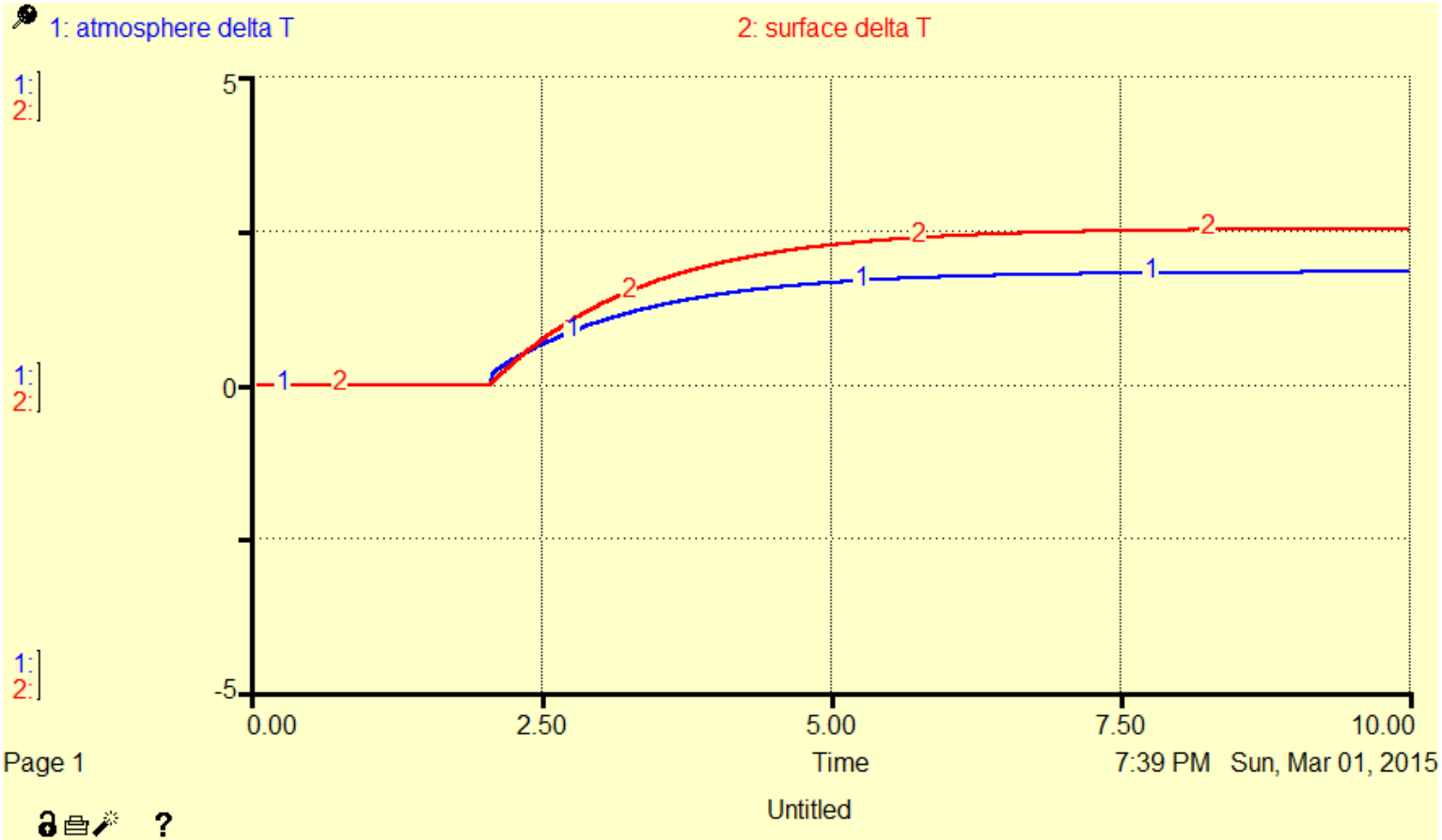
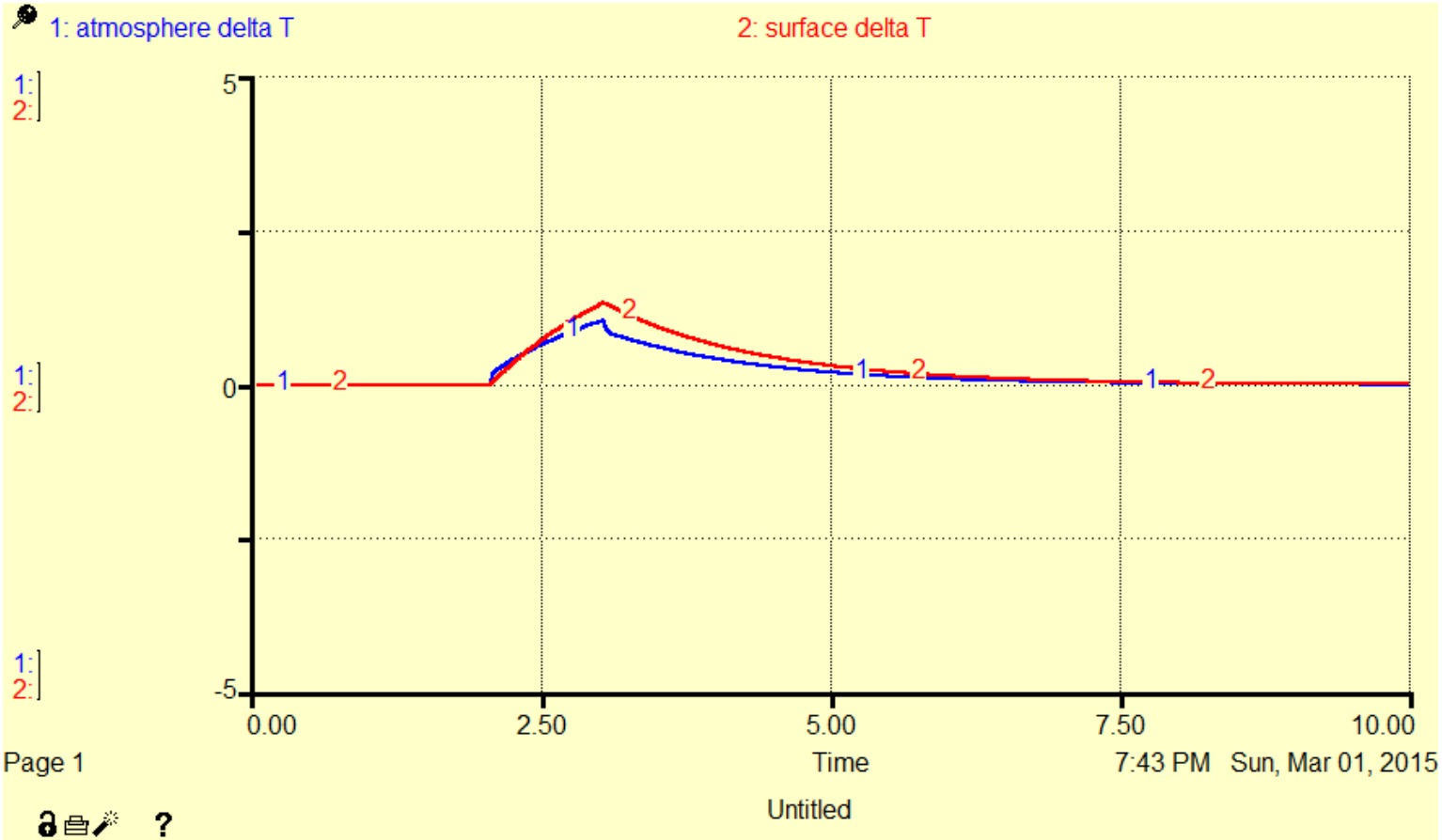
Global energy balance

