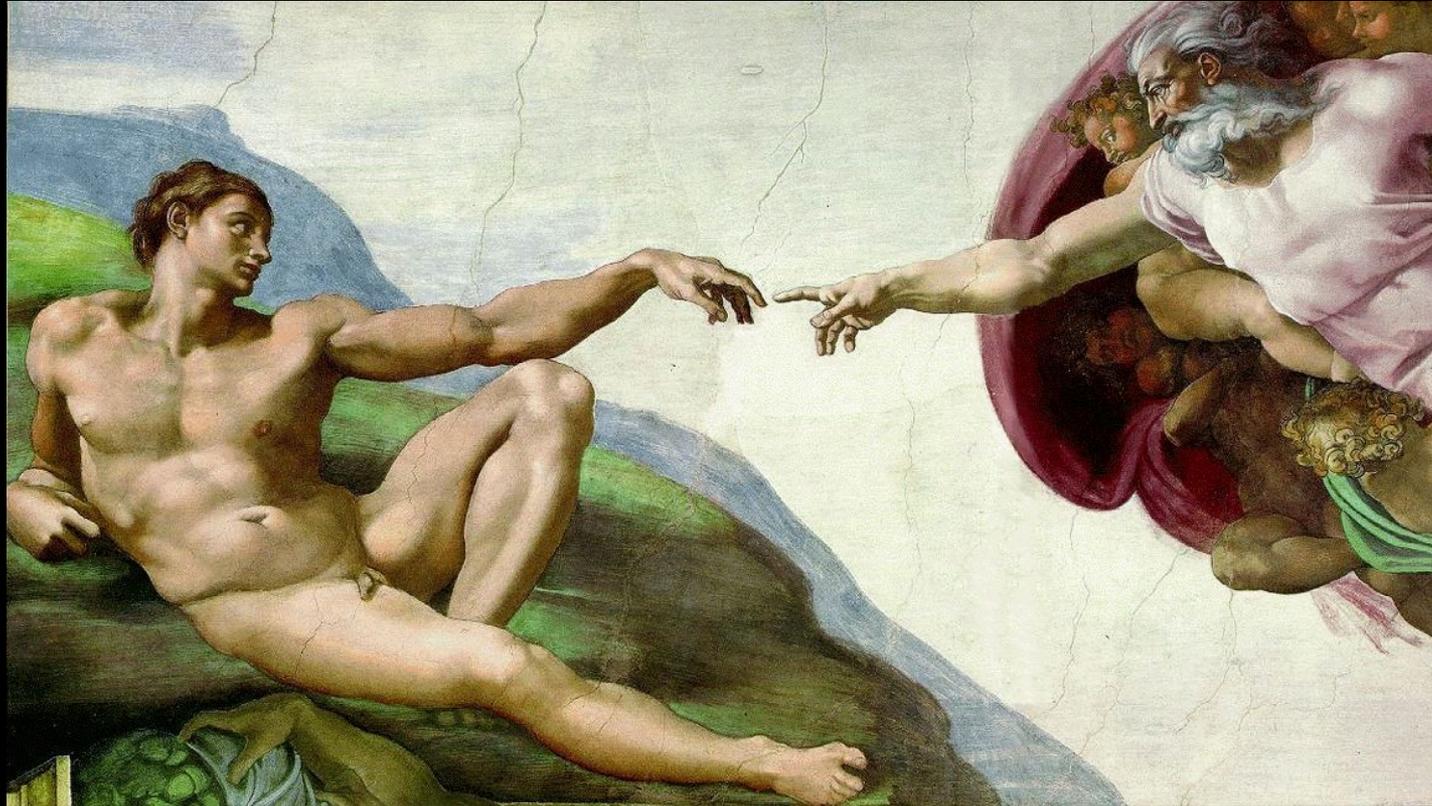


# A Plague of Too Much Data? Challenges and Opportunities for Using Authentic Data in the Classroom

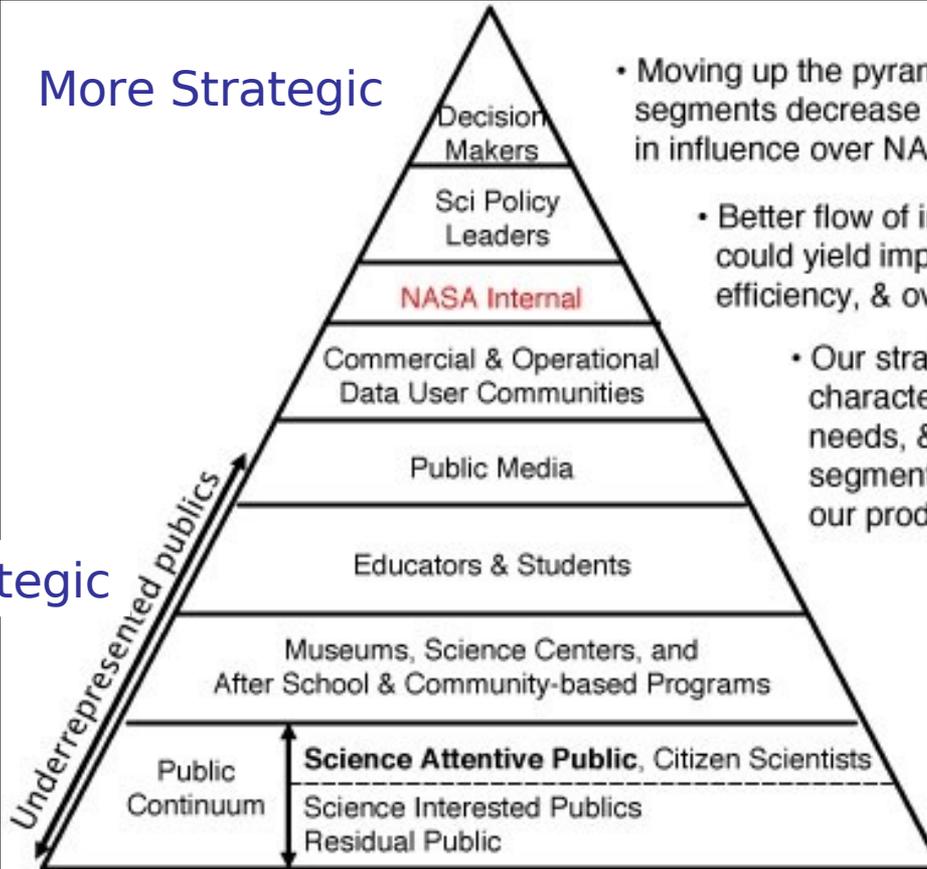


*Emily CoBabe-Ammann*

*Laboratory for Atmospheric and Space Physics, University of Colorado*

# Data has Lots of Audiences

More Strategic



- Moving up the pyramid, these audience segments decrease in size while increasing in influence over NASA's budget & agenda.
- Better flow of information within NASA could yield improved synergy, efficiency, & overall effectiveness.
- Our strategy should be to characterize the information wants, needs, & expectations of each segment of the public, & then tailor our products/programs accordingly.

- The 'science attentive' public considers itself knowledgeable & willing to participate in policy-relevant discussions. Thus, this is a particularly beneficial audience to target.

From "Why EPO?", a NASA internal report on science education, 2005

# Why is Data Important in Science Education?

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Data is a critical component for understanding how science works. With it, we can:

- o Design and conduct scientific investigations
- o Understand the quality of data and the role of uncertainty in results
- o Focus on quantitative analysis and reasoning
- o Explore tools for visual representation

Virtual Observatories provide new mechanisms for collecting, manipulating, and aggregating data. They also provide the opportunity for new kinds of student experiences.



# Creating the “Real World” Experience

Data can be used to highlight the complexity of natural systems and the importance of an interdisciplinary approach to the natural world.

- o Allows students to explore scenarios where they have to make real decisions regarding and using data.
- o Given an appropriate level of structure and guidance, virtual observatories can be explored by the student in a way that promotes discovery-based learning.

