

# Earth's Climate: Past, Present and Future; Concerns and Solutions

Week 4: Wednesday February 13<sup>th</sup>, 2019

Paul Belanger

**Modeling, Skepticism vs. Denial, Video Resources,  
How Ice Cores are taken**

# Revised syllabus

- <https://denverclimatestudygroup.com/wp-content/uploads/2019/02/Belanger-2019-winter-syllabus-Earth-climate-past-present-future20190213.pdf>

## Starting with Today:

### Wednesday 1-3, February 13<sup>th</sup>:

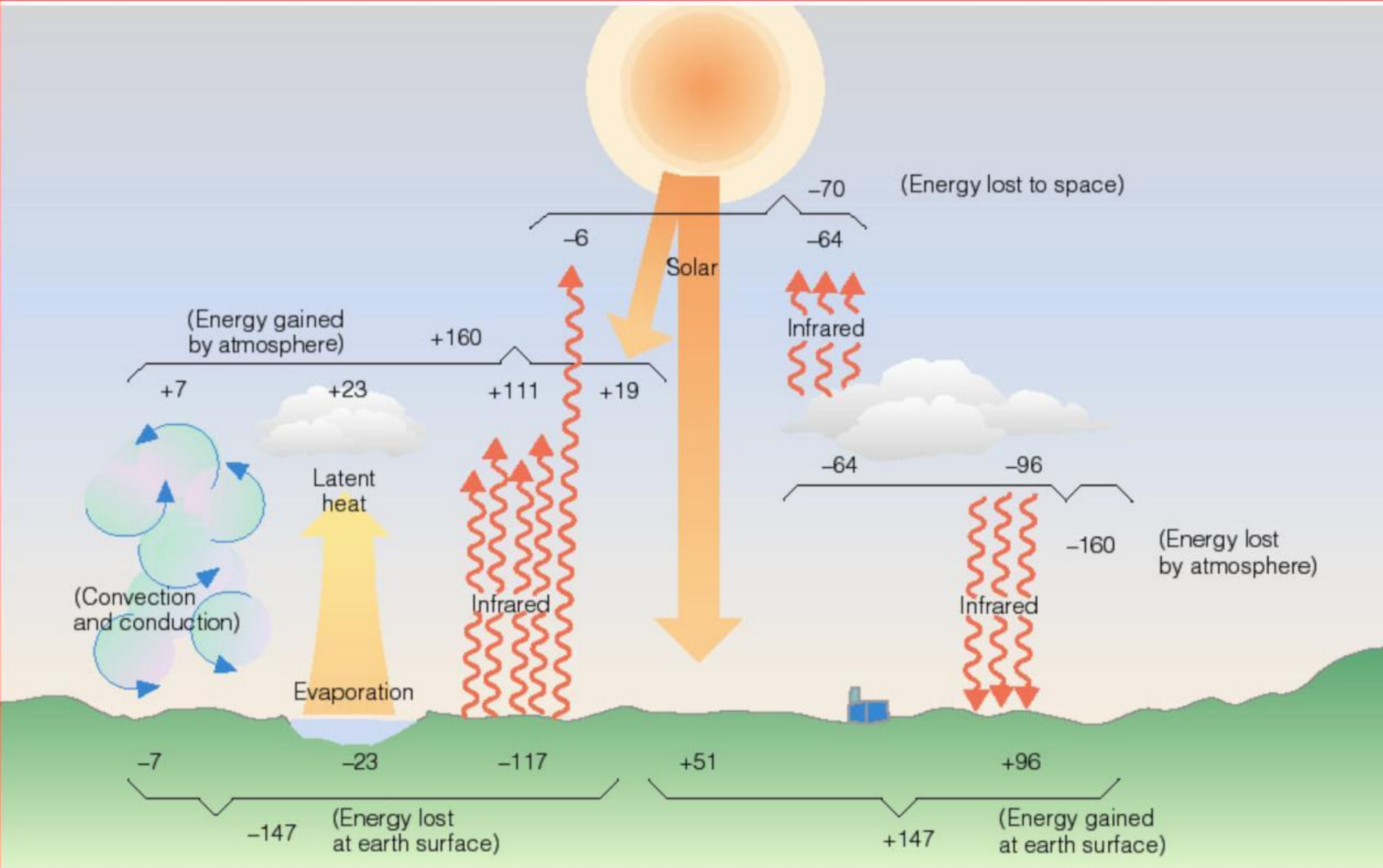
- Models, physics and what do they tell us
- Skepticism vs. Denial:
  - 5 Characteristics
  - List of videos that might be useful: <https://skepticalscience.com/denial101x-videos-and-references.html>
  - Denial 101x: here's a link to a newly available self-paced version of the course I took in April and May: <https://www.edx.org/course/making-sense-of-climate-science-denial-2>
- Industry statements past and present
- Ice coring – see next week list if time permits

### Wednesday 1-3, February 20<sup>th</sup>:

- Antarctic ice cores
- Arctic Ice cores
- What the data tells us
- **Solutions Part A: – start of discussion onward (see below)**

# Modeling

# A Schematic Model



# Models – 2 videos

Principles that models are built on – view today (4:43 minutes)

<https://www.youtube.com/watch?v=mYU2uawYPIE&feature=youtu.be> ;

and related Wiki links: [https://en.wikipedia.org/wiki/Climate\\_model](https://en.wikipedia.org/wiki/Climate_model) and [https://en.wikipedia.org/wiki/Global\\_warming](https://en.wikipedia.org/wiki/Global_warming)