1. Altering the solar input



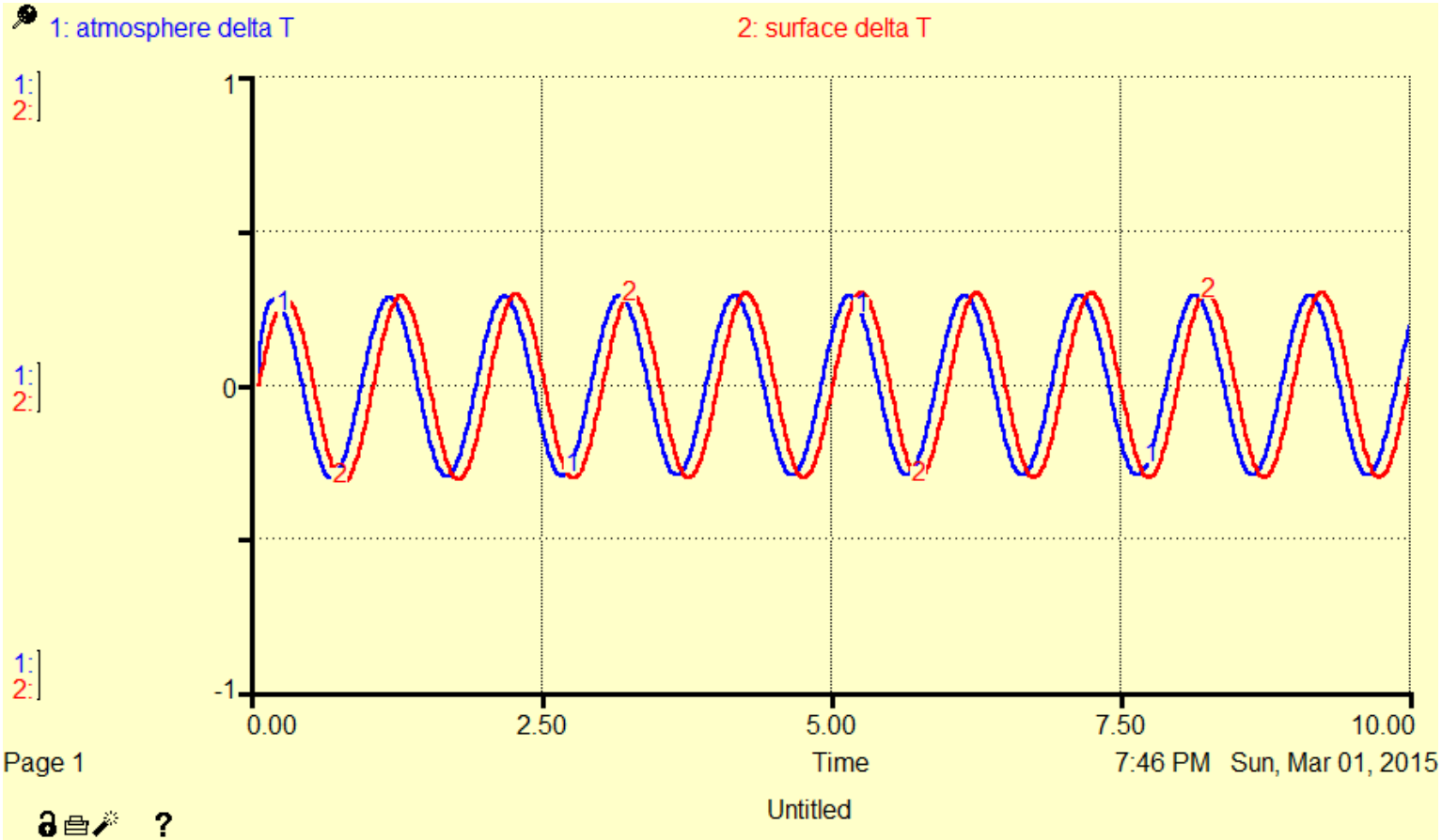
- Increased solar input from 100 to 103 and held constant

