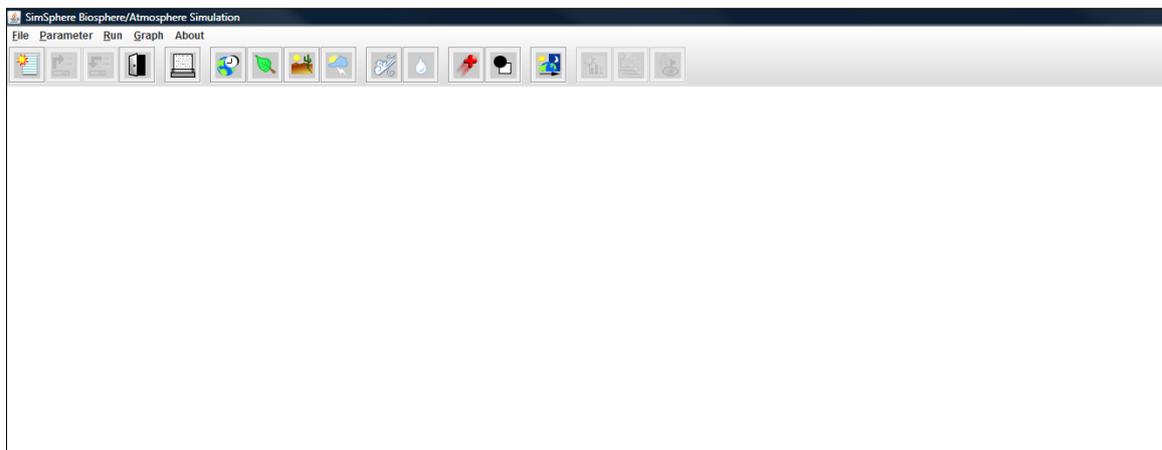


EA12210 Practical:

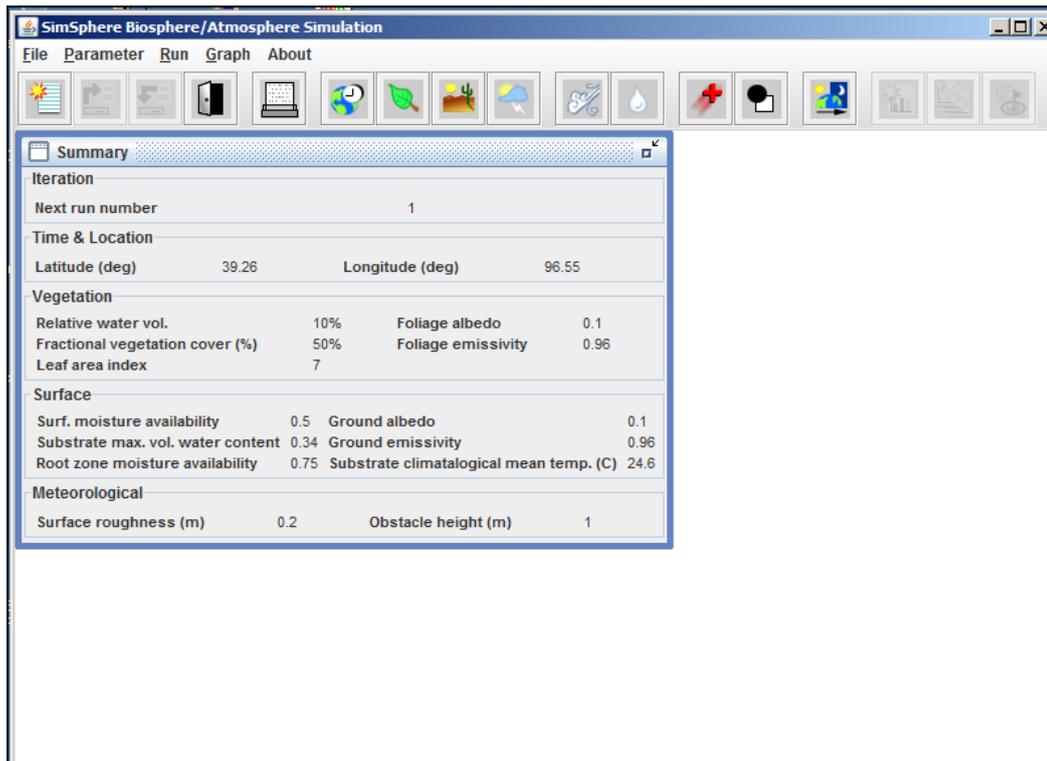
Using SimSphere Simulation Process Model

In this practical you will use the SimSphere 1-d land surface process model to compute different parameters characterising Earth's land surface interactions and to explore feedback processes that may exist between those parameters. Here some of the basic functions of this land biosphere will be presented, whereas for more detailed information on the topic you can look at the model User's Manual that can be found at <http://www.aber.ac.uk/simsphere>.

