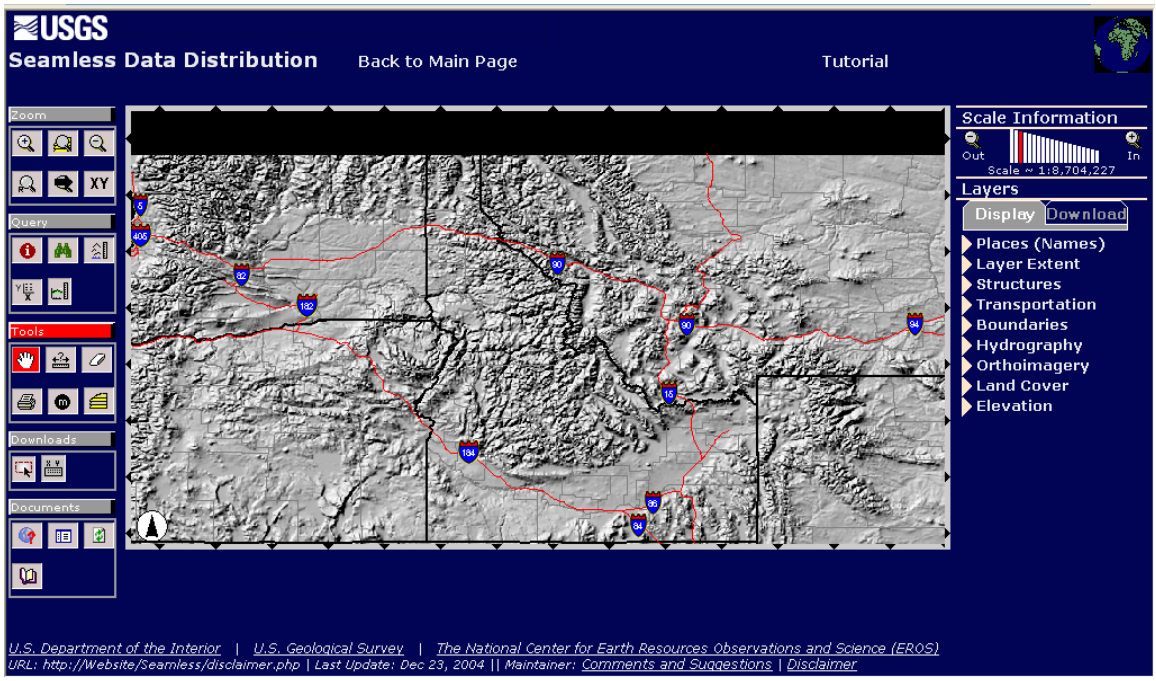
Exercise 15
Insolation Modeler

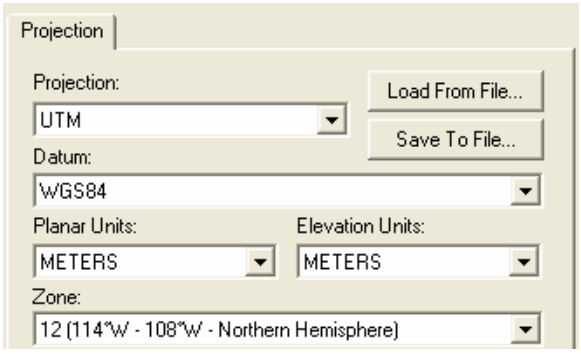
About this exercise and the data set

The data set used in this exercise is taken with permission from Dr. Pat Clark, ARS Boise, Idaho. To run the insolation modeler all we need is a Digital Elevation Model (DEM). The DEM used in this exercise was downloaded from the USGS web site. DEMs consist of a raster grid of regularly spaced elevation values that have been primarily derived from the USGS topographic map series. The USGS produces five types of elevation data. The type used in this exercise is the 7.5-Minute DEM which corresponds to the USGS 1:24,000 topographic quadrangle maps. These are cast to the Universal Transverse Mercator (UTM) projection system and are referenced to either the North American Datum (NAD) of 1927 (NAD27) or the NAD of 1983 (NAD83). Most files will have a grid spacing of 30 meters, but 10-meter grids are also available for some locations. The average file size of a 30-meter DEM is 1.1 megabytes and 9.9 megabytes for a 10-meter DEM. They are available in Native and Spatial Data Transfer Standard (SDTS) format. You can learn more about USGS DEM using the following link:
http://edc.usgs.gov/products/elevation/dem.html