1. Altering the solar input



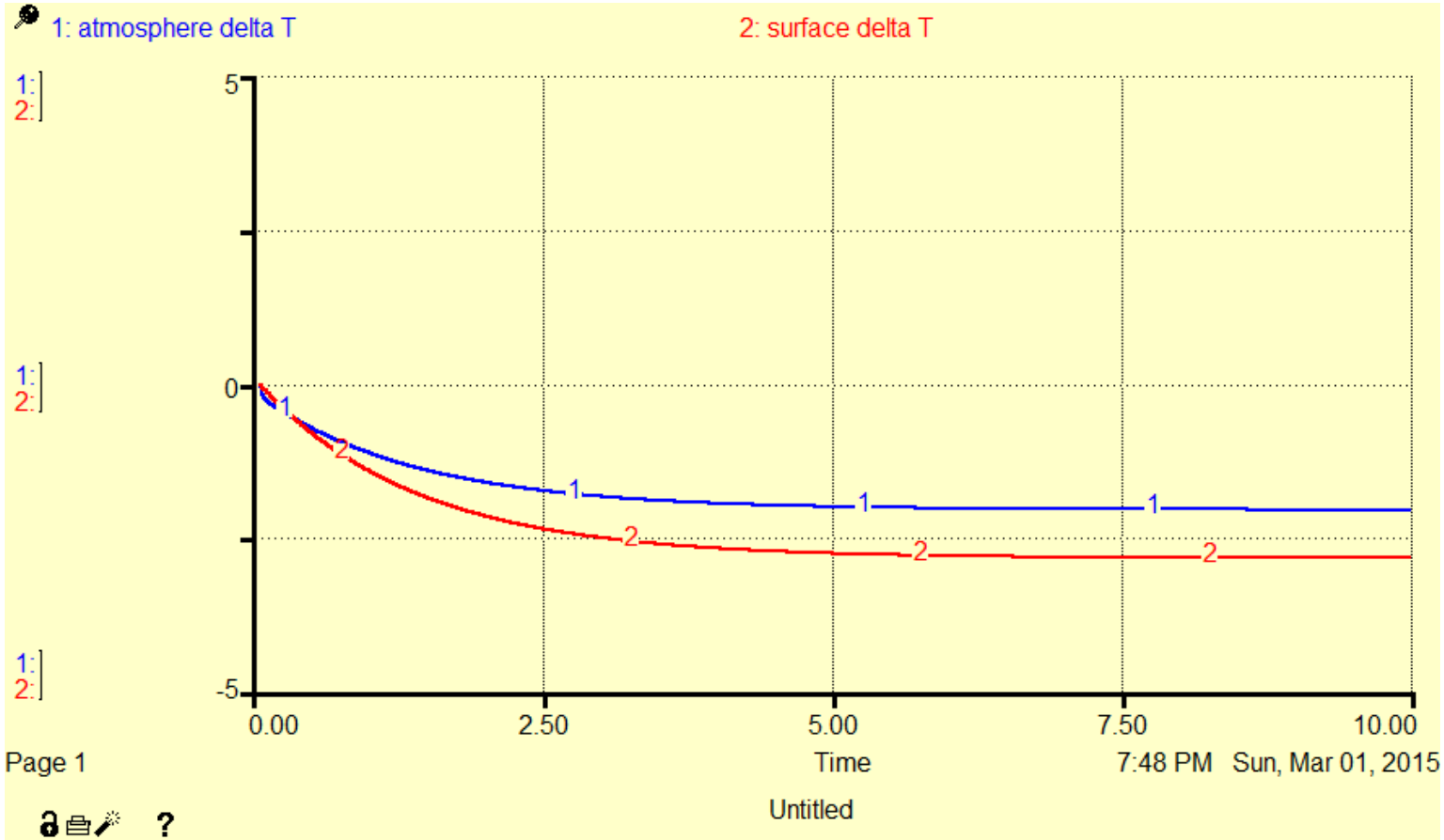
- Temporarily increased solar input from 100 to 103 for one year

