A introduction to Data Visualization and Manipulation System

Chapter 1: Purpose

Interactive Visualization of Geographical Temporal data

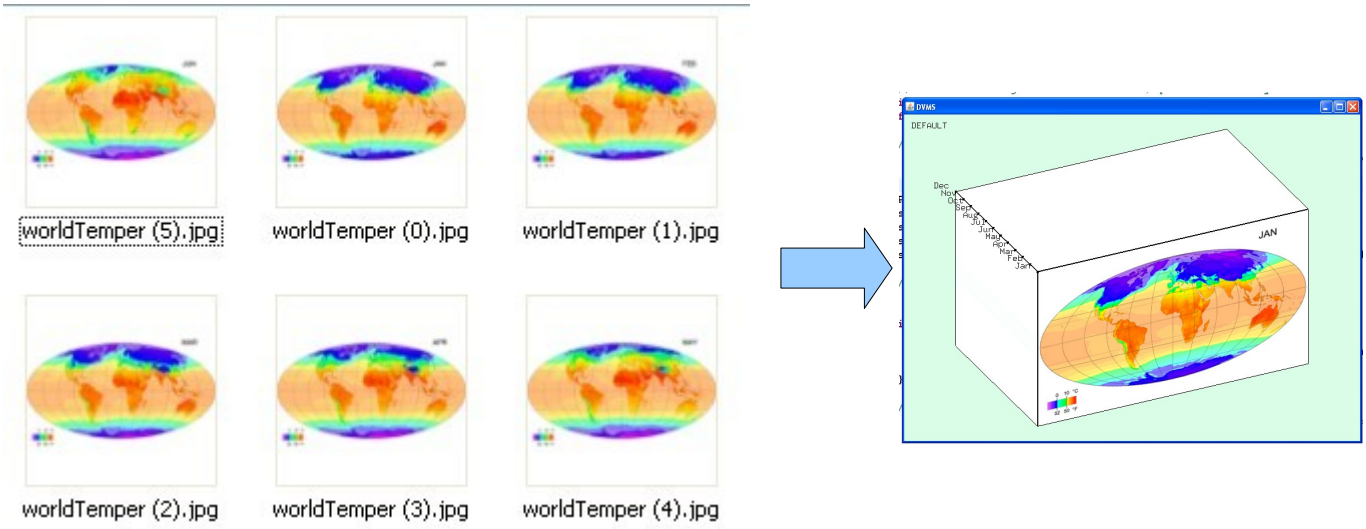
The purpose of this internship will be to prototype an interactive visualization tool for exploring spatio-temporal data, with a focus on time-evolving geographical data. Examples include surface temperature records, per-country statistical measures such as GDP, major historical events, and the evolution of country borders over History. At present, there is no effective and easy-to-use tool for navigating into that type of data, and this is a promising avenue for research.

The interactive visualization tool will be based on a layer paradigm, where temporal data is laid out on an axis orthogonal to the map plane. Data exploration will be supported by innovative (mostly non-WIMP) interaction techniques involving mixed 2D/3D representations, animated transitions, transparency and other visual effects, and mouse- or pen-based sketching. For example, the tool might support gestures for cutting into the spatio-temporal data volume, tearing this volume away, or extracting cores. For the sake of usability, no explicit 3D navigation will be required.

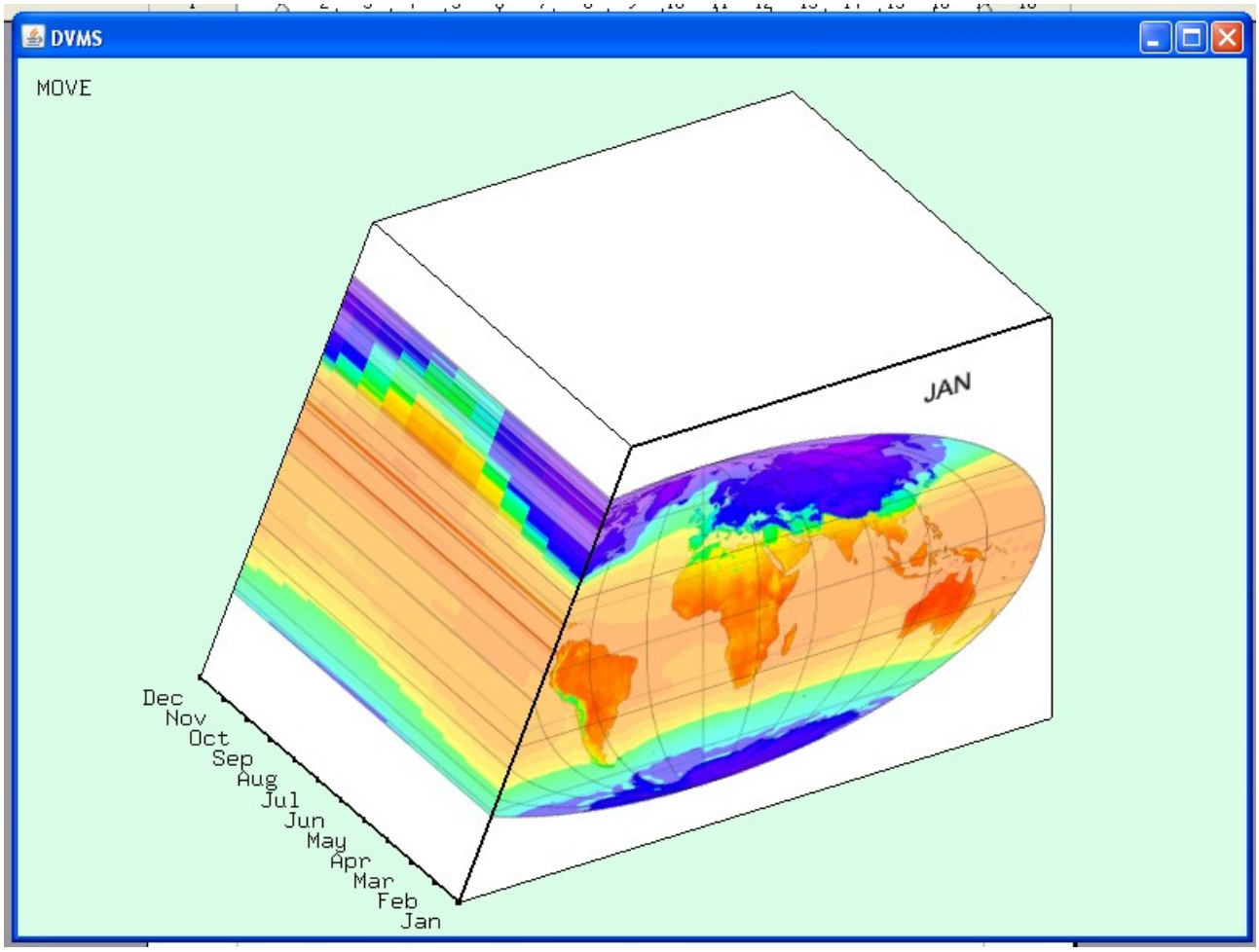
As a first step, the student will gather and visualize simple examples of geographical data having a temporal component. Then, the student will implement, test and refine new interaction techniques for navigating into the data using the metaphors described above. If time allows, the tool might be later extended to support non-geographical data such as vector graphics visualizations (e.g., time-varying scatterplots) and bitmap data (e.g., scientific simulations or videos). The goal will not be to build a full GIS system, but to develop a prototype used for demonstration and testing purposes.

Chapter 2 : Basic Introduction

This system visualize data by create 3D model with a series of pictures. As below:

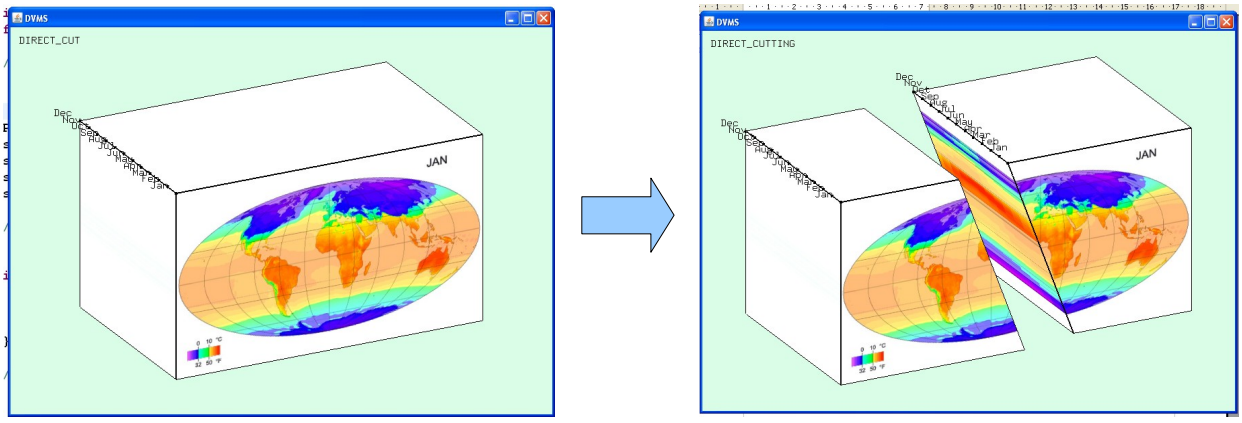


Than we can interact with the system by moving the control point, edge to explore the data. As below:

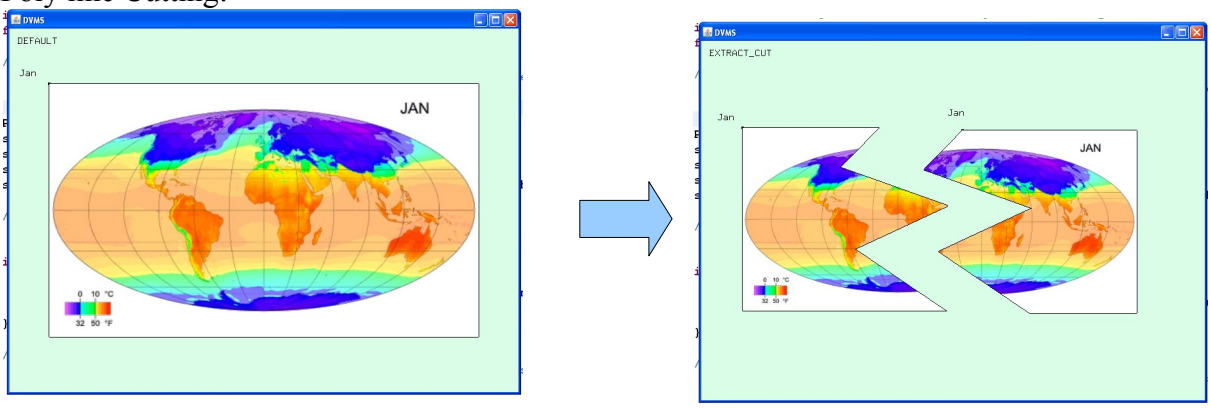


This kind of operations allow us to have a view on how the data of a certain position or on certain line varies through time. From the picture we can see that the temperature in the arctic circle rises much in Jun.

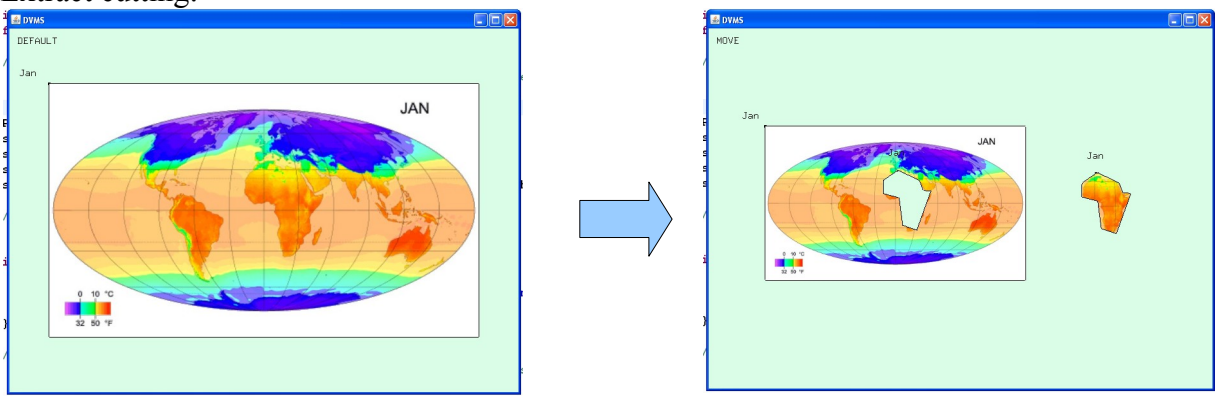
Other operations include several kinds of cutting tools like :
Direct cutting :



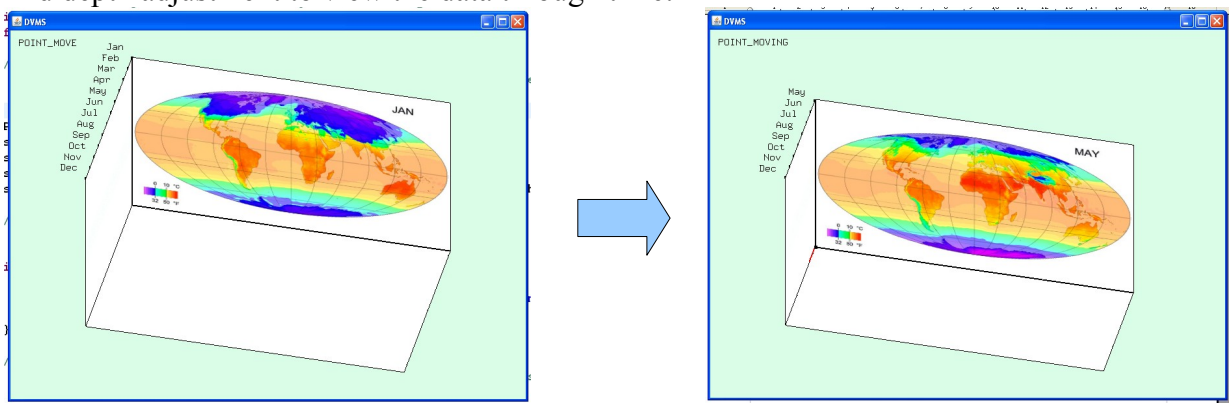
Poly line Cutting:



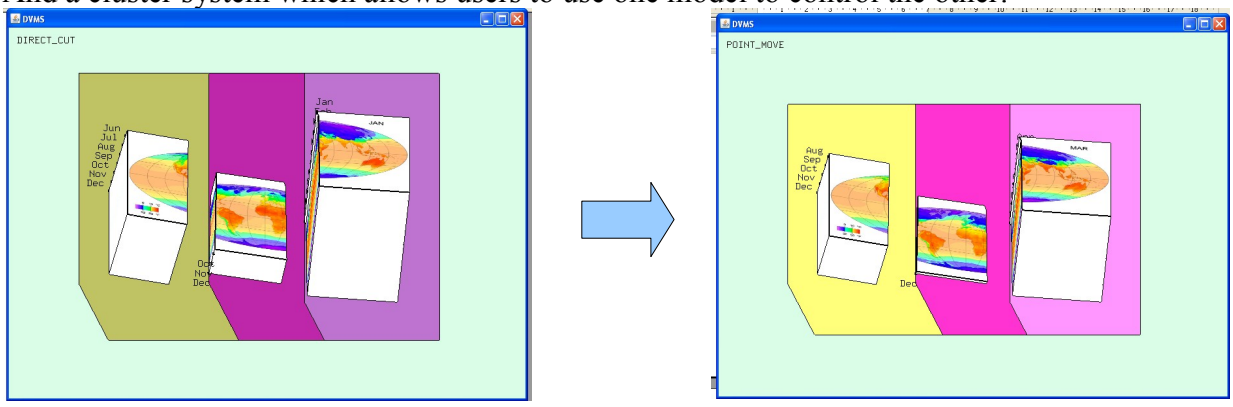
Extract cutting:



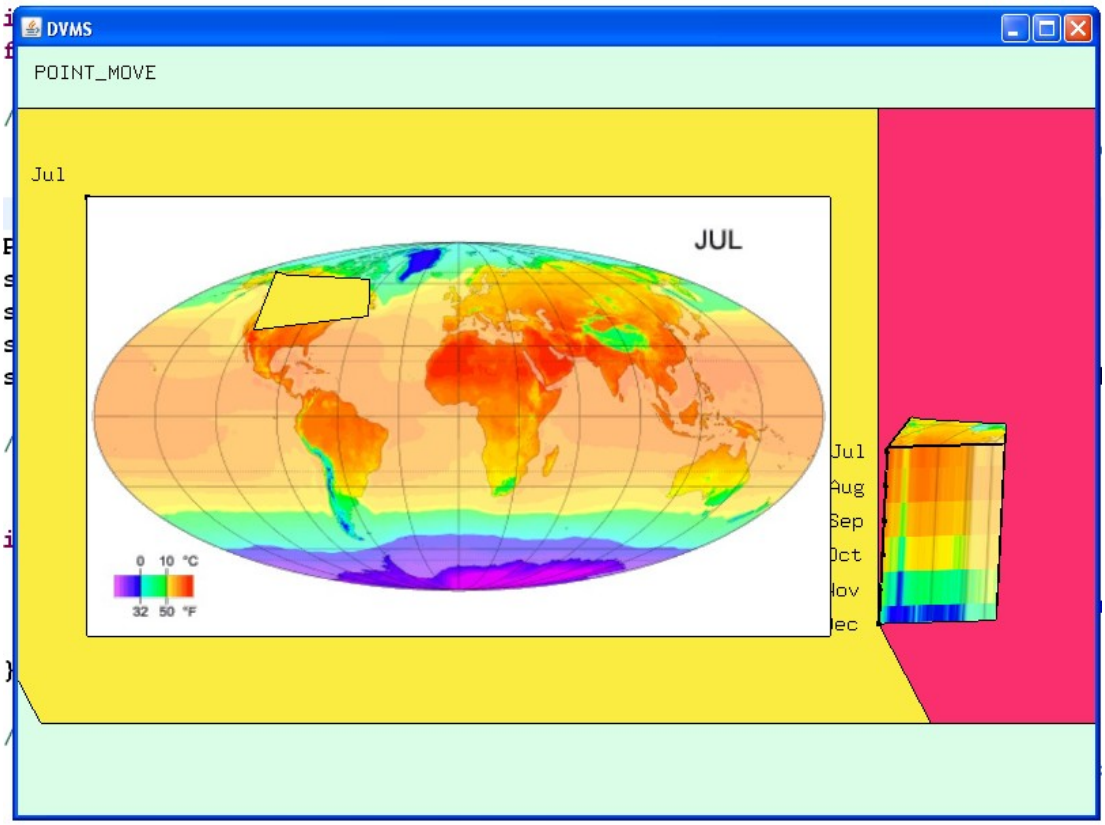
And depth adjustment to view the data through time:

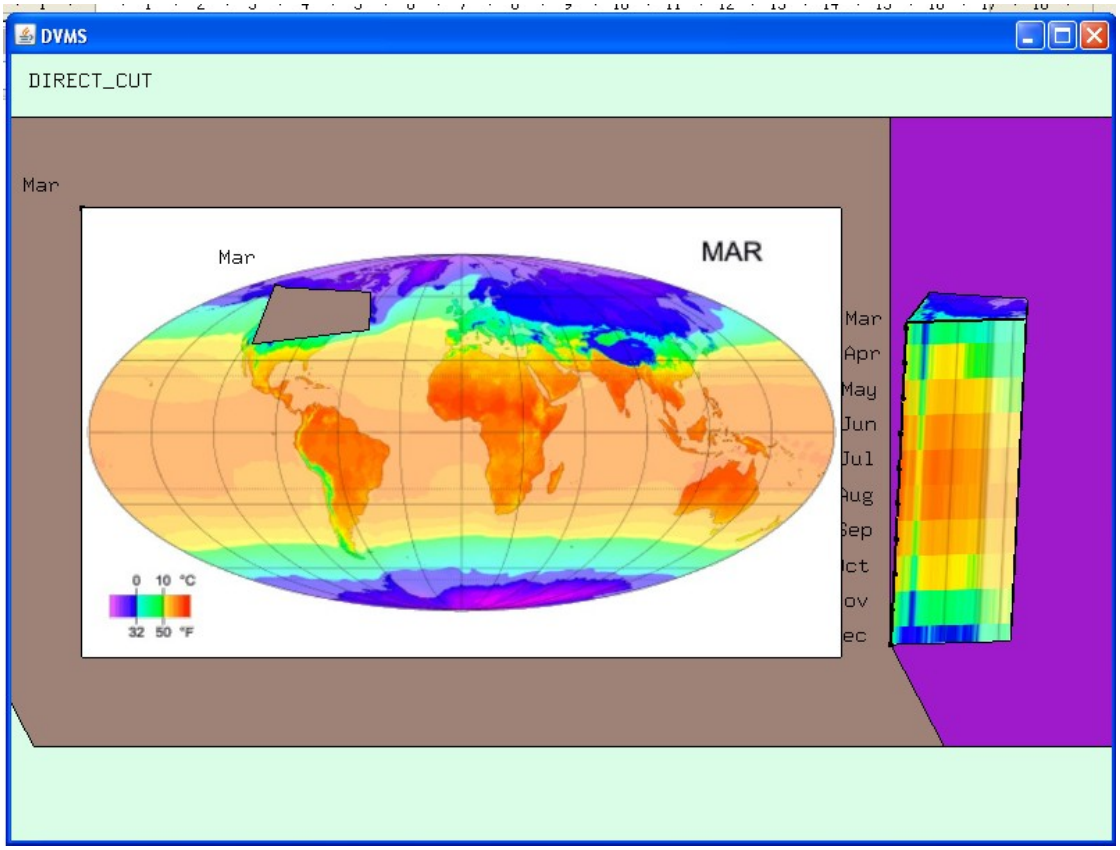


And a cluster system which allows users to use one model to control the other:



The grouped models have connections with each other, which means the adjustment to the time of any model will be applied to others in the group. This function can be used to find the implicit connection between two parts of the data. For example, when America is hot in Jul, how is the Europe at the same time? And other month?





Chapter 3 : Basic Operation

How to use the system:

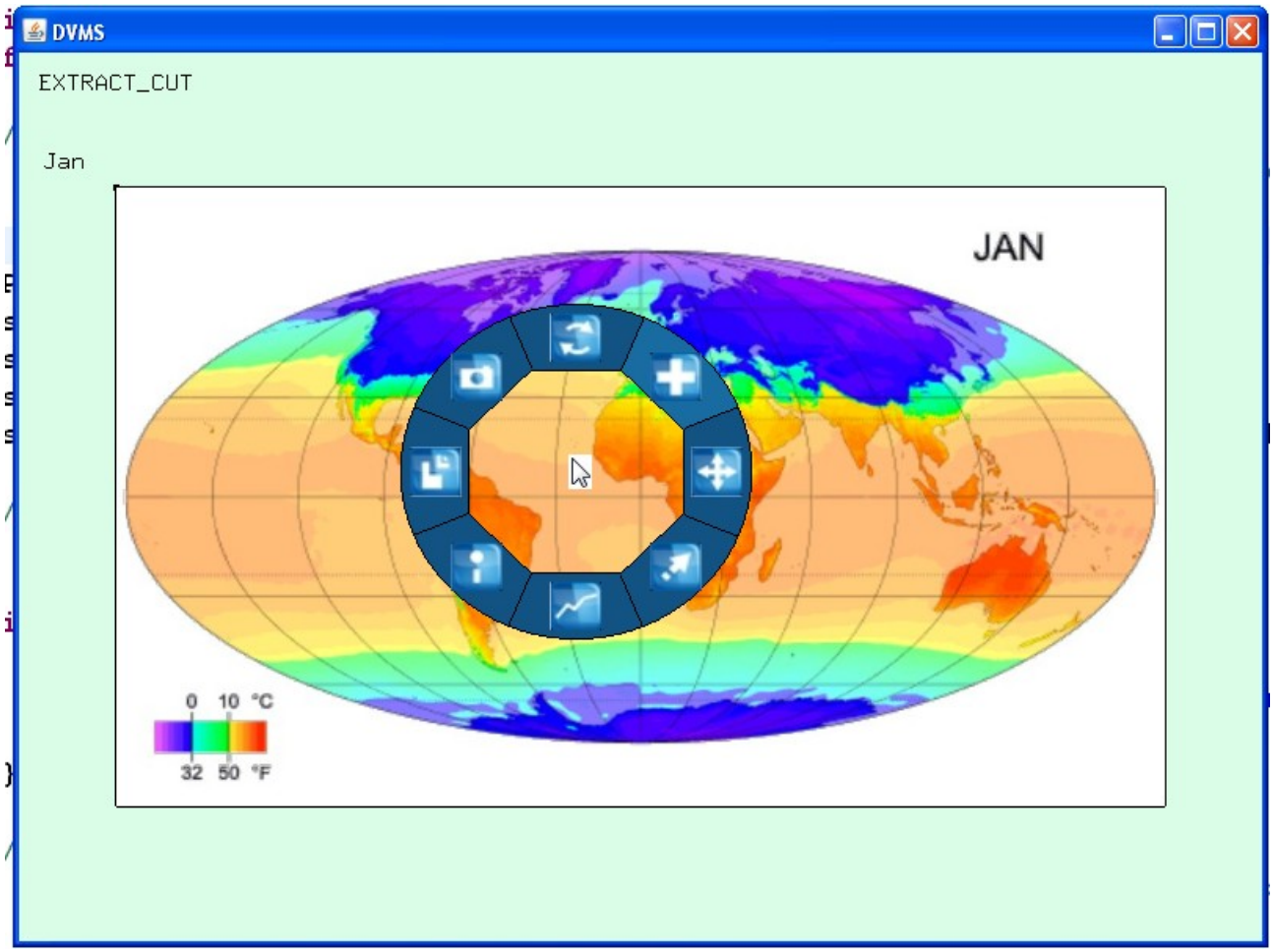
Global Operations:

Command Selection:

The most important command for the whole system is that to select tool that the user want to use. As we do not want to use WIMP system, we use a new command selection tool which is based on the mouse gesture (more accurately speaking, based on the moving speed and direction of the cursor).

Press “d” to show and hide the tool selection menu.

The menu will appear just around the mouse:

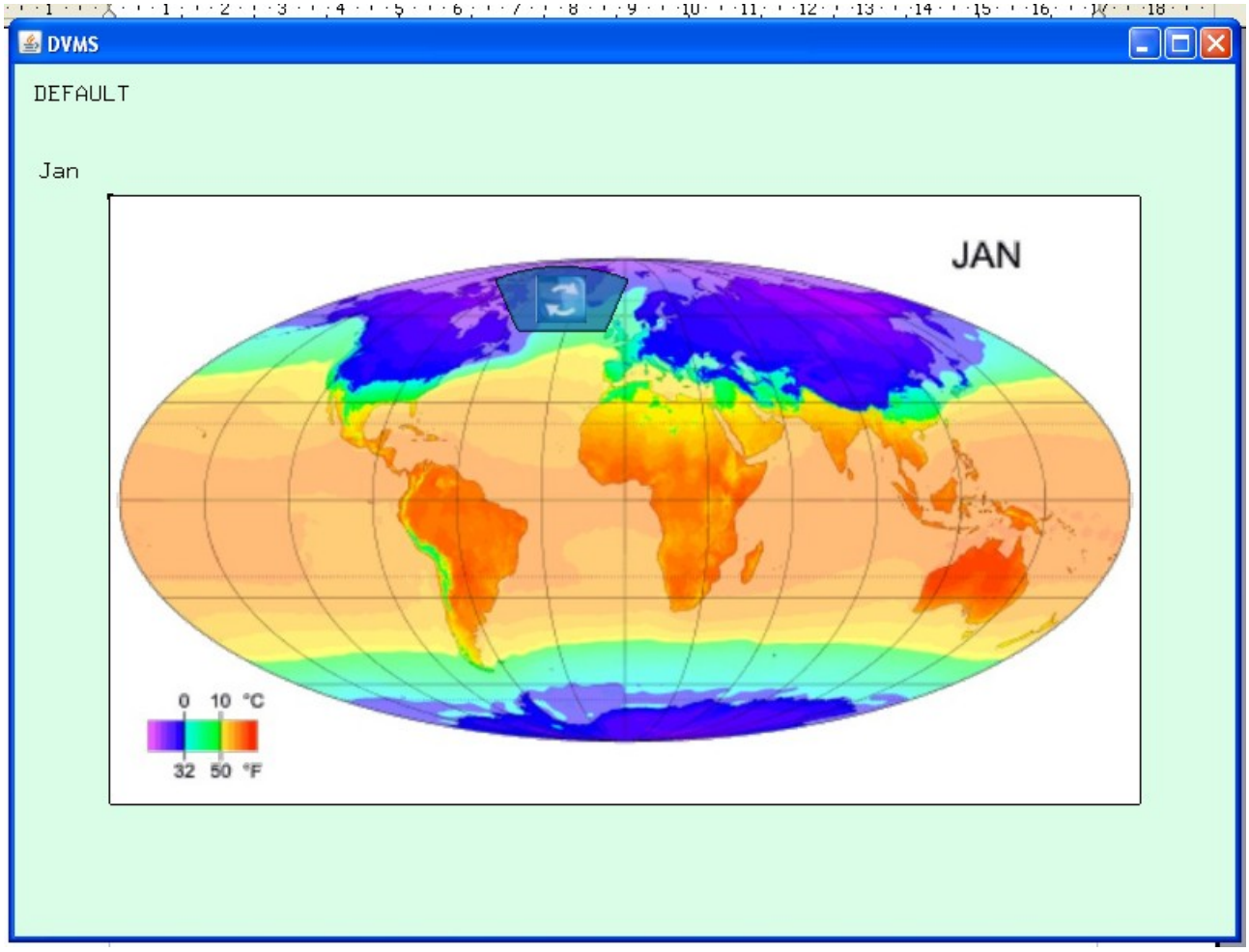


And the menu will just follow the cursor as it moves.

If the user wants to select a command, just move fast to the direction. E.G, move up fast to select

“ROTATE” or move right fast to select “MOVE”.

If the command is selected successfully, the item selected will automatically fade out.



When the user gets to used to the system, he/she may not need to show the menu and can directly select what he/she want by fast moving.

View zoom in/out:

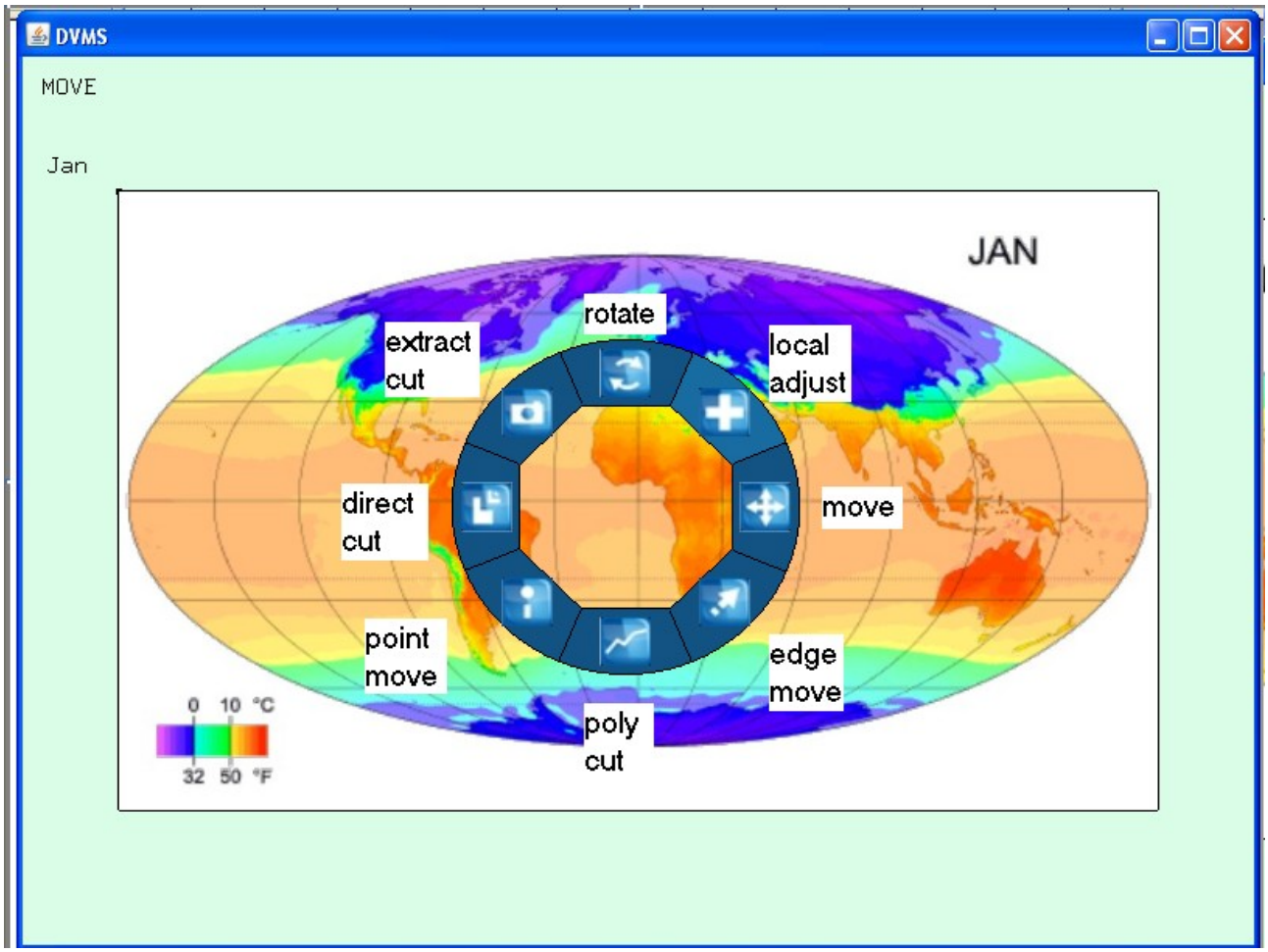
Use the mouse wheel to zoom in and out. In fact the system will automatically zoom in and out when user move or rotate the models. If user wants to switch back to automatically zooming, just press the mouse wheel.

All model move:

To move all the models, right click on the background and move.

Single Command:

There is basically eight commands:



Rotate:

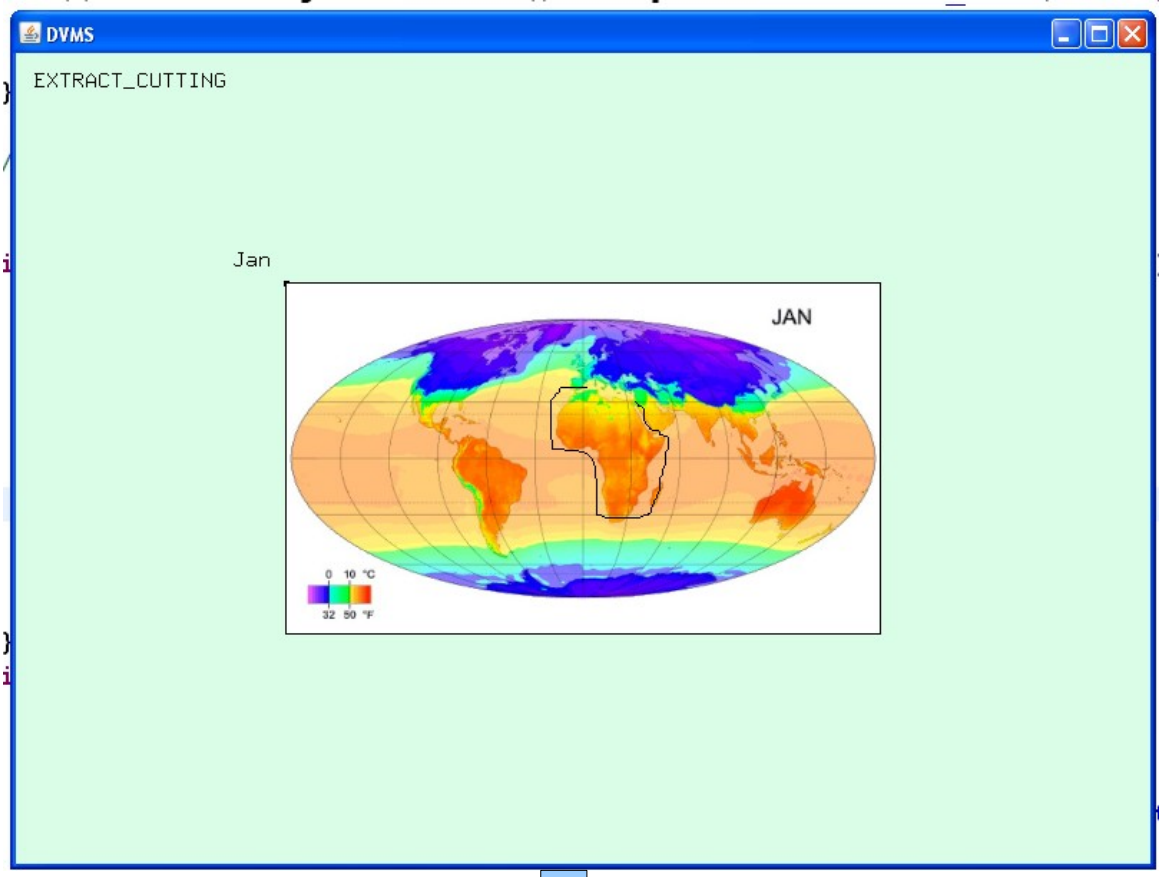
To rotate one model, select this tool, and left click on the model and dragging.