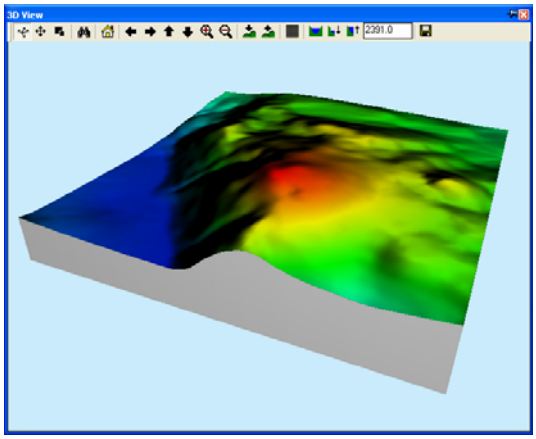
To download (FTP site) USGS DEM click on the following link:
http://seamless.usgs.gov/website/seamless/viewer.php

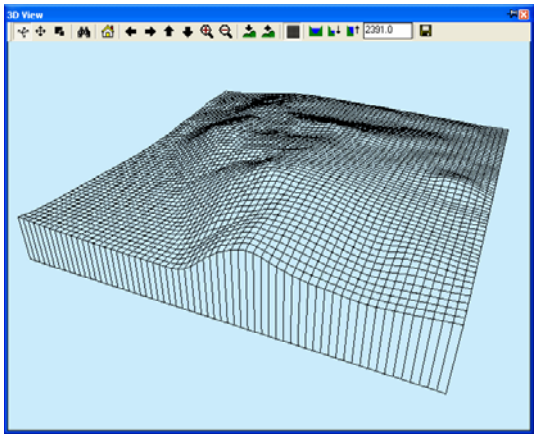


To properly fit over the data set the data was projected to UTM WGS84 Zone 12.



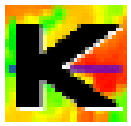
For the purpose of this exercise we windowed a small portion of the area. We concentrated on the dome. This will make the analysis run faster. Two data layers, **Aspect** and **Slope** needed to run the analysis will be generated. There is no constraint layer for this data set.

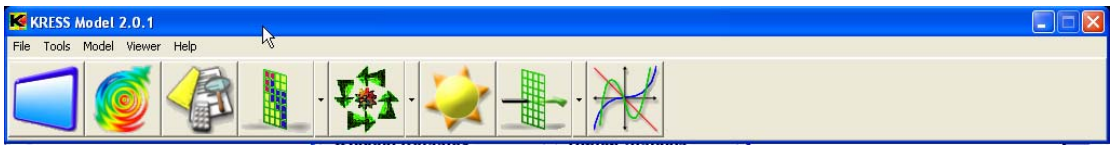




Step 1: Starting KRESS Program

To launch the KRESS model, double click on the icon.

