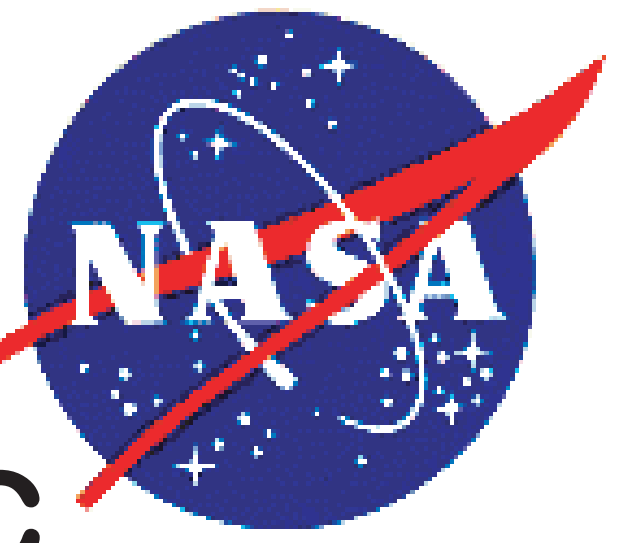




# A Virtual Observatory for the ITM Community



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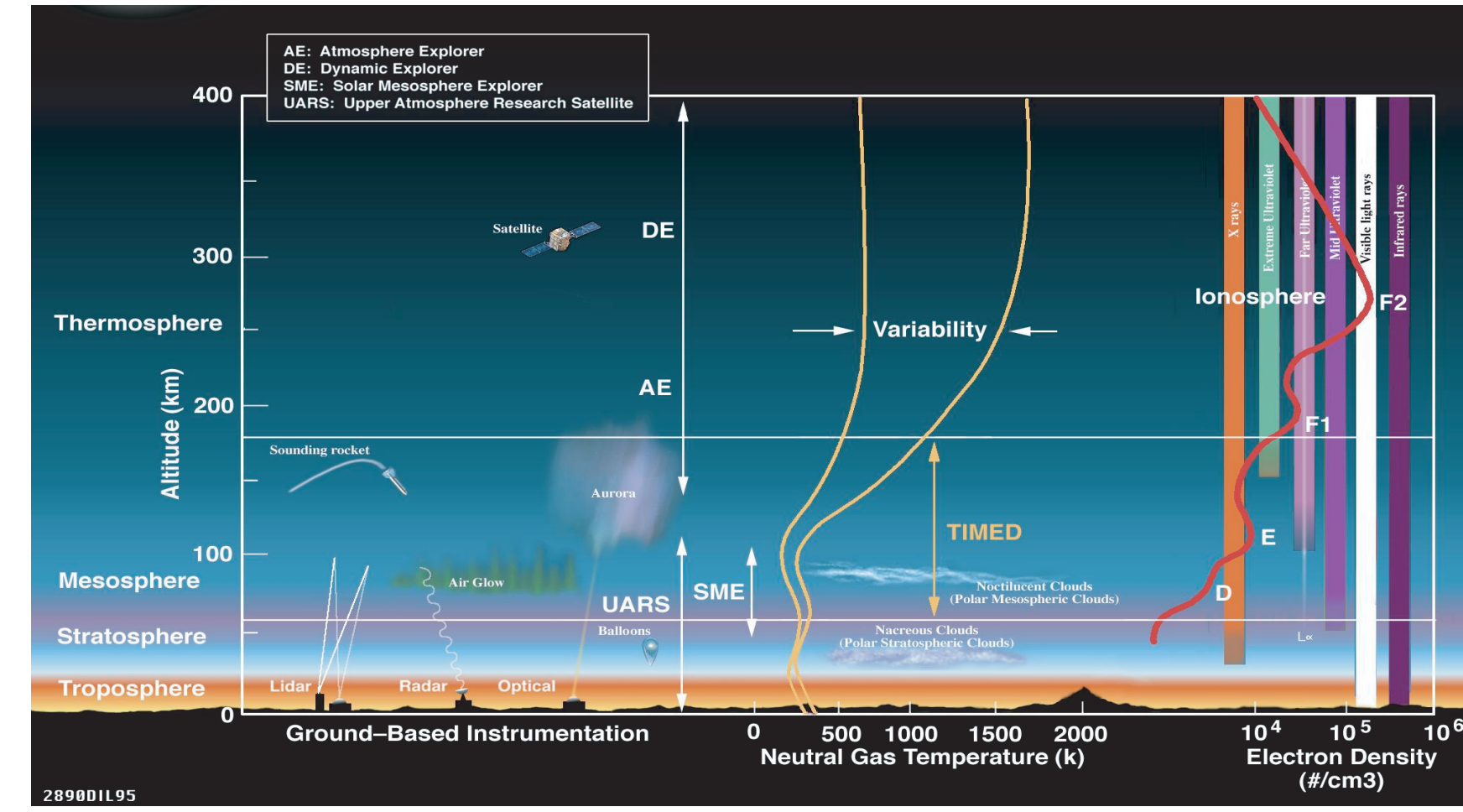
<sup>2</sup>NASA/GSFC

