

Developing Interactive Models To Support a Digital Collection Of Earth System Science Resources

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Premise:

Starting with the Fall 2002 semester, incoming University of Illinois students are required to take two courses that incorporate quantitative reasoning into the curriculum.

Motivation:

Restructure an Introductory Meteorology course to incorporate active learning techniques to meet these new university guidelines.

Challenges:

1) Develop a hands-on meteorology session where students use emerging computer and Internet technologies to interact with various atmospheric concepts and principles.

2) Create exercises and a lesson plan around this hands-on session to engage students in order to offer a richer learning experience than in a solely passive learning environment.

Schedule

Goal for Summer 2002 term: 8 ICMs
☐ Beta test in small class

Goal for Fall 2002 term: 4 more (12 total)

At the start of Fall 2002: 21 ICMs ready
+8 ICMs from VGEE (see ICM section)
+1 applet from Weather World 2010

30 ICMs completed for full implementation in Fall 2002 semester!

Java™ Applications

The ICMs in this project are Java™ applications.

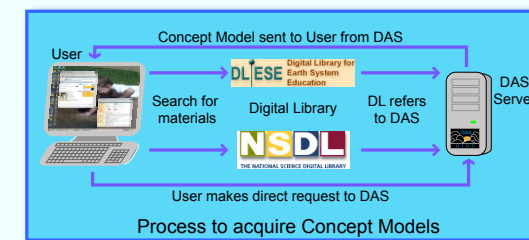
Benefits:

- Easily created interactive interfaces
 - File Input/Output (Data collected by students)
 - Image manipulation (Rotation, Transparency, etc.)
 - Code Sharing (Extensible, Object Oriented structure)
 - Compatible with other geoscience education efforts
 - ☐ VGEE (see ICM section), Integrated Data Viewer (IDV)
- Possible Detractions:**
- Difficult to download, install and execute solved with Java™ Web Start (see Delivery section)
 - Extra Download (Java Web Start)
 - Applets requiring a Java 2 plug-in would need one too

Digital Libraries and Collections

The ICMs, their data, and exercises can be packaged as a digital collection.

- There are two primary methods to access the Hands-On digital collection.
- 1) **Searching a digital library** – They refer the teacher to the collection's host site.
 - 2) **Direct access** – only feasible if the user has prior knowledge of the collection.
- ☐ (This illustrates the power of the Digital Library.)



Appropriate Digital Libraries:
Digital Library for Earth System Education (DLESE)
National Science Digital Library (NSDL)

This collection will be soon be submitted to the DLESE Collections Review System

Delivery

Why is Delivery an issue?

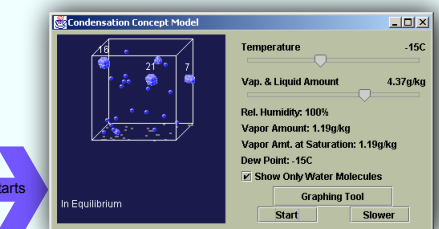
- 1) ☐ Java™ applets launch straight from a web browser -- no extra work for user
- 2) ☐ The ICMs are Java applications, traditionally requiring more work to run -- not user friendly.



Java Web Start (JWS), by Sun Microsystems eliminates this problem.

Now applications can run over the Web like applets.

Click the link...



The result...
Powerful Java applications on your computer with just one-click



The web site is also a vital element to delivery. It houses content for teacher and student alike.

Students:

- Links to relevant ICMs
- Download homeworks and exercises
- View other Concept Models not yet assigned

Teachers:

- Admin section to easily create / edit assignments
- ICM Documentation

Example pages are shown below.

