BOSTON UNIVERSITY

Classroom Use of CCMC Tools

Nicholas Gross, Boston University
CISM and HSS Teams

BOSTON UNIVERSITY

Experiences and Applications

- LWS Heliophysics Summer School
- CISM Summer School
- Research Students and New Space Weather Professionals
- Education vs. Training

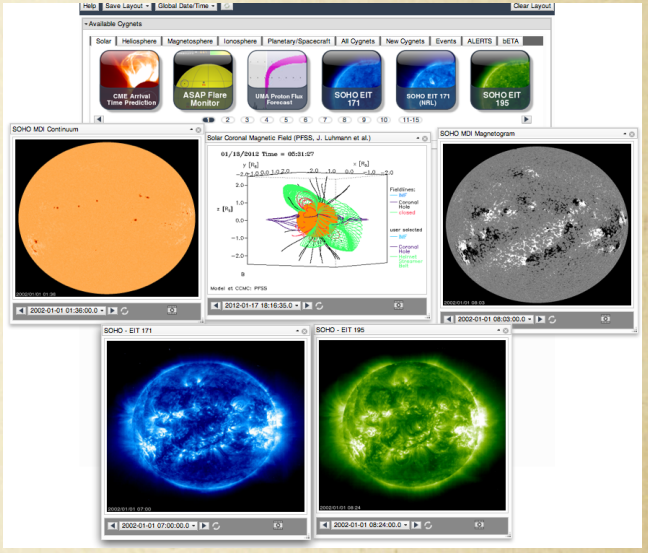
National Science Foundation
WHERE DISCOVERIES BEGIN

