

**Global Warming
Is the result of
Earth's Energy Imbalance (EEI)**

**Welcome to the Climate Science Study Group - 2
(starting September 20, 2023) !**

Each week we will introduce the fundamental concepts of Climate Science. You will find that there really are only a few essential terms to be learned, but that we will go into sufficient depth so that you should become able to:

1. See them as descriptions of REAL occurrences in Nature, going on around you,
2. Assist others in understanding the World around them,
3. Understand the news, commentaries, and scientific articles which address these concepts,
4. Discern simplistic, ill-informed, or distorted claims about the science, and
5. Make better decisions for your personal responses to the situation you come to understand.

Global Warming

Is the result of

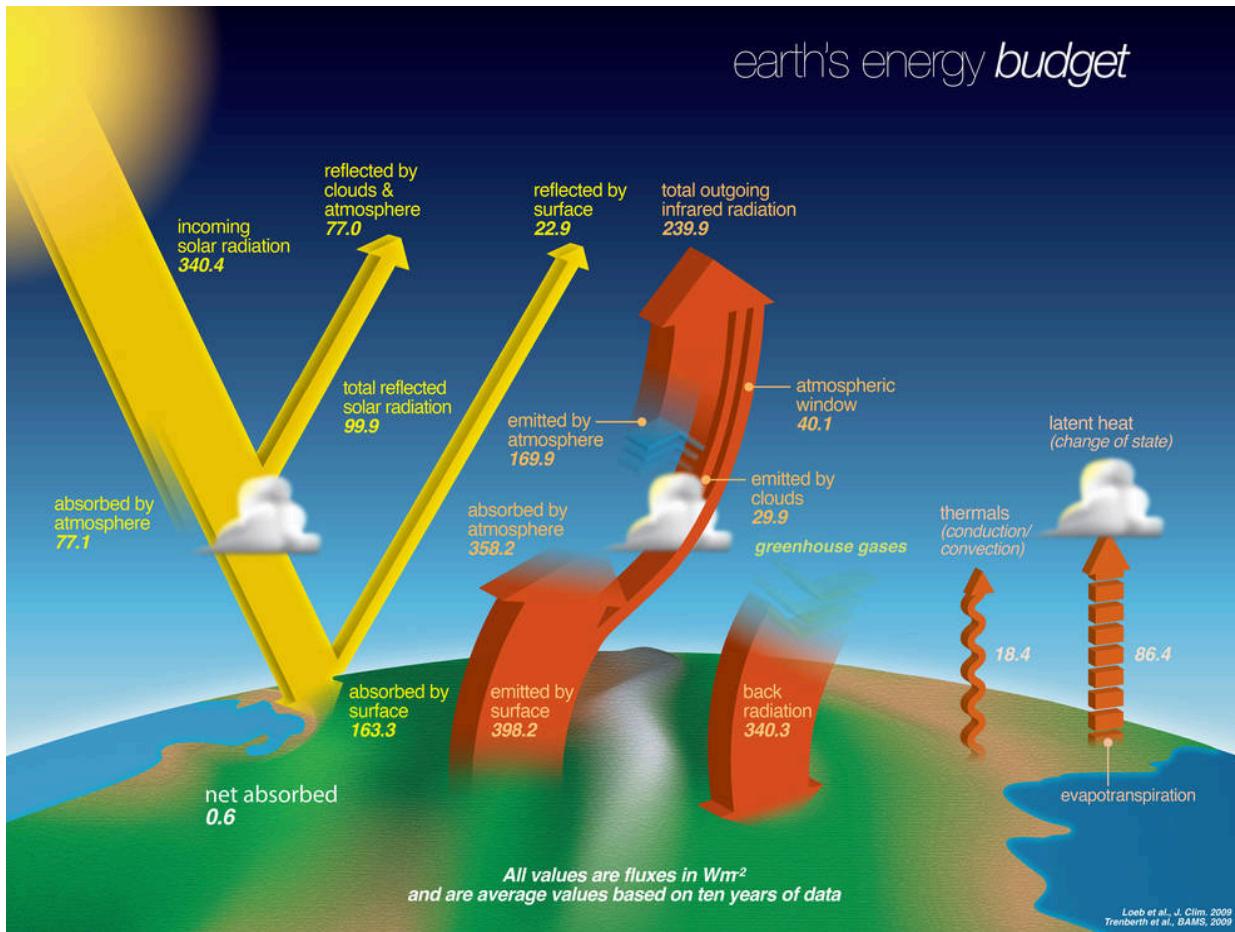
Earth's Energy Imbalance (EEI)

We start with...

What is Global Warming?

You will recognize today's materials from our recent Presentation.