## ITM Domain

**ITM Science Domain**  
The ionosphere, thermosphere and mesosphere (ITM)  
- A transition region diverse in observables and disciplines  
- Need for data from geospace environment as well as lower atmosphere; relevant to future studies of middle-lower atmosphere and magnetosphere-ionosphere coupling

**ITM Science Data Domain**  
- Legacy and current ground-based and space-borne missions  
- Significantly available data; however, different formats not always transparently accessible.  
- Heterogeneous heritage of data and models  
- ITM is a heterogeneous data community with diverse file formats and granularity of observables  
- Need to integrate the complex data/model environment for upcoming ITM science.  
- Ground/space, in-situ/remote, outside ITM inputs, observations / models / assimilations  
- Ready access to all relevant data/simulations is required for efficient research.

**ITM Science Community Needs**  
- Discovery of Data  
- Provide efficient discovery and access to comprehensive and historical data & models  
- Easy Browsing - more than data query, enhanced by use of meta-data  
- Delivery of / access to readers, and other tools / new services  
- ITM is a heterogeneous data community with diverse file formats and granularity of observables  
- Access to distributed science expertise  
- Integrated view of distributed community resources of data & models and services  
- Data providers have an integral role to provide data access, description, and meta-data  
- Coordinate with other VOs and data systems of major ITM players (NASA, NSF, NOAA, DoD, International)  
- Open access to data and model simulations  
- Robust cost-efficient system that evolves to meet changing user needs.



## Principles

- VO Principles:**
- Facilitate cross-discipline, cross-platform, cross-instrument studies to increase science effectiveness.
  - Data sources include ground and space-based instruments as well as modeling and data assimilation.
  - Use existing technologies and standards where feasible.
  - Leverage existing data and service providers.
  - Have community involvement from development through implementation.
  - Open data policy for both model simulations and data.
  - Enabling framework for more and more useful data – legacy and future
  - Enabling framework for modular & evolving capabilities

## VO Paradigm

**Virtual Observatory (VO) - Vision of a future ITM data environment**  
- Where data, models and services can be highly distributed  
- While end users see an integrated view  
- Where all potentially-useful data and model simulations are readily findable, accessible, useable  
- With appropriate services across mission-instrument boundaries

