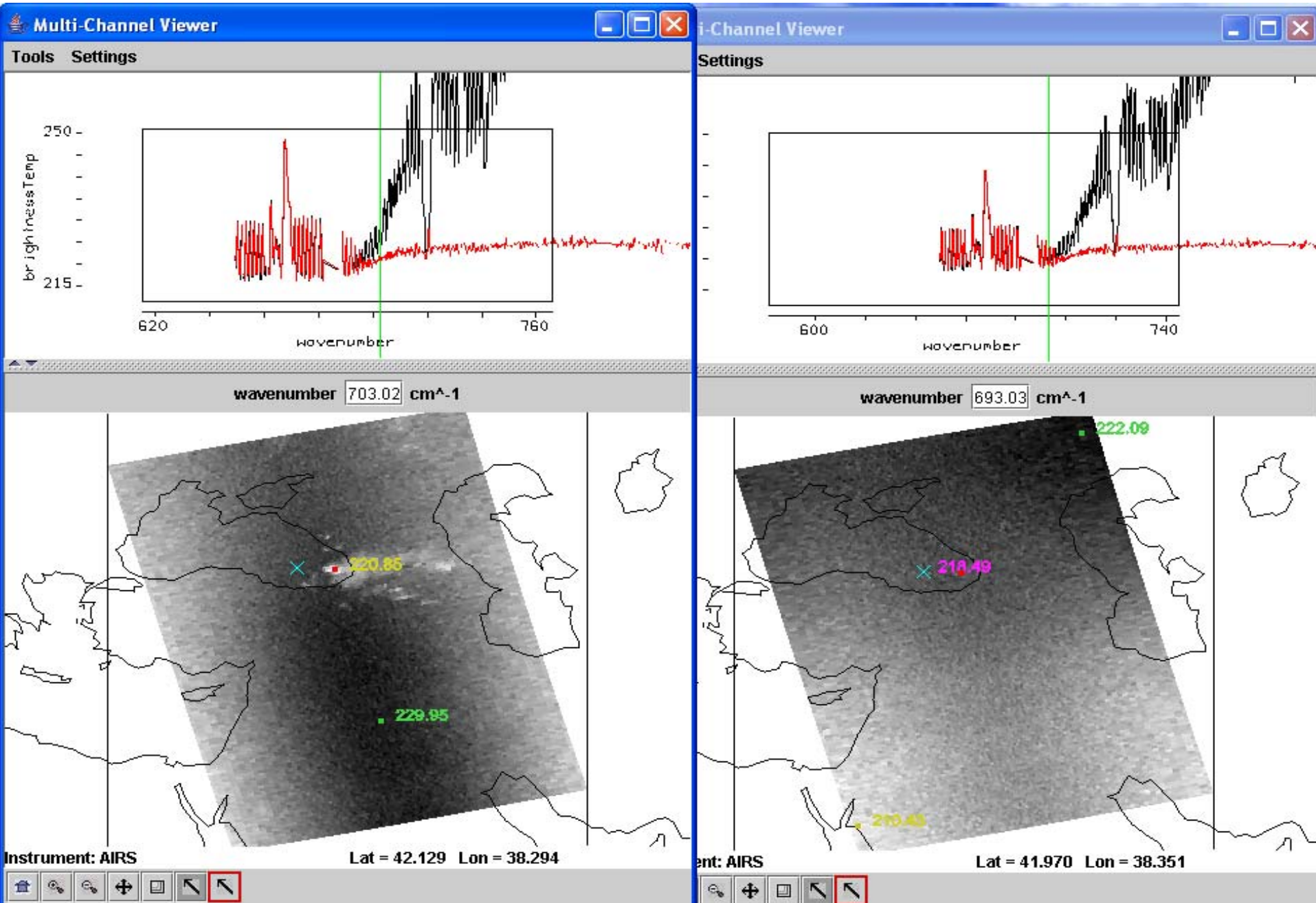
over
Black & Caspian Seas
28 August 2005

BT1384.5 minus BT1387.2

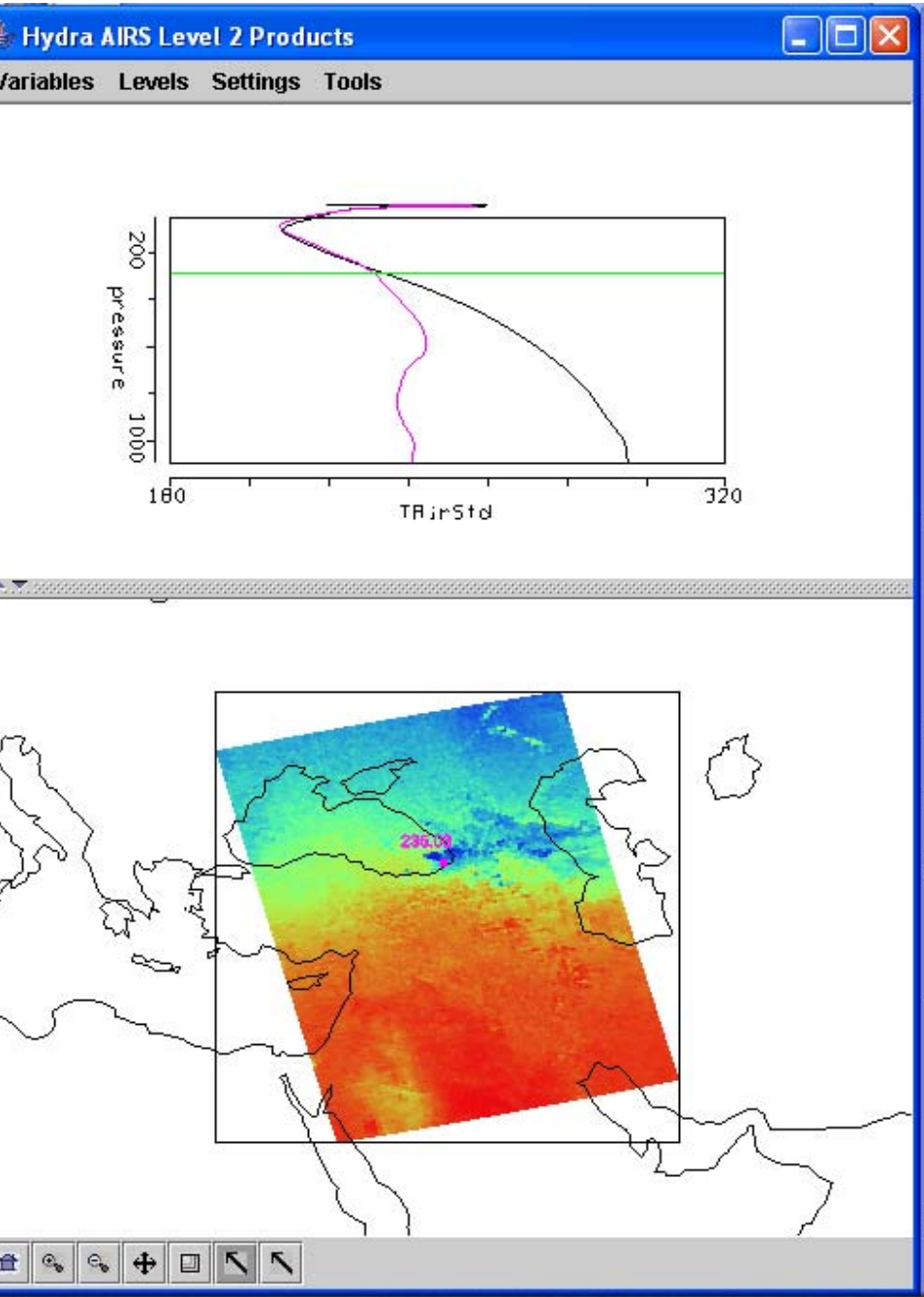


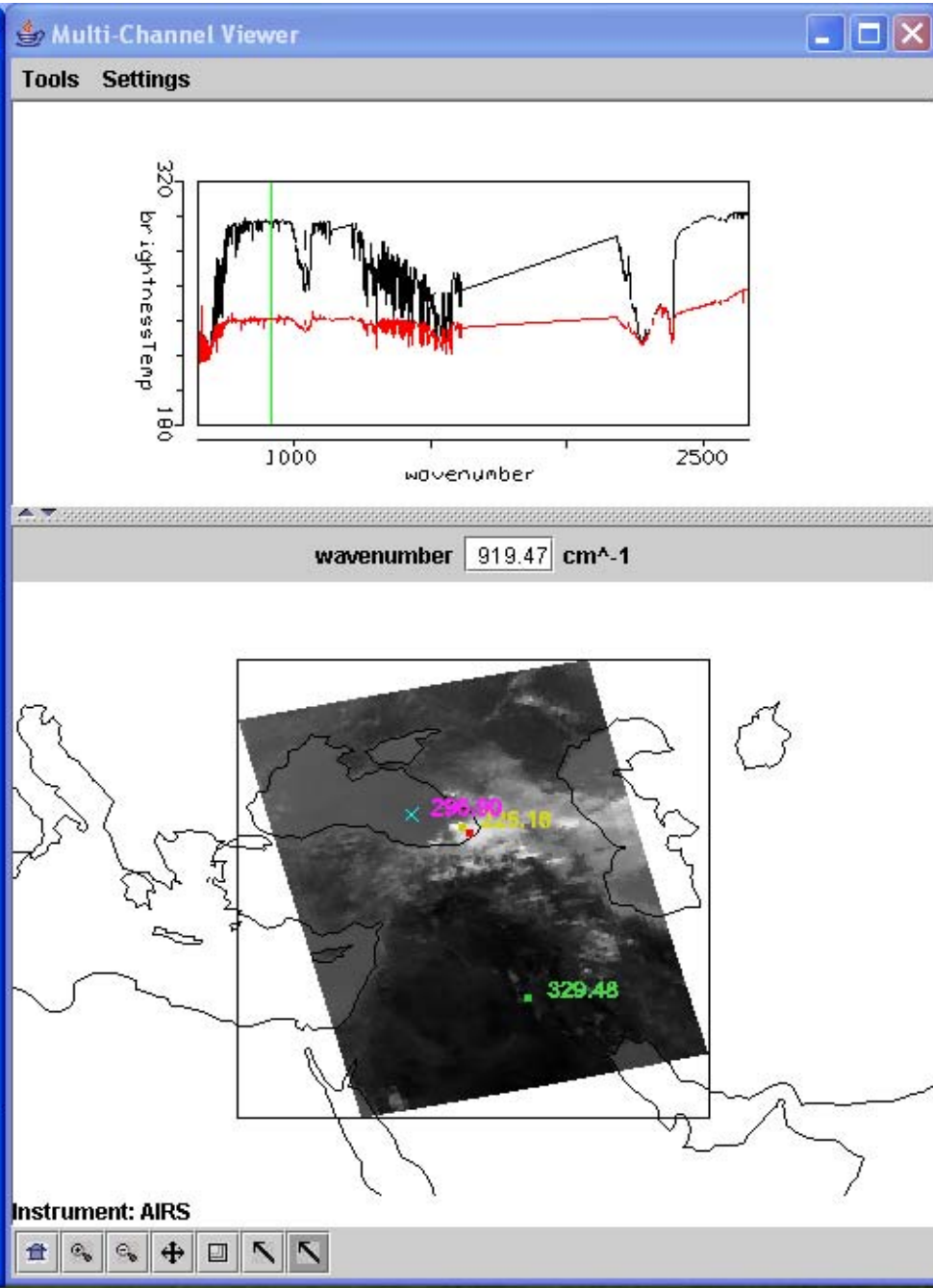
BT differences of more than 40 K are seen in clear regions and less than 1 K in opaque high cloudy regions