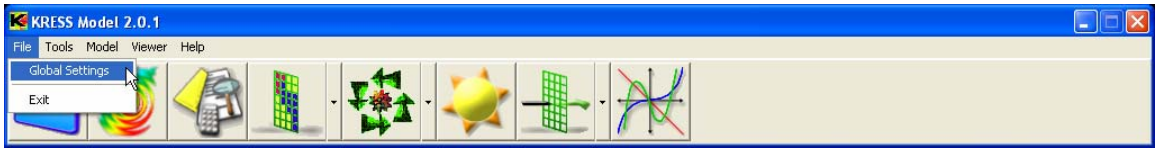




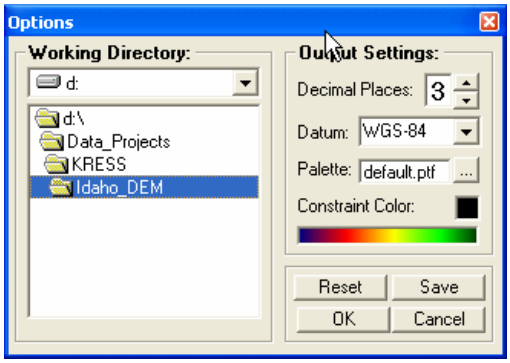
Once the system has loaded, notice that the screen has two types of command menus, the top one consisting of drop-down menus and the bottom one showing pictorial emblems. The drop-down menus – File, Tools, Model, Viewer, and Help – are used for the most control and manipulation of the program. The tool bar of icons is used to control display preferences and to access commonly used facilities.

Step 2: Setting the Working Directory and Output Setting

A project is a compilation of data files. Therefore, it is necessary to create a **Working Directory**. This is the most fundamental element in organizing data files; both the input files to be used and the output files subsequently created by you, as well as your written analysis results. Creating a working directory activates the **Project Environment** module, allowing you to set the data paths of your file folders. In order to access the working directory, go to the drop-down menu labeled **File** and click on **Global Settings**.



This will open a new window, as pictured below.



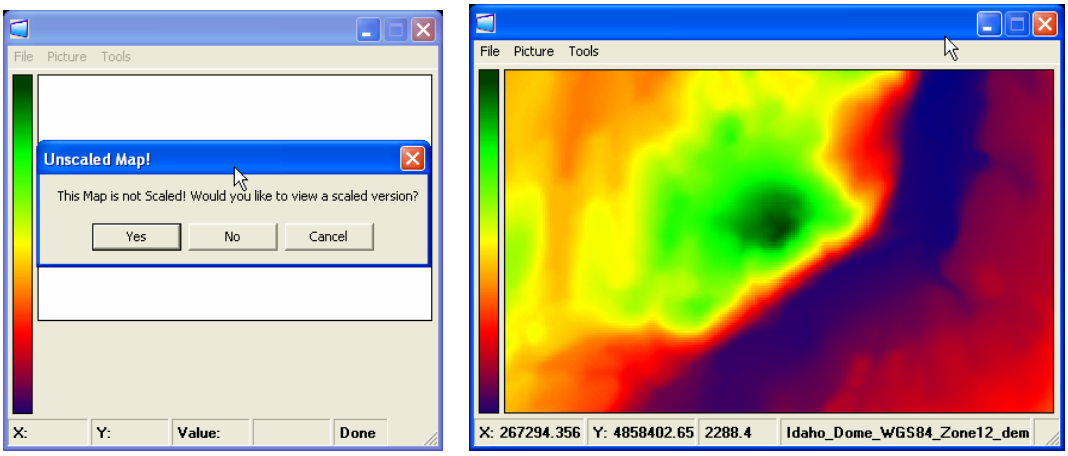
The first time the KRESS Model is launched, the program refers to the default working directory, usually found in the c (or data) drive, named c:\Program Files\KRESS. If it is not set up this way, use the drop-down menu to change the working directory drive. On the right-hand side of this window there are options for the output settings. You can either use the default settings or reset your preferences pertaining to the number of decimal places, the display palette and the constraint color. Factors are displayed in multiple colors, in contrast with the constraints, which are shown in a single solid color. For this example, we are using the default palette, or the "KRESS Model Default Quantitative Palette".

It is possible to specify a different input or output path using the browse button **"…"** and selecting from another folder. The instructions are written assuming that all default paths were accepted during installation. If the tutorial data was installed and then routed to a different location, the files will be found there rather than in the default settings; therefore, these instructions may not be applicable and should be adjusted accordingly.