1. Altering the solar input



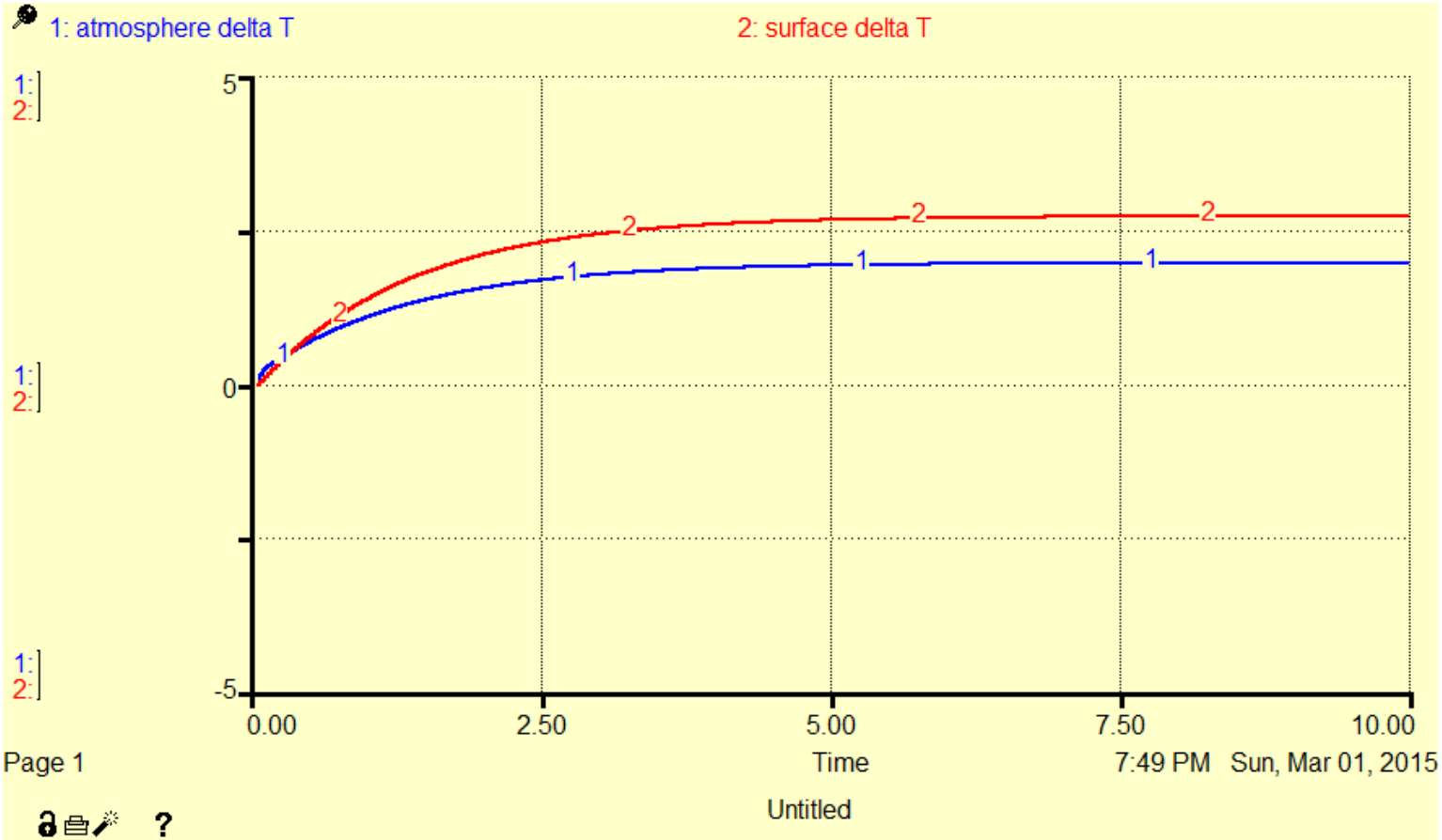
- Seasonal variability in solar input

2. Altering the cloud cover



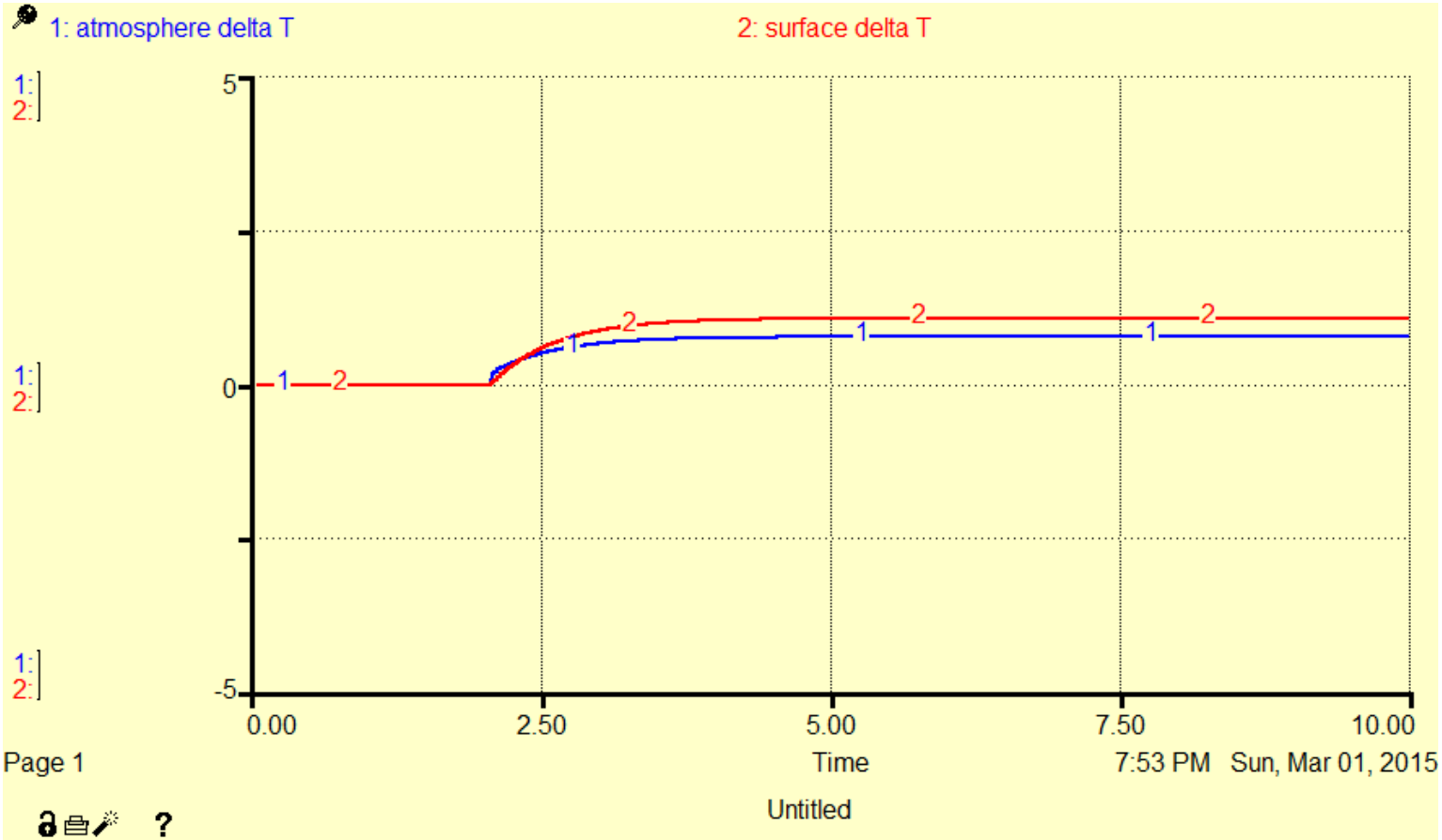
- Increased cloud cover from 60% to 65% $\Rightarrow$ increase in albedo, decrease in absorption of the Earth, and increased greenhouse effect