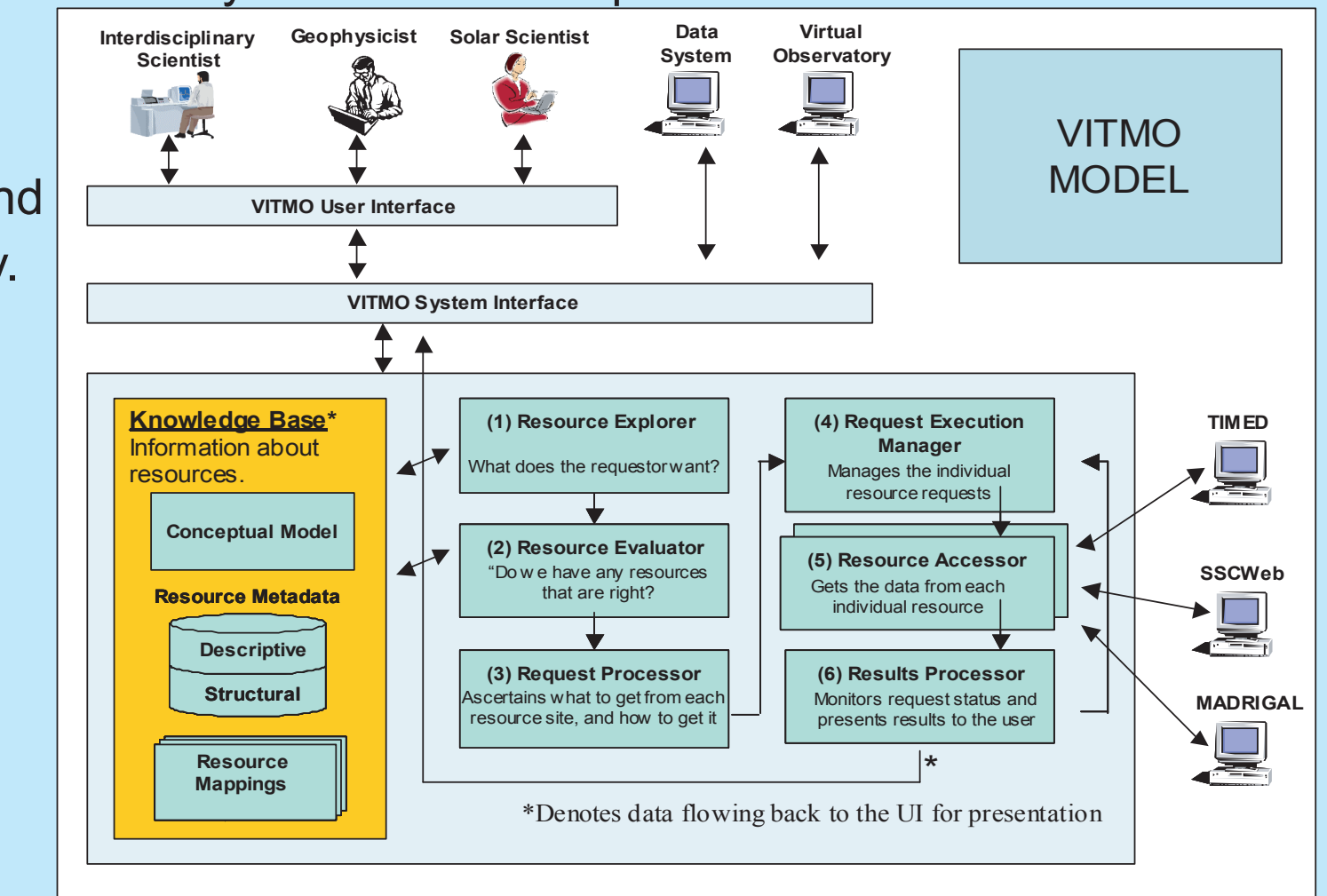
### VO Model

**Characteristics:**  
- Functions as a broker for data search, discovery and delivery between these users and data resources.  
- Provides users with a user-friendly interface to simultaneously search the multiple distributed data sources of the ITM community.

- Provides efficient and easy access to all existing and future ITM data regardless of file type or granularity.  
- Routes data delivery from the source directly to the user and not through VIO.  
- Relies upon industry-standard protocols; e.g. TCP/IP, http, XML, SOAP, Web Services.

### Extensions to the VO model:

- Support for browsing data characteristics  
- Ready access to data display services