## Connecting a student from their backyard to the world



# Important Things to Know About Teachers

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- 1) The life of a teacher is one of limited time and high expectations. They have very little time to teach anything outside the standards, but almost all data can support those content goals.
- 2) Teachers are not scientists nor necessarily computer savvy.
  - \* Complex user interfaces can be a major barrier for utilization.
  - \* Offering visualization tools can be a good thing.

What are they looking for? **DATA STORIES!!!**  
Prepackaged, refined data that addresses some specific aspect of the science they need to teach

# Levels of Support from Science Institutes

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- *Provides educational support for the subject, but not necessarily access to 'live' data*
- *Access to 'live' data that is already packaged*
- *Access to 'live' data, using tools especially developed for general audiences*



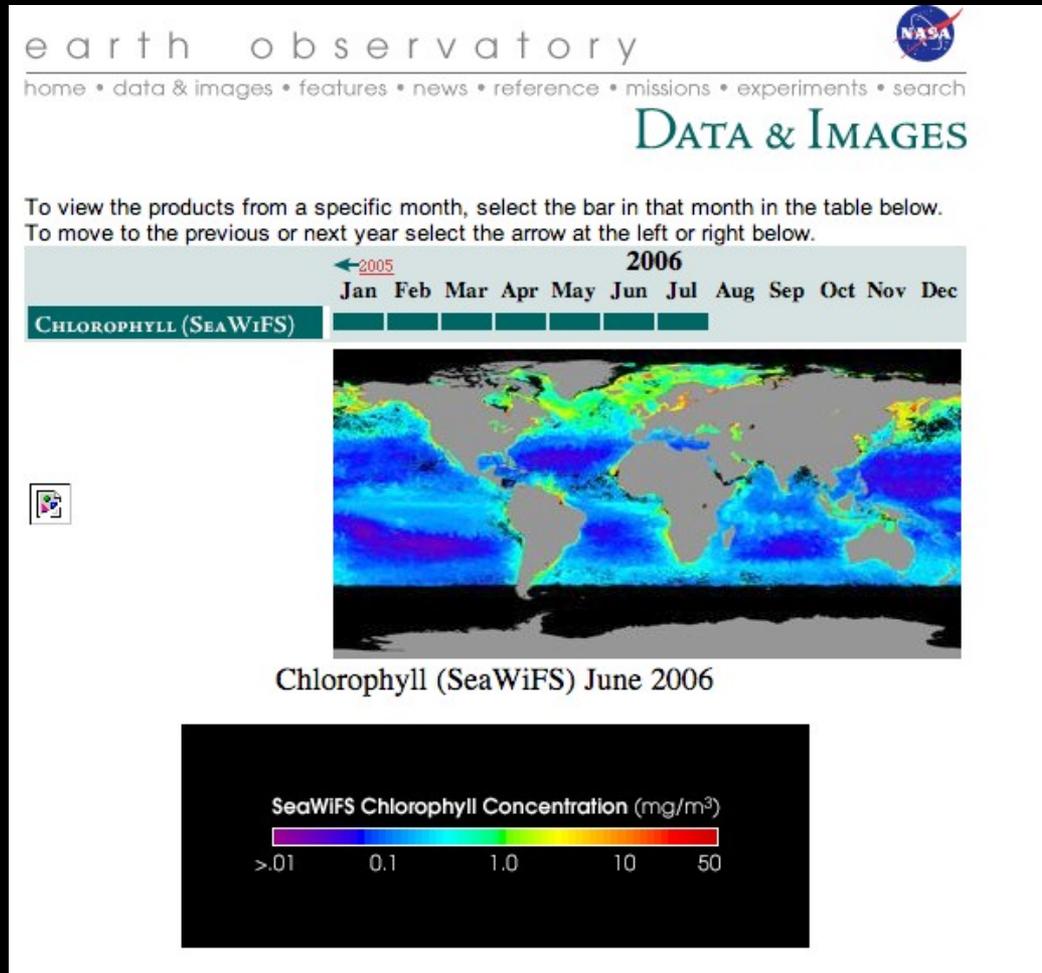
# Educational Support -- Familiar Resources