Step 2: Displaying the DEM

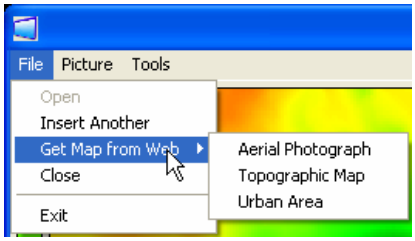
Using the first bottom **Viewer** displays the study area DEM.

When asked to scale the map, click on **Yes**.

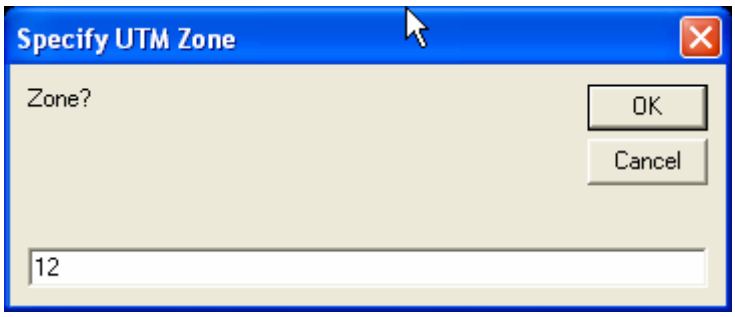


Step 3: Displaying Additional Maps

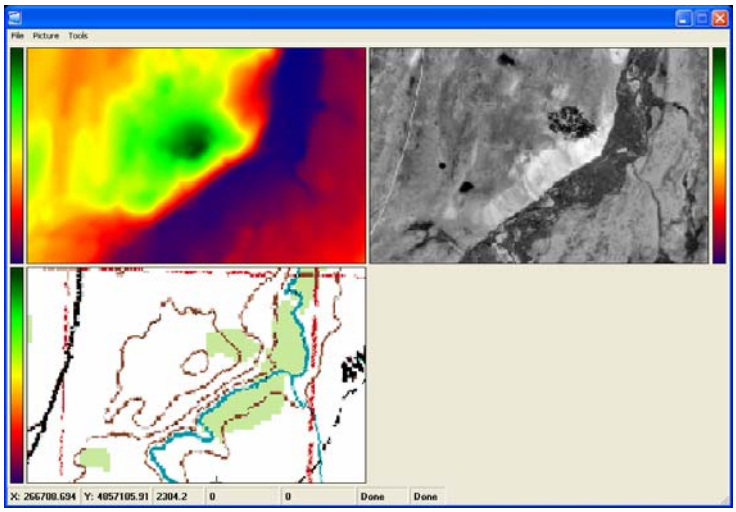
If you have connection to the internet and would like to open additional viewer for the same area, you can do so from the viewer module, as shown below.



As mentioned earlier, the study area is in Zone 12.

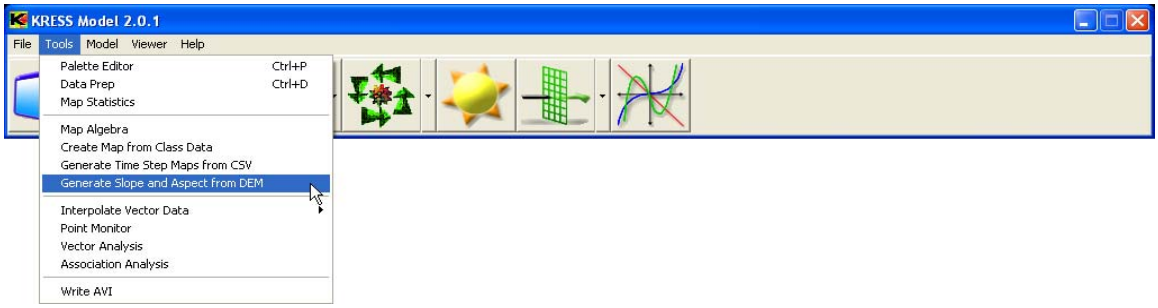


Add the Aerial photograph (DEQ) and the topographic map (Digital Raster Graphic).