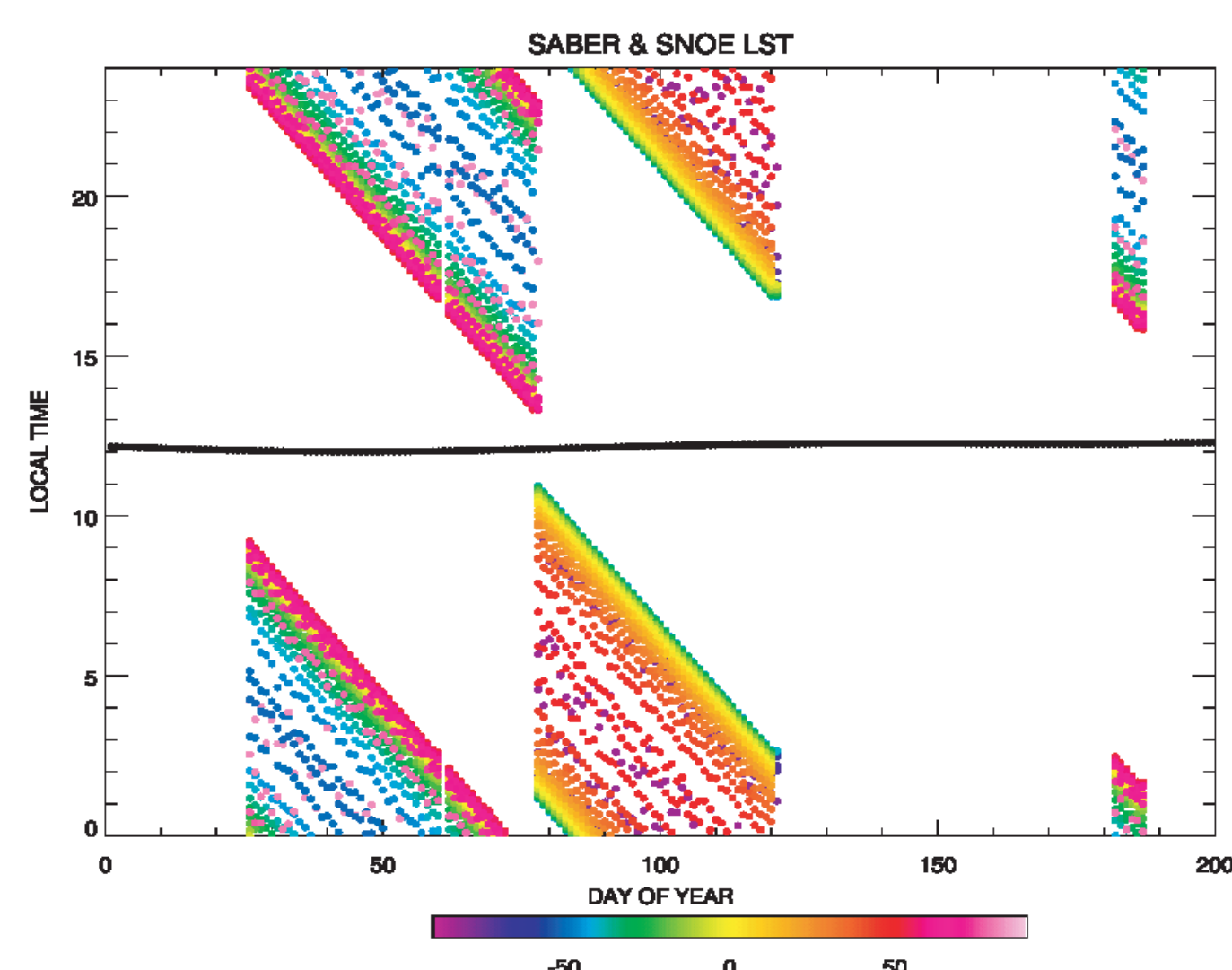


## Data and Services customized to users needs:

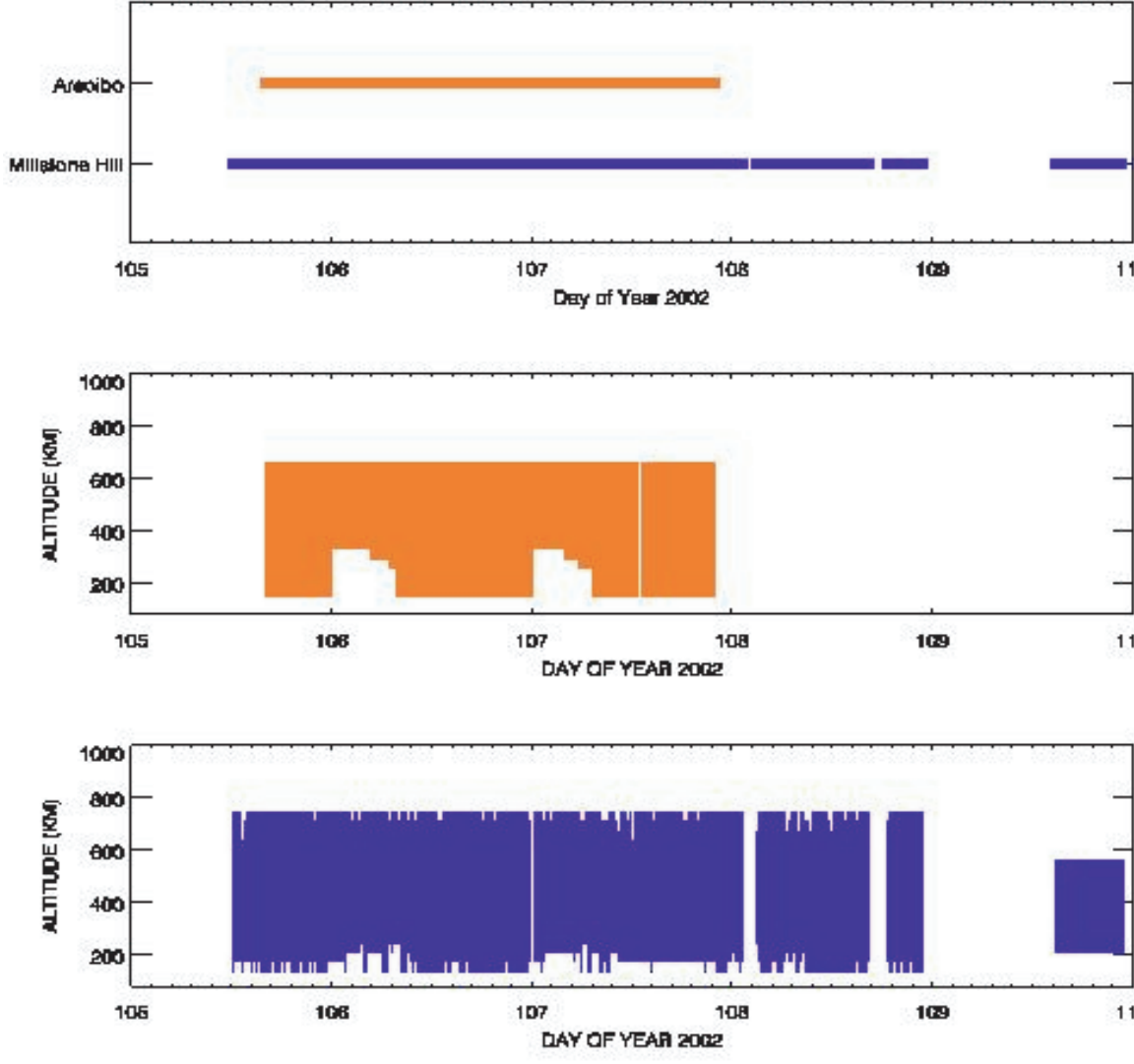
- **Inquiring user** - Starts with step 1.  
Starts by learning which time periods, parameters, altitudes, etc., are of use.
- **Informed user** - Starts at step 2.  
Is aware of the data or desired parameters so begins with data query.
- **Focused user** - Relies upon step 5.  
The focused user wishes to askask for detailed queries. They may ask for coincidences between different satellites, ground-based sites, and geophysical conditions. They will use detailed querying capabilities provided by many sites, with the results integrated by the VITMO.