Here's one version of the big picture, in this case presented by NASA. We'll leave the numbers around the chart for another time. While it's not very important to study them individually for our purposes, the fact that they can be measured is kind of amazing. So next time we'll do that ourselves!



<https://www.nasa.gov/feature/langley/what-is-earth-s-energy-budget-five-questions-with-a-guy-who-knows>

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Let's all be a Study Group for a few minutes and get into an essential first bit of Science...

**What is
Global
Warming
??**



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WARMING

results from:

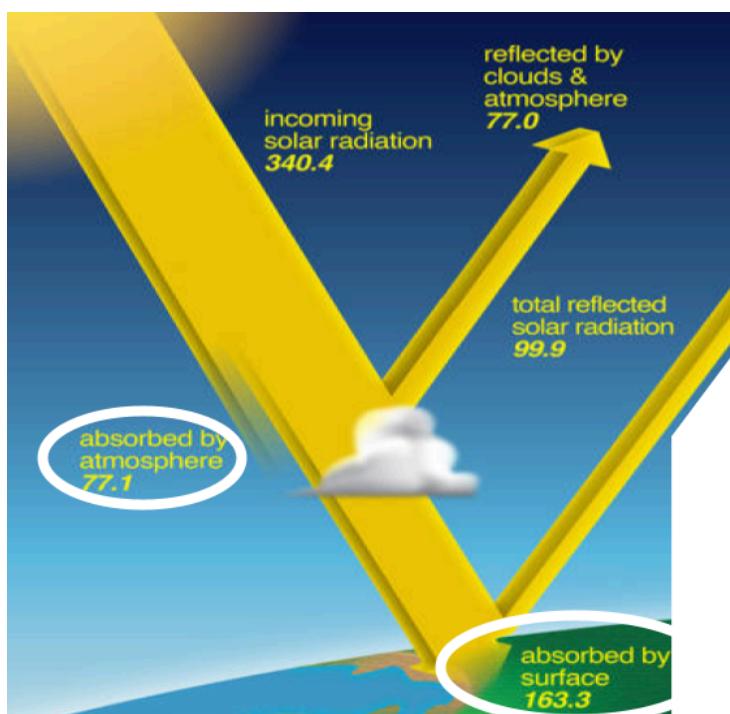
More Energy
 absorbed
 from the Sun

**Energy
 IN**

than can be sent
 Back out to Space

**Energy
 OUT**

28 M



“Energy IN”