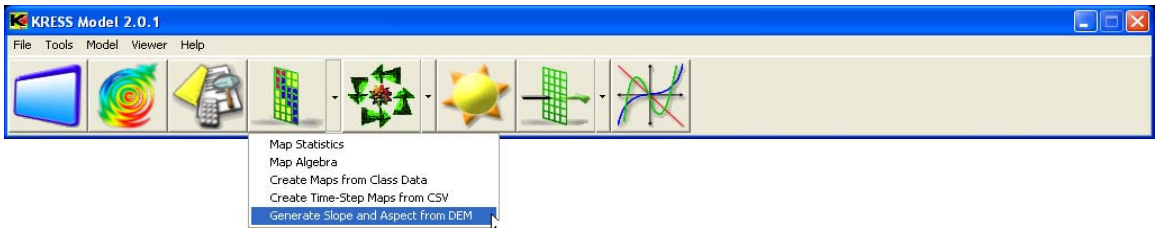


Step 4: Generating Slope and Aspect Maps

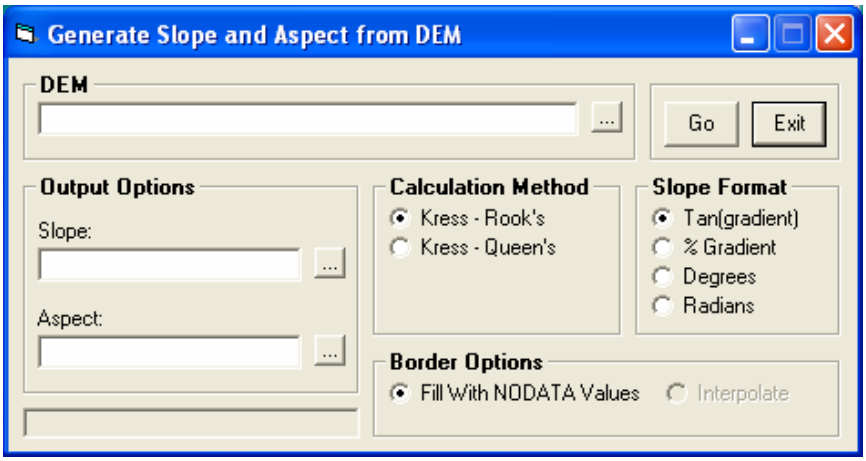
Before we can run the insolation modeler we need to create the slope and aspect maps.
From the **Tools** menu, select **Generate Slope and Aspect from DEM**.



You can also access the same function from the raster tools button:



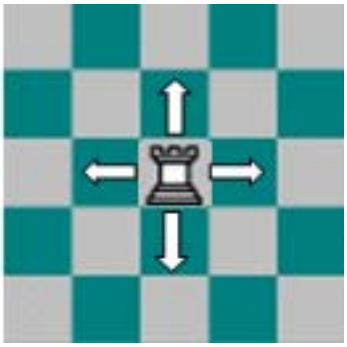
A new window will open.



