
# Climate Change MEL

# Recall...

What is *plausibility*?

What is *falsifiability*?

# Model Plausibility Ratings

If you are pretty sure a model might be true, that means the plausibility is high—7, 8, or 9 on the scale.

If you are pretty sure a model is false, that means the plausibility is low—1, 2, or 3.

# Model Plausibility Ratings: Causes of Current Climate Change

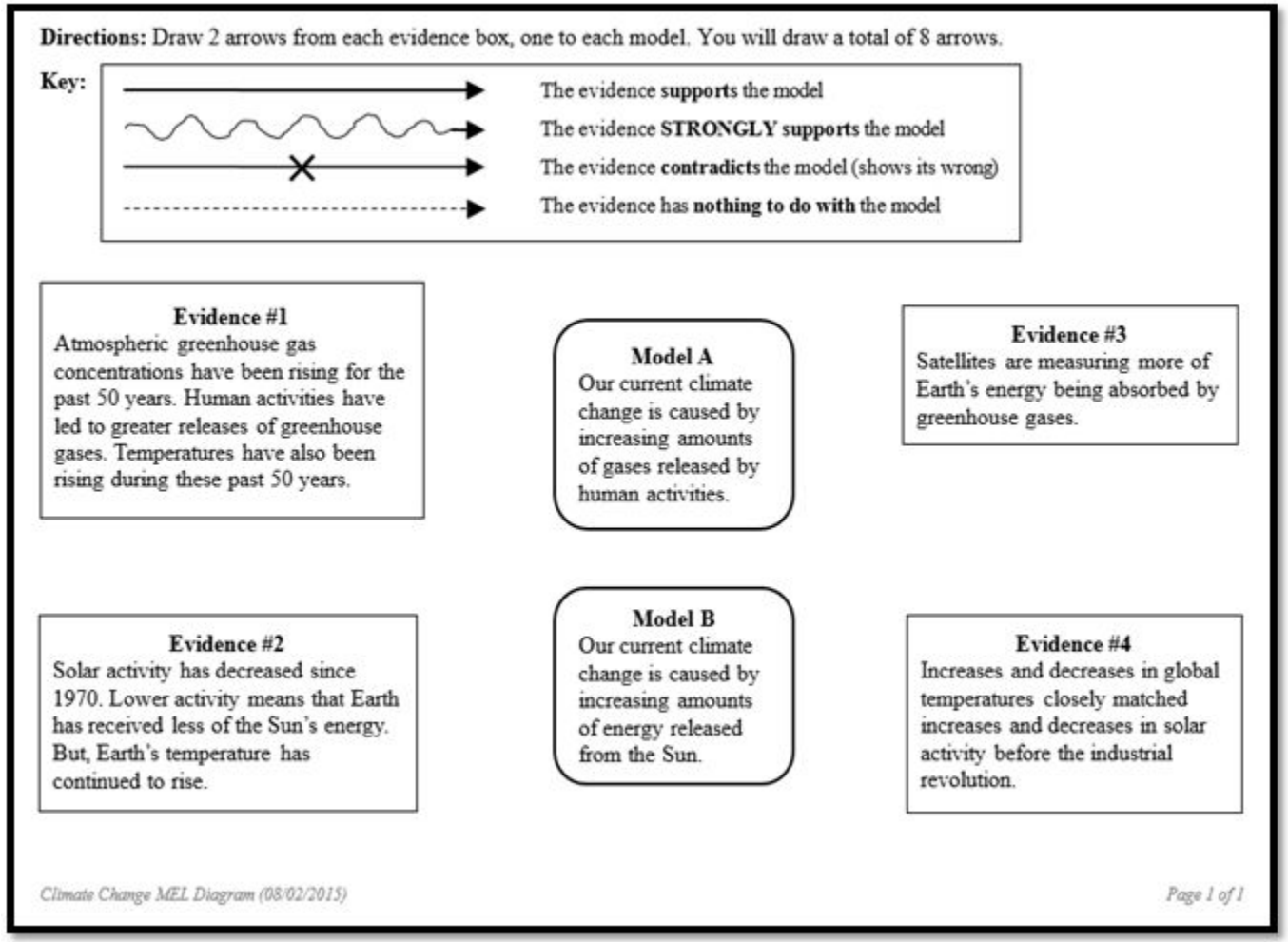
**Circle the plausibility of each model. [Make two circles. One for each model.]**