**is the absorbed
energy.**

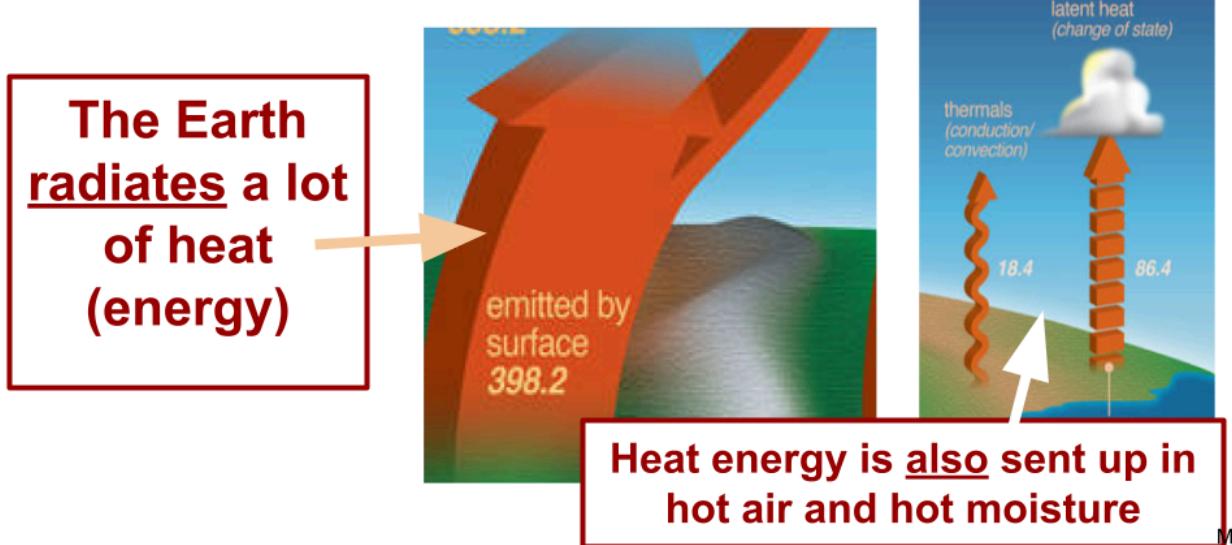
29 M

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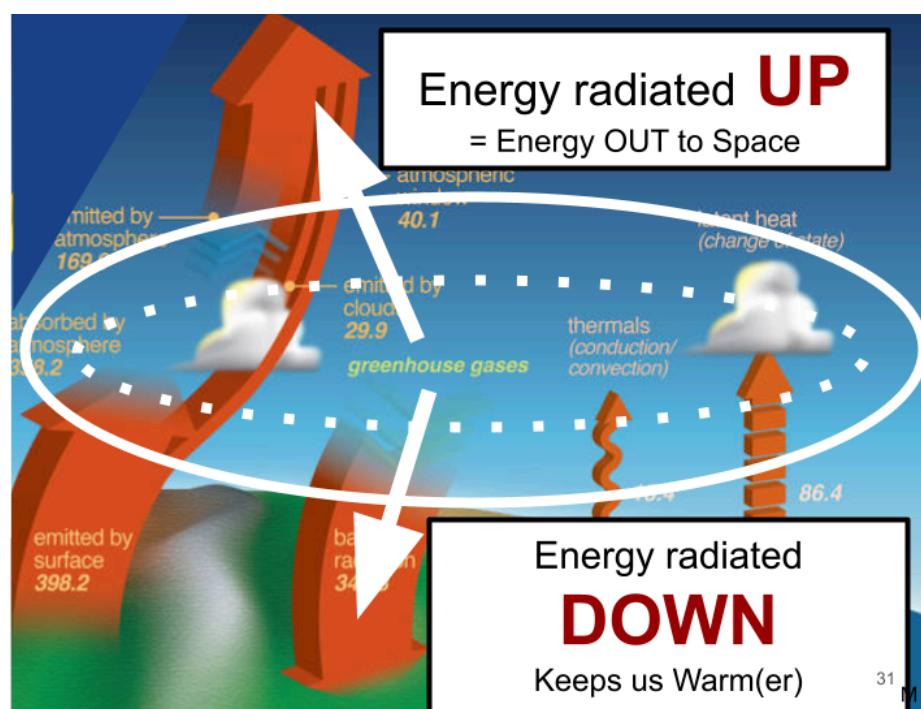
Meanwhile, the Earth is trying to send Energy back out



Atmosphere plays a role!

Greenhouse Gases (GHGs) absorb energy,

then radiate it back out



Global Warming

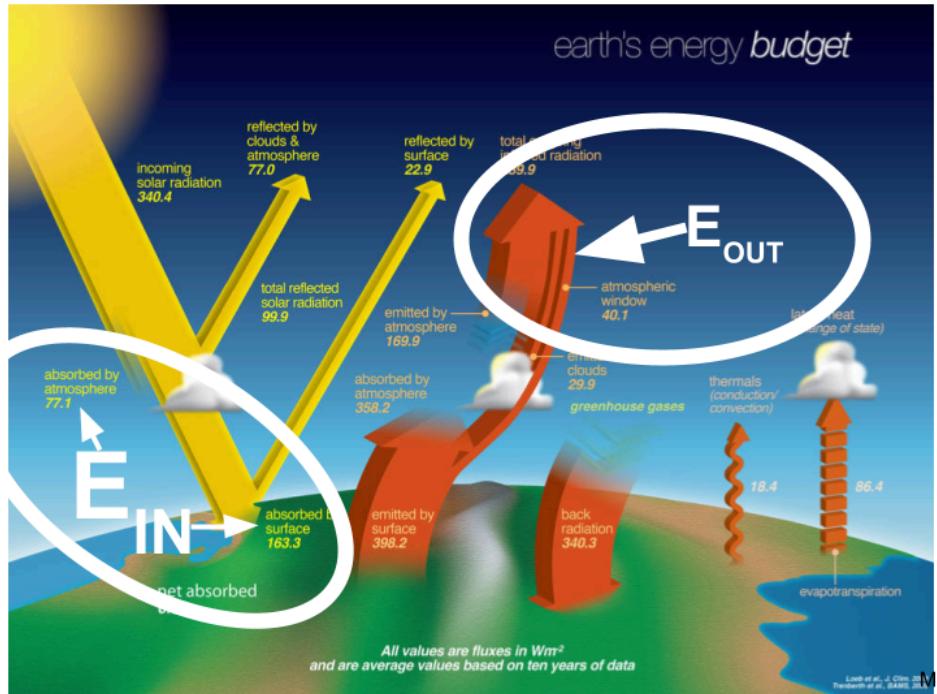
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Putting it all together

It turns out that, for decades

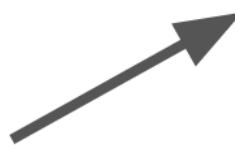
$$E_{IN} > E_{OUT}$$



The Punchline is that:

Global Warming

is Occurring