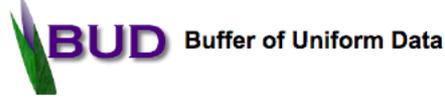
## Eruptions of Mount St. Helens: Past, Present, and Future



# Packaged Data



# 'Live' Data with Full Support



[help](#) || [about BUD](#)

Virtual Net:

Define data filter:   
(asterisk is a wildcard)

network:

station:  location:

Select region:  <= LAT <=  ,  <= LON <=

**Advanced Options**  
Selections below will be applied to the filtered data set and

Make a map of:  Location  Data Latency  
(choose one)

Show table of:  Data Latency  Feed Latency  Summarize table

The **show** option allows you to view a table of latency times of the filter summarized by network, station or channel. For more details about this click [here](#)

or

## IRIS



**VO DataScope Query**  
VO Tools and Services  
National Virtual Observatory Hosted at NASA/HEASARC

### Welcome to the NVO DataScope

If you have comments or suggestions send us [feedback](#).

[Table of recent transients/GRBs](#)

What do we know about a given point or region in the sky?  
To find out, just enter a target or position. The NVO DataScope will show you the results from hundreds of resources.

Position:

Use a target name (e.g., 3c273) or position (e.g., 10 10 10.1, 20 20 20.2)

Size:  (in degrees, max is 2)

Run query:

Skip cache?  Refresh registry?

Do not add to list of recent queries?

Some recent queries:

- [mrk 421 \(0.25\)](#)
- [ngc 3690 \(0.25\)](#)
- [288.83, 11.011 \(0.1333\)](#)
- [288.83, 11.010 \(0.1333\)](#)
- [243.00, 55.399 \(0.54\)](#)

**Positions** may be entered in decimal (dd.f, sdd.f) or sexagesimal (hh mm ss.f, dd mm ss.f) notation or as targets recognized by SIMBAD.

The **Size** should be entered in decimal degrees.



# What do these successful programs have in common?

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- They develop an educational context
- They treat educators as a class of users
- They constrain the user interface to limit choices -- *Already knowing what teachers and students are going to ask for...*

# What is a Virtual Observatory?

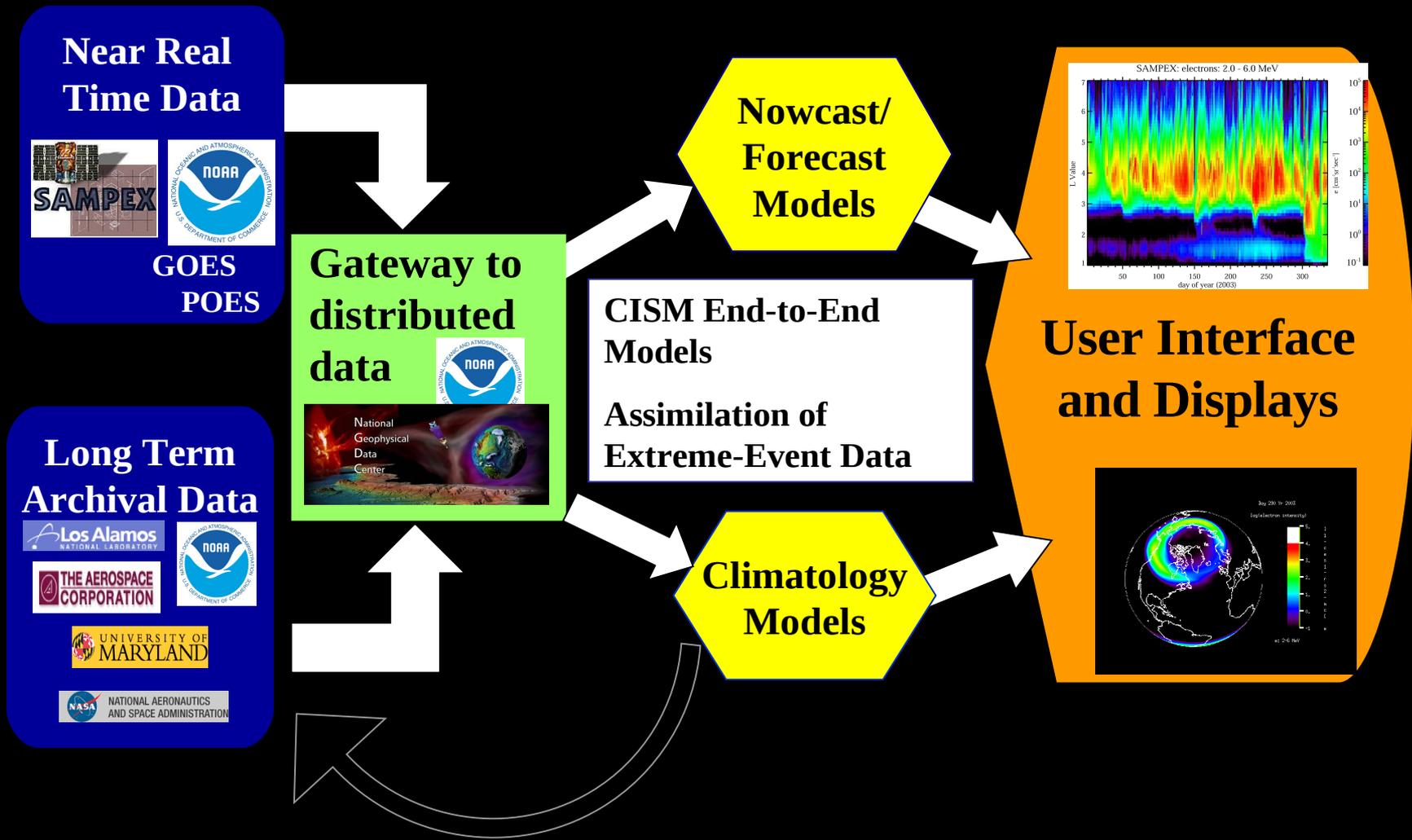
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*It's a distributed data system....*

