The Hot Debate Motion: The Sun is a primary driver of 20th century climate change

Moderator: Prof. Raimund Muscheler

Opponent: Dr. Jasa Čalogović Proponent: Dr. Benjamin Laken

How it works

- Make your preliminary vote on motion: agree, disagree, or undecided?
- Proponent and Opponent of the motion will argue why they are correct
- They will reply to each others statements
- There will be an open question and discussion period
- Closing remarks
- Final vote on motion
- Some final remarks

Proponent of the Motion Dr. Benjamin Laken (University of Oslo)

The Sun is the driving force behind Earth's climate

The Sun is driving climate on Earth



Opening arguments in support of the motion

Ice cores show CO_2 and temperatures change together for hundreds of thousands of years. This must mean CO_2 changes temperatures right?

...but CO₂ actually changes 800 years after temperatures...



Opening arguments in support of the motion

Past climate changes driven by changes in energy received from Sun



Present global warming occurred in two periods and first period is likely to be from 'natural' forcing



Brönnimann, 2009, Nature Geosciences

The warming since the 1960s is attributed largely to anthropogenic influences. By contrast, the warming from the 1910s to the 1940s, here termed early twentieth-century warming, still defies full explanation.

Opponent of the Motion Dr. Jaša Čalogović (University of Zagreb)

Humans and greenhosue gases are primary primary driver of global warming, NOT the Sun

Solar activity doesn't change in a way that could link solar activity changes to global warming



Opening arguments against the motion

Dominant cause of global warming since industrial times are human emissions of greenhouse gases and CO₂

Recent CO₂ changes



Recent calculations using climate models show dominant role of human emissions and greenhouse gases

Model simulations of future climate change (IPCC)



Visualization NASA

Opening arguments against the motion

Climate models show that the role of solar induced changes on climate change is quite small and it will remain small in the future compared to the influence of greenhouse gases



1. Solar activity doesn't line up perfectly to current climate changes...

Maybe true, but the general levels of solar activity are higher than they have been for thousands of years. It is unclear how fast Earth respond to solar changes (e.g. oceans)

2. Climate models show the Sun isn't so important...

Importance of CO_2 and greenhouse gases can be overestimated if the processes linking the Sun to climate aren't in the model

Future: Climate models predict too much warming and doomsday scenarios



Models can't reproduce past, or present, <u>so how</u> <u>can we trust the future</u> <u>predictions?</u>

Some big issues:

Key processes occur at scales too small to put into climate models.

We don't know what we don't know.

Reply in support of the motion

Solar influence on clouds



Reply to arguments against the motion

Humans have driven CO₂ concentration levels in the atmosphere to extent that was not present in the atmosphere for at least million years and more



Current climate models aren't perfect but they represent the best guess how the climate will look like if we don't take adequate measures (eg. reduce greenhouse emissions)

Many dangers and big problems in the future are evident from models and present observations like:

- Global temperature rise
- Sea level rise
- Increase in unpredictable weather (eg. droughts and floods)
- Ocean acidification
- Melting of sea ice, glaciers...



Questions & discussion!

Conclusion: The role of natural factors, like the Sun, has been under-estimated

Past: We have records of hundreds of thousands of years. They show CO2 was not driving climate change, the Sun was.

Present: Around half of recent climate change it still is not explained by mainstream climate science, but was probably natural.

Future: By assuming the warming in the second half of the 20th century was from CO2, and using this as a basis to predict the future, we have overestimated the importance of CO2, and ignored natural factors like the Sun. We can already see we are far cooler than they predicted 20 years ago.

"In the history of science it has often happened that the majority was wrong and refused to listen to a minority that later turned out to be right." Freeman Dyson Closing arguments in support of the motion

Best evidence of global warming so far?

Positive proof of global warming.



There is a strong scientific consensus that current climate changed a lot from pre industrial times

97 out of 100 climate experts think humans are changing global temperature

Closing arguments against the motion

Now it is maybe expensive to act on climate change, but if we wait, the possible fatal consequences and costs in the future may be much bigger than now



Hopefully we won't end up like this... ③