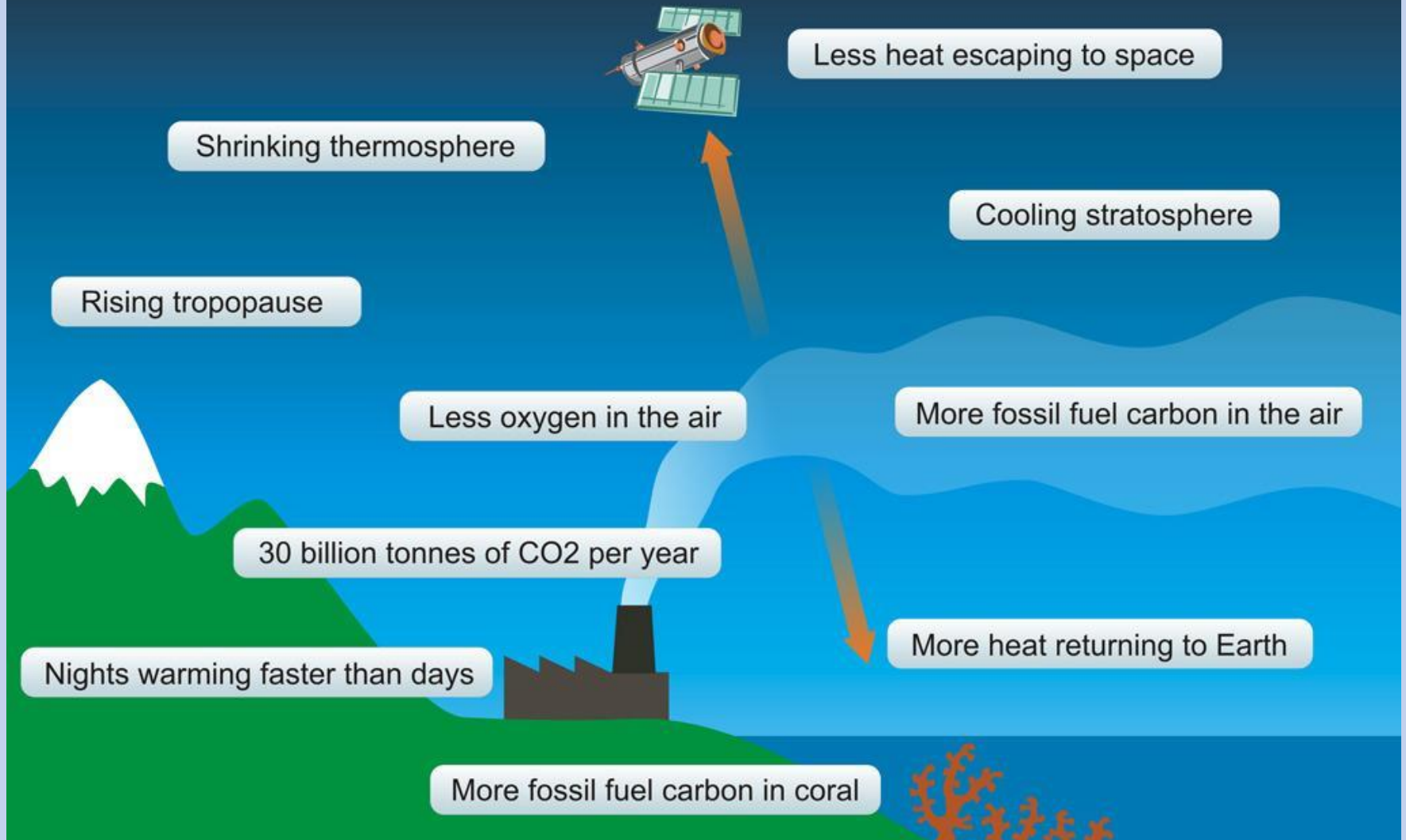
From the experts: Climate models – leaving it for you to view at your leisure: 10:30 minutes

<https://www.youtube.com/watch?v=PZo1TYpsy2U&feature=youtu.be>

NOAA's Science On a Sphere (SOS)