Cld and clr spectra in CO2 absorption separate when weighting functions sink to cloud level

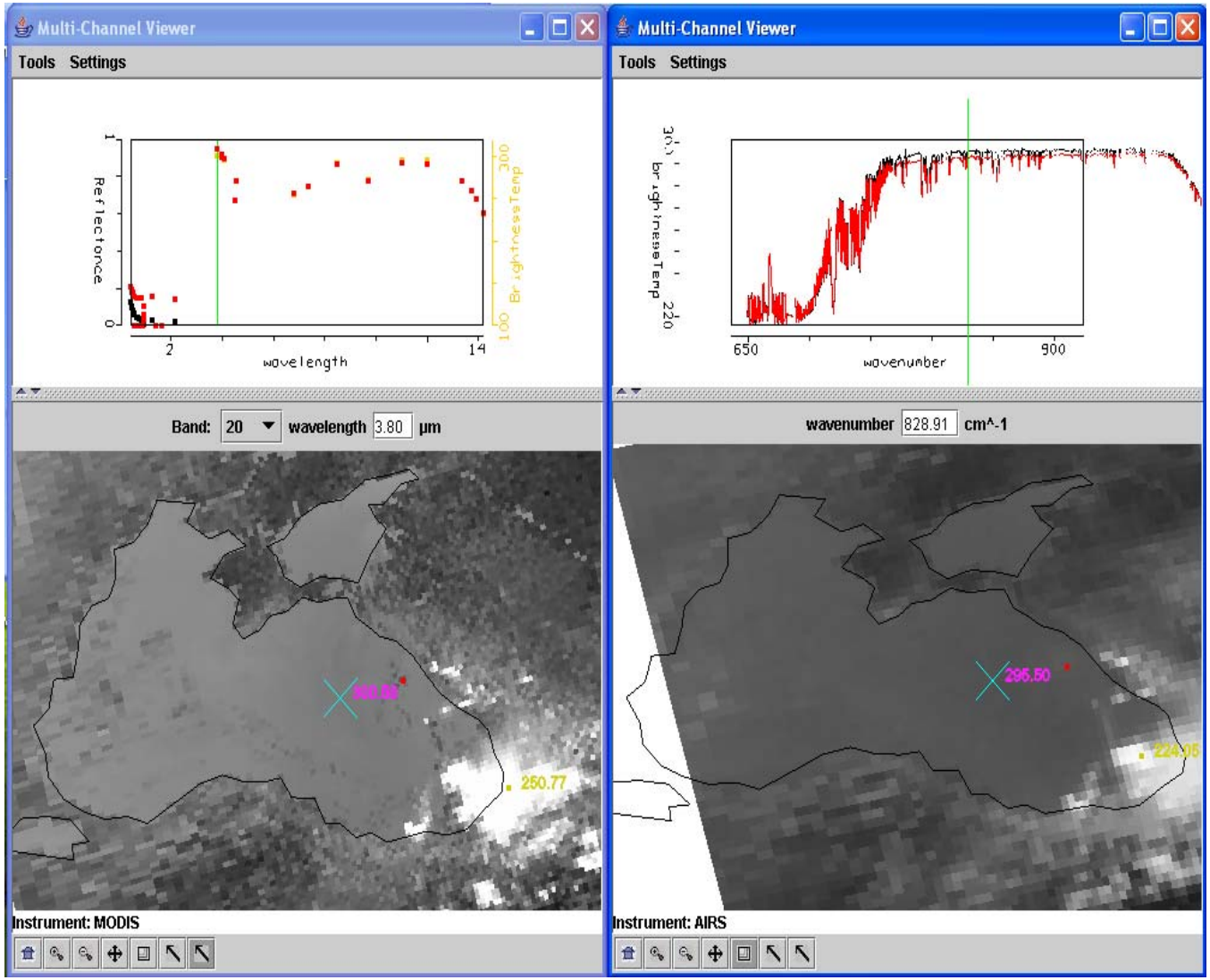


Cld and clr soundings indicate cloud is at 250 HPa

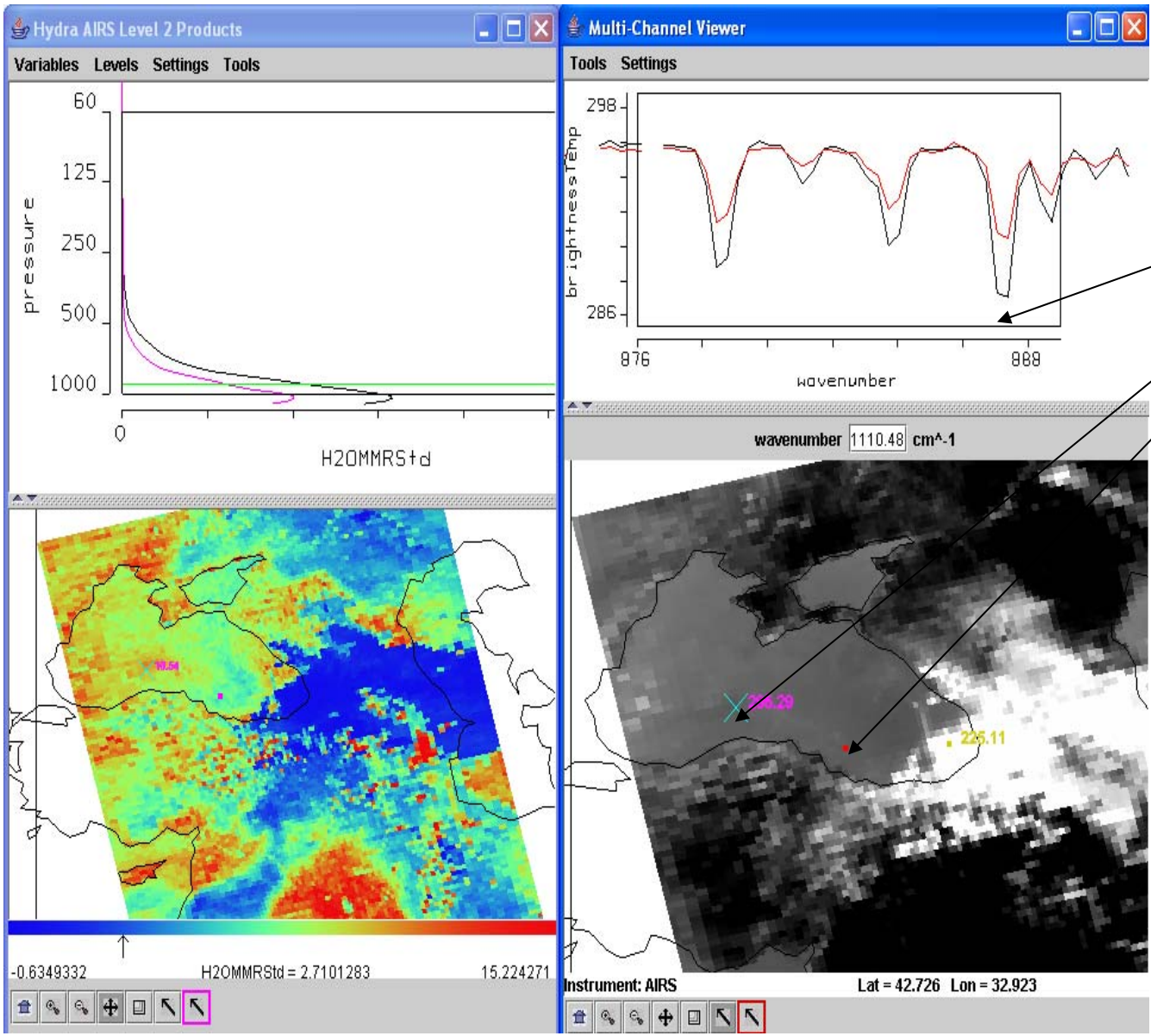




AIRS (right) and MODIS (left) co-located display of spectra

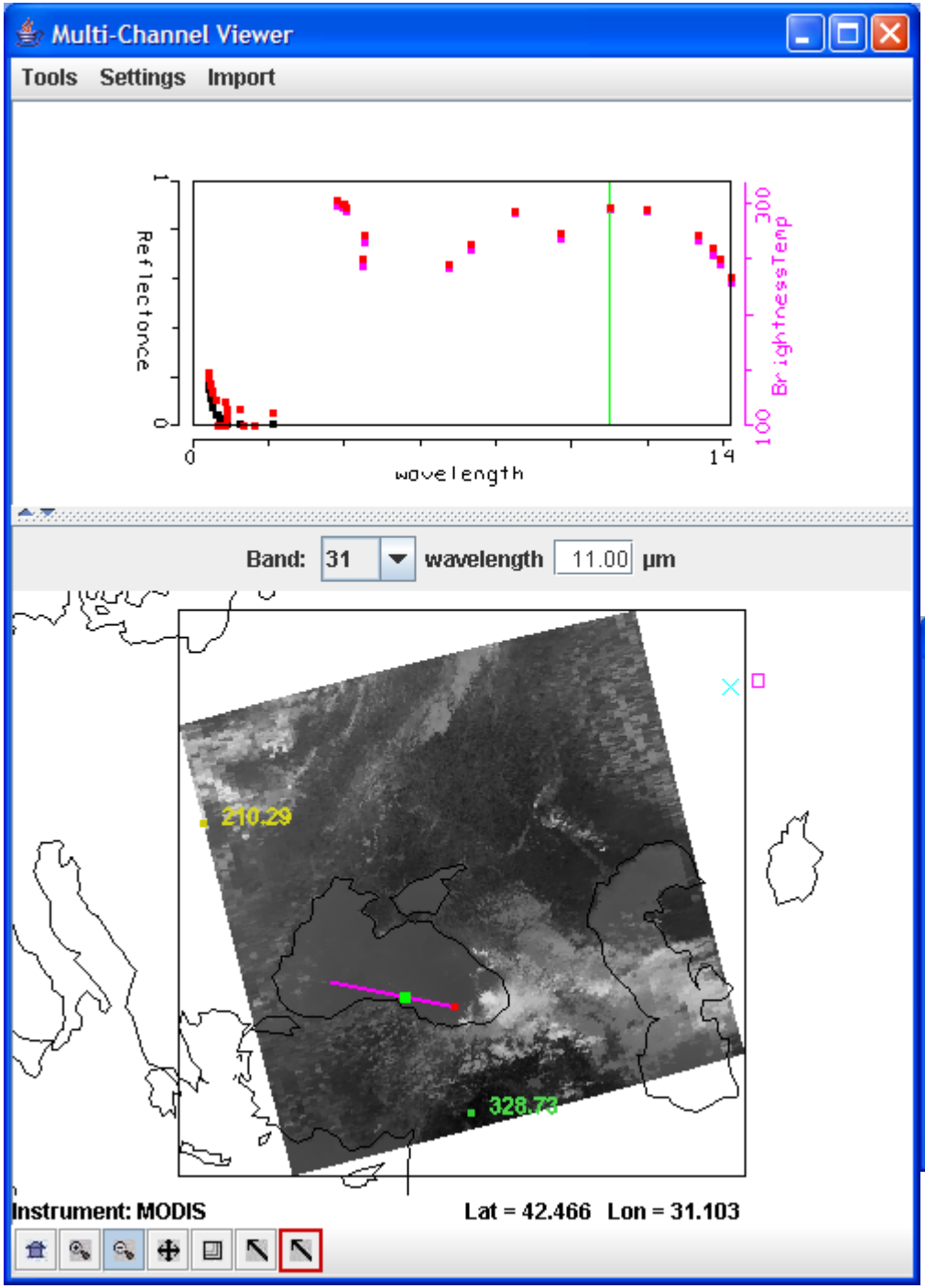


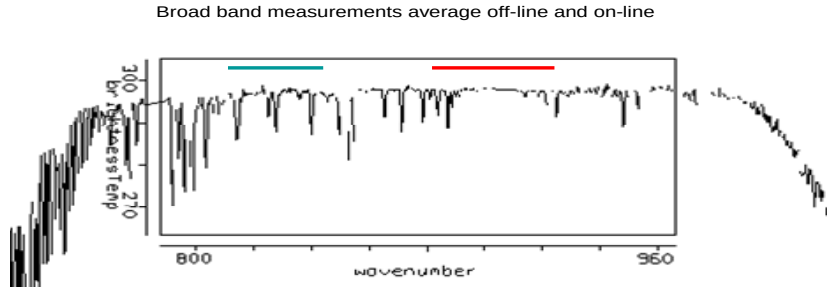
Investigating AIRS Retrievals



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.

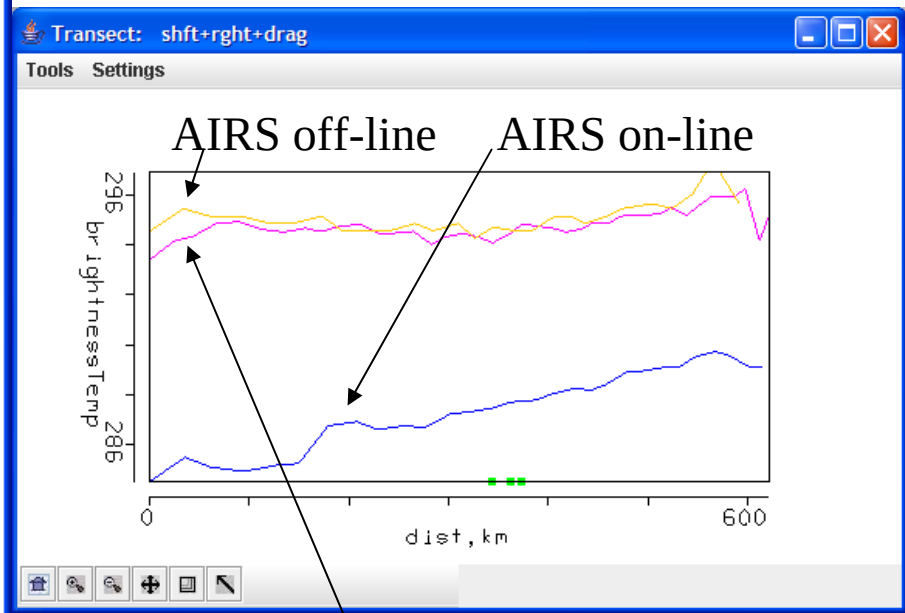
This is confirmed by moisture profiles (upper left); 900 hPa retrieved moisture image (lower left) shows moisture gradients