## Browsing Data Characteristics

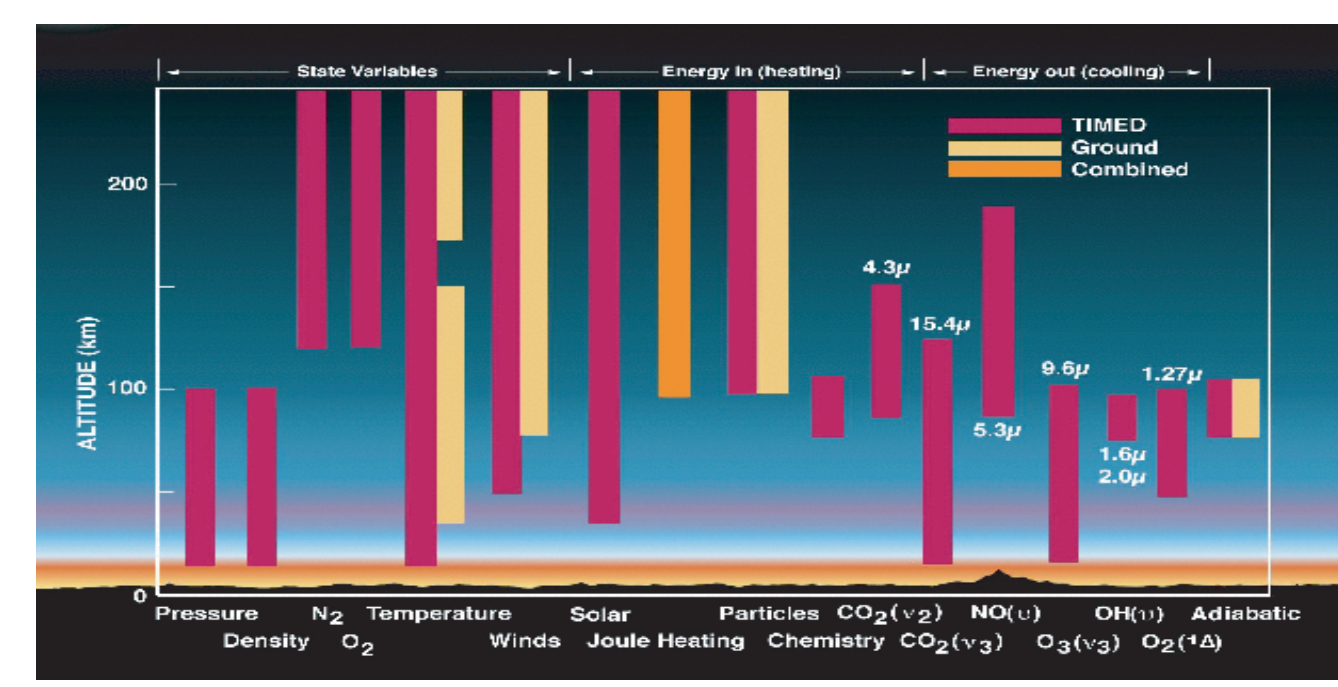
Often before data query can occur, it is necessary to first plan what information would be useful to study. Views to support this might be as simple as plots of the characteristics of one or more data sources or as complex as computations and maps of the coincidence between two instruments' fields of observation.