2. Altering the cloud cover



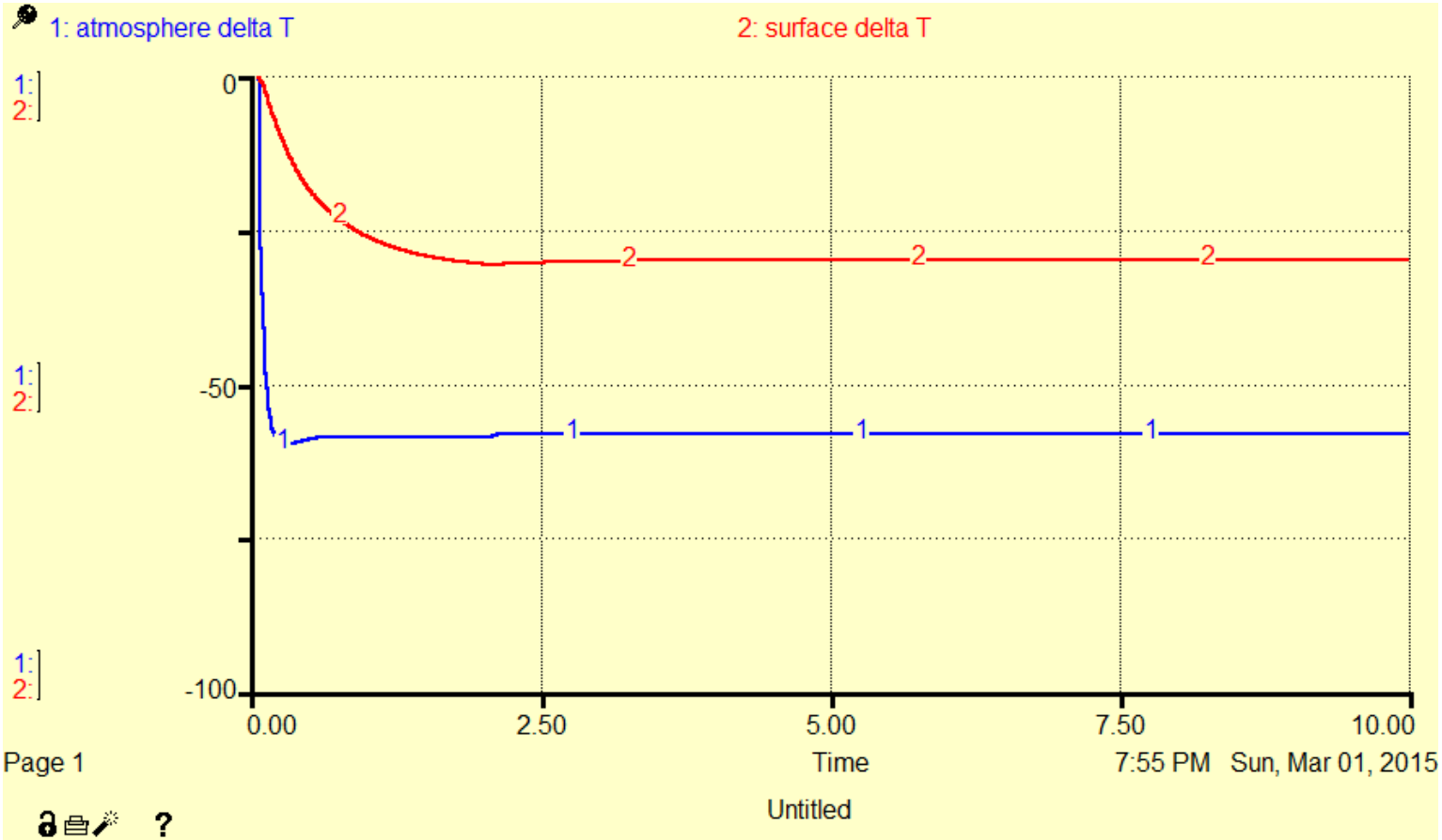
- decreased cloud cover from 60% to 55% $\Rightarrow$ decrease in cloud albedo, decrease in greenhouse effect, and increase in EarthâĂŹs absorption