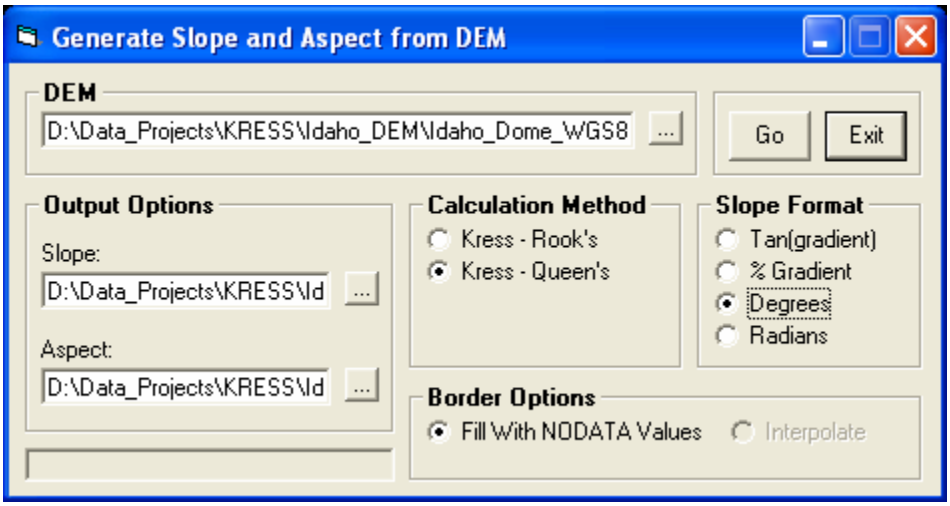
Load DEM: Idaho_Dome
Name output: Slope and Aspect

Calculation methods:
The rook's method goes 5 cells (North, South, East and West)

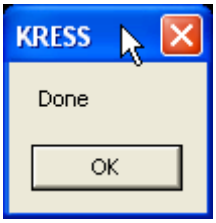
The queen's method goes 9 cells (All directions)



Choose the Queens method
Slope format: Degrees
Border options: Fill with no data values



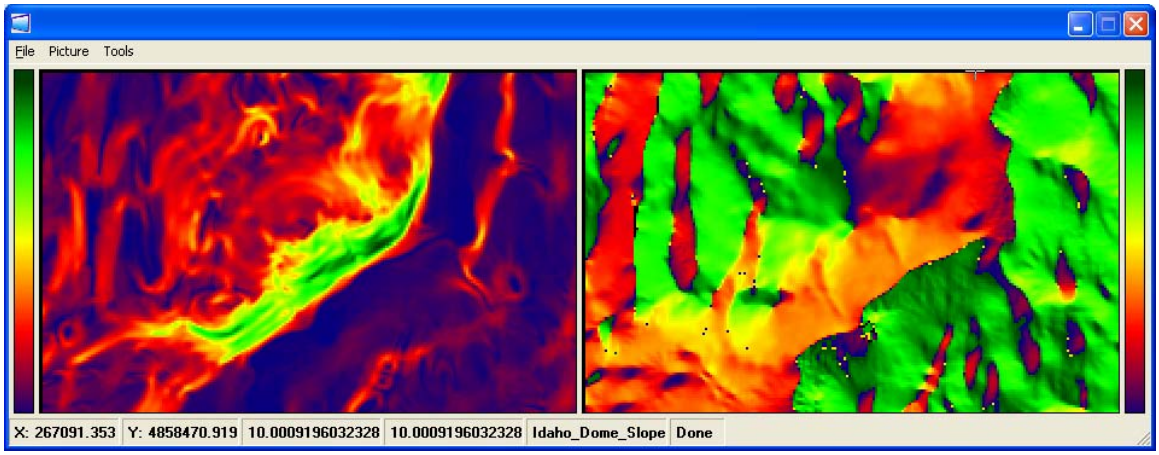
Click on **Go** to run the program. Then click on **OK** when the following window pops up.



Click on **Exit** to exit the **Generate Slope and Aspect** window.

