A 5th Grade Calculation Explains Global Warming

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This is a published talk now on youtube
As of 2/19/2020
Climate Change Forcing Causes & Effects

Actually Explaining this part

<table>
<thead>
<tr>
<th>Global Warming Root Causes →</th>
<th>Urban Heat Islands &amp; Roads, Greenhouse Gases</th>
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</thead>
<tbody>
<tr>
<td>Global Warming Amplification Effects →</td>
<td>Increase in Specific Humidity, Decrease in land albedo due to cities &amp; roads, Ice &amp; Snow Melting</td>
</tr>
</tbody>
</table>
McKitrick and Michaels

- (2007) *UHI may explain as much as half the observed land-based warming trend.*

- *Highly controversial paper between IPCC members and these authors who have had to defend their paper over many years*


- R. McKitrick, P. Michaels, Quantifying the influence of anthropogenic surface processes and inhomogeneities on gridded global climate data, J. of Geophysical Research-Atmospheres, 2007


Goals of This Talk

• Using a Back of the Envelope 5th Grade Calculation
• Raise Awareness that UHI are a significant cause of Global Warming
• Get the IPCC and World Leaders to set Albedo Goals for Cities & Roads
• Encourage you to get the full understanding by seeing our 1 hour talk (next Slide)

• IPCC =International Panel on Climate Change
• Part 2 of a 3 part series Full Understanding

• **Part 2:** Global Warming Forcing Cause & Effects: UHI, CO2 & IPCC Issues – Full Understanding

(Level of Talk is For Everyone also)
Concept of Urban Heat Island (UHI)

• UHI concept needed for this talk is a phenomena of many cities. The temperature profile mimics an island like profile. Cities designs create complex problems with the Environment & Warming
Infrared Urban Hotspots Picture

• Note differences in Car Colors & Dark Roofs, Roads Surfaces
Thermal Images of Urban Hotspots

Albedo White Paint = 0.8 (looks like ~93F)
Albedo of Asphalt = 0.04 (looks like ~103F)
Albedo Concept Needed for this Talk

- Albedo – is a measure of the reflectivity from the sun. Example: Snow 0.8 (or 80% reflective 20% absorbing), Black Roads 0.04 (of 4% reflective or 96% absorbing).
- Cities and Roads are hotter – absorb more sunlight than rural areas.

Albedo of 0.1
Global Warming Trend - Exhibit A

- A 0.95°C Rise Corresponds to a 1.7°F Rise
- 1950 Average Temp 57°F
- 2019-2020 Average Temp=58.73°F
Calculation Requires Common Sense

Reflectivity

Energy balance
Power Absorbed = Incident - Reflected

Only ~ ¼ of percent in Albedo!
Earth Albedo (Reflectivity) 2019

Reflectivity Model  From 29% 1950 to 28.72% in 2019

Only ~ ¼ of percent in Albedo!
Let’s Make it Simple!!
Back of the Envelop Calculation

• Don’t you think its possible with all the millions of black city roofs, roads and buildings in the world that an albedo change of about ¼ of a percent (out of 29%) or greater is highly likely from 1950 to 2019??

• Keep in Mind that over ½ world lives in Urban areas

• Then we can do a simple calculation to verify
LETS MAKE IT SIMPLE – Two Equations

- \( P_{\text{Energy Budget}} = 1361 \text{ W/m}^2 \ \{0.25 \times 1-\text{Albedo}\} \)
- \( P = \sigma T^4 \) Black Body Radiation Formula, \( \sigma = 5.670367 \times 10^{-8} \text{ W. m}^{-2} \cdot \text{K}^{-4} \)

<table>
<thead>
<tr>
<th>Year</th>
<th>Albedo</th>
<th>1-Albedo</th>
<th>Power Absorbed</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>29%</td>
<td>0.71</td>
<td>241.58 Watts/m²</td>
<td>255.5K~0.22°F Cold (-17.65°C)</td>
</tr>
<tr>
<td>2019</td>
<td>28.72%</td>
<td>0.7128</td>
<td>242.53 Watts/m²</td>
<td>255.73K~0.64°F Cold (-17.42°C)</td>
</tr>
</tbody>
</table>

Amount Warmer = -17.66°C - (-17.42°C) = -0.24°C Warmer due to Cities
Full Amount Warmer is 0.95°C
i.e. 25% of Global Warming Due to Small Albedo Change of Only 0.28%
### My UHI Albedo Study Results

#### Table 5 Calculated Forced Effects Causing Global Warming from 1950 to 2019

<table>
<thead>
<tr>
<th>Forced Effect</th>
<th>Contributing Change</th>
<th>Temperature Increase</th>
<th>Radiative Forcing (W/m²)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albedo (Cities &amp; Roads)</td>
<td>0.29 to 0.2872</td>
<td>0.43°F (0.24°C)</td>
<td>1.05</td>
<td>25.2%</td>
</tr>
<tr>
<td>Water Vapor</td>
<td>183 PPM increase</td>
<td>0.638°F (0.355°C)</td>
<td>2.1</td>
<td>37.3%</td>
</tr>
<tr>
<td>$CO_2$</td>
<td>100 PPM increase</td>
<td>0.638°F (0.355°C)</td>
<td>2.1</td>
<td>37.3%</td>
</tr>
<tr>
<td>Greenhouse Gas Increase</td>
<td>1.46%=60.8%-59.32%</td>
<td>(~0.63°F, $H_2O + CO_2$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>283PPM</td>
<td>1.71°F (0.95°C)</td>
<td>5.25</td>
<td>100%</td>
</tr>
</tbody>
</table>

- Estimates ignore other greenhouse gases and holds all albedo and areas constant except area Change of cities

## Climate Change Forcing Causes & Effects

### Global Warming Root Causes →
- Urban Heat Islands & Roads,
- Greenhouse Gases

### Global Warming Amplification Effects →
- Increase in Specific Humidity,
- Decrease in land albedo due to cities & roads,
- Ice & Snow Melting

Actually Explaining this part
Global Warming (GW) Risk Believe it is Only CO2

- Risk = Probability of Failure x Severity
- To Quantify
  - If you are a 99% GW only CO2 (Prob. of Fail=1%)
  - Severity = World Population \(7.7 \times 10^9\)
- GW Risk = 1% x 7.7 Billion People = 77 Million People
- This is the risk if
- IPCC – Does not recognize UHI global warming need for Albedo Goals

- Conclusion: **Better Safe Than Sorry!**
Global Warming Forcing Causes & Effects: UHI, CO2 & IPCC Issues

Author

Part 2

1950-2019

February 12, 2020

This Presentation is Posted on Youtube
(Slides & Calculator Available at https://www.dfrsoft.com/DfR_Articles.html)

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