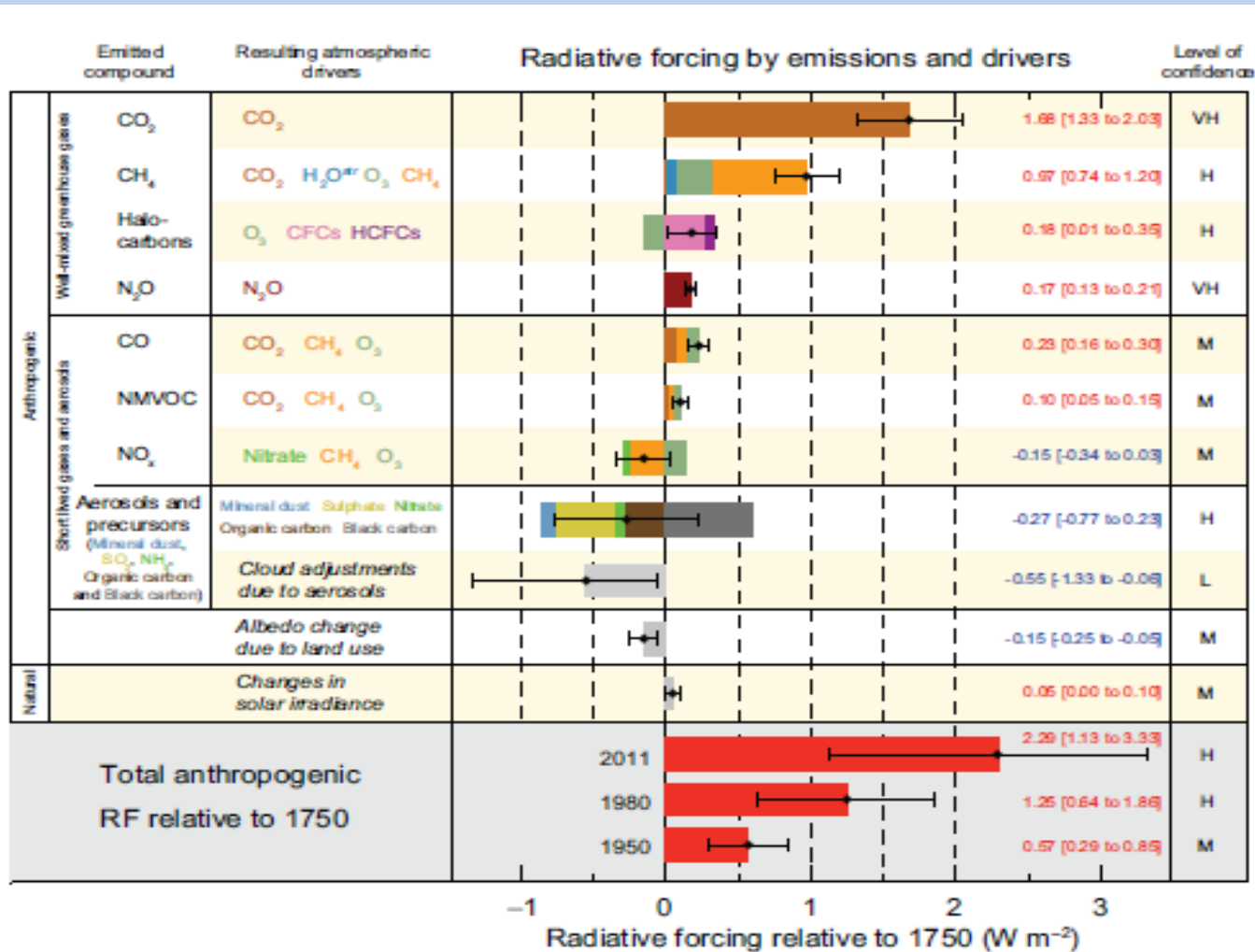
[http://sos.noaa.gov/What\\_is\\_SOS/index.html](http://sos.noaa.gov/What_is_SOS/index.html)

# 10 Indicators of a Human Fingerprint on Climate Change



# 1: THE CLIMATE IS WARMING

- Drivers, aka forcings (causes)



# Skepticism vs. Denial



# Five characteristics of science denial: FLICC

- <https://www.youtube.com/watch?v=wXA777yUndQ&feature=youtu.be>

## Scientific

### skepticism/conclusions:

- data/consider the evidence,
- Hypothesize and test,
- come to a conclusion as the evidence becomes overwhelming

### Denial arguments presented as if real skepticism:

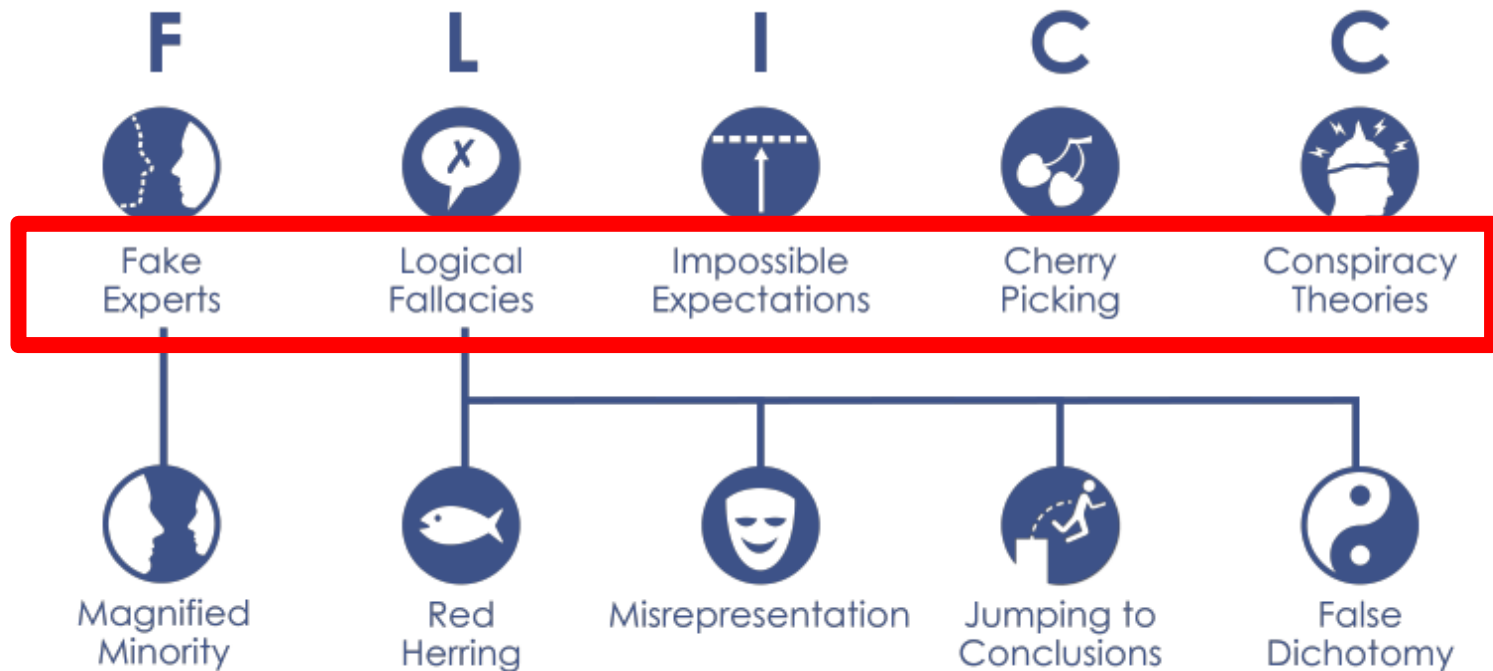
- Have a conclusion 1<sup>st</sup>
- Deny the evidence / ignore the data