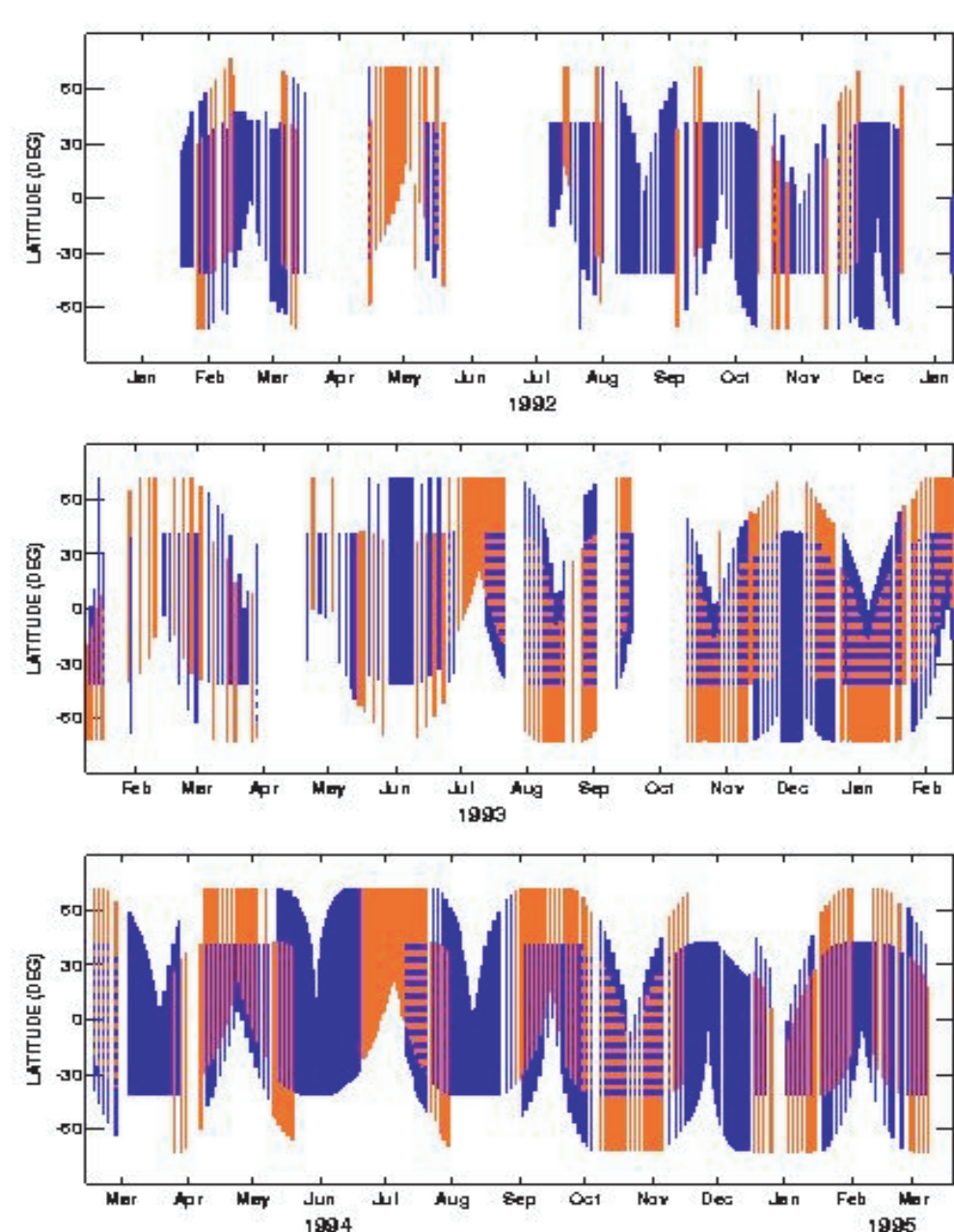
TIMED/SABER and SNOE coverage in local time vs. time