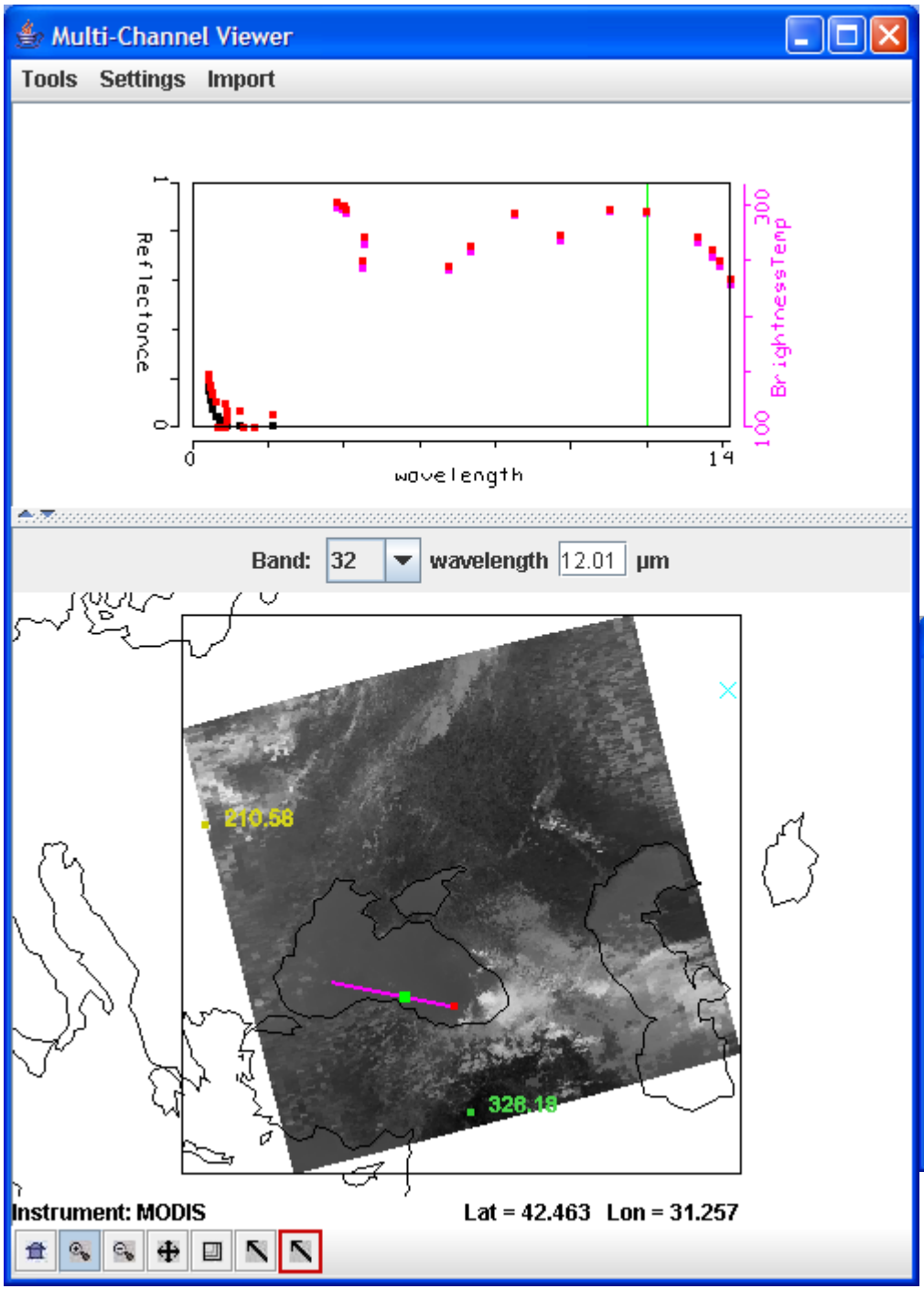


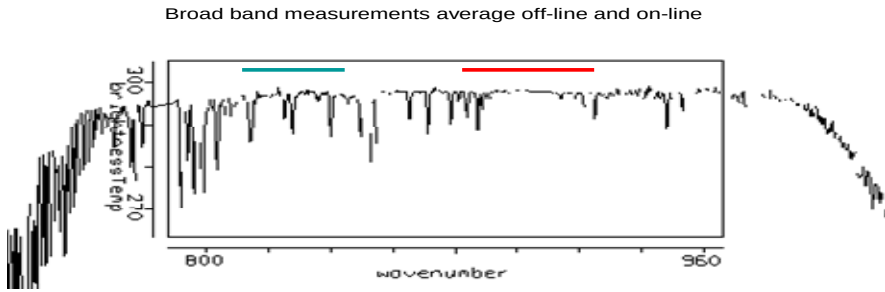
AIRS BT spectrum between 800 and 960 cm-1
MODIS split window (band 32 and 31)

Transect in Black Sea comparing where MODIS IRW does not see low level water vapor hence BTs are closest to Off-H2O-line AIRS BTs



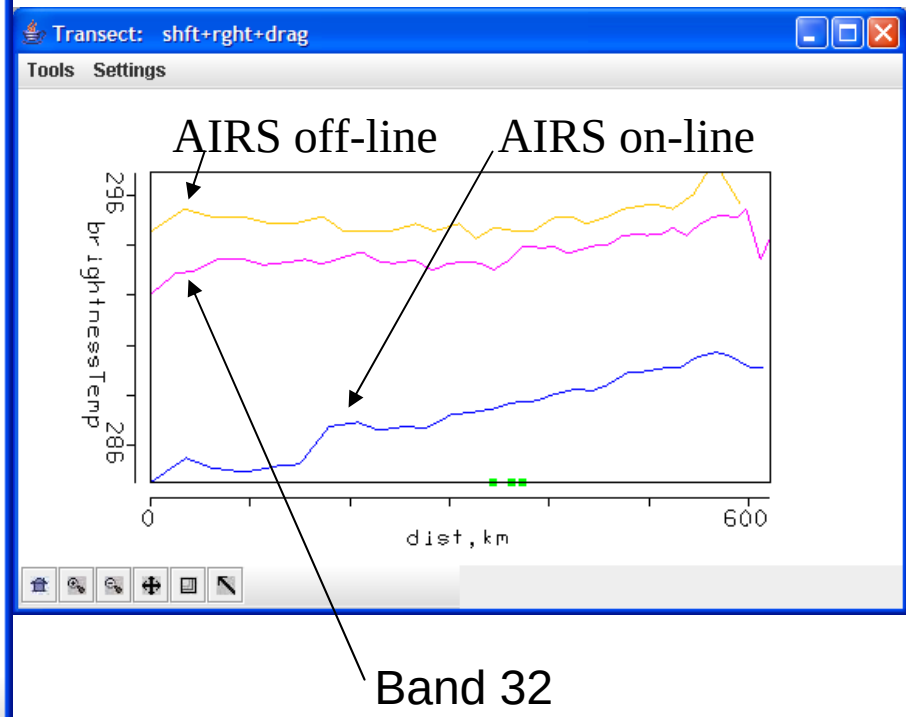
Band 31



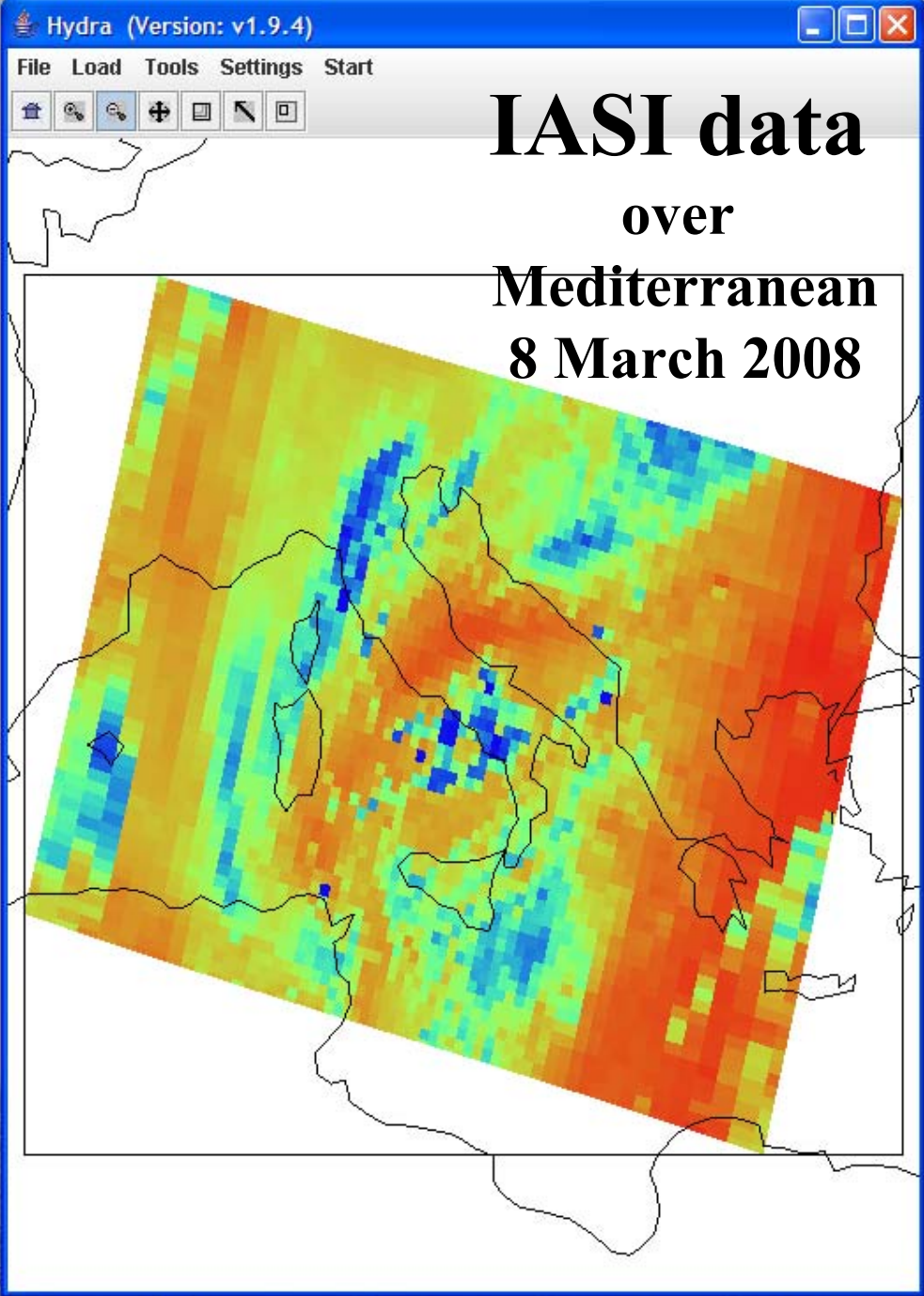


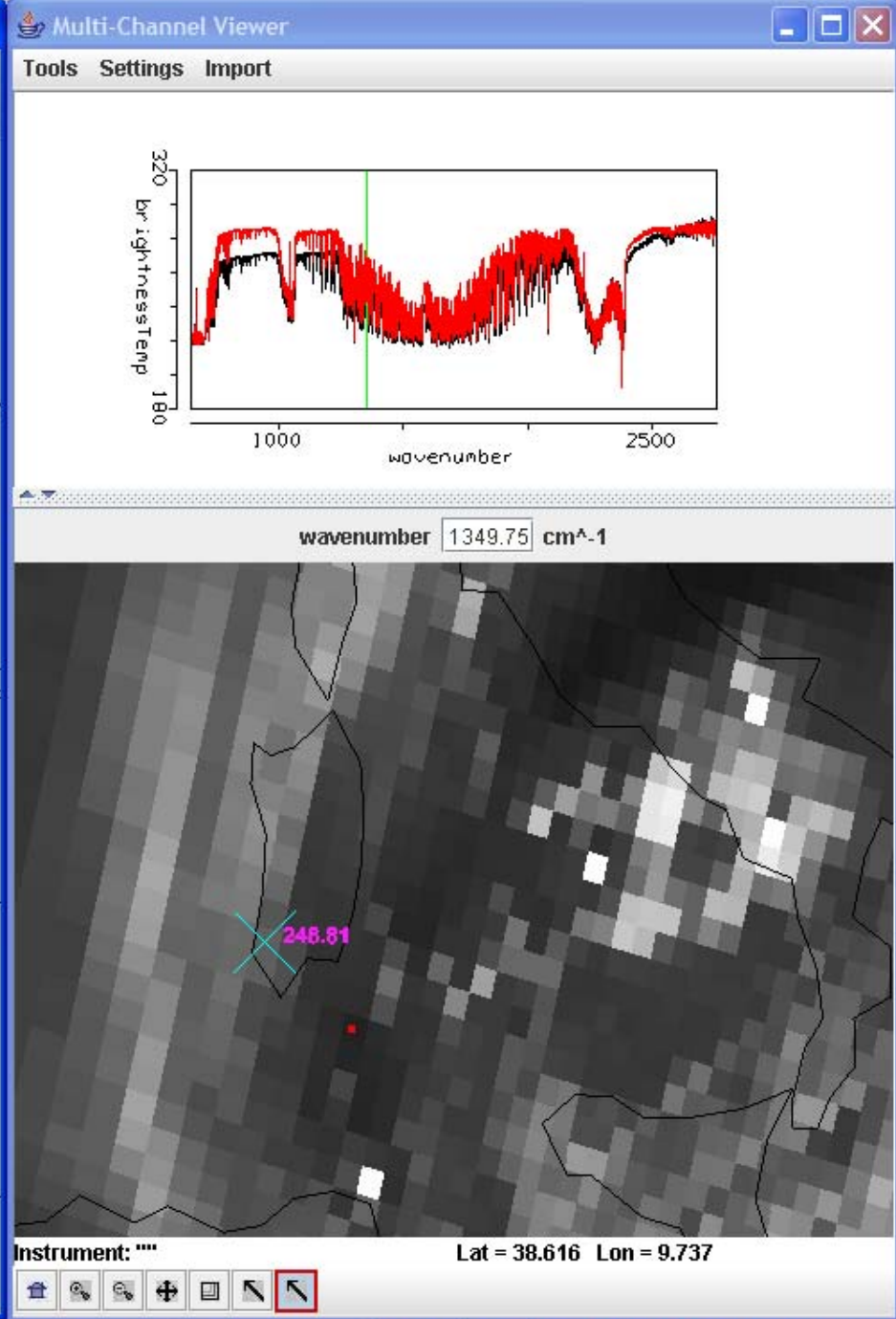
AIRS BT spectrum between 800 and 960 cm-1
MODIS split window (band 32 and 31)

