The Next Generation of McIDAS: McIDAS-V

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What is McIDAS?

(Man computer Interactive Data Access System)

- Collection of user programs and libraries for visualizing and analyzing geophysical data (focus on environmental satellites)
  - UNIX, PC & Mac capable
- A synergistic tool that integrates numerous data types into one system
- First developed in the early 1970s
- Still in use world-wide at research, operational, educational, and commercial sites
McIDAS Functionality

• Digital Image Processing
• GIS Applications
• Weather and Climate Data Analysis and Applications
• Graphical Displays of Data & Information
• Gridded Data Processing and Analysis Tools
• Display & Process Control Utilities
• Interactive and Background Processing
Current McIDAS Users

- NOAA – NESDIS, AWC, SPC, TPC, etc.
- NASA – STS, LaRC, MSFC, JPL
- Unidata – 130 universities, colleges and international collaborators
- International – EUMETSAT, Spain, Greece, Mexico, Australia
- Industry – Honeywell, Weathernews, Universal Weather, Meteorlogix, Weather Central, etc.
Why the Change?

• Forthcoming GOES-R & NPOESS operational satellite data cannot be optimally utilized
  – great increase in data rates
  – new tools for working with these large data sets

• McIDAS software (written in Fortran 77 and C) has a 30+ year heritage resulting in limited extensibility potential

• New data analysis and visualization concepts cannot be incorporated (e.g. 4-D)
Direct Broadcast Continuous Evolution

Spacecraft and Instrument Evolution

Standardization and Increasing RF, Modulation, and Bandwidth Requirements

- **POES/DMSP/SeaStar**
  - L-Band, S-Band
  - 665 - 2 Mbps
  - BPSK

- **Terra**
  - X-Band
  - 13.1 Mbps
  - Convolutional
  - UOQPSK
  - NRZ-M

- **Aqua**
  - X-Band
  - 15 Mbps
  - OQPSK
  - NRZ-M

- **NPP**
  - X-Band
  - 15 Mbps
  - Convolutional
  - QPSK
  - NRZ-M
  - Compression

- **NPOESS**
  - X-Band, L-Band
  - 20 Mbps/3.8 Mbps
  - Convolutional
  - QPSK
  - NRZ-M
  - Compression

- **SSM/I, SSMIS**
  - AVHRR
  - SeaWiFS
  - OLS
  - HIRS

- **SSM/T, SSM/T-2**

- **MIS**
  - CMIS
  - VIIRS
  - CrIS
  - CrIS
  - ATMS
  - OMPS
  - OMPS
Hyperspectral Altitude-Resolved Water Vapor Winds

Simulated GOES-R winds (left) versus current GOES (right)
McIDAS-V: Looking to the Future

We seek to advance the functionality of McIDAS to meet the challenges of the future while retaining its current capabilities, including user-developed code.

We are developing a means to transition existing McIDAS applications to operate in a new environment that supports the next generation of observing systems and does not have the limitations of the current McIDAS system.
What is McIDAS-V?

McIDAS-X ➔ VisAD + IDV + HYDRA = McIDAS-V
VisAD
Developer: Bill Hibbard, UW SSEC

- Open-source, Java library for building interactive and collaborative visualization and analysis tools

**Features include:**
- Powerful mathematical data model that embraces virtually any numerical data set
- General display model that supports 2- and 3-D displays, multiple data views, direct manipulation
- Adapters for multiple data formats (netCDF, HDF-5, FITS, HDF-EOS, McIDAS, Vis5D, etc.) and access to remote data servers through HTTP, FTP, DODS/OpenDAP, and OpenADDE protocols
- Metadata can be integrated into each data object
What is the IDV?

- Unidata developed, VisAD-based, scientific analysis and visualization library and toolkit
- Open Source, Java™ framework and reference application
- Provides 2- and 3-D displays of geo-scientific data (plus, of course, animations)
- Stand-alone or networked application

http://www.unidata.ucar.edu/idv
HYDRA (Hyperspectral Data Research Application) enables interrogation of multispectral and hyperspectral fields of data

- Individual pixel location and spectral band measurements can be easily displayed
- Spectral channels can be combined in linear functions and the resulting images displayed
- False color images can be constructed from multiple channel combinations
- Scatter plots of spectral channel combinations can be viewed
- Pixels in images can be found in scatter plots and vice versa
- Transects of measurements can be displayed
- L2 products; e.g. soundings of temperature and moisture as well as spectra from selected pixels can be compared
- Integrated data exploration and analysis between GEO and POLAR observing platforms
Mt Etna viewed by AIRS
28 Oct 2002

SO2 signal 1284-1345 cm⁻¹
The “X to V” Bridge

- Interacts with a McIDAS-X remote session
- Users provides command line input in a McIDAS-V Data Chooser that sends commands to a server running McIDAS-X
- Runs all McIDAS-X commands, including status, text, imagery and graphics
  - McIDAS-X output displayed in McIDAS-V
- Allows bi-directional interactive communication between McIDAS-V and McIDAS-X
The “X to V” Bridge
McIDAS-V Transition Plan

• Build upon the existing capabilities of VisAD/IDV
• Incorporate the functionality of the Hyperspectral Data for Research Analysis (HYDRA) toolkit
• Allows McIDAS-X heritage code to be usable in the new environment without a need to rewrite
  – ‘Bridge’ software allows McIDAS-X commands to be submitted from the McIDAS-V display
• Provides a new environment for developing algorithms and new visualizations that take advantage of multi and hyper-spectral data from emerging observing systems
McIDAS-V is a collection of software tools, and networked services and data designed to take advantage of a scalable distributed computing environment to meet user needs.
McIDAS-V Future Work

• Complete HYDRA integration
• Complete development of the ‘X to V Bridge’ to provide an evolutionary path for MUG into McIDAS-V (October 2007)
  – Beta 1.0 release set for September 2008
• Support the development of applications for the NPP/NPOESS and GOES R science teams (ongoing)
  – Data management and accessibility
  – Broad array of formats and services
  – Advanced analysis and visualization tools
The Web Site

http://www.ssec.wisc.edu/mcidas
McIDAS-V: A Small Demonstration

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McIDAS-V main windows
Extra attributes

• On-line help
  - Context sensitive
  - Examples

• Many types of data readers
  - Point (in situ)
  - Grids
  - Images

• Supported file formats
  - NetCDF, AREA, ADDE Point, HDF5, etc.
  - ....but what is in the file?

• User Preferences
  - Look and feel choices

• Server manager
  - ADDE servers – local and remote
Display some satellite images
Fun with grids.....
Make isosurfaces of relative humidity > 90%

Color code by temperature in the range -4°C to +10°C

Shows aircraft icing potential
Hyper-spectral analysis
Your own formulae

```python
>>> a = selector(1000, Color.red)
>>> b = selector(1305, Color.green)
>>> c = 3*a - 5*b
>>> combine(c)
```
Some IASI Data
Making “case studies” -- bundles
Displaying local HRIT data
Using Local ADDE Servers
Where to get McIDAS-V

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