# Five characteristics of science denial: FLICC

Terminology you'll see being used regarding misrepresentation

## 5 CHARACTERISTICS OF SCIENCE DENIAL



<https://skepticalscience.com/5-characteristics-consensus-denial.html> and see link within called 5 inevitable characteristics

## VIDEO LINK:

### 13 Misconceptions About Global Warming

<https://www.youtube.com/watch?v=OWXoRSIxyIU&feature=youtu.be>

# Quick review

- Kerry Emanuel video – hoping you'll find it useful: One hour 29 minutes  
<https://www.youtube.com/watch?v=7so8GRCWA1k>
- 20 point NAS-Royal Academy PowerPoint or PDF:
  - [Belanger joint NAS-Royal Society answers to 20 points Pptx](#); or [Belanger joint NAS-Royal Society answers to 20 points pdf](#)

# Useful Video and MOOC Links

1. List of videos that might be useful:  
<https://skepticalscience.com/denial101x-videos-and-references.html>
2. Denial 101x: here's a link to a newly available self-paced version of the course I took in a few years ago and available at your self-paced speed:  
<https://www.edx.org/course/making-sense-of-climate-science-denial-2>

# Useful Video and MOOC Links

1. List of videos that might be useful: 6 pages worth:

<https://skepticalscience.com/denial101x-videos-and-references.html>

# Week 1 – Overview of the climate controversy

<b>Consensus of evidence</b>	<a href="https://youtu.be/5LvaGAEwxYs">https://youtu.be/5LvaGAEwxYs</a>
Consensus of scientists	<a href="https://youtu.be/WAqR9mLJrcE">https://youtu.be/WAqR9mLJrcE</a>
Consensus of papers	<a href="https://youtu.be/LdLgSirToJM">https://youtu.be/LdLgSirToJM</a>
<i>From the experts:</i> Scientific consensus	<a href="https://youtu.be/tU_aMg73h90">https://youtu.be/tU_aMg73h90</a>
Knowledge based consensus	<a href="https://youtu.be/HUOMbK1x7MI">https://youtu.be/HUOMbK1x7MI</a>
Vested interests	<a href="https://youtu.be/8i-fDTeHyd8">https://youtu.be/8i-fDTeHyd8</a>
Dragons of inaction	<a href="https://youtu.be/b3mxyFGjelA">https://youtu.be/b3mxyFGjelA</a>
Ideological bias	<a href="https://youtu.be/nj1-tDKuHno">https://youtu.be/nj1-tDKuHno</a>
<i>From the experts:</i> Psychology of denial	<a href="https://youtu.be/qLF6S7vIZDA">https://youtu.be/qLF6S7vIZDA</a>
Manufacturing doubt	<a href="https://youtu.be/uhykhXxjzGE">https://youtu.be/uhykhXxjzGE</a>
<i>From the experts:</i> Skepticism vs Denial	<a href="https://youtu.be/--pyeRHCpRM">https://youtu.be/--pyeRHCpRM</a>
Media balance-as-bias	<a href="https://youtu.be/YdUVe0kd24A">https://youtu.be/YdUVe0kd24A</a>
Structure of an effective debunking	<a href="https://youtu.be/SSPLiCvh7xA">https://youtu.be/SSPLiCvh7xA</a>
Five characteristics of science denial	<a href="https://youtu.be/wXA777yUndQ">https://youtu.be/wXA777yUndQ</a>
<i>From the experts:</i> Spread of denial	<a href="https://youtu.be/OjMx7dFZsr4">https://youtu.be/OjMx7dFZsr4</a>
<i>From the experts:</i> Attack on science	<a href="https://youtu.be/aeSNhayqGcl">https://youtu.be/aeSNhayqGcl</a>
Week 1 wrap up	<a href="https://youtu.be/znJkCgibsO0">https://youtu.be/znJkCgibsO0</a>
Scientific Method	<a href="https://youtu.be/OBYwy8vMvNI">https://youtu.be/OBYwy8vMvNI</a>
Full interview with Ben Santer	<a href="https://youtu.be/EOrUYQhGzT8">https://youtu.be/EOrUYQhGzT8</a>
Full interview with Naomi Oreskes	<a href="https://youtu.be/suz_13pXgEw">https://youtu.be/suz_13pXgEw</a>
Full interview with Peter Doran	<a href="https://youtu.be/TGbYpmhpXzY">https://youtu.be/TGbYpmhpXzY</a>
Full interview with Stephan Lewandowsky	<a href="https://youtu.be/7FQUsCyLzIE">https://youtu.be/7FQUsCyLzIE</a>
Full interview with Lawrence Hamilton	<a href="https://youtu.be/m0dXY2e6SrY">https://youtu.be/m0dXY2e6SrY</a>
Full interview with Katharine Hayhoe	<a href="https://youtu.be/BjhrwA9f4G8">https://youtu.be/BjhrwA9f4G8</a>
Full interview with Michael Mann	<a href="https://youtu.be/k3j9j6WNpRM">https://youtu.be/k3j9j6WNpRM</a>
Full interview with Eugenie Scott	<a href="https://youtu.be/sCk_3RNWdZI">https://youtu.be/sCk_3RNWdZI</a>
Full interview with Ritayan Mitra	<a href="https://youtu.be/s4DxkYiDXhY">https://youtu.be/s4DxkYiDXhY</a>