Transect in Black Sea comparing where MODIS DIRW does see low level water vapor but BTs are still close to Off-H2O-line AIRS BTs



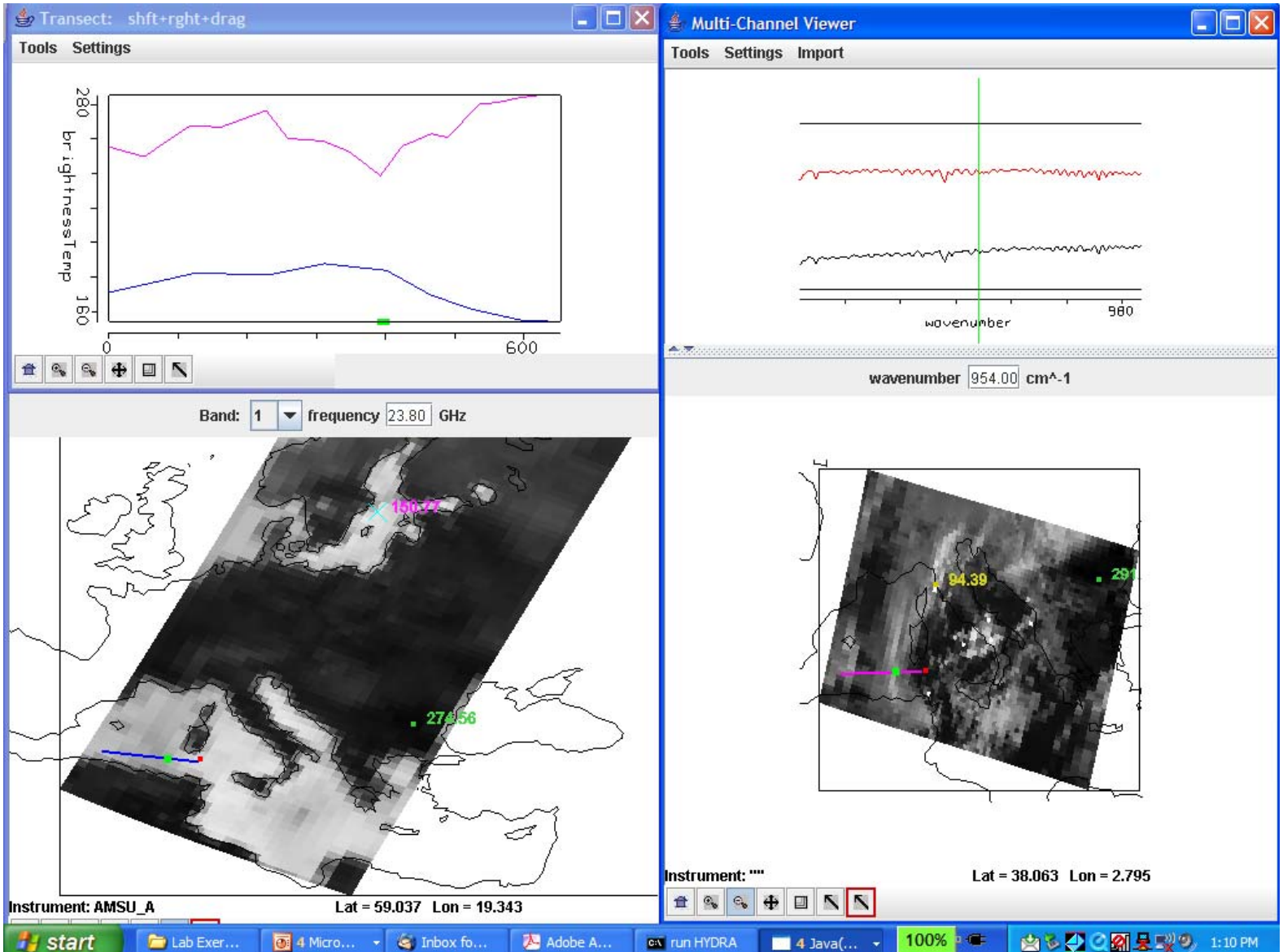
IASI data
over Mediterranean
8 March 2008

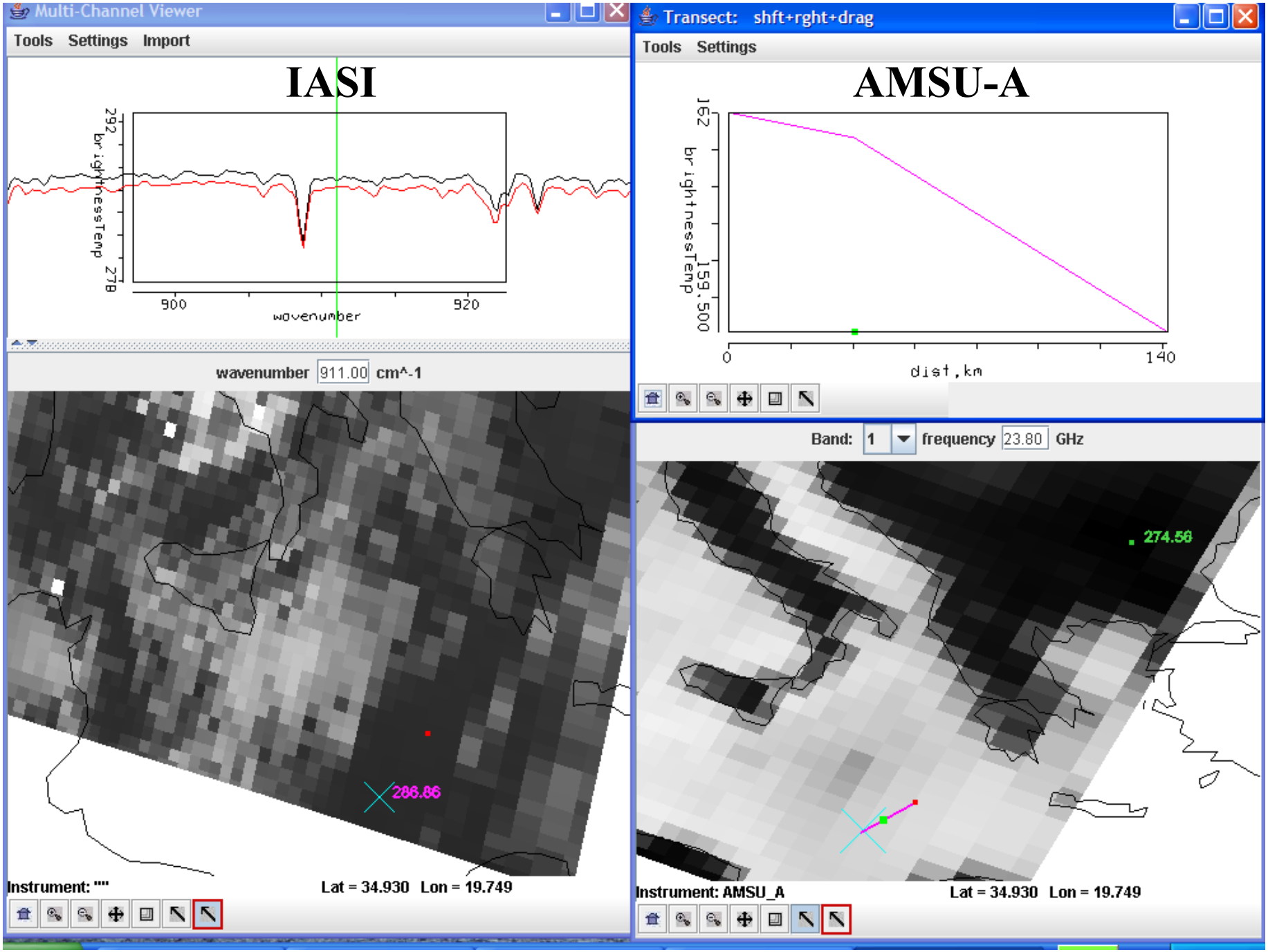




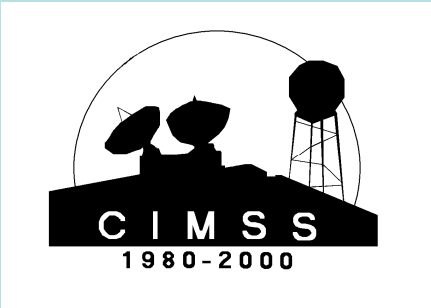
IASI (right) and AMSU-A (left)

display of BT transect for 23GHz and 940 cm-1




Multi-Channel Viewer
Tools Settings Import
IASI
292
brightnessTemp
278
900
wavenumber
920
wavenumber 911.00 cm^-1
286.86
Instrument: ""
Lat = 34.930 Lon = 19.749
Transect: shft+rght+drag
Tools Settings
AMSU-A
162
brightnessTemp
159.500
0
dist,km
140
Band: 1 frequency 23.80 GHz
274.56
Instrument: AMSU_A
Lat = 34.930 Lon = 19.749