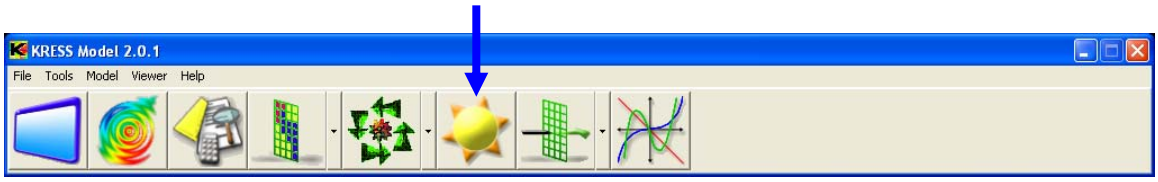
Step 5: Displaying Both Maps

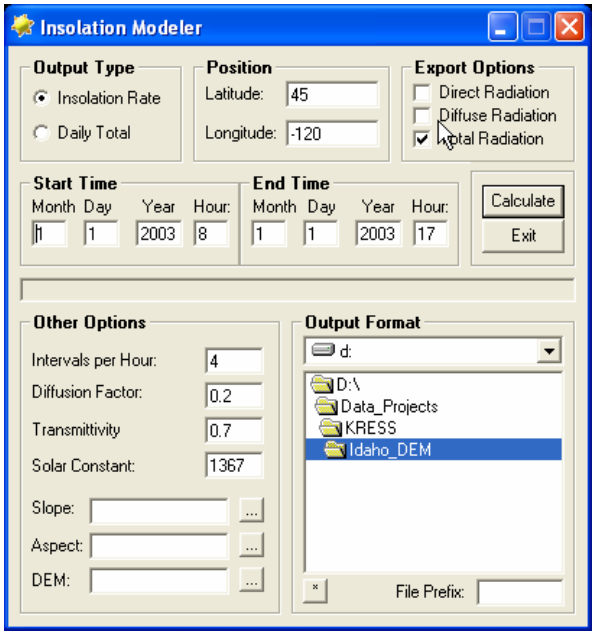
Click on the viewer icon and open the slope and aspect maps.



Step 6: Starting the Insulation Modeler

From the tool bar click on the Insolation Modeler.





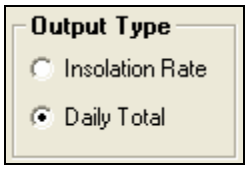
In the next steps we will fill this table:

Step 7: Output Type

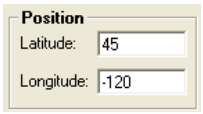
Insolation Rate is the amount of incoming solar radiation (shortwave) reaching earth's surface. It varies with transparency of environment (how many clouds), angle of sun above the horizon, and local reflectivity of the surface. Therefore, solar angle will be affected by latitude and season.

Insolation Rate = watt per m^2

Daily Total: Joule ($m^2 \cdot kg \cdot s^{-2}$)



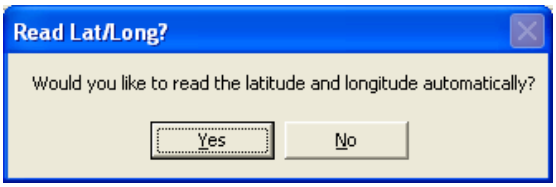
Step 8: Position



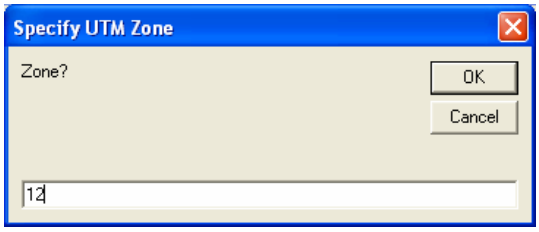
Load any of the 3 maps required to run the modeler.

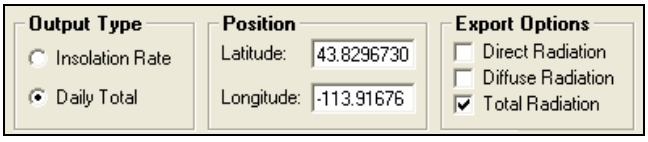
The program will ask you if you would like to read the latitude and longitude automatically.

Click **Yes**.