1. To access SimSphere, first open Internet Explorer.
2. Go to <http://www.aber.ac.uk/simsphere>
3. Under '*Running the Simulation*', click on '*SimSphere applet*' and follow the instructions. Wait for the applet to appear in a new window as shown below:



4. Click on **File > New Simulation**. The default set of initial conditions for the model run will appear in the small window as shown below:



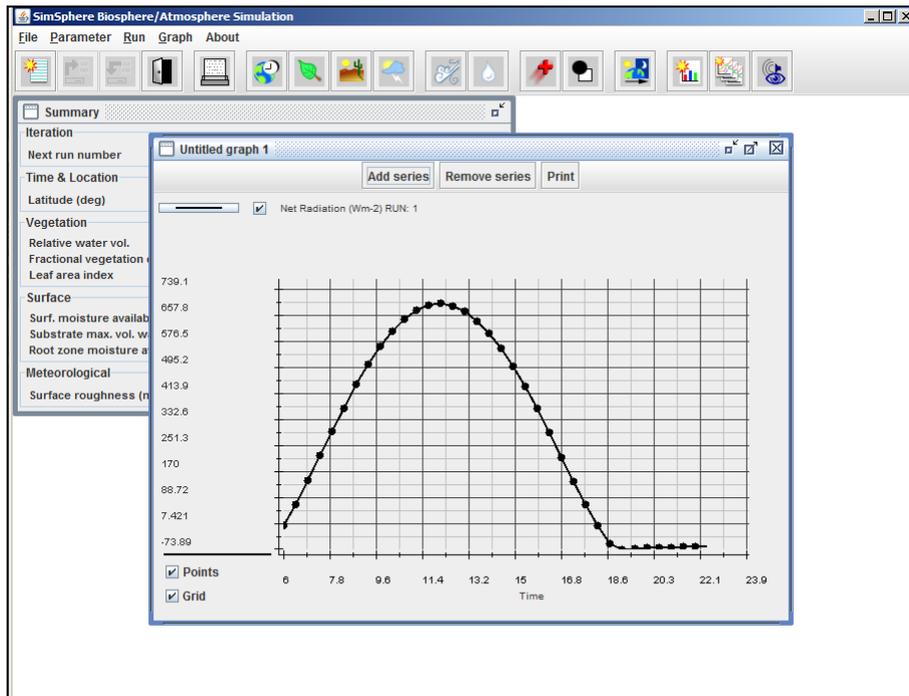
TASK 1

Our first task is to explore the model initial conditions for the different “groups” of the model input parameters. To do so, on the main menu go to “**Parameter**” and then look at each of the different options you see. For example, clicking on **Parameter > Time and Location** will show more detailed settings related to the geographical location on which you wish to perform the simulation. Similarly, clicking on **Parameter > Vegetation**, you will see the different inputs that are required by the model to describe the vegetation. Click Cancel to close this window after looking at each of the groups of parameters.

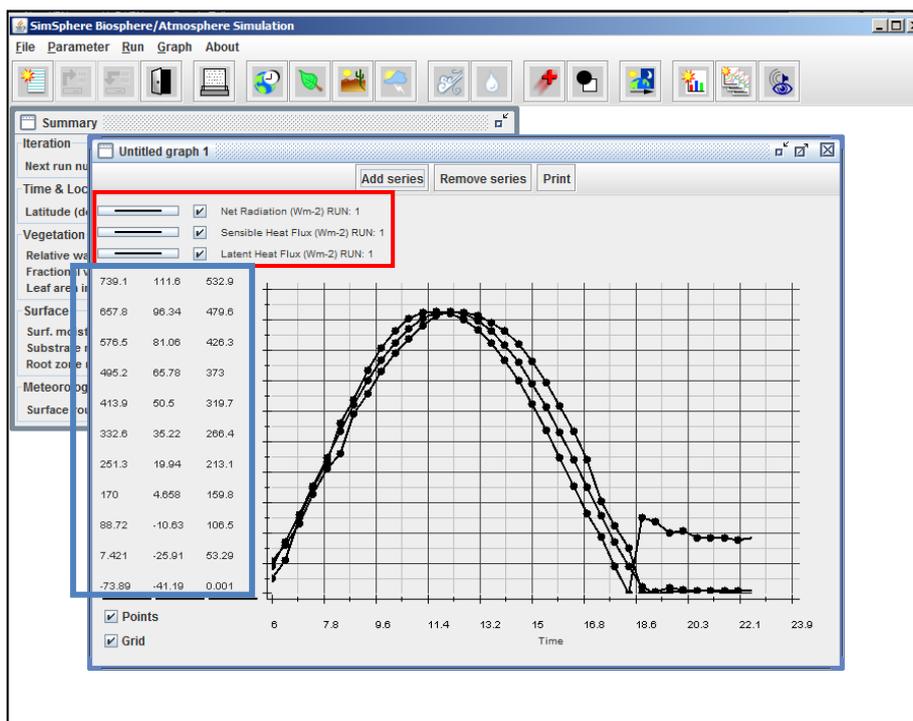
TASK 2

Our next objective is to perform a simulation using the default model parameterisation which we just explored and to see graphically how key parameters of the energy balance equation vary diurnally.