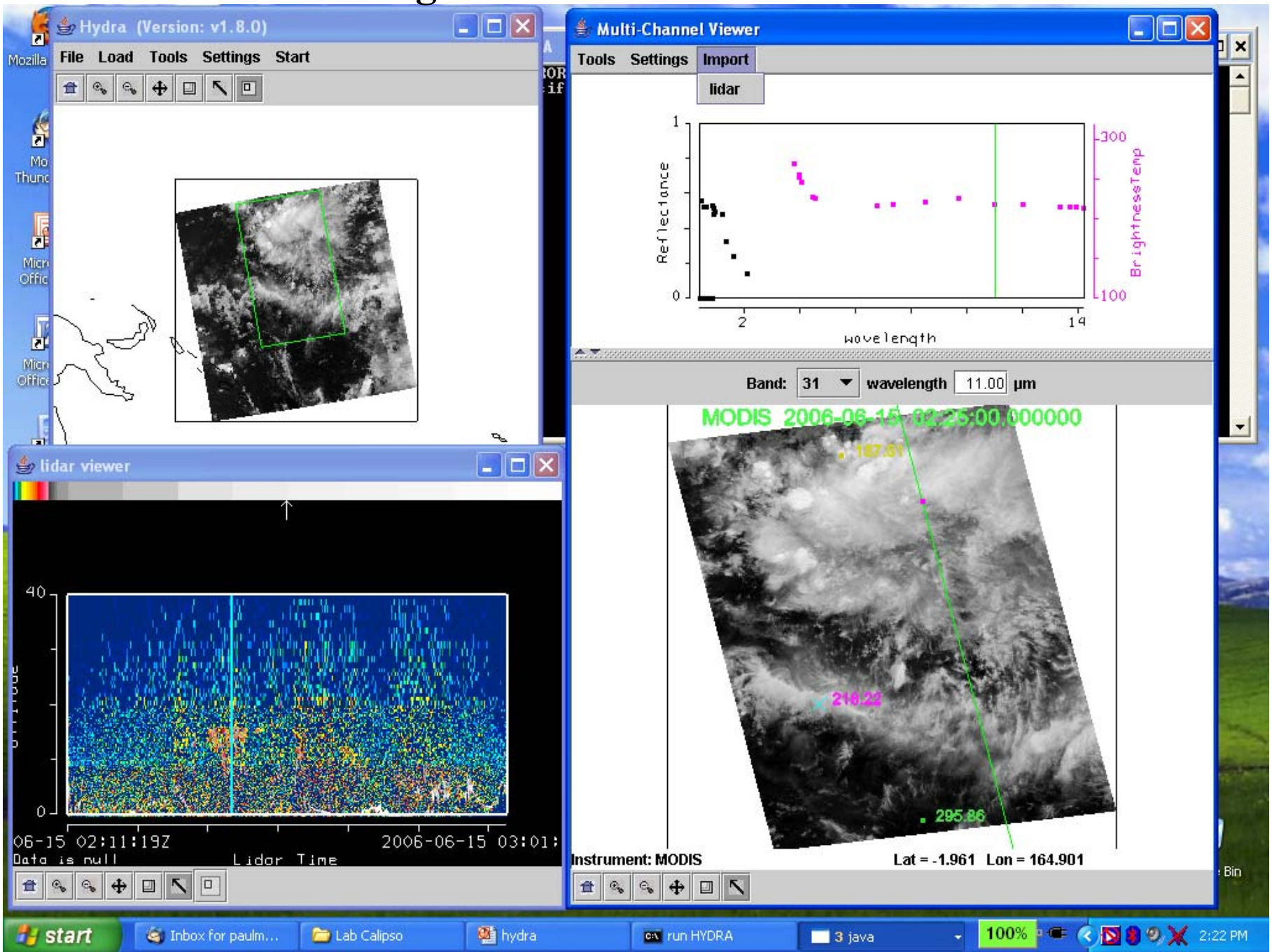
Inspecting multi-spectral and hyper-spectral data using HYDRA



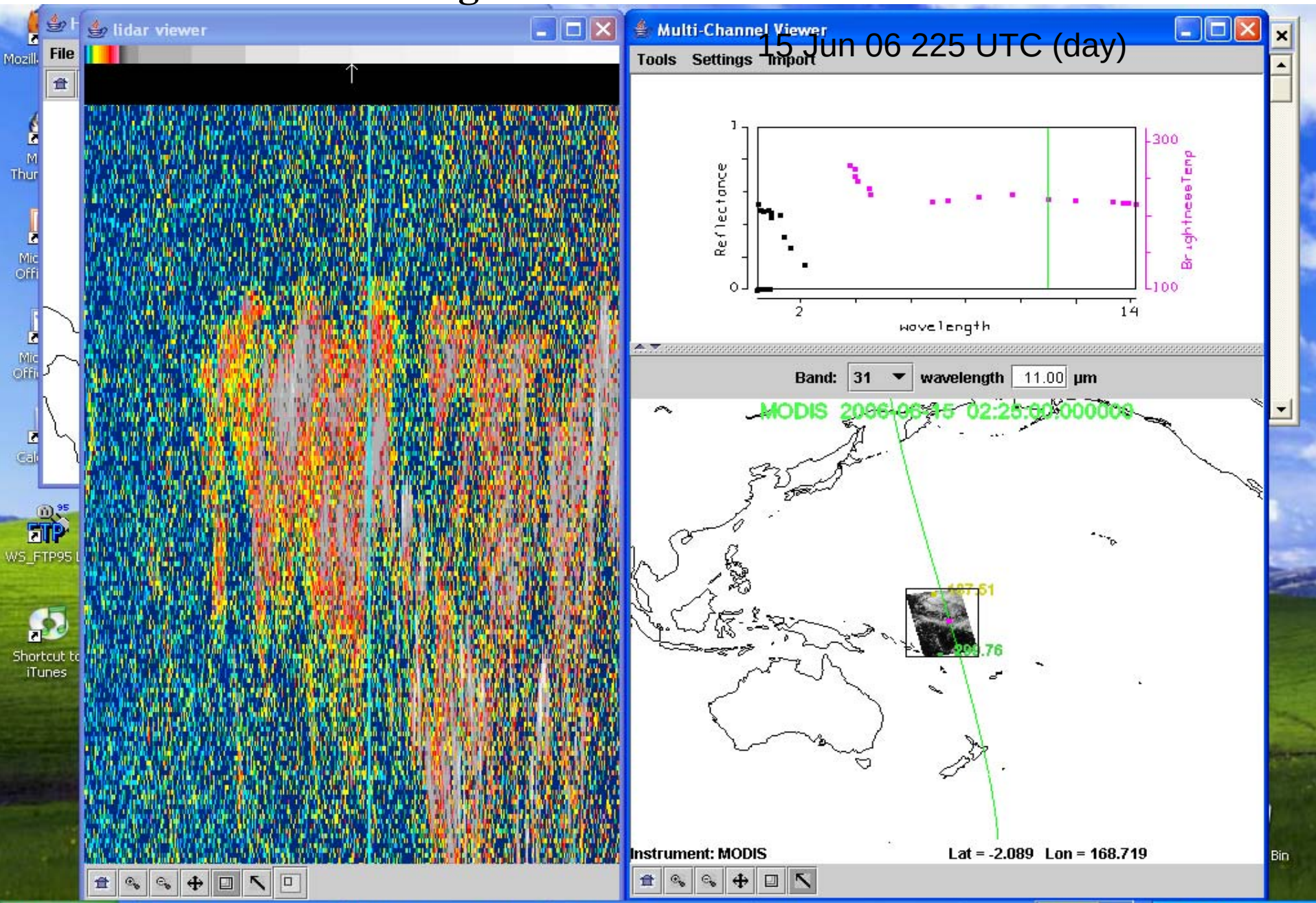
Paul Menzel
University of Wisconsin - Madison