2. Altering the cloud cover

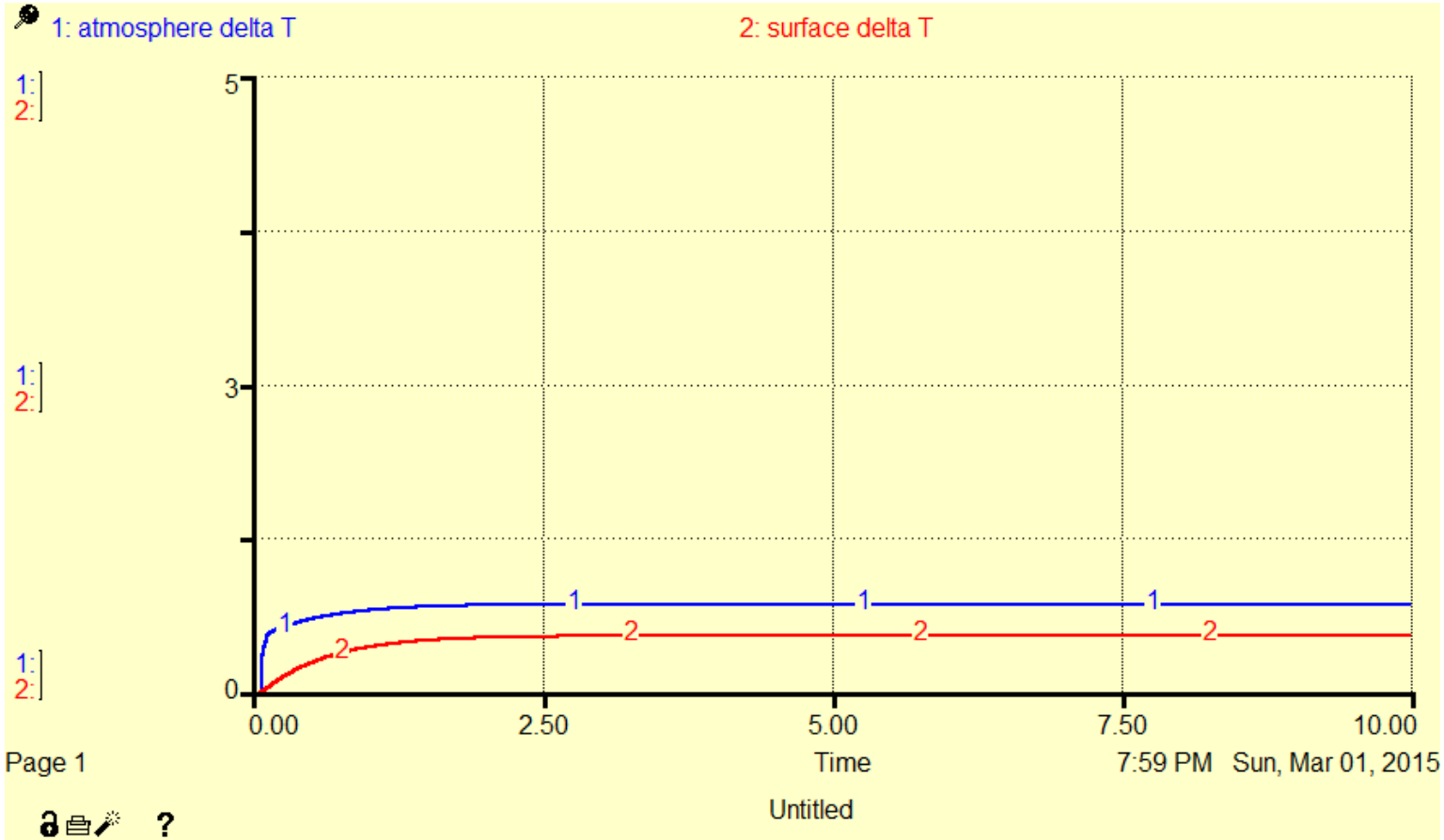


- cloud cover depends on temperature, change solar steady at 100 then changes to 103 $\Rightarrow$ quicker response and smaller change in temperature