NASA

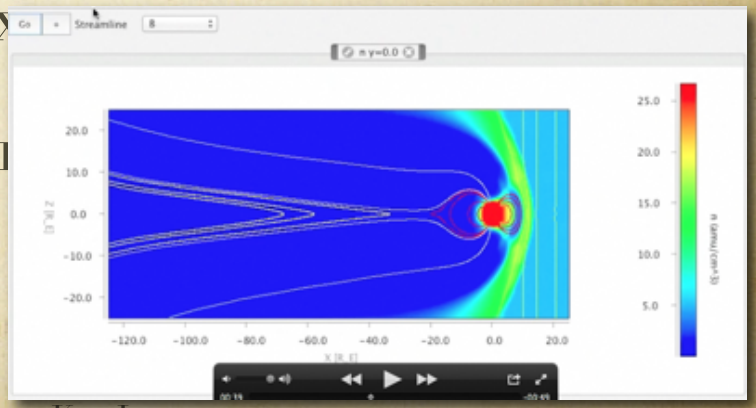
BOSTON UNIVERSITY

Tools

- Data Exploration - iSWA
  - allows for a wide variety of data to be explored

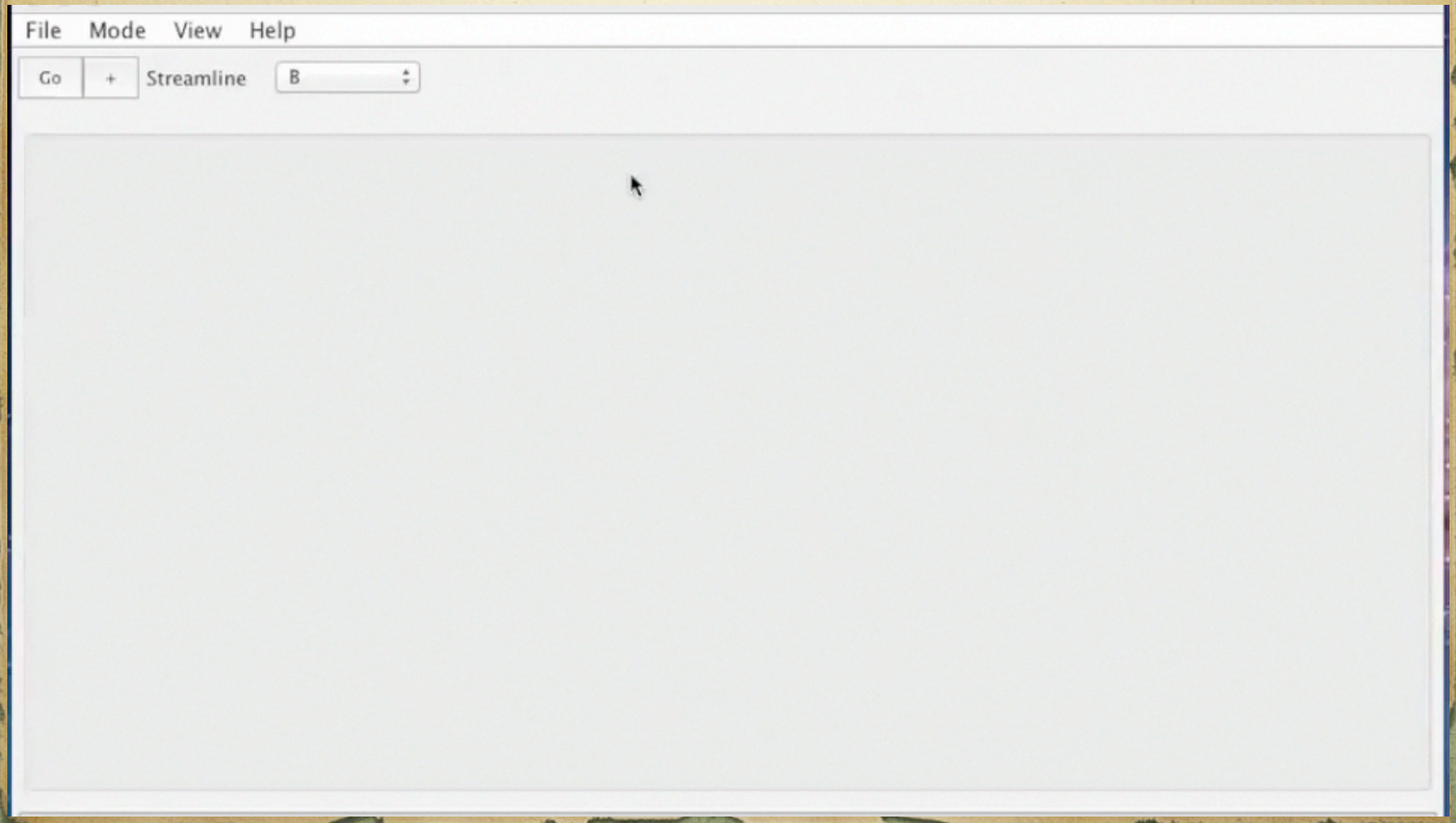


- Space Weather Explorer - SWx
  - Allows 2-D & 3-D exploration of simulation results



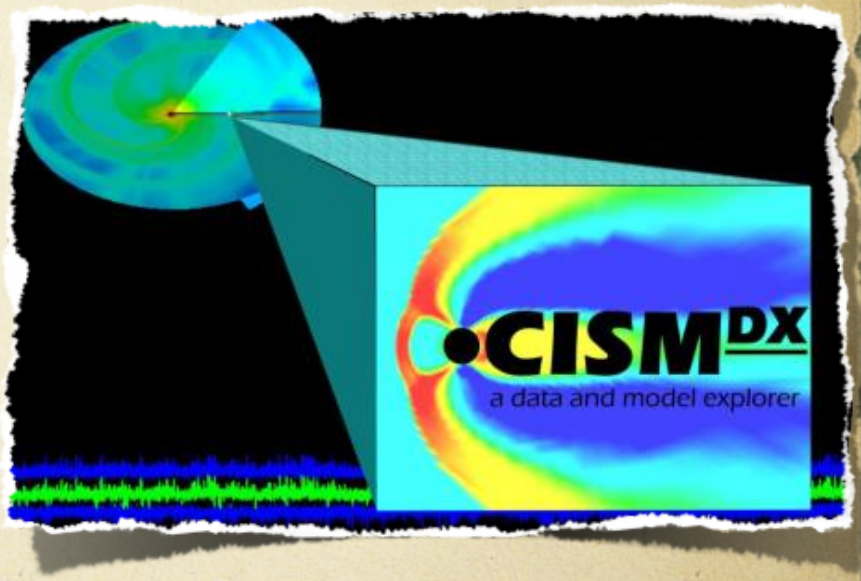
BOSTON UNIVERSITY

SWx 2x Demo



BOSTON UNIVERSITY

CISM-DX: Visualization and Data Analysis



- Open Source Visualization and Analysis Package
- Space Physics Specific Modules
- Primary Developers: Mike Wiltberger
  Bob Weigel