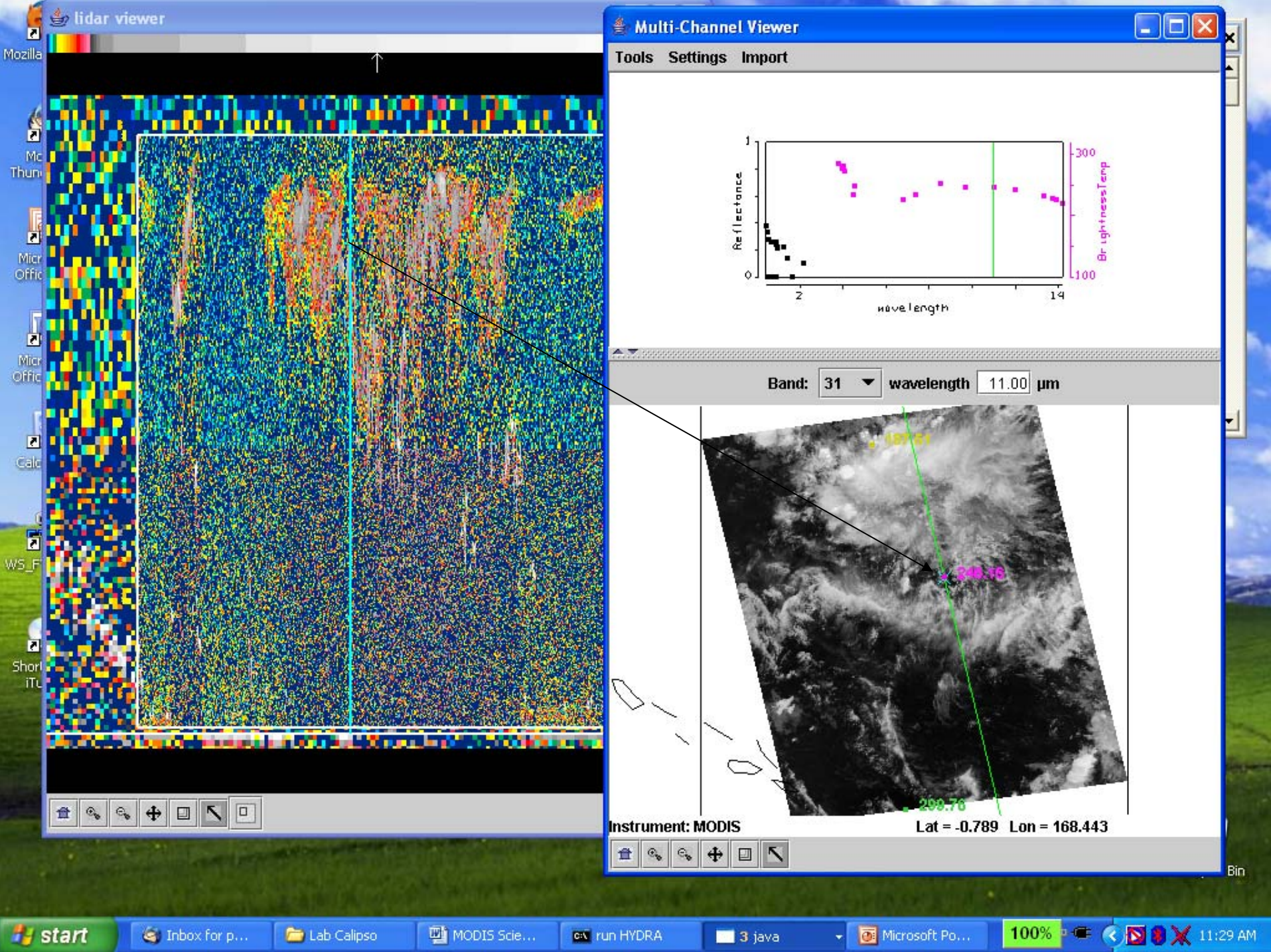
What is HYDRA?
What can it do?
→ Some examples with CALIPSO
How to get it?