- *Access to multiple data sets through a single portal*
- *User interface that takes care of database idiosyncracies*
- *Allows users to interact with wide variety of data seamlessly*
- *Often also involved specialized data tools*



# Virtual Radiation Belt Observatory



# The Many Flavors of VOs!

*No part of the Earth and its Environment Untouched*

*Atmospheres*

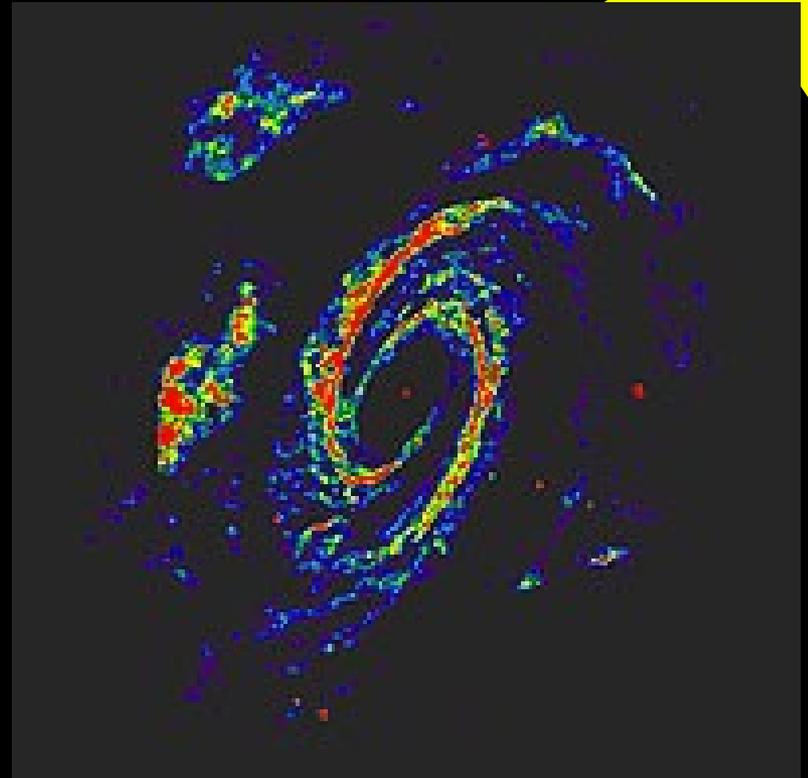
*Oceans*

*Geology and Hazards*

*Sun-Earth Connection*

*Biospheres*

*Not to mention, our Universe!*



# The Many Flavors of VOs!

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*It's not just the subject areas that are wide reaching....It's also about the data....*

*real time vs. archived*

*raw data*

*images*

*spectral data*

*time series*

You may also have tools  
on hand to help....