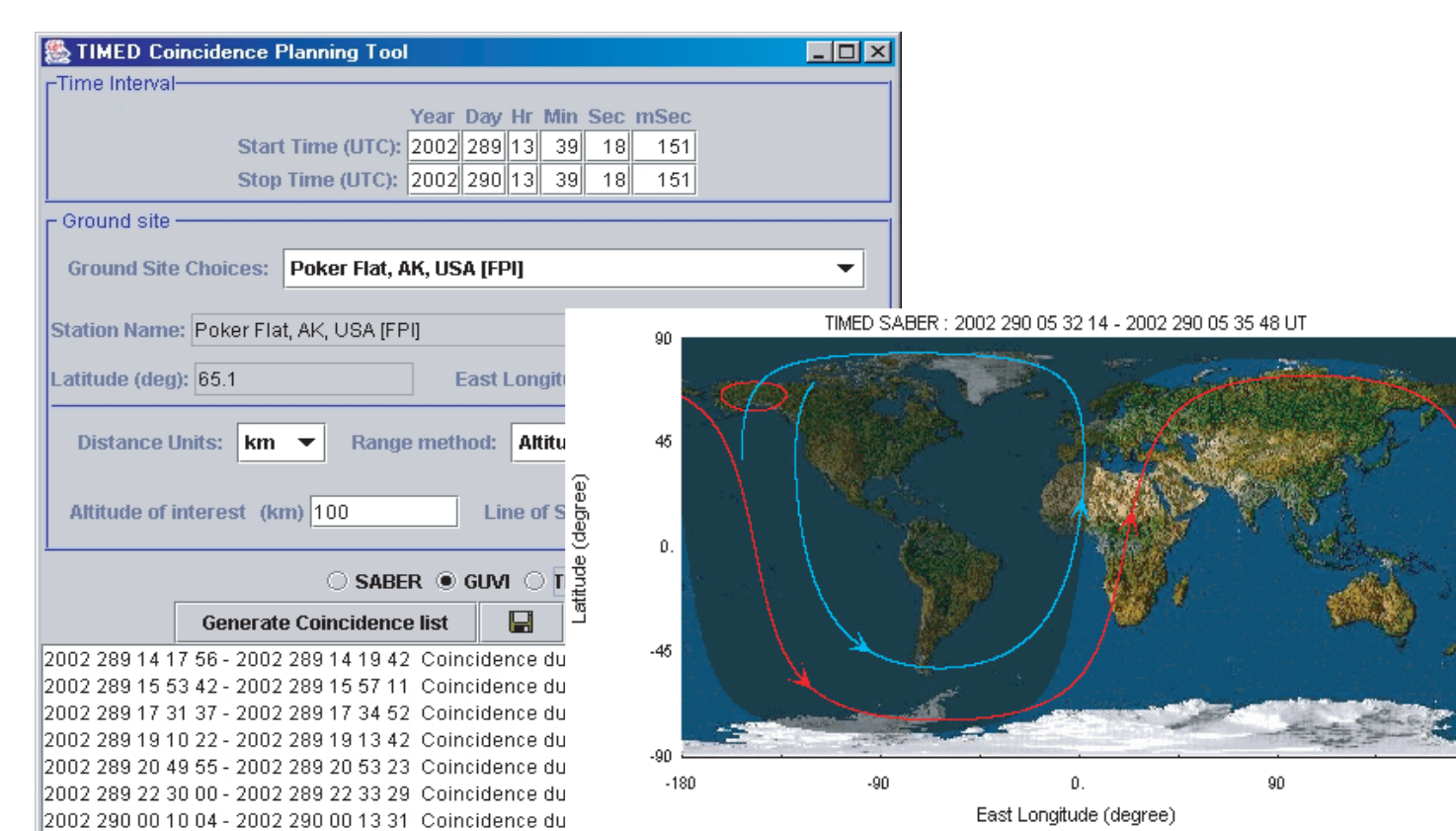
Altitude vs. coverage time for ISRs



Altitude vs. TIMED & GBI sensor parameters

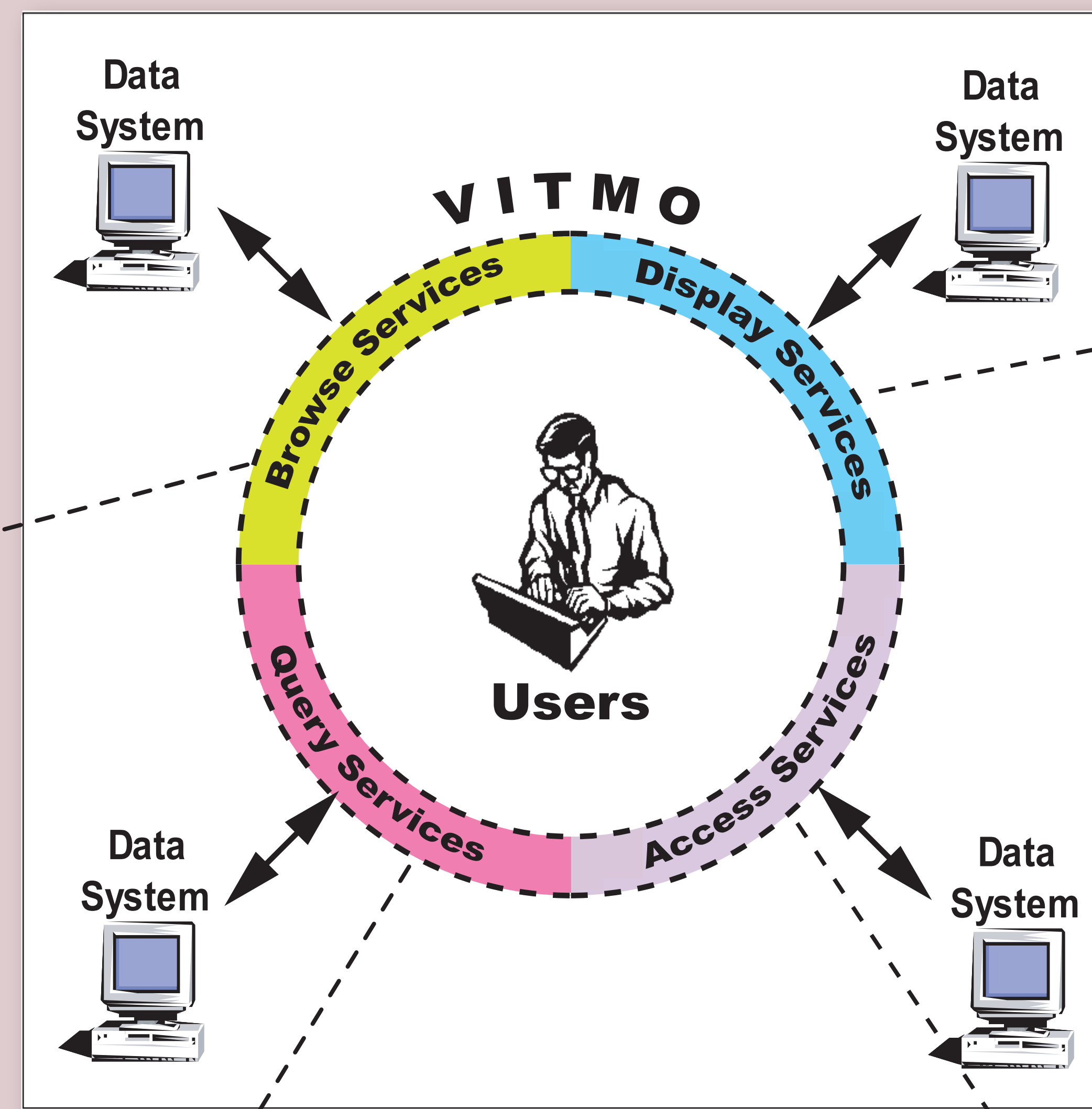


UARS sensor coverage over latitude vs. time



Coincidences of TIMED/GUVI coverage and Poker Flat FPI

# The VITMO Prototype Integration of Data Services



- Integrate results of queries from multiple systems
- Retrieve data without the data flowing through the VITMO
- Format conversion
- Integrated display/plotting of data from multiple sources

## Data Query

In a widget-based interface through a browser, or an API, the user selects and answers criteria that qualify the data of interest. These specifications are then passed to the Query Construction Engine which determines all applicable Data Providers and sends them a translated query that is specific for each provider.

## NSSDC/SECIA Access to Data and Information

## Data Delivery

Requested data is sent directly from the data provider to the user via Internet protocols (ftp, http, etc.), not through the VIO. Additionally, read routines and other software (listing or plotting programs) can be delivered along with the data.