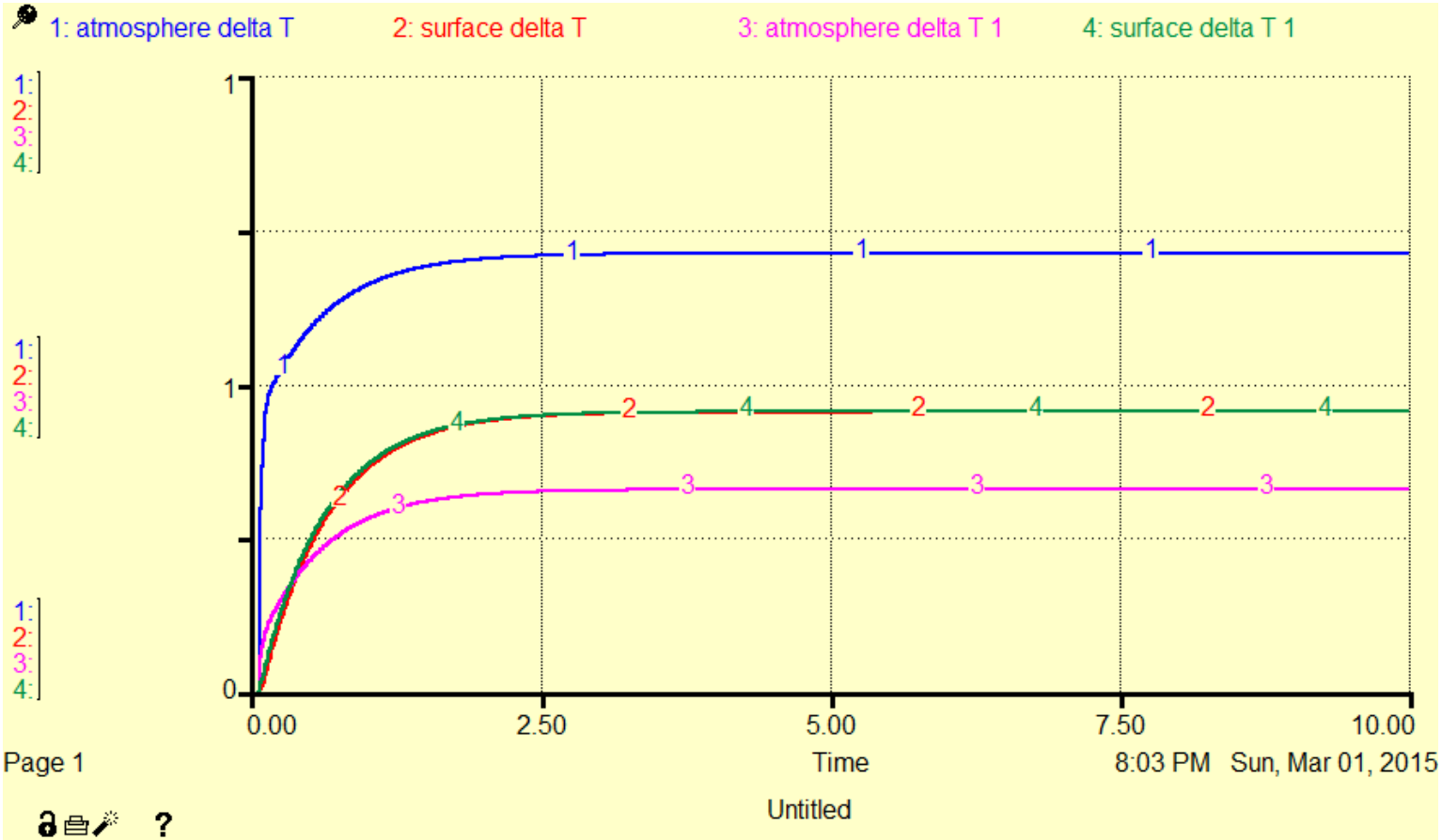
3. Removing the greenhouse effect



4. Enhancing the greenhouse effect



5. Comparing different sources of warming



- With the greenhouse effect, the atmosphere responds more strongly than Earth surface (and more quickly in both cases)

Key ideas

- System components don't always evolve at the same time, and in some cases may produce systems that are never able to reach a steady state
- Created a negative feedback by making cloud cover depend on temperature $\rightarrow$ the model still responds to perturbations, but the negative feedback makes it less sensitive to perturbations
- To understand what is driving changes in a system, often need to look at multiple variables $\rightarrow$ in our case, increased greenhouse gases and increased solar input caused similar changes in the temperature of the Earth's surface, but the former caused a large change in the temperature of the atmosphere was the latter had a smaller impact on the atmosphere
- Note: important to use the same scale when comparing results from different simulations!