*How you receive the data...*

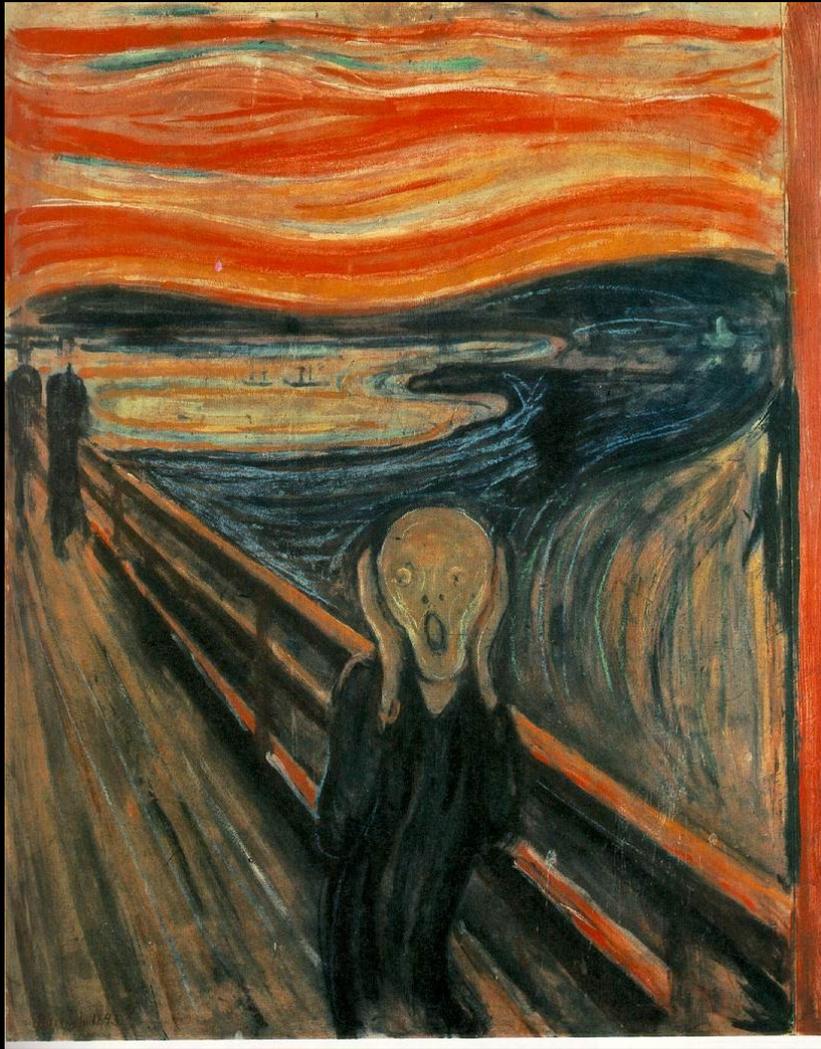
*ascii files*

*excel spreadsheets*

*fits files*

*level 2 and 3 data products*

# Yikes!



*So.....*

*The data are there,  
They are a tremendous  
opportunity*

*How do you get at it?*

# This is an Emerging Field...



*The best VOs are taking a smart approach:*

- Starting with a conversation between educators, scientists and technologists*
- Working to develop the educational context*
- Using teachers and curriculum developers as consultants to inform their architecture*
- Leveraging programs through existing educational channels (NASA, NSF, NSTA...)*