## Query Results

The Query Results Engine assembles the responses returned from the Data Providers into a single uniform list of choices from which the user makes selections for downloading to their system.

The results of your query are:

Row Number	Product Name	Data Start Time	Data End Time	URL
1	Sondrestrom Michelson Interferometer OH temperature	1997 268 00:47:00	2002 093 06:17:59	http://cedarweb.hao...
2	Laconson Is. Tidal Harmonic Fits	2002 001 00:00:00	2002 117 23:59:59	http://sisko.colorado...
3	Mauna Kea Tidal Harmonic Fits	2002 001 00:00:00	2002 117 23:59:59	http://sisko.colorado...
4	Rarotonga Tidal Harmonic Fits	2002 174 23:59:59	2002 174 23:59:59	http://sisko.colorado...
5	Saskatoon Tidal Harmonic Fits	2002 001 00:00:00	2002 235 23:59:59	http://sisko.colorado...
6	Poker Flat Tidal Harmonic Fits	2002 001 00:00:00	2002 127 23:59:59	http://sisko.colorado...
7	Obninsk Tidal Harmonic Fits	2002 001 00:00:00	2002 161 23:59:59	http://sisko.colorado...
8	Rarotonga Tidal H...			
9	Rothera Tidal H...			
10	Fort Yukon noct...			
11	Poker Flat all...			
12	CSI LIDAR			
13	TIDI RAW LOG	2002 090 00:01:00	2002 091 00:09:51	ftp://fidi02.engin.um...

VIO information and user feedback is to be available at <http://www.vioconcept.jhuapl.edu>

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