# Week 2 – Global warming is happening

<b>Week 2 overview</b>	<a href="https://youtu.be/UWrg96LEZgE">https://youtu.be/UWrg96LEZgE</a>
Heat build-up	<a href="https://youtu.be/Lepc2OKX6uQ">https://youtu.be/Lepc2OKX6uQ</a>
Hot records	<a href="https://youtu.be/5IxYhEKbsZo">https://youtu.be/5IxYhEKbsZo</a>
Sea level rise	<a href="https://youtu.be/dBs_K59K6GY">https://youtu.be/dBs_K59K6GY</a>
Shrinking glaciers	<a href="https://youtu.be/we39vRtT1d0">https://youtu.be/we39vRtT1d0</a>
Greenland ice loss	<a href="https://youtu.be/M9hQBGXsEP0">https://youtu.be/M9hQBGXsEP0</a>
Antarctic land ice vs sea ice	<a href="https://youtu.be/9PUmKHBtnIA">https://youtu.be/9PUmKHBtnIA</a>
Cryosphere: Expert Interviews	<a href="https://youtu.be/ERLd15drxDA">https://youtu.be/ERLd15drxDA</a>
Building a robust temperature record	<a href="https://youtu.be/YKQiyBkt4Vs">https://youtu.be/YKQiyBkt4Vs</a>
Heat in the city	<a href="https://youtu.be/pidRKmq2iGI">https://youtu.be/pidRKmq2iGI</a>
Wavy jet stream	<a href="https://youtu.be/B1fwNnJUyGU">https://youtu.be/B1fwNnJUyGU</a>
Climate change vs global warming	<a href="https://youtu.be/HAF9jl6fupA">https://youtu.be/HAF9jl6fupA</a>
Week 2 wrap up	<a href="https://youtu.be/z0vJHeVjE5A">https://youtu.be/z0vJHeVjE5A</a>
Full interview with Phil Jones	<a href="https://youtu.be/fuRU10ocuds">https://youtu.be/fuRU10ocuds</a>
Full interview with Jonathan Bamber	<a href="https://youtu.be/evOy3e4tNQU">https://youtu.be/evOy3e4tNQU</a>
Full interview with Fabrice Calmels	<a href="https://youtu.be/3ECc5d1j8L4">https://youtu.be/3ECc5d1j8L4</a>
Full interview with Antoni Lewkowicz	<a href="https://youtu.be/PmTfqLOmNXc">https://youtu.be/PmTfqLOmNXc</a>
Full interview with Eric Rignot	<a href="https://youtu.be/kzaKaLq86pE">https://youtu.be/kzaKaLq86pE</a>
Full interview with Lonnie Thompson	<a href="https://youtu.be/Z3sU24BD5vQ">https://youtu.be/Z3sU24BD5vQ</a>
Full interview with Isabella Velicogna	<a href="https://youtu.be/VRbVoA3Ccos">https://youtu.be/VRbVoA3Ccos</a>