**Start by Googling “Virtual Observatory”.**

# Right now, This is a VO issue....

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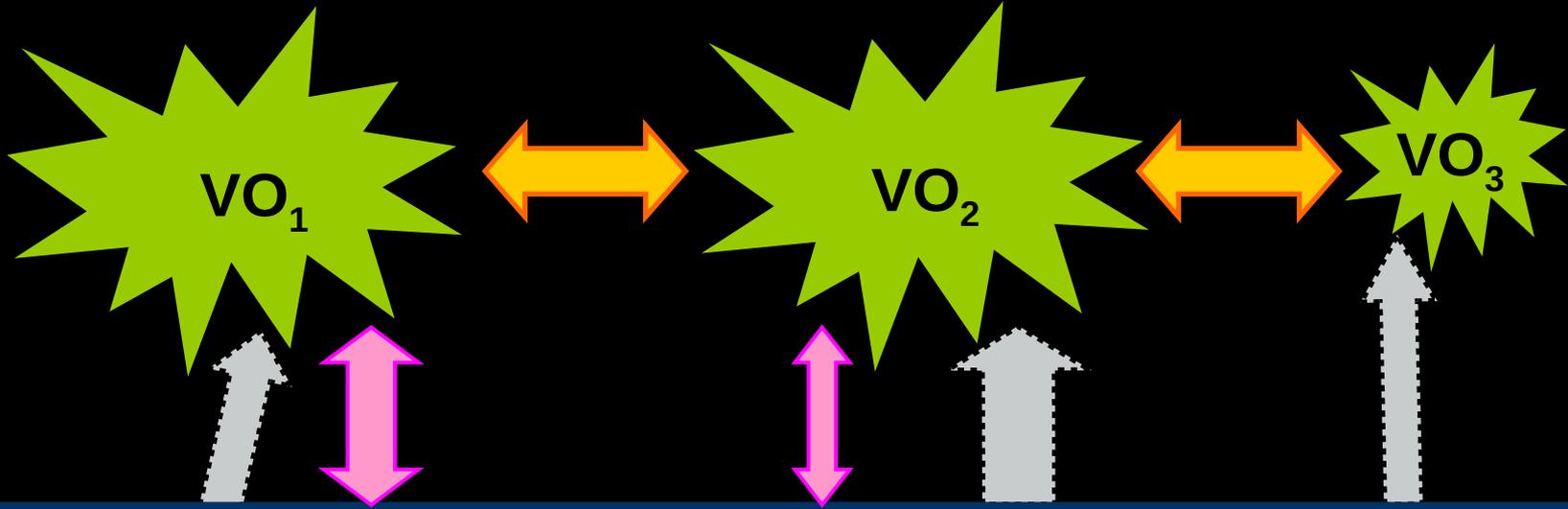
*Virtual Observatories are recognizing the need to look outward, to bring their data to a broader set of audiences.*

*Several are developing a 'non-specialist' use case for the VOs... The framework that will allow them to serve the needs of teachers and students...*



Education, clearinghouses, other services, disciplines, etc.

Semantic mediation layer - SWEET, ..



Semantic mediation layer

$DB_1$

$DB_2$

$DB_3$

$DB_n$



# What is a Non-Specialist Use Case?



Someone should be able to query a virtual observatory without having specialist knowledge

Teacher accesses internet goes to An Educational Virtual Observatory and enters a search for "Aurora".

# What should the User Receive?



Teacher receives four groupings of search results:

1) Educational materials:

[http://www.meted.ucar.edu/topics\\_spacewx.php](http://www.meted.ucar.edu/topics_spacewx.php) and  
<http://www.meted.ucar.edu/hao/aurora/>

2) Research, data and tools: via VSTO, VSPO and VITMO, knows to search for brightness, or green/red line emission

3) Did you know?: *Aurora is a phenomena of the upper terrestrial atmosphere (ionosphere) also known as Northern Lights*

4) Did you mean?: Aurora Borealis or Aurora Australis, etc



# What does a VO need to make this happen?

- A set of rules that define the users needs... Use Case!
- This use case can be applicable across VOs...
- But there are some other kinds of visionary leaps that have to be made...