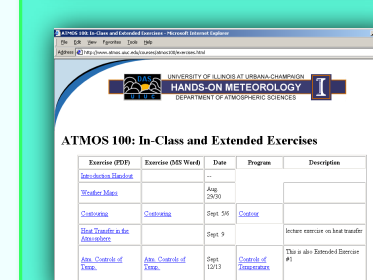
Student accessible pages



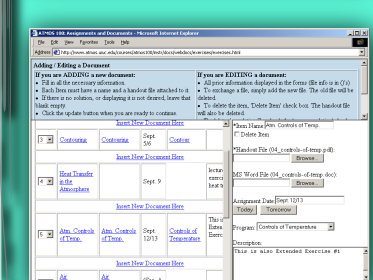
Teacher accessible pages



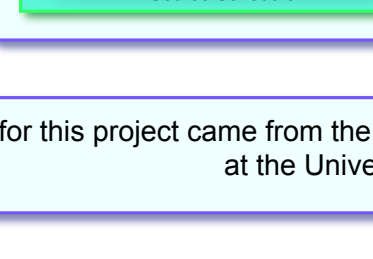
Concept Model Lists



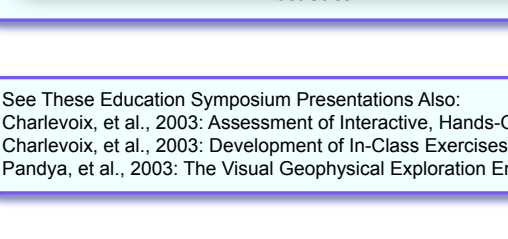
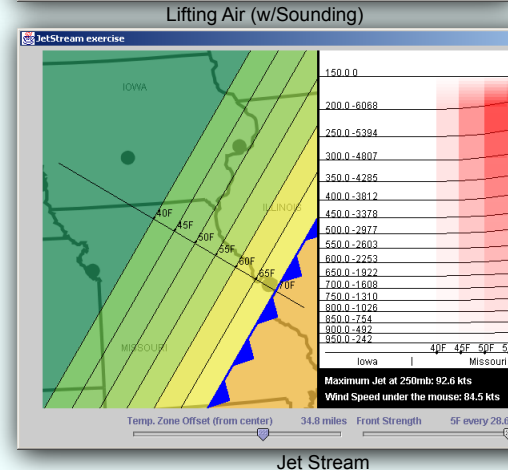
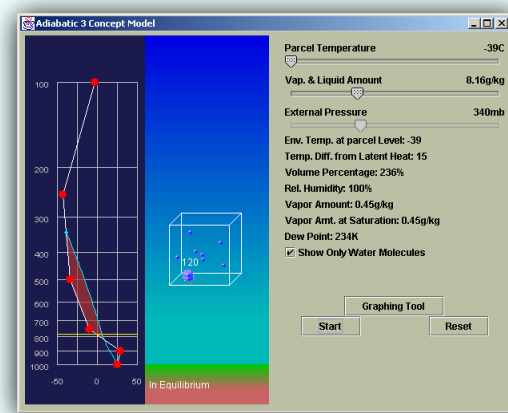
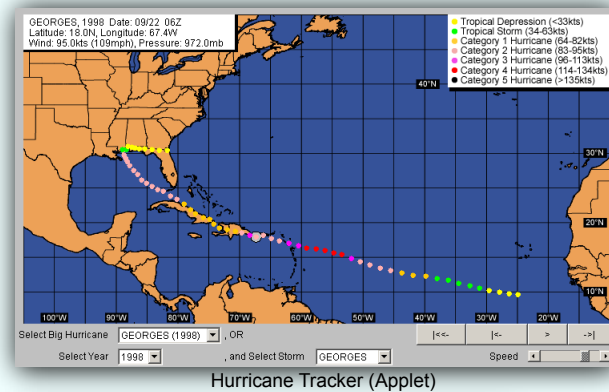
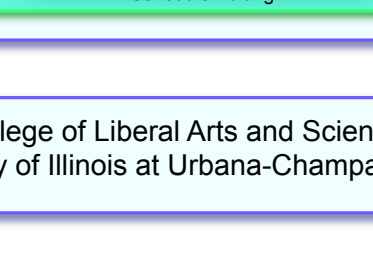
Concept Model Documentation



Course Schedule



Schedule Editing



Interactive Concept Models (ICMs)

Idea:

Originally conceived from NSF-funded Visual Geophysical Exploration Environment (VGEE).

Goal:

Help the students learn about a specific process or a group of processes in a way difficult to duplicate with a textbook or on paper.

Examples:

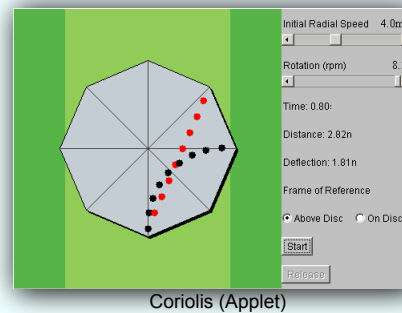
- Controls of Temperature ICM
- ☐ Students manipulate atmospheric parameters
- ☐ They see how it affects air temperature.