5. To perform a simulation with SimSphere click on **Run > Run Simulation**
6. To graph the diurnal variation of any parameter simulated by the model, click on **Graph > New Graph > Add series**. Scroll down and click first on **Net Radiation**. Click **Add**. A graph of daily net radiation will appear as shown below.



7. Now follow exactly the same steps outlined above to plot **Latent Heat Flux** and **Sensible Heat Flux** on the same graph by clicking on "Add Series".
8. You can now change the way the graphs are appearing. To do so, use the buttons highlighted in the red box below to change the colour or the shape of the line graphs. The checked boxes can also be used to turn data series on and off. Note that each graph is plotted on a different scale (see blue box). This can be confusing! It is essential to look at the scale when analysing these outputs, therefore, rather than at the line graphs only.

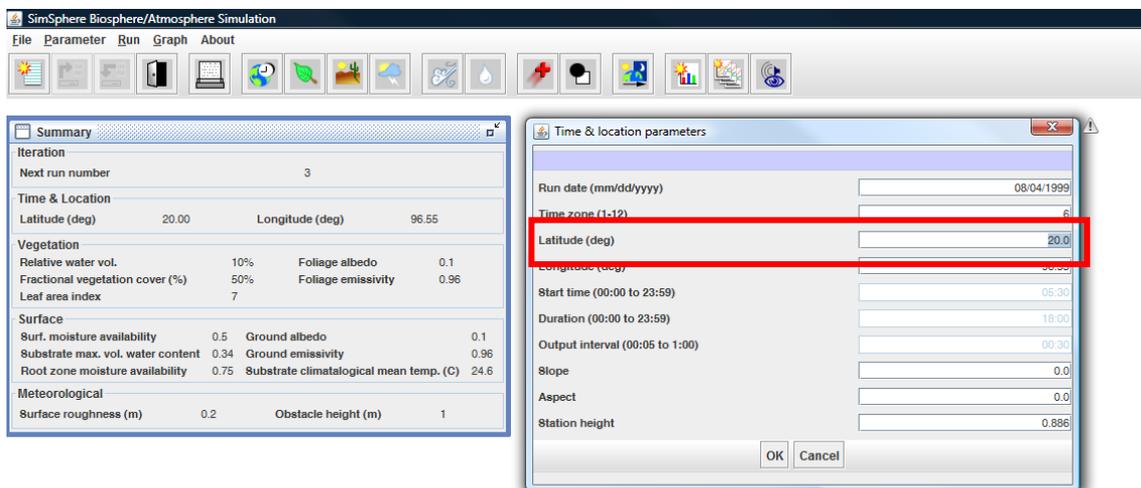


TASK 3

9. The next objective of the exercise is using to use the SimSphere model to explore the relationship between net radiation and geographical location for the given initial conditions used so far:
- In other words: *ok, what would be my net radiation if I had exactly the same conditions in everything but my site was located at a latitude of 20° (the latitude of the border between Libya and Sudan) instead of Kansas (that is the default location for which I just had my simulation)?*

To examine this “scenario”

10. First we need to change the location and date of the simulation. Click on **Parameter > Time and Location** and change latitude to 20°. Click OK.



- Click on **Run > Run Simulation**. On your graph Click Add Series and choose **net radiation**. This will be the net radiation of your second run at 20°. Uncheck the Sensible Heat Flux and Latent Heat Flux of Run 1 and change the colour of Net Radiation of Run 2 so that you can compare the net radiation at Kansas and on the lower latitude. How are they different? Why?
- Repeat this process, but this time for **Latent Heat Flux**. You do not need to run the simulation again. Just click on **Add Series** and choose **Latent Heat Flux**.
- Repeat again same steps as in 12, but this time for **Sensible Heat Flux**.
- Now go back to the model initial conditions and change the latitude to 60° (representing location of Alaska).
- Run SimSphere again and compare net radiation, latent heat flux and sensible heat fluxes between the three latitudes. What do you observe? What is causing the differences observed in the energy balance parameters you examined?

TASK 4

16. Your next task is now to use your default initial conditions and explore how the month of the year may affect net radiation, latent heat flux and sensible heat flux.

17. First change the simulation date from April to August and following the steps outlined already above compare net radiation, latent heat flux and sensible heat flux for Kansas in April and August. Do they differ and if so, why?



TASK 5

18. Now you can begin experimenting with some of the other parameters. Try changing some of the vegetation (% cover, type), surface (soil moisture availability, soil type) and meteorological (cloud cover) parameters. Try to explore and analyse how changing one or more input parameters influences the key outputs (net radiation, latent heat flux and sensible heat flux). In other words, try to identify the different “feedback processes” between different parameters characterising the Earth system

19. Note that apart from the parameters you have plotted already, you can also include other variables in your graphs e.g. air temperature at different heights, humidity and surface moisture availability.

20. Using the model’s tools, export the data and import it into Microsoft Excel. Think about how you would plot these data in Excel and how you could statistically compare these modelled data to actual measurements derived from in-situ instrumentation, if available. What statistical tests and graph types would you use for this purpose?

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