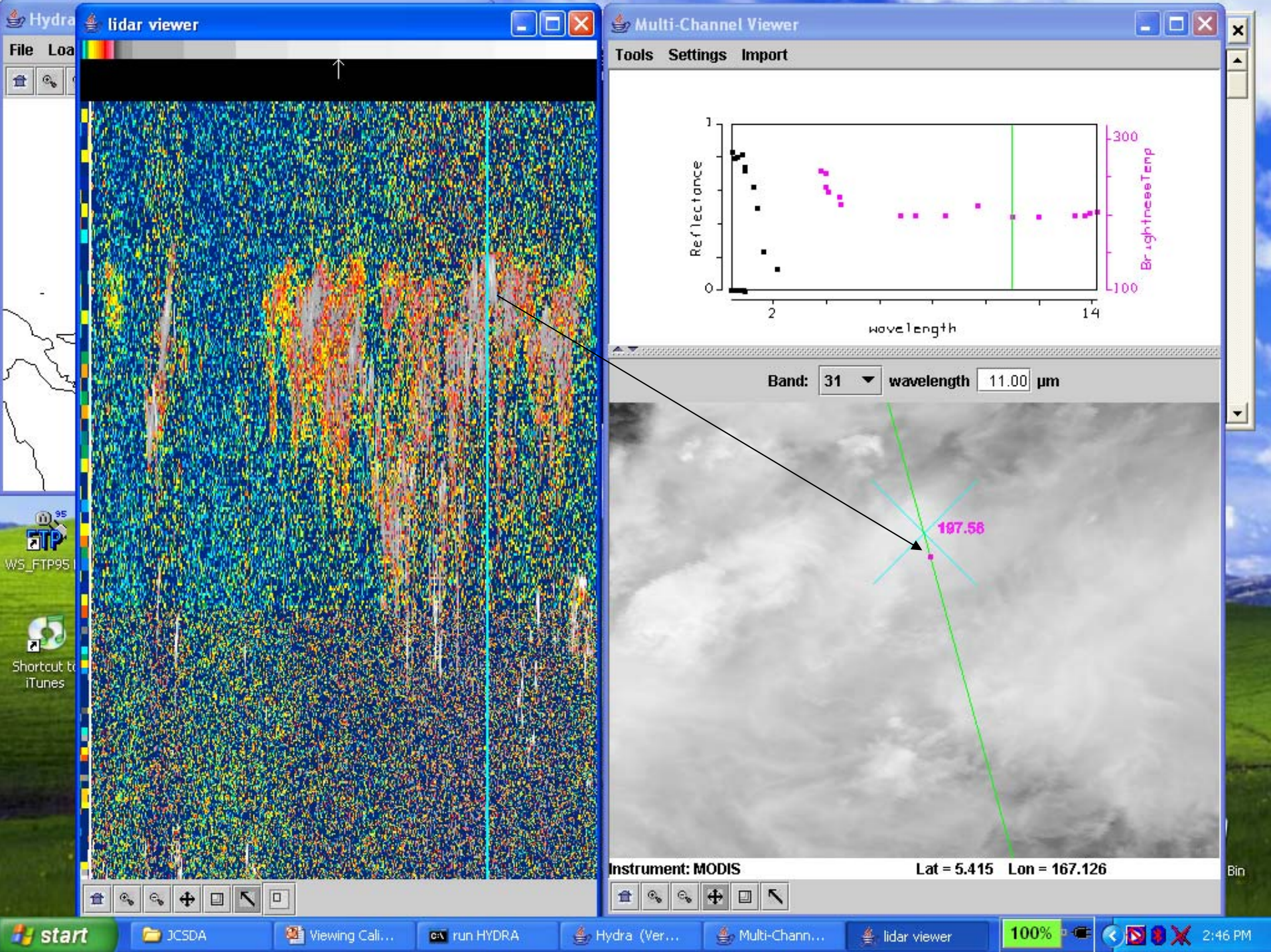
Colocating CALIOP within MODIS

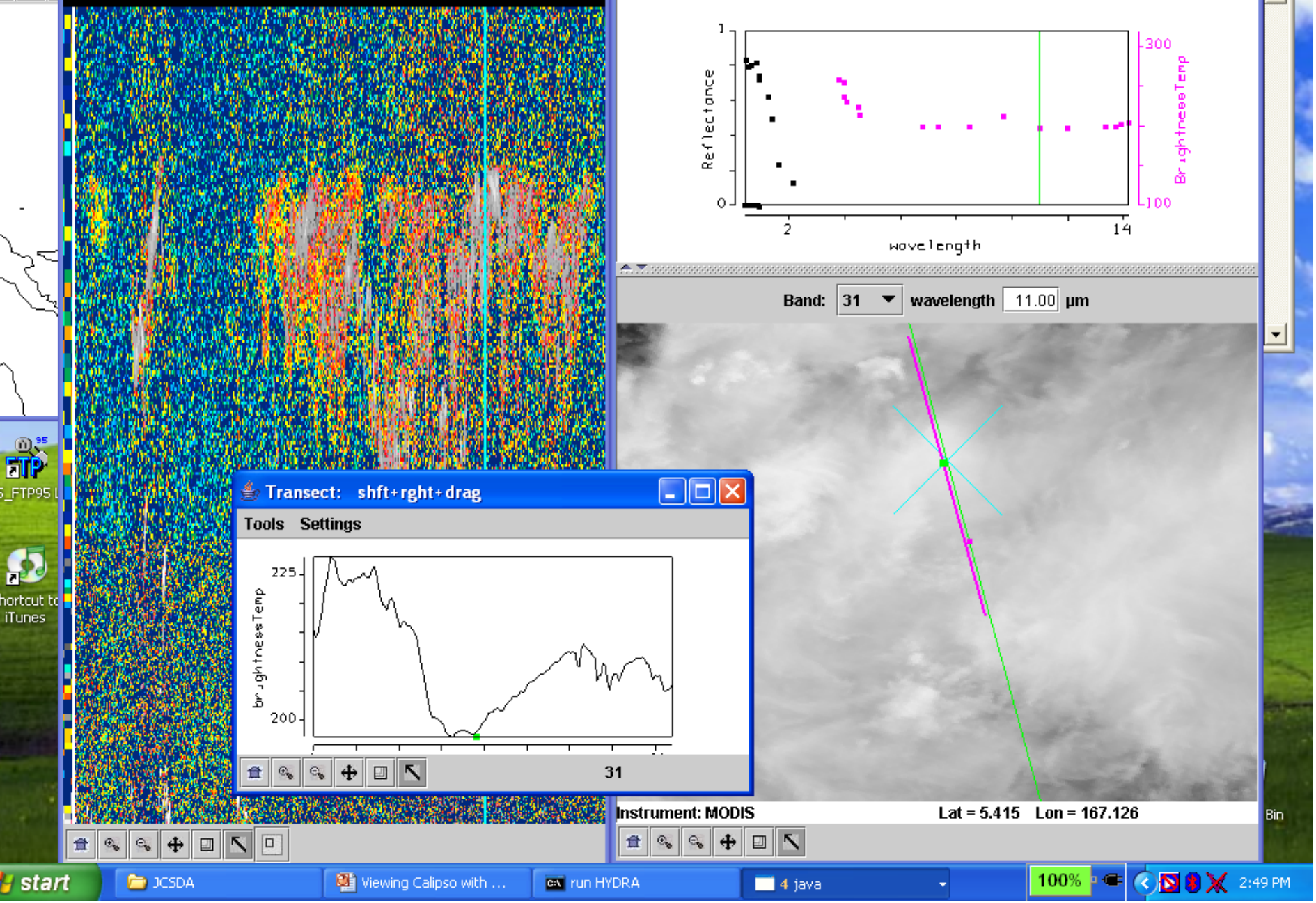


Colocating CALIOP within MODIS

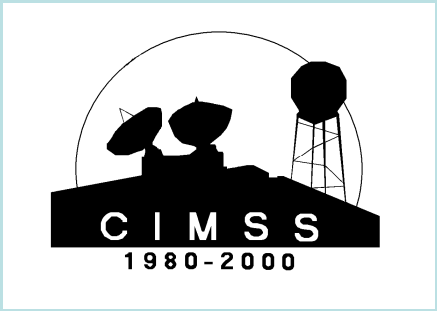



lidar viewer
Multi-Channel Viewer
Tools
Settings
Import
Reflectance
BrightnessTemp
wavelength
Band:
31
wavelength
11.00
μm
Instrument: MODIS
Lat = -0.789
Lon = 168.443
start
Inbox for p...
Lab Calipso
MODIS Scie...
run HYDRA
3 java
Microsoft Po...
100%
11:29 AM


lidar viewer
Multi-Channel Viewer
Tools
Settings
Import
Reflectance
BrightnessTemp
wavelength
Band:
31
wavelength
11.00
µm
197.56
Instrument: MODIS
Lat = 5.415
Lon = 167.126
start
JCSDA
Viewing Cali...
run HYDRA
Hydra (Ver...
Multi-Chann...
lidar viewer
100%
2:46 PM


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
start
JCSDA
Viewing Calipso with ...
run HYDRA
4 java
100%
2:49 PM

Inspecting multi-spectral and hyper-spectral data using HYDRA



Paul Menzel
University of Wisconsin - Madison

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

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

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.

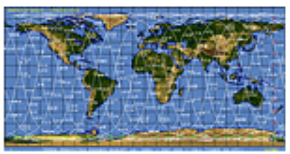
Running the HYDRA application

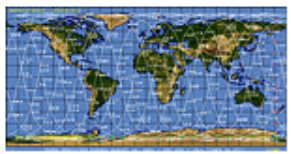
To startup the Hydra application, either click on the menu item (Windows) or type the command *runhydra.bat*. On Linux, you will likely just type in the command *runhydra*. Please see the on-line tutorial for more details.

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

00:00 UTC	03:15 UTC	06:20 UTC	09:45 UTC	12:55 UTC	16:05 UTC	19:40 UTC
						
4km	4km	4km	4km	4km	4km	4km
2km	2km	2km	2km	2km	2km	2km
1km	1km	1km	1km	1km	1km	1km
500m	500m	500m	500m	500m	500m	500m
250m	250m	250m	250m	250m	250m	250m

Goddard Earth Sciences (GES) Data and Information Services Center (DISC) - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Access data at http://daac.gsfc.nasa.gov/

Back Search Favorites

Address http://daac.gsfc.nasa.gov/ Go Links

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FIND IT @ NASA : + GO

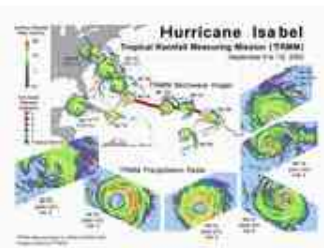