# Week 3 – We are causing global warming

<b>Week 3 overview</b>	<a href="https://youtu.be/cSYHn2ubmAE">https://youtu.be/cSYHn2ubmAE</a>
Upsetting the natural balance	<a href="https://youtu.be/kQ9hPI9dl98">https://youtu.be/kQ9hPI9dl98</a>
Human CO2 emissions trump volcanoes	<a href="https://youtu.be/w5p9osQqpSE">https://youtu.be/w5p9osQqpSE</a>
Taking up residence	<a href="https://youtu.be/8R4YavfQ7jk">https://youtu.be/8R4YavfQ7jk</a>
<i>From the experts:</i> Carbon cycle	<a href="https://youtu.be/iEDnjleBRk8">https://youtu.be/iEDnjleBRk8</a>
The greenhouse effect	<a href="https://youtu.be/PTfnuX-HVk8">https://youtu.be/PTfnuX-HVk8</a>
Increasing the greenhouse effect	<a href="https://youtu.be/we8VXwa83FQ">https://youtu.be/we8VXwa83FQ</a>
Reinforcing feedback	<a href="https://youtu.be/dHozjOYHQdE">https://youtu.be/dHozjOYHQdE</a>
<i>From the experts:</i> Greenhouse effect	<a href="https://youtu.be/H4YSwajvFAY">https://youtu.be/H4YSwajvFAY</a>
Structure of our atmosphere	<a href="https://youtu.be/LM_sKZCv26A">https://youtu.be/LM_sKZCv26A</a>
Measuring from space	<a href="https://youtu.be/wEuSfMRB7pU">https://youtu.be/wEuSfMRB7pU</a>
Daily and yearly cycle	<a href="https://youtu.be/FhHuaq1xQbU">https://youtu.be/FhHuaq1xQbU</a>
Week 3 wrap up	<a href="https://youtu.be/irWfvG32q0o">https://youtu.be/irWfvG32q0o</a>
Full interview with Corinne Le Quéré	<a href="https://youtu.be/JBqcZQxYPrs">https://youtu.be/JBqcZQxYPrs</a>
Full interview with Ed Hawkins	<a href="https://youtu.be/tgzTDcpA3oM">https://youtu.be/tgzTDcpA3oM</a>
Full interview with Steve Sherwood	<a href="https://youtu.be/2i1xJ68SREQ">https://youtu.be/2i1xJ68SREQ</a>
Full interview with Luke Barnard	<a href="https://youtu.be/CG7WjmkXbCA">https://youtu.be/CG7WjmkXbCA</a>
Full interview with Joanne House	<a href="https://youtu.be/EkShFvzt1W4">https://youtu.be/EkShFvzt1W4</a>
Full interview with Mike Lockwood	<a href="https://youtu.be/NqHQ8i6G-el">https://youtu.be/NqHQ8i6G-el</a>
Full interview with Bill Ruddiman	<a href="https://youtu.be/CaUHSV6yCA8">https://youtu.be/CaUHSV6yCA8</a>

# Week 4 – The past tells us about the future

<b>Week 4 Overview</b>	<a href="https://youtu.be/Dxp5YJNWPI0">https://youtu.be/Dxp5YJNWPI0</a>
Modern vs. past climate change	<a href="https://youtu.be/H5kejSYPD7U">https://youtu.be/H5kejSYPD7U</a>
The Little Ice Age	<a href="https://youtu.be/0n3bX_5d7vA">https://youtu.be/0n3bX_5d7vA</a>
Ancient CO2 levels	<a href="https://youtu.be/aqkGoCgIp_U">https://youtu.be/aqkGoCgIp_U</a>
<i>From the experts:</i> The past	<a href="https://youtu.be/GGEjfUHPVcE">https://youtu.be/GGEjfUHPVcE</a>
Medieval warm period	<a href="https://youtu.be/AD16nCsvjqs">https://youtu.be/AD16nCsvjqs</a>
Confused decline	<a href="https://youtu.be/dc8A6SIJijs">https://youtu.be/dc8A6SIJijs</a>
<i>From the experts:</i> The decline	<a href="https://youtu.be/yP6N9nbmS54">https://youtu.be/yP6N9nbmS54</a>
Principles that models are built on	<a href="https://youtu.be/mYU2uawYPIE">https://youtu.be/mYU2uawYPIE</a>
Climate model success stories	<a href="https://youtu.be/Y_jKXcgR_QA">https://youtu.be/Y_jKXcgR_QA</a>
Weather vs climate	<a href="https://youtu.be/YwfX5I9FuPI">https://youtu.be/YwfX5I9FuPI</a>
Climate science in 1970s	<a href="https://youtu.be/_F6bq0l18Ng">https://youtu.be/_F6bq0l18Ng</a>
Future ice age	<a href="https://youtu.be/jaVM5H_TGrU">https://youtu.be/jaVM5H_TGrU</a>
Tendency to underestimate climate impacts	<a href="https://youtu.be/NfggcaM666s">https://youtu.be/NfggcaM666s</a>
<i>From the experts:</i> Climate Models	<a href="https://youtu.be/PZo1TYpsy2U">https://youtu.be/PZo1TYpsy2U</a>
Week 4 wrap up	<a href="https://youtu.be/W-Gx9lfYao4">https://youtu.be/W-Gx9lfYao4</a>
The Climate of Middle Earth: Part 1	<a href="https://youtu.be/jJNkd5g6oxl">https://youtu.be/jJNkd5g6oxl</a>
Full interview with Tim Osborn	<a href="https://youtu.be/mWF--68qo1s">https://youtu.be/mWF--68qo1s</a>
Full interview with Andy Pitman	<a href="https://youtu.be/trlp4yBbHrU">https://youtu.be/trlp4yBbHrU</a>
Full interview with Greg Webb	<a href="https://youtu.be/lwd4_ILxql">https://youtu.be/lwd4_ILxql</a>
Full interview with Katrin Meissner	<a href="https://youtu.be/IPfQAlvfWkA">https://youtu.be/IPfQAlvfWkA</a>
Full interview with David Stevens	<a href="https://youtu.be/2fwx_COshsY">https://youtu.be/2fwx_COshsY</a>