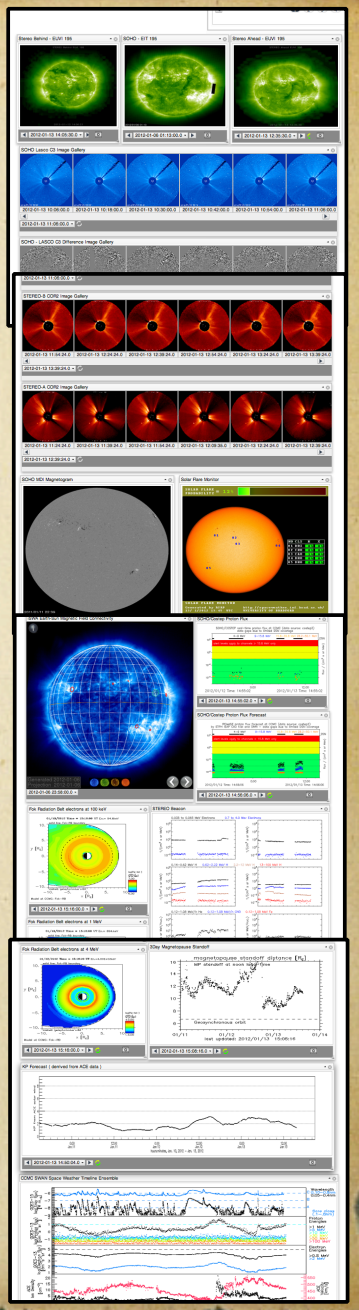
http://www.bu.edu/cism

National Science Foundation
WHERE DISCOVERIES BEGIN

BOSTON UNIVERSITY

Sequencing and Scaffolding: Don't use the Tool as a Bludgeon

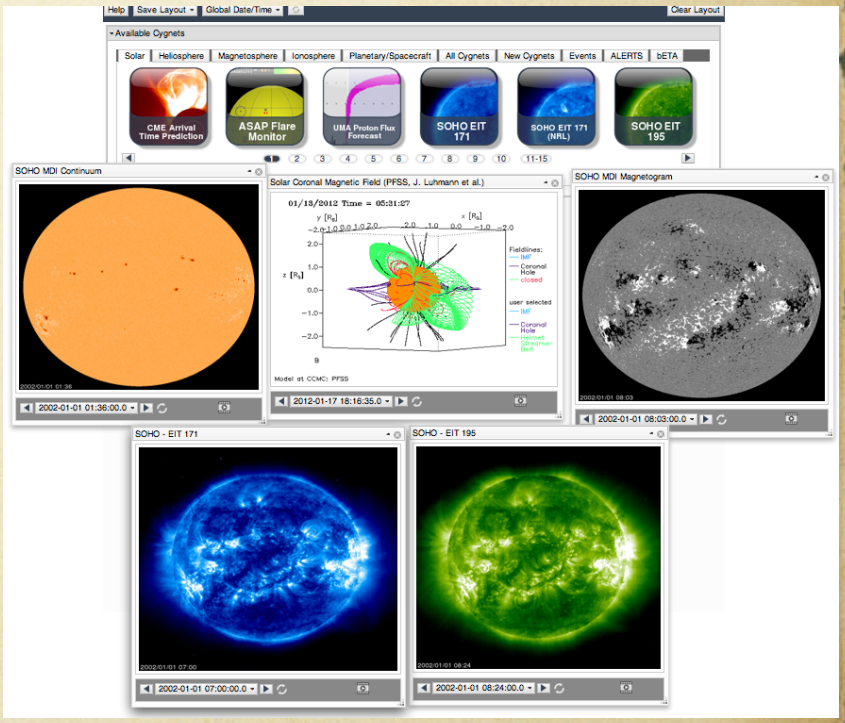
- Sequencing - Order in which concepts are introduced
- Scaffolding - support for using the tools to explore concepts