Growing Seasons ICM:

- ☐ Students attempt to grow crops
- ☐ They learn about Growing Degree-Days and crop selection.

Other ICMs:

- ☐ Interacting with past hurricane tracks
- ☐ Drawing/annotating on weather maps and images.



Coriolis (Applet)

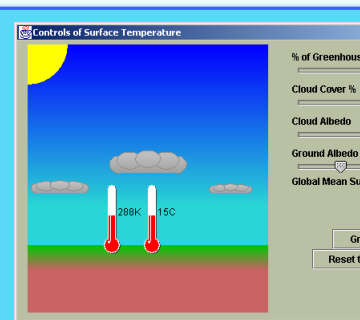
The ICMs have features that add richness to the learning experience.

Graphing Tool:

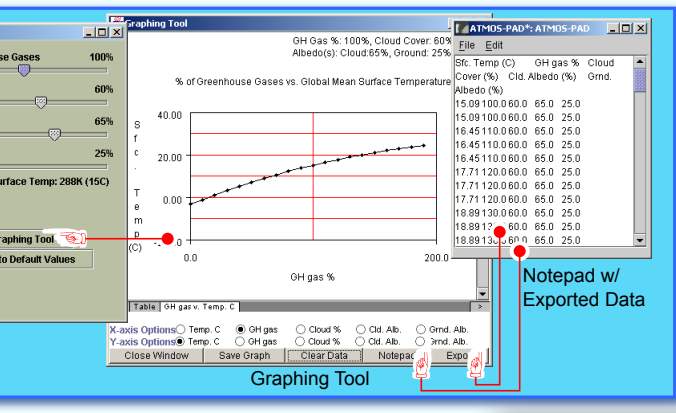
- Tables and graphs collected data
- Graphs can be saved as images
- ☐ Turn in with homework
- ☐ Post on the Web.

Notepad:

- Linked directly to the ICM
- Make notes
- Export collected data to spreadsheet
- ☐ Perform more in-depth analyses



Controls of Temperature



Graphing Tool

Notepad w/ Exported Data

Concept Models

- Condensation*
- Contour
- Contour (Temperature Only)
- Contour (Pressure Only)
- Coriolis*
- Coriolis (Lecture Size)
- Coriolis (Applet)
- Controls of Temperature
- Cyclone
- Ekman*
- Evaporation*
- Fronts
- Growing Seasons
- Humidity
- Hurricane Tracker (Applet)
- Jet Stream
- Lifting Air (Dry)*
- Lifting Air (Moist)*
- Lifting Air (w/Sounding)*
- Mountains
- Mountains (Changeable)
- Mountains (Lecture Size)
- Pollution
- Radar
- RadSat
- Slide Viewer
- Temperature*
- Temperature (Lecture Size)
- Thunderstorm
- Tornado

*Developed as part of VGEE

Use Case: Introduction to Meteorology

Course: Introduction to Meteorology

Enrollment: 300 (many are first and second year students)
Initial Format: 3 1-hour lectures per week.
New Format: 2 1-hour lectures + 1 1-hour Hands-On session

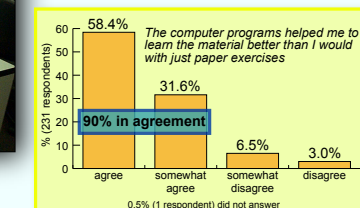
The lab:
30 computers (Max. class size: 30)

The Computers:
Pentium 4 1.4 GHz processor
512 MB of memory
CD-RW drive for saving data.

The instructor also has a computer that is connected to a large display system.



Students evaluated the course by agreeing or disagreeing with teacher specified statements. The one below best reflects the ICMs' involvement.



This collection was beta tested in the Summer 2002 semester and fully implemented in the following fall.

See These Education Symposium Presentations Also:
Charlevoix, et al., 2003: Assessment of Interactive, Hands-On Meteorology Exercises in a course for Undergraduate Non-Majors. **Poster Session 2 #P2.4**
Charlevoix, et al., 2003: Development of In-Class Exercises to Accompany Interactive, Hands-On Meteorology for Undergraduate Non-Majors. **Session 5 #5.2**
Pandya, et al., 2003: The Visual Geophysical Exploration Environment: A Scientific Tool Kit for Learners. **This Session #JP1.5**

<http://www.atmos.uiuc.edu/courses/atmos100>

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