| | Greatly implausible (or even impossible) | | | | | | | | | Highly Plausible |
|---|---|---|---|---|---|---|---|---|---|---|
| **Model A** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **Model B** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Model A: Humans are the cause of current climate change.

Model B: Increasing amounts of energy from the sun are the cause of current climate change.

# Model-Evidence Link (MEL) Diagram: Causes of Current Climate Change



**Directions:** Draw 2 arrows from each evidence box, one to each model. You will draw a total of 8 arrows.

**Key:**

- The evidence **supports** the model
- The evidence **STRONGLY supports** the model
- The evidence **contradicts** the model (shows its wrong)
- The evidence has **nothing to do with** the model

**Evidence #1**
Atmospheric greenhouse gas concentrations have been rising for the past 50 years. Human activities have led to greater releases of greenhouse gases. Temperatures have also been rising during these past 50 years.

**Model A**
Our current climate change is caused by increasing amounts of gases released by human activities.

**Evidence #3**
Satellites are measuring more of Earth's energy being absorbed by greenhouse gases.

**Evidence #2**
Solar activity has decreased since 1970. Lower activity means that Earth has received less of the Sun's energy. But, Earth's temperature has continued to rise.

**Model B**
Our current climate change is caused by increasing amounts of energy released from the Sun.

**Evidence #4**
Increases and decreases in global temperatures closely matched increases and decreases in solar activity before the industrial revolution.

*Climate Change MEL Diagram (08/02/2015)*

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# Evidence Texts

**Evidence #1: Atmospheric greenhouse gas concentrations have been rising for the past 50 years. Human activities have led to greater releases of greenhouse gases. Temperatures have also been rising during these past 50 years.**

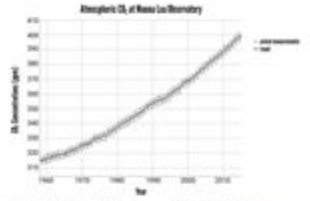

Figure 1. Carbon dioxide levels in the atmosphere. Credit: Wright Imagery

The symbol for carbon dioxide is $CO_2$. These levels have been increasing (Figure 1). $CO_2$ in the atmosphere absorbs infrared energy emitted by Earth. People call $CO_2$ a greenhouse gas because it keeps some of Earth's energy from escaping to space.

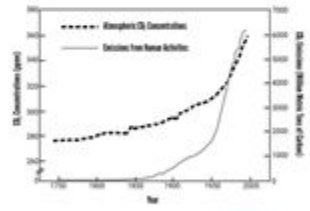

Figure 2. $CO_2$ released by human activities. Credit: Wright Imagery

Figure 2 shows increasing releases of $CO_2$ by the human activity of burning fossil fuels, including coal, gasoline, natural gas, and wood. Burning fossil fuels releases $CO_2$ into the atmosphere.



**Evidence #2: Solar activity has decreased since 1970. Lower activity means that Earth has received less of the Sun's energy. But, Earth's temperature has continued to rise.**

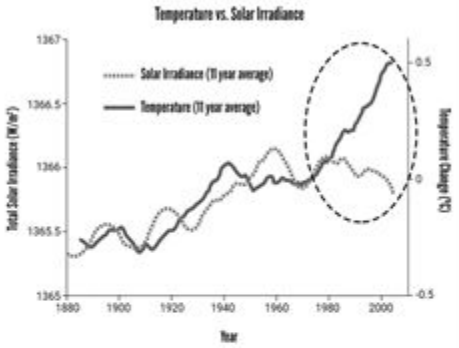


Figure 1. Solar activity levels over time. Credit: Wright Imagery

The Sun's brightness is one way to measure solar activity. In Figure 1, the dashed line shows the Sun's brightness. Since 1970, the Sun's brightness has been decreasing. The solid line on the graph shows Earth's temperature. The graph shows that temperatures are increasing while solar activity is decreasing. The region outlined by the dash-dot oval shows where solar activity is decreasing and temperature is increasing.