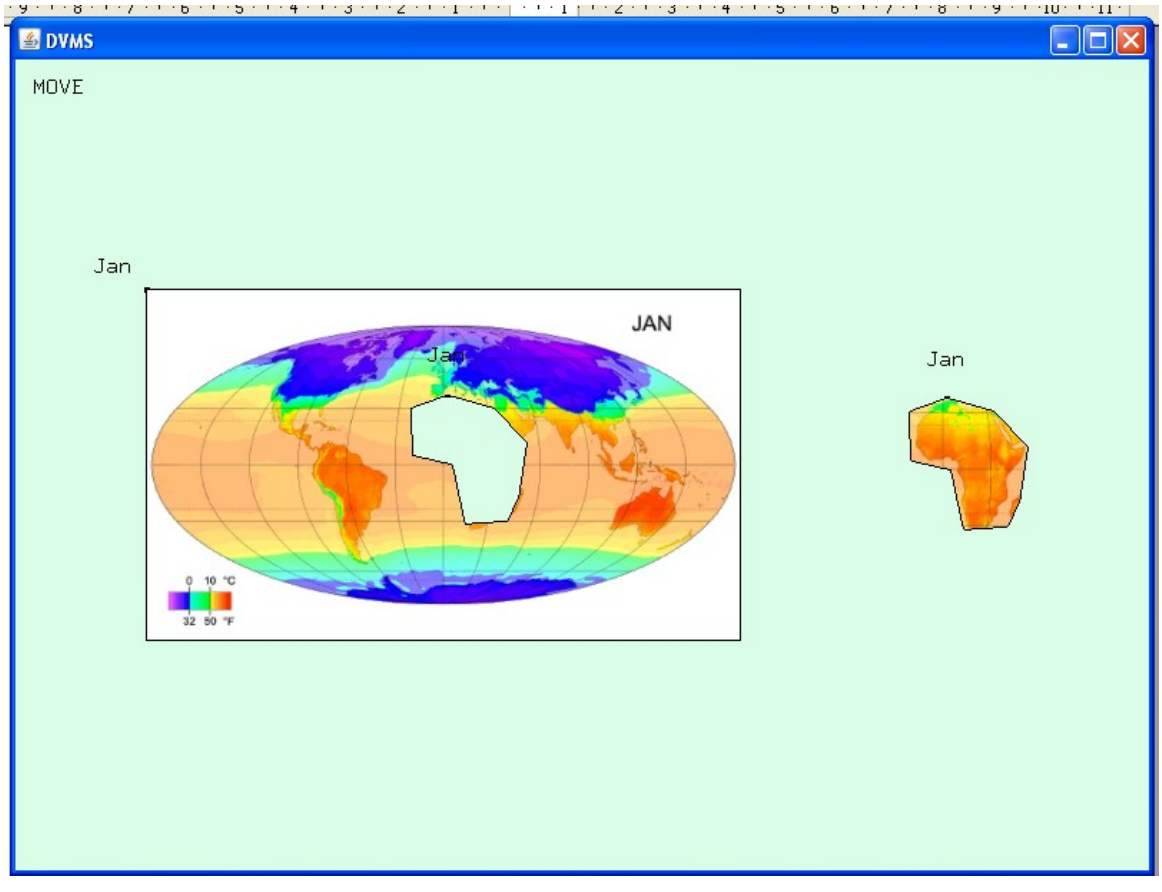
The rotation has snap function, which means the model which automatically rotate to 90° or 180° and etc.

Note : no matter what tool is selected (but not in action) , the user can always use the right button to rotate the model. And this rotation will not snap. The rotate will be fixed so that the user can easily observe the model.

Extract cutting:

Select the tool and draw a curve on any model to extract one part of it. Note the curve shouldn't have crosses. And the system will automatically connect the start point and the end point.


DVMS
EXTRACT_CUTTING
Jan
JAN
0 10 °C
32 50 °F


DVMS
MOVE
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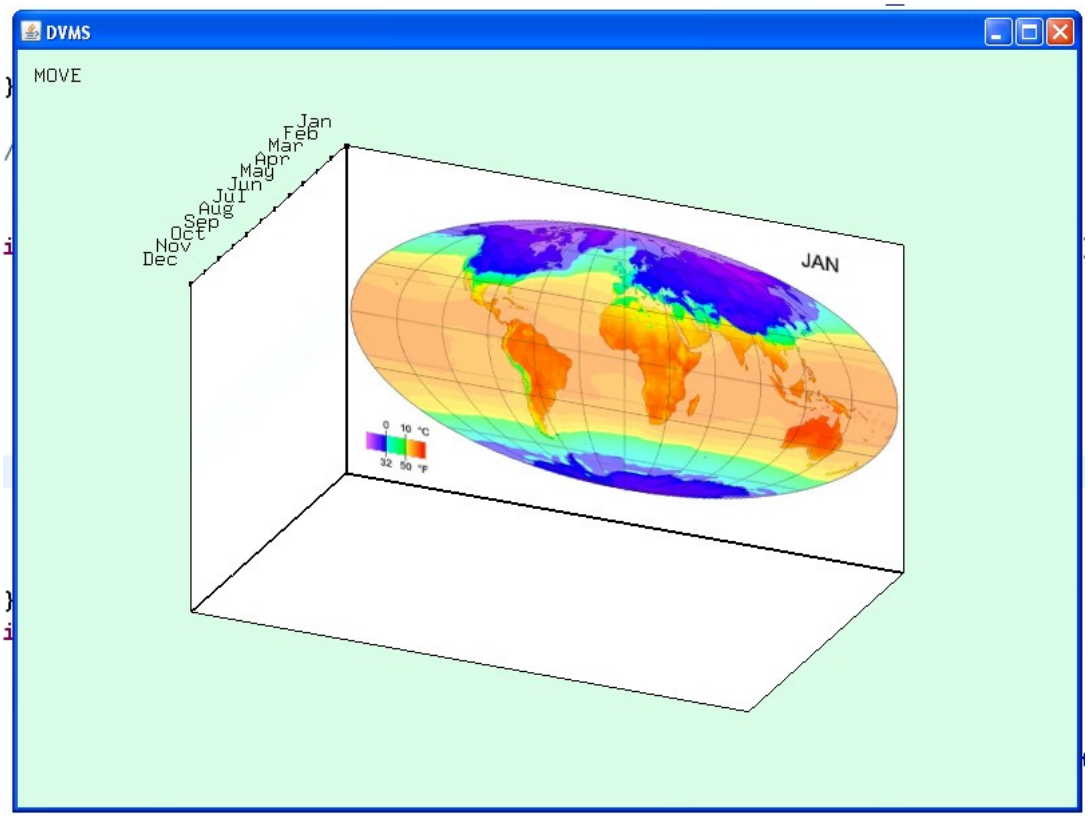
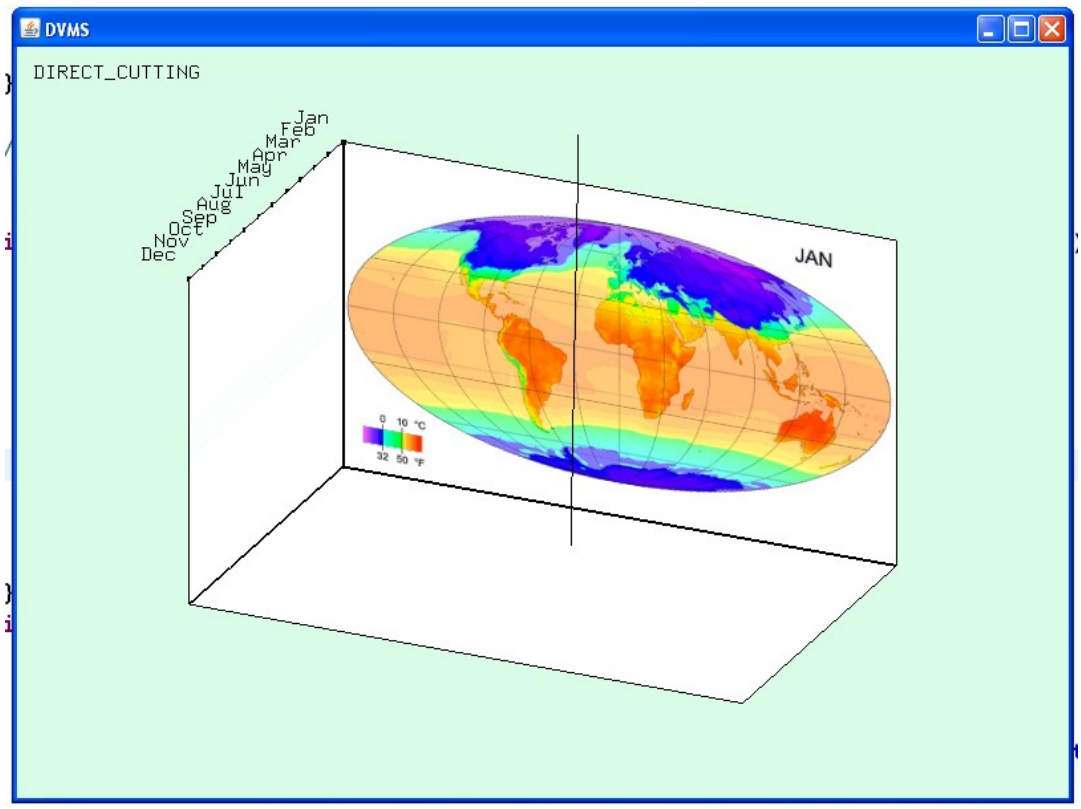
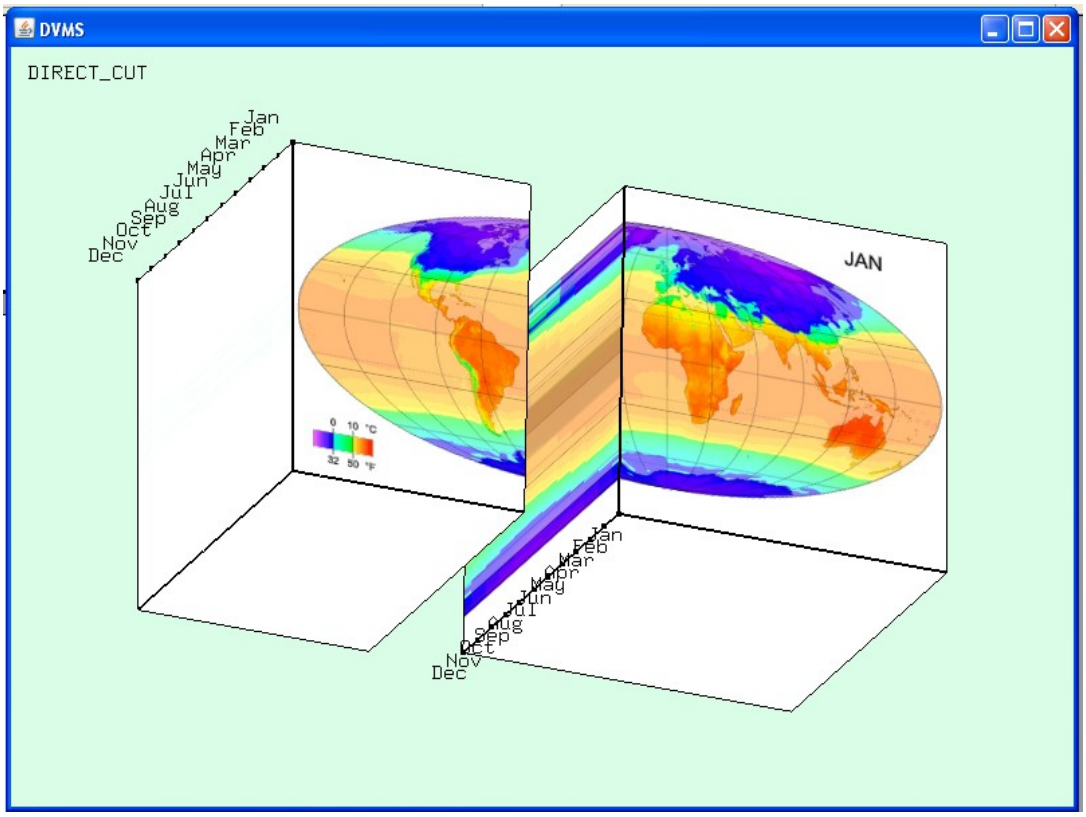
Direct cutting:

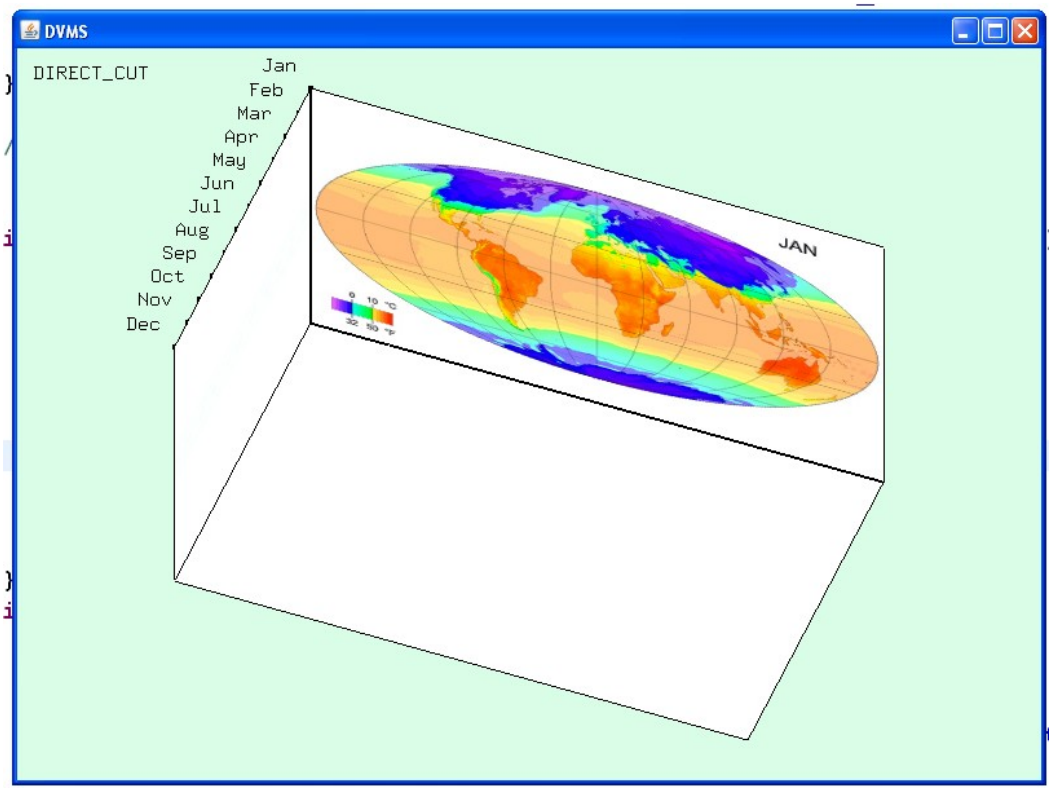
Direct cutting can be applied on rotated faces and on side face of the model. Just click and drag out a segment to cut on any number of model. This tool can be applied on several models at the same time.

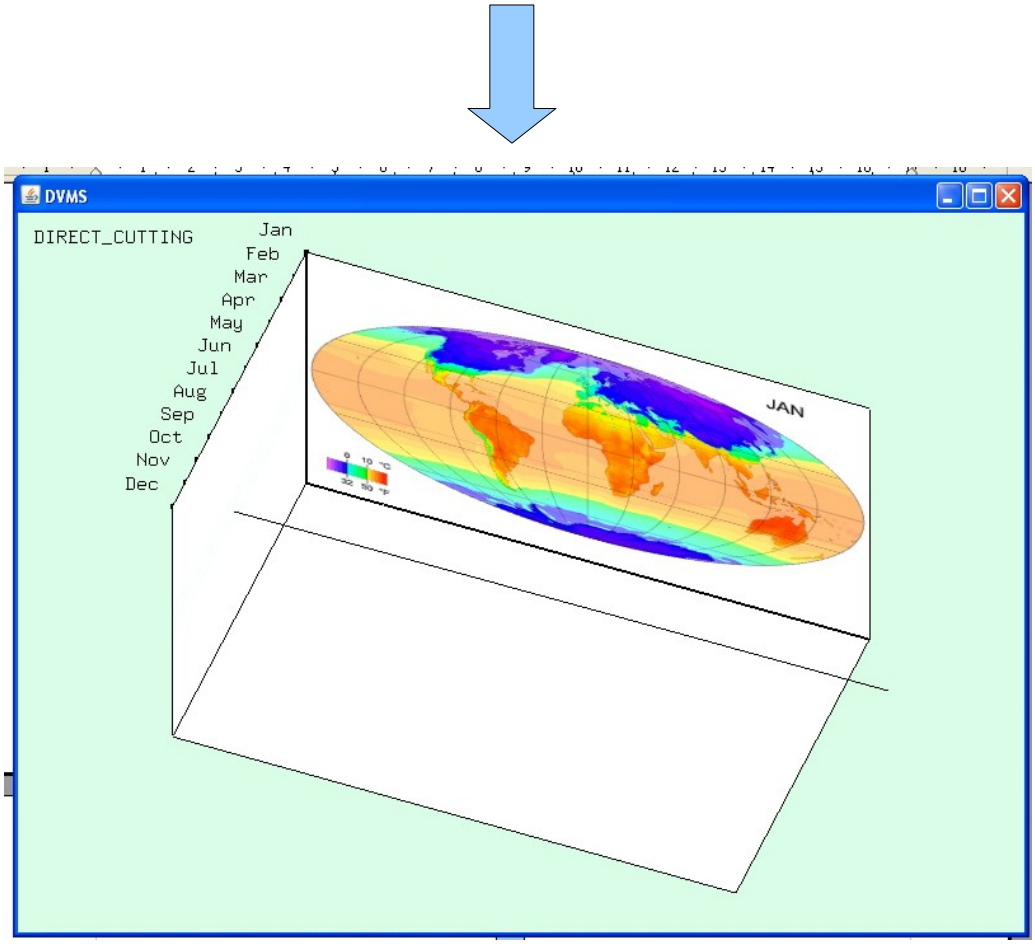


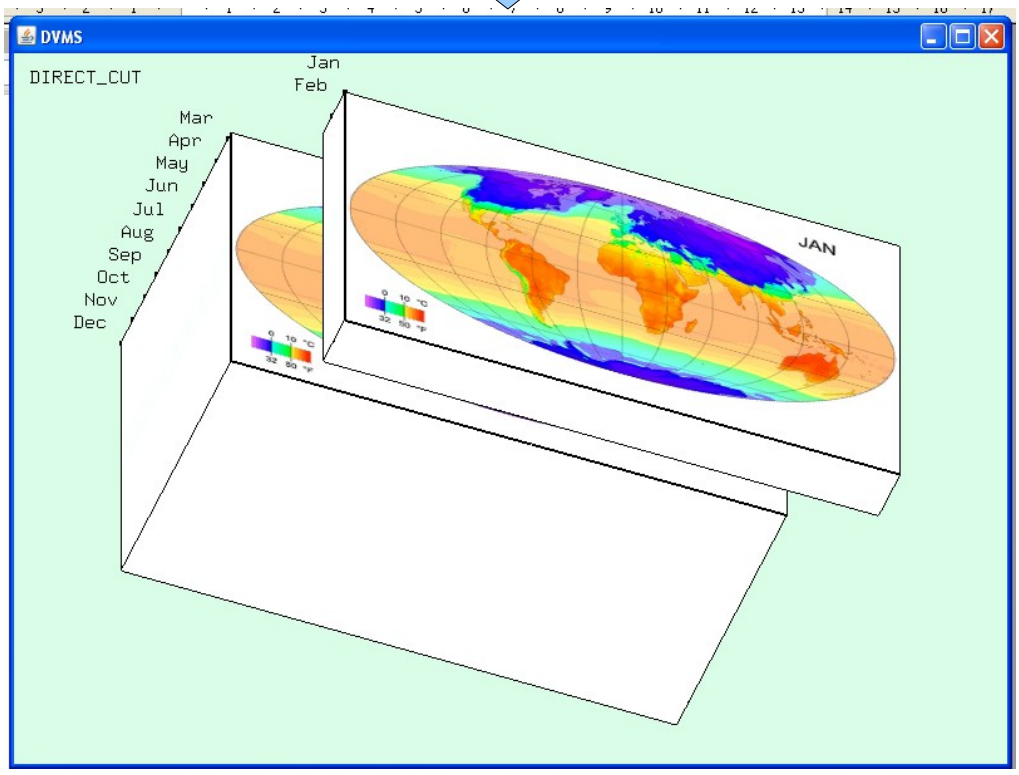




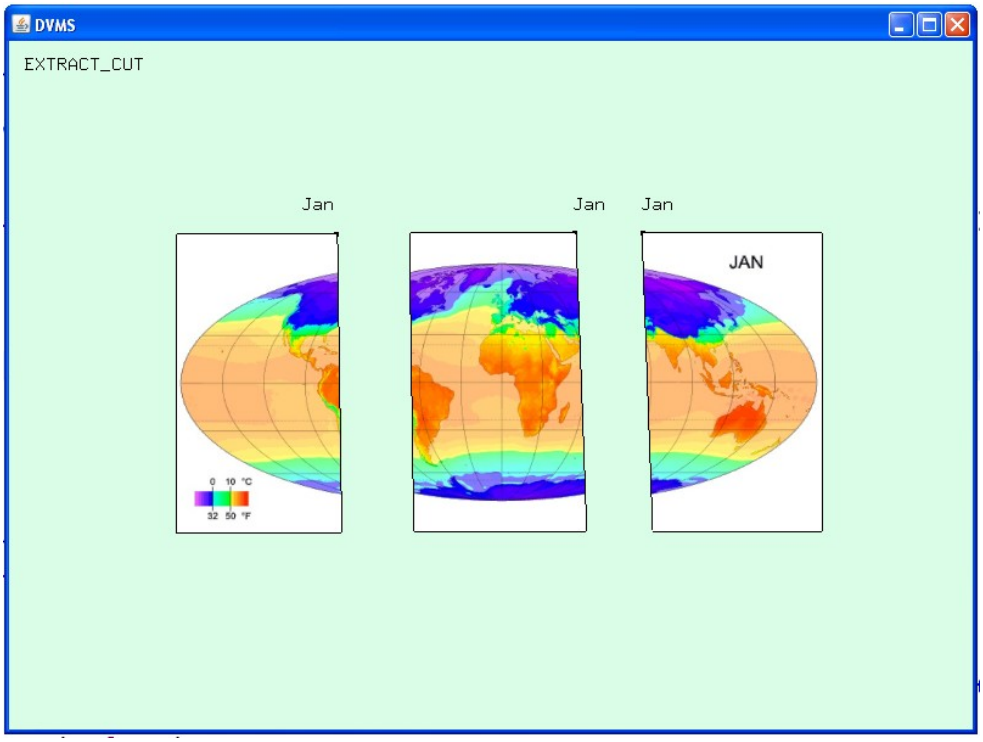
Cutting On Rotated Surface







Cutting on side face


DVMS
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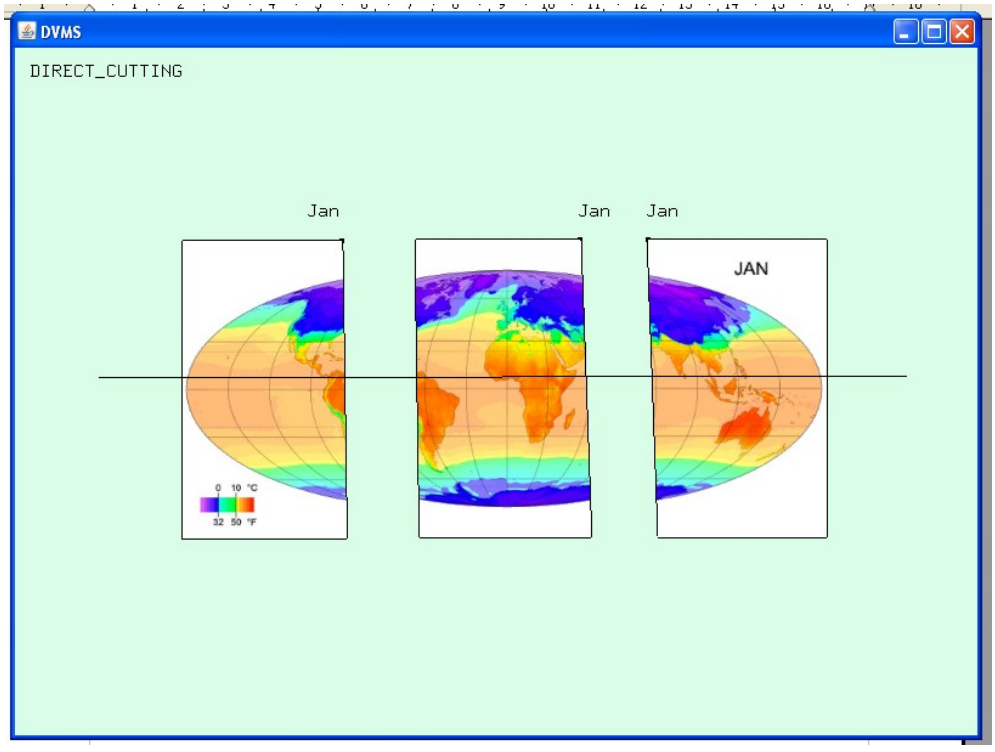
DVMS
DIRECT_CUTTING
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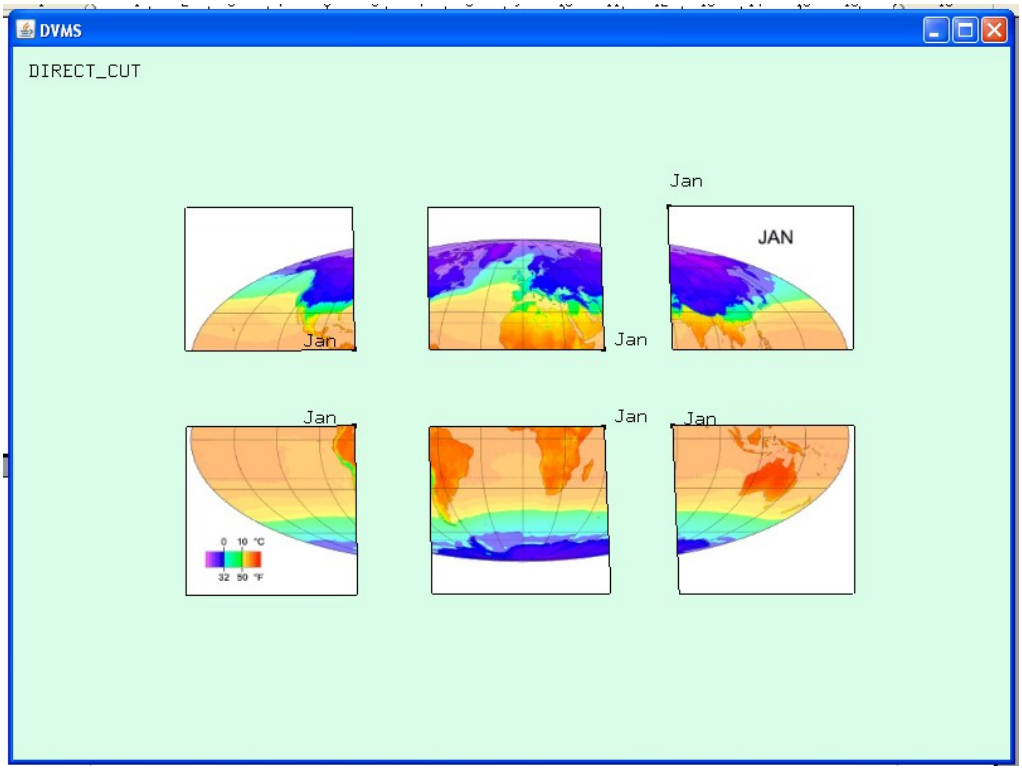
32 50 °F



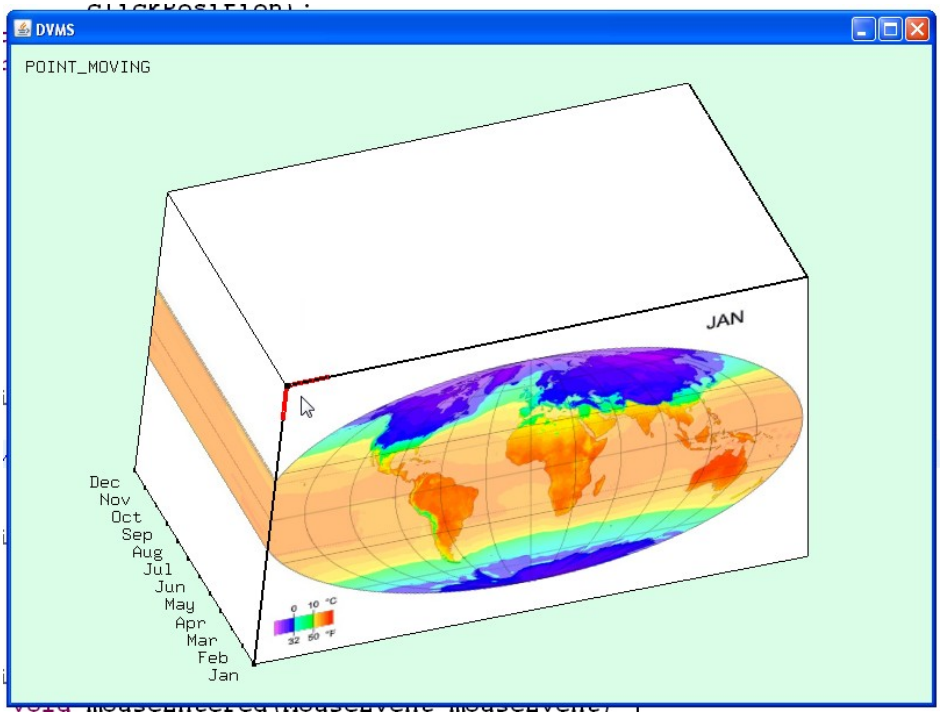
cutting several models a time

Move:

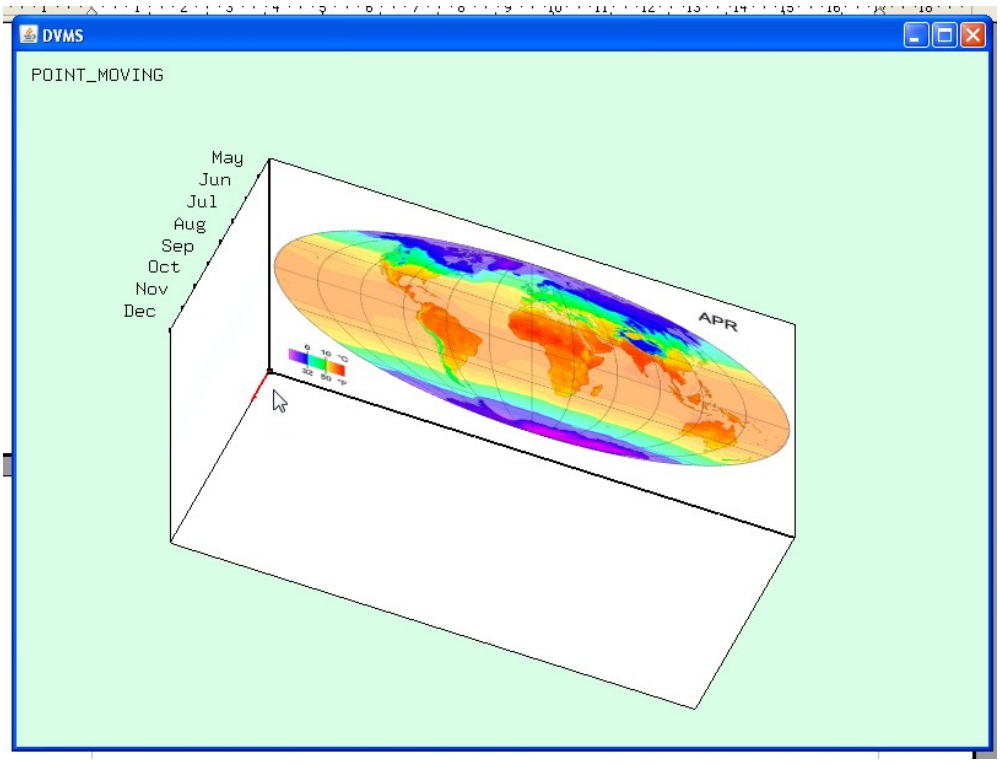
To move the model, click on it and drag.

Point move:

To move the point, select the tool and click and drag the point.

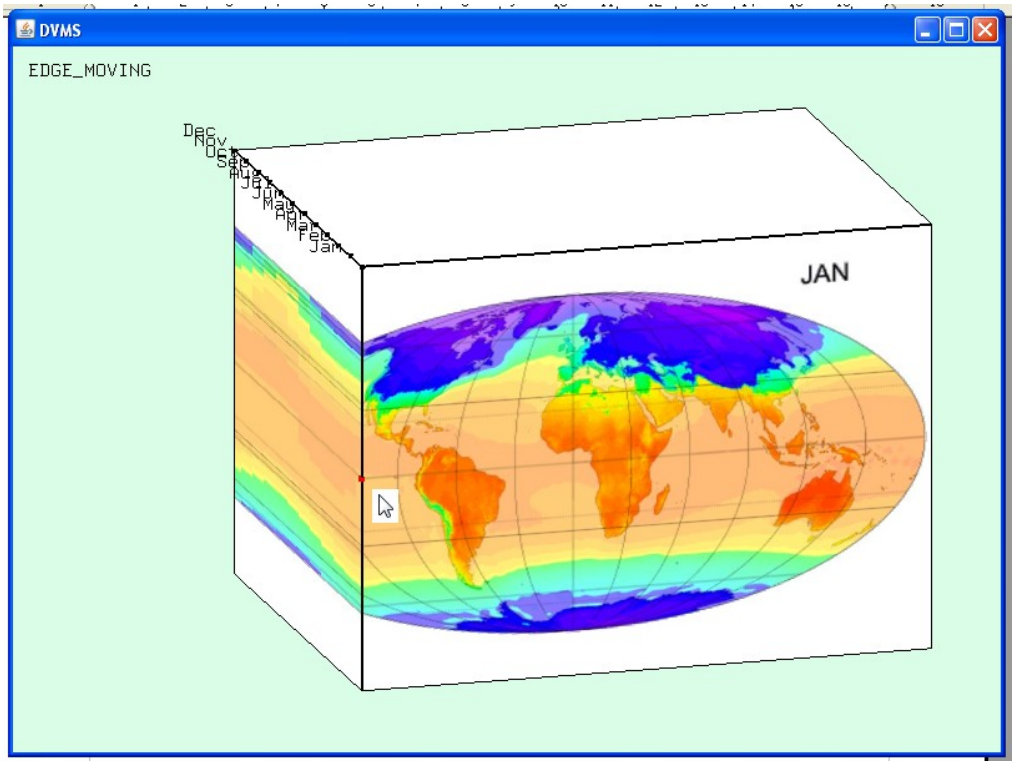


Also the depth:



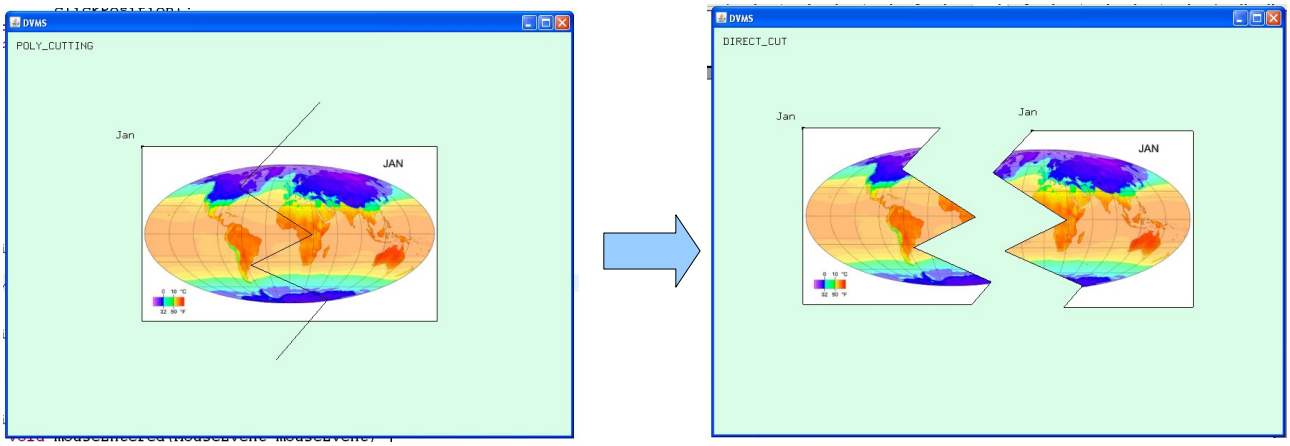
Edge move:

The same with the point move. The control point will be the center of the edge.



Poly cutting:

To use the poly cutting tool, select the tool and draw a poly line with several clicks. Note the poly line cutting can only be used on model which hasn't been rotated as poly cutting line is hard to explain on rotated surfaces.



Bubble cluster system:

Just move the model close to each other (note they must be arrange horizontally). And the models will be automatically grouped.

The user can adjust the depth of the grouped models simultaneously.

Move the model away will break the cluster.

HOT KEYS:

Q:Exit system;

C:Direct Cut;

P:Point Move display Switch;

E:Edge Move display Switch;

F:Free Hand Cut;

M:Move;

G:Graduate Display Switch;

B:Box Display Switch;

L:Bubble Display Switch;

D:Donut Menu Display Switch;