MODELLING CLIMATE CHANGE:
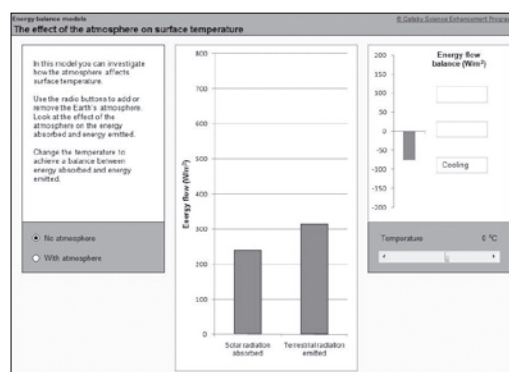## THE NATURAL GREENHOUSE EFFECT

A simple computer model on a spreadsheet can be used to calculate estimates of the Earth's average surface temperature. With this energy balance model of the climate system you will see how the Earth's atmosphere keeps the surface warm – the 'natural greenhouse effect'.

Task A Estimating the Earth's surface temperature with no atmosphere

1. Open the Excel spreadsheet *MCC_EnergyBalance* and click on the tab 'Model 1'. Click on the button 'No atmosphere'.

2. The two bars on the graph show the energy absorbed and energy emitted at the Earth's surface. Move the 'surface temperature' slider bar backwards and forwards. What happens to the energy absorbed and the energy emitted?

3. Adjust the temperature until the energy absorbed by the Earth is equal to the energy emitted by the Earth. The model is now in equilibrium. Record the temperature that this happened at in a table like the one shown.

Task B How does the atmosphere affect surface temperature?

4. Click on the button 'With atmosphere'. What happens to the amount of energy emitted by the Earth? Can you explain the change?

5. Move the temperature slider bar again. What happens as you increase and decrease the temperature?

6. Find the temperature at which the model is in equilibrium. Record this temperature in the table.

7. What effect does the atmosphere have on the surface temperature of the Earth? Can you explain why the atmosphere has this effect?

8. What are the limits of this model?

Surface	Temperature at equilibrium (°C)
No atmosphere	
With atmosphere	

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