BOSTON UNIVERSITY

Sequencing

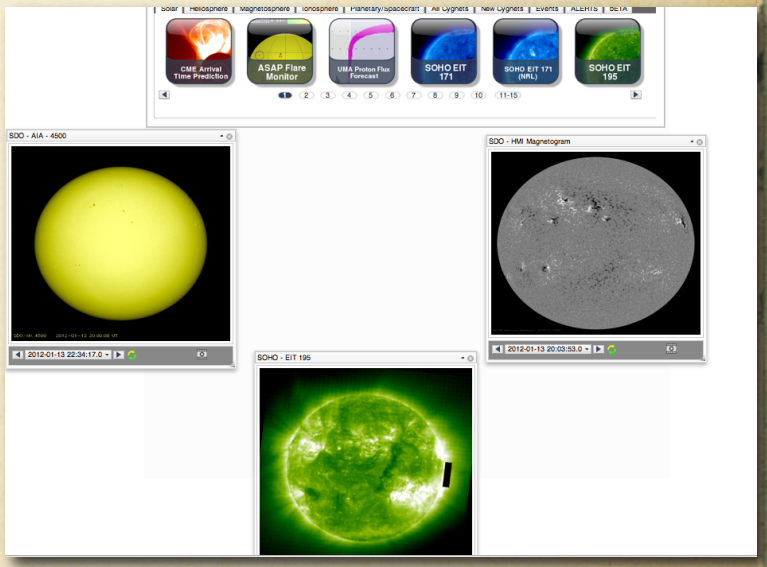
- Sequence by Domain
  - Sun
  - Solar Wind
  - Magnetosphere
  - Ionosphere
- By Physics
- By Impact



BOSTON UNIVERSITY

Scaffolding

- Start by providing as much support as you can
- Remove the some support
- Students complete tasks on their own



BOSTON UNIVERSITY

Classroom Culture

- Direct Instruction: The Lecture/Demonstration
  - Broadcasts a lot of information in a short amount of time
  - Compelling Speaker: Charles Mason, David Koresh
  - Compelling Topic: Randy Pausch - The Last Lecture
- Group Learning in the Student Centered Classroom
- Reformed Teaching Methods

BOSTON UNIVERSITY

Student Centered Classroom as Seen through RTOP

- Reformed Teaching Observation Protocol (RTOP)
- Values:
  - Student Prior Knowledge
  - Student - Teacher and Student - Student Communication
  - Teacher as Listener and Resource
  - Student's taking charge of their own learning
  - Student's constructing their own knowledge

- Piburn, M., Sawada, D., Falconer, K., Turley, J. Benford, R., Bloom, I. (2000). Reformed Teaching Observation Protocol (RTOP). ACEPT IN-003.

BOSTON UNIVERSITY

The Benefits of Group Learning

- Interdependence:
  Goals, Rewards, Resources, Roles
- Face-to-Face Interaction
- Individual and Group Accountability
- Interpersonal and Small-Group Skills
- Group Processing

✳ Productive Group Work, Frey et. al., 2009
✳ Learning Together and Alone, Johnson and Johnson (1975)

BOSTON UNIVERSITY

Role of Ensembles in Different Classrooms

- Introductory Classroom
  - Provides and opportunity for students to construct their own knowledge
  - Provide Opportunities for Students to Develop Skills (communication, argumentation, model building...)
- Professional Development
  - Opportunities for participants to share different skill sets and experiences
  - Networking with other participants and instructors

BOSTON UNIVERSITY

Considerations for a Student Centered Classroom Moves

- Thoughtful Activity - "tangibles" and "ponderables "
- Setting up the Room, Coordinating the Groups
- Instructing the groups in the activity, defining outcomes
- Interacting with students

BOSTON UNIVERSITY

"Tangibles" and "Ponderables"

- Provide interesting activities:
  - Explore Model Output (particularly in 3D and interactive)
  - Explore data in a self directed way
- Ask a thoughtful questions:
  - Compare the structure of the solar magnetic field at solar minimum and solar maximum
  - How do the plasma parameters change at the bow shock?
  - When does the new Solar Cycle Begin? What is your evidence?
  - NOT, "What is the value of the magnetic field at geosynchronous orbit?"

BOSTON UNIVERSITY

Setting up the Space

- Traditional Classroom
  - teacher the focus
  - limits student interaction
- The SCALE-UP Classroom
  -teacher at center as resource
  -students provided opportunities to interact

BOSTON UNIVERSITY

Groups and Workspace

- Seating around the table
- Demote the Computer to a Tool
- 3’ by 2’ news print

BOSTON UNIVERSITY

Social Engineering: Setting Up Groups

- Purpose and Audience
- Roles: leader, facilitator, note taker…etc.
- Heterogenous vs. Homogenous Groups
- Expertise and Networking
- Gender Issues

BOSTON UNIVERSITY

Shameless Plug

- NSF CISM Summer School - Boulder, July 16-27
- NASA/LWS Heliophysics Summer School - Boulder, May 31 - June 07