**Evidence #3: Satellites are measuring more of Earth's energy being absorbed by greenhouse gases.**

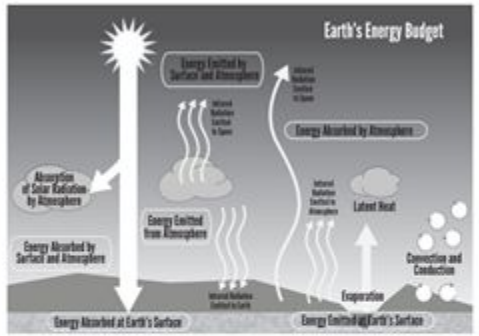


Figure 1. Earth's energy budget. Credit: Wright Imagery

Figure 1 above shows Earth's energy budget. Earth absorbs about half of the Sun's energy. Most of the Sun's energy comes to Earth as visible light. Earth reradiates this absorbed energy as invisible light called infrared. Some of this infrared energy is absorbed by the atmosphere and sent back to Earth. Some escapes into space. Over time, NASA satellites orbiting Earth have recorded less infrared energy leaving Earth's atmosphere.



**Evidence #4: Increases and decreases in global temperatures closely matched increases and decreases in solar activity before the industrial revolution.**

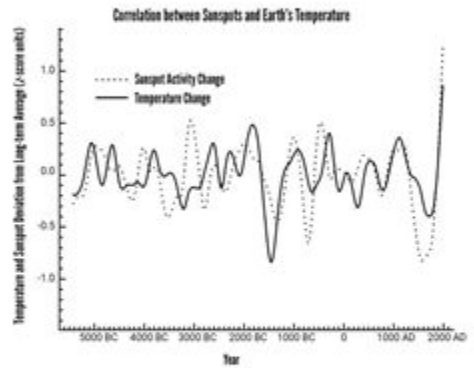


Figure 1. Sunspot activity and temperature over time. Credit: Wright Imagery

In Figure 1, sunspot activity is the dashed line. Solar activity increases when the Sun has more sunspots. The solid line shows temperature. The shapes of the sunspot and temperature curves match closely. Peaks in the temperature are near peaks in sunspot activity. Dips in temperature are near dips in sunspot activity.

These data show sunspot activity and temperature for the past 9000 years. These data are based on evidence collected from tree rings. Some of the tree rings are from trees that are still living. Some of the trees rings are from ancient trees that have died.



THE MEL PROJECT

# Generating Explanations

**Please work on this individually.**

Provide a reason for three of the arrows you have drawn. **Write your reasons for the three most interesting or important arrows.**

A. Write the number of the evidence you are writing about.
B. Circle the appropriate word (**strongly supports | supports | contradicts | has nothing to do with**).
C. Write which model you are writing about.
D. Then write your reason.

**1. Evidence # ____ strongly supports | supports | contradicts | has nothing to do with Model _____ because:**

**2. Evidence # ____ strongly supports | supports | contradicts | has nothing to do with Model _____ because:**

**3. Evidence # ____ strongly supports | supports | contradicts | has nothing to do with Model _____ because:**

**Circle the plausibility of each model. [Make two circles, one for each model.]**

| | Greatly implausible (or even impossible) | | | | | | | | | Highly plausible |
|---|---|---|---|---|---|---|---|---|---|---|
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*Climate Change MEL Explanation Task (08/02/2015)* *Page 1 of 1*

# ACKNOWLEDGEMENTS