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

Developed at CIMSS by
Tom Rink
Tom Whittaker
Kevin Baggett

With guidance from
Paolo Antonelli
Liam Gumley
Paul Menzel

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

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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

\[(a \pm x / b) \pm x / (c \pm x / d)\]

**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
Linear Combination BT4 – BT11
Linear Combination BT4 – BT11
BT4 > BT11 in low clouds along coastline
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 $r_{\text{vis}}$ vs $BT_{11}$ with colors highlighting locations of pixels in plot on images.
Linear Combinations Pseudo Image of Normalized Vegetation Index \[\frac{(r_2 - r_1)}{(r_2 + r_1)}\]
MODIS level 2 cloud mask display

clear = green
probably clear (95% certain) = turquoise
uncertain = red
cloudy = white
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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
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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.
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 transfer 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 transfer 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.
Access data at http://daac.gsfc.nasa.gov/
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/

After mid Aug 2006 go to
https://ladsweb.nascom.nasa.gov/data
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)