# Week 5 – Impacts of climate change

<b>Week 5 overview</b>	<a href="https://youtu.be/4YHOMi58aGc">https://youtu.be/4YHOMi58aGc</a>
Climate is sensitive	<a href="https://youtu.be/u4L8w5wUh9s">https://youtu.be/u4L8w5wUh9s</a>
Water vapor amplifies warming	<a href="https://youtu.be/u9L49p9Y8Mg">https://youtu.be/u9L49p9Y8Mg</a>
The role of clouds in climate change	<a href="https://youtu.be/TW33e9J3fRc">https://youtu.be/TW33e9J3fRc</a>
Methane clathrate feedback	<a href="https://youtu.be/IOYHKlvRYMc">https://youtu.be/IOYHKlvRYMc</a>
Adaptation takes time	<a href="https://youtu.be/LrIN6gK3S0A">https://youtu.be/LrIN6gK3S0A</a>
<i>From the experts:</i> Ecological impacts	<a href="https://youtu.be/ijEx2L7keEY">https://youtu.be/ijEx2L7keEY</a>
Polar bears	<a href="https://youtu.be/MddWTJEFrTc">https://youtu.be/MddWTJEFrTc</a>
Ocean acidification	<a href="https://youtu.be/W1TZ8g8JYVU">https://youtu.be/W1TZ8g8JYVU</a>
<i>From the experts:</i> Coral bleaching and ocean acidification	<a href="https://youtu.be/JMaFknj3e4k">https://youtu.be/JMaFknj3e4k</a>
Overall impacts	<a href="https://youtu.be/TcxxhDVvTXU">https://youtu.be/TcxxhDVvTXU</a>
Carbon Dioxide is a pollutant	<a href="https://youtu.be/quU3bG7IVfY">https://youtu.be/quU3bG7IVfY</a>
Agricultural impacts	<a href="https://youtu.be/wcDUaB08T34">https://youtu.be/wcDUaB08T34</a>
<i>From the experts:</i> Impacts on society	<a href="https://youtu.be/Zhv8bvXJ5fs">https://youtu.be/Zhv8bvXJ5fs</a>
Extreme weather	<a href="https://youtu.be/ljwu1DLaE9w">https://youtu.be/ljwu1DLaE9w</a>
Heat waves	<a href="https://youtu.be/POaVUANp5j0">https://youtu.be/POaVUANp5j0</a>
Hurricanes	<a href="https://youtu.be/9mKC49AUVUo">https://youtu.be/9mKC49AUVUo</a>
Week 5 wrap up	<a href="https://youtu.be/N85TuCJX65o">https://youtu.be/N85TuCJX65o</a>
Making sense of the slowdown	<a href="https://youtu.be/CE1yQz_VJHc">https://youtu.be/CE1yQz_VJHc</a>
The Climate of Middle Earth: Part 2	<a href="https://youtu.be/sRS1ptPOF54">https://youtu.be/sRS1ptPOF54</a>
Full interview with Richard Alley	<a href="https://youtu.be/JQimNeJn9D4">https://youtu.be/JQimNeJn9D4</a>
Full interview with Ove Hoegh-Guldberg	<a href="https://youtu.be/_tCChCDT8oI">https://youtu.be/_tCChCDT8oI</a>
Full interview with Charlie Veron	<a href="https://youtu.be/SCek8oTB5KM">https://youtu.be/SCek8oTB5KM</a>
Full interview with Annamieke Van De Heuvel	<a href="https://youtu.be/3-lxN7TCS0A">https://youtu.be/3-lxN7TCS0A</a>
Full interview with Sir David Attenborough	<a href="https://youtu.be/Hs73hRhWovQ">https://youtu.be/Hs73hRhWovQ</a>
Full interview with Christine Hoskings	<a href="https://youtu.be/louEPslspV0">https://youtu.be/louEPslspV0</a>
Full interview with Kevin Trenberth	<a href="https://youtu.be/su5FVlzOBi0">https://youtu.be/su5FVlzOBi0</a>

# Week 6 – Responding to denial

<b>Week 6 overview</b>	<a href="https://youtu.be/gJ0xTCDNnmo">https://youtu.be/gJ0xTCDNnmo</a>
Vocal Minority	<a href="https://youtu.be/uKWDGIBKIGc">https://youtu.be/uKWDGIBKIGc</a>
Worldview Backfire Effect	<a href="https://youtu.be/CtSk03efSqQ">https://youtu.be/CtSk03efSqQ</a>
<i>From the experts:</i> Moving past barriers to change	<a href="https://youtu.be/9It19FHT50g">https://youtu.be/9It19FHT50g</a>
Inoculation Theory	<a href="https://youtu.be/K3YngyVdyrl">https://youtu.be/K3YngyVdyrl</a>
Sticky science	<a href="https://youtu.be/TM-zNO02phw">https://youtu.be/TM-zNO02phw</a>
Flu Shots	<a href="https://youtu.be/wfq0Xrgsn_4">https://youtu.be/wfq0Xrgsn_4</a>
<i>From the experts:</i> Debunking	<a href="https://youtu.be/4pg0fDdo85l">https://youtu.be/4pg0fDdo85l</a>
<i>From the experts:</i> Climate metaphors	<a href="https://youtu.be/UBa0f4uoQm0">https://youtu.be/UBa0f4uoQm0</a>
Week 6 wrap up	<a href="https://youtu.be/2sxx2R09jOI">https://youtu.be/2sxx2R09jOI</a>
The Climate of Middle Earth: Part 3	<a href="https://youtu.be/zle6EefVjTw">https://youtu.be/zle6EefVjTw</a>
Full interview with Dan Lunt	<a href="https://youtu.be/HpaJ3mKftas">https://youtu.be/HpaJ3mKftas</a>
Full interview with Simon Donner	<a href="https://youtu.be/CZENiRzi2q0">https://youtu.be/CZENiRzi2q0</a>
Full interview with Ullrich Ecker	<a href="https://youtu.be/VT6QjLnYGu8">https://youtu.be/VT6QjLnYGu8</a>
Full interview with Michael Ranney	<a href="https://youtu.be/EIRSUGRo4dU">https://youtu.be/EIRSUGRo4dU</a>
Full interview with Courtney St. John	<a href="https://youtu.be/8cDx3ijVb78">https://youtu.be/8cDx3ijVb78</a>
Full interview with Mark McCaffrey	<a href="https://youtu.be/gnU6DxllNLk">https://youtu.be/gnU6DxllNLk</a>