+ Advanced Search

+ ABOUT NASA | + NEWS & EVENTS | + MULTIMEDIA | + MISSIONS | + POPULAR TOPICS | + MyNASA

+ GES DISC Home

GES DISC

FEATURED IMAGE



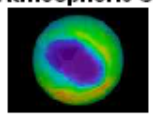
+ ABOUT US
+ DATA ACCESS
+ IMAGE GALLERY
+ SCIENCE FOCUS
+ SERVICES
+ TOOLS
+ CONTACT US
+ USER FORUM
+ TECHNOLOGY LAB
+ REFERENCES

SEARCH DISC + GO

WHAT'S HOT

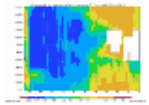
Mirador: A new and fast search and order interface
Mirador is a drastically simplified, clean interface employing Google technology for metadata keyword searches. Other features include quick response, data file hit estimator, Gazetteer, and an interactive shopping cart.
+ Start using Mirador
+ Learn more about Mirador

Atmospheric Composition DISC



This is a virtual data portal that provides convenient access to all Atmospheric Composition (AC) data sets.
+ Visit the ACDISC

Giovanni tool helps scientists analyze data online



Giovanni is a powerful online analysis tool that is helping scientists better understand Earth science data without downloading data.
+ Learn More about Giovanni

S4PM released under NASA's open source license
The Simple, Scalable, Script-based Data Science Processor for Measurements (S4PM) supports industrial strength processing.
+ Learn More about S4PM
+ Download S4PM now!

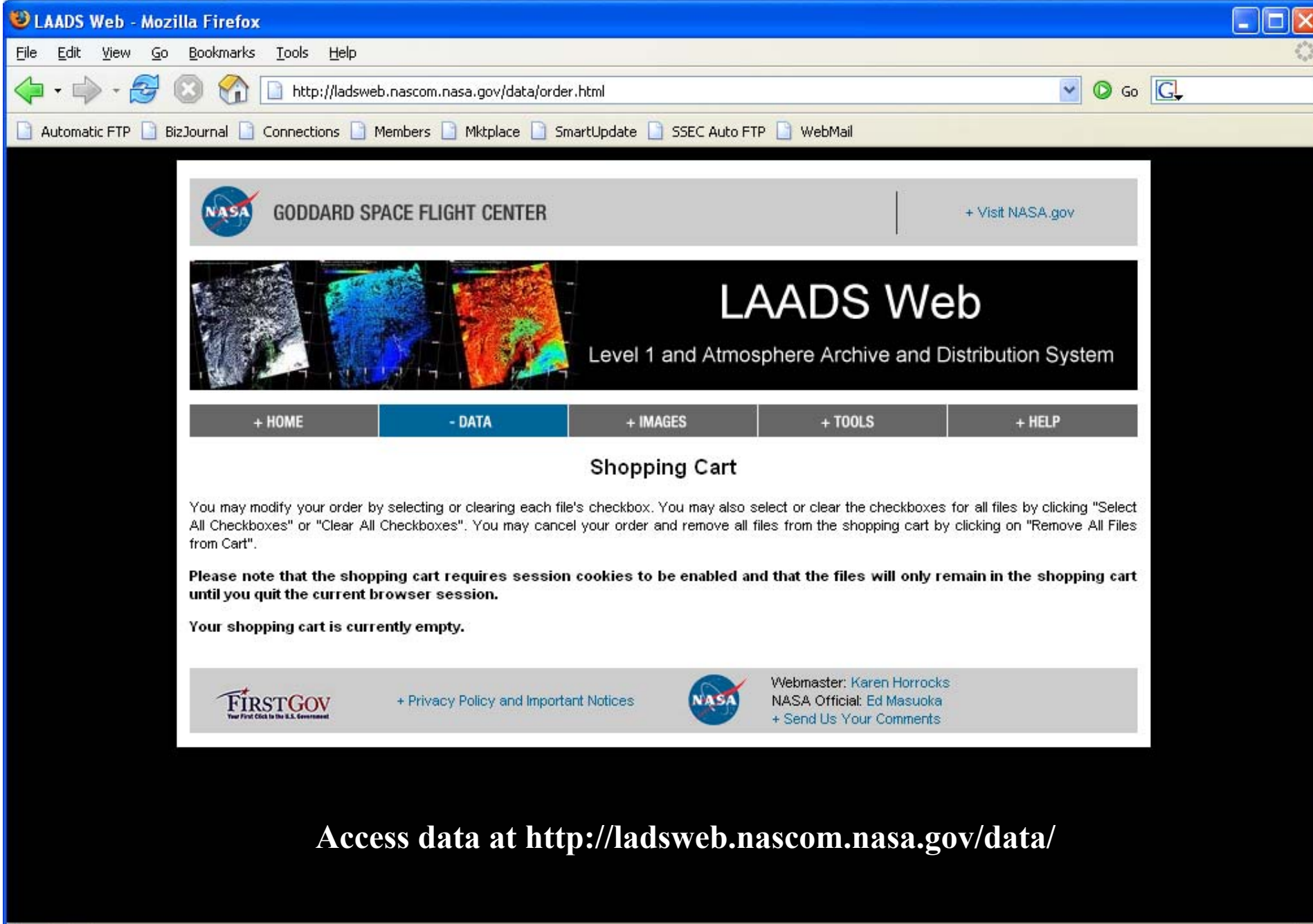
LATEST NEWS

EARTH MEASUREMENTS
+ PRECIPITATION
+ ATMOSPHERE
+ OCEANS
+ RADIANCES

RECENT MISSIONS
+ AURA
+ SORCE
+ AIRS
+ MODIS

http://daac.gsfc.nasa.gov/get_data.shtml Internet

start | Search Results | 2 Microsoft Office P... | VZAccess Manager | Goddard Earth Scienc... | 100% | 11:06 AM



Access data at http://ladsweb.nascom.nasa.gov/data/

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

For data and quick browse images
http://rapidfire.sci.gsfc.nasa/realtime

For MODIS and AIRS data orders
http://daac.gsfc.nasa.gov/

http://ladsweb.nascom.nasa.gov/data

Hydra has been part of environmental remote sensing training, education, and outreach

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)
Benevento, Italy (Jun07)