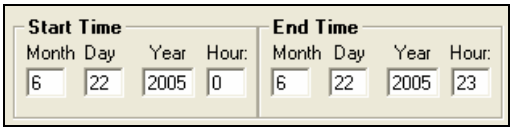
Specify the UTM Zone. Enter 12.





Step 9: Filling in Starting and Ending Time

Choose a starting and ending time for the model to run:

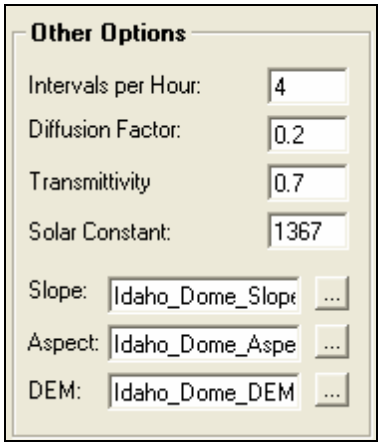


Step 10: Other Options

Solar Constant describes the solar radiation that falls on an area above the atmosphere at a vertical angle.

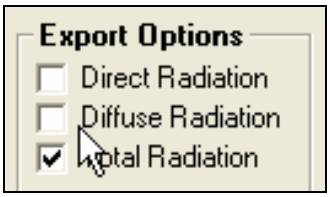
Solar constant = 1.37 kW / m²

In space, solar radiation is practically constant; on earth it varies with the time of day and year as well as with the latitude and weather. The maximum value on earth is between 0.8 and 1.0 kw/m².



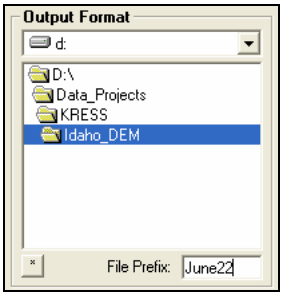
Step 11: Export Options

In this exercise we will export the total radiation. Feel free to experiment the other two options.



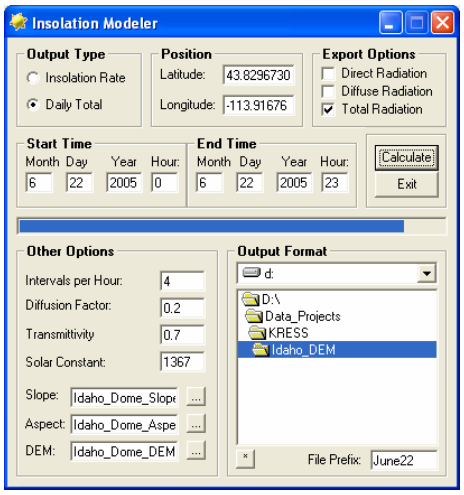
Step 12: Output Format

Specify the output folder.



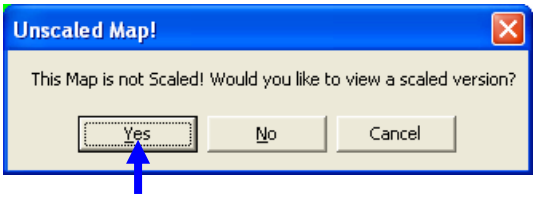
Step 13: Running Insolation Modeler

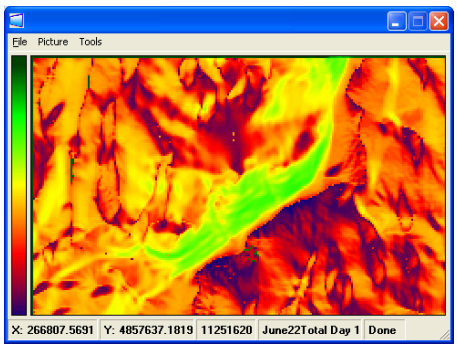
Now you are ready to run the insolation modeler. Click on **Calculate**.



Step 14: Viewing Map in KRESS Viewer

Open the july22 daily total insolation map using the KRESS viewer.





Move your cursor over the map and check the values (watt per m^2).