# Useful Video and MOOC Links

1. List of videos that might be useful:  
<https://skepticalscience.com/denial101xvideos-and-references.html>
2. Denial 101x: here's a link to a newly available self-paced version of the course I took in a few years ago and available at your self-paced speed: Starts March 4<sup>th</sup>, 2019
  - <https://www.edx.org/course/making-sense-of-climate-science-denial-2>

# What you'll learn

- How to recognise the social and psychological drivers of climate science denial
- How to better understand climate change: the evidence that it is happening, that humans are causing it and the potential impacts
- How to identify the techniques and fallacies that climate myths employ to distort climate science
- How to effectively debunk climate misinformation
- View Course Syllabus – essentially following the list of videos above

<https://www.edx.org/course/making-sense-of-climate-science-denial-2>

# About this course

- In public discussions, climate change is a highly controversial topic. However, in the scientific community, there is little controversy with 97% of climate scientists concluding humans are causing global warming.
- Why the gap between the public and scientists?
- What are the psychological and social drivers of the rejection of the scientific consensus?
- How has climate denial influenced public perceptions and attitudes towards climate change?
- This course examines the science of climate science denial.
- We will look at the most common climate myths from “global warming stopped in 1998” to “global warming is caused by the sun” to “climate impacts are nothing to worry about.”
- We’ll find out what lessons are to be learnt from past climate change as well as better understand how climate models predict future climate impacts. You’ll learn both the science of climate change and the techniques used to distort the science.
- With every myth we debunk, you’ll learn the critical thinking needed to identify the fallacies associated with the myth. Finally, armed with all this knowledge, you’ll learn the psychology of misinformation. This will equip you to effectively respond to climate misinformation and debunk myths.
- This isn’t just a climate MOOC; it’s a MOOC about how people think about climate change

<https://www.edx.org/course/making-sense-of-climate-science-denial-2>

# Why I've come to my conclusions

- I've studied and generated data about climate
- I've looked at the data:
  - Isotopes of Oxygen and Carbon: forams and ice core
  - CO<sub>2</sub> data (ice core) and CO<sub>2</sub> proxy data
  - Milankovitch Orbital parameters
  - Time trends
  - Exceptions: PETM and other hyperthermals, Azolla, etc.
- And concluded that the science is sound and gives me reason for concern.
- One has to step back to not be bothered by minutes “curves” in how it's going to happen....but there are solutions

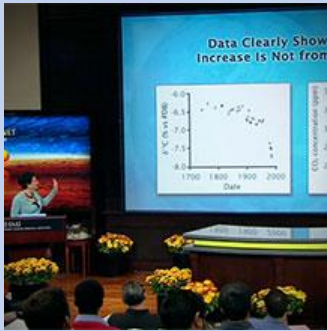


# Psychology: DENIAL 101X: World view Backfire effect

<https://www.youtube.com/watch?v=CtSk03efSqQ&feature=youtu.be> 9 minutes, 30 seconds

# OTHER – for your perusal

## Naomi Oreskes and George Marshall



Climate Change: How Do We Know We're Not Wrong?  
**THIS IS PART OF: CHANGING PLANET: PAST, PRESENT,  
FUTURE**

[Climate Change: How Do We Know We're Not Wrong?](#)

by Naomi Oreskes, PhD

And here's the link to the **George Marshall** video:

<https://www.youtube.com/watch?v=wBITu9Tpvvo>

# Industry views: past

Exxon's past role:

[Exxon's Climate Concealment NOreskes-NYTimes](#)

Present views/links:

[Climate Change Statements](#)

# Ice Coring

- Other PowerPoint – too large to load on web; bring a flash drive if you want a copy

# Solutions

- [https://www.nytimes.com/interactive/2019/02/13/climate/cut-us-emissions-with-policies-from-other-countries.html?smid=fb-nytimes&smtyp=cur&fbclid=IwAR13rNqUxYrK0omsaKQKotuuYQ1SBUK\\_IlddhZbL0E9INp70f9NHhuy8\\_Nw](https://www.nytimes.com/interactive/2019/02/13/climate/cut-us-emissions-with-policies-from-other-countries.html?smid=fb-nytimes&smtyp=cur&fbclid=IwAR13rNqUxYrK0omsaKQKotuuYQ1SBUK_IlddhZbL0E9INp70f9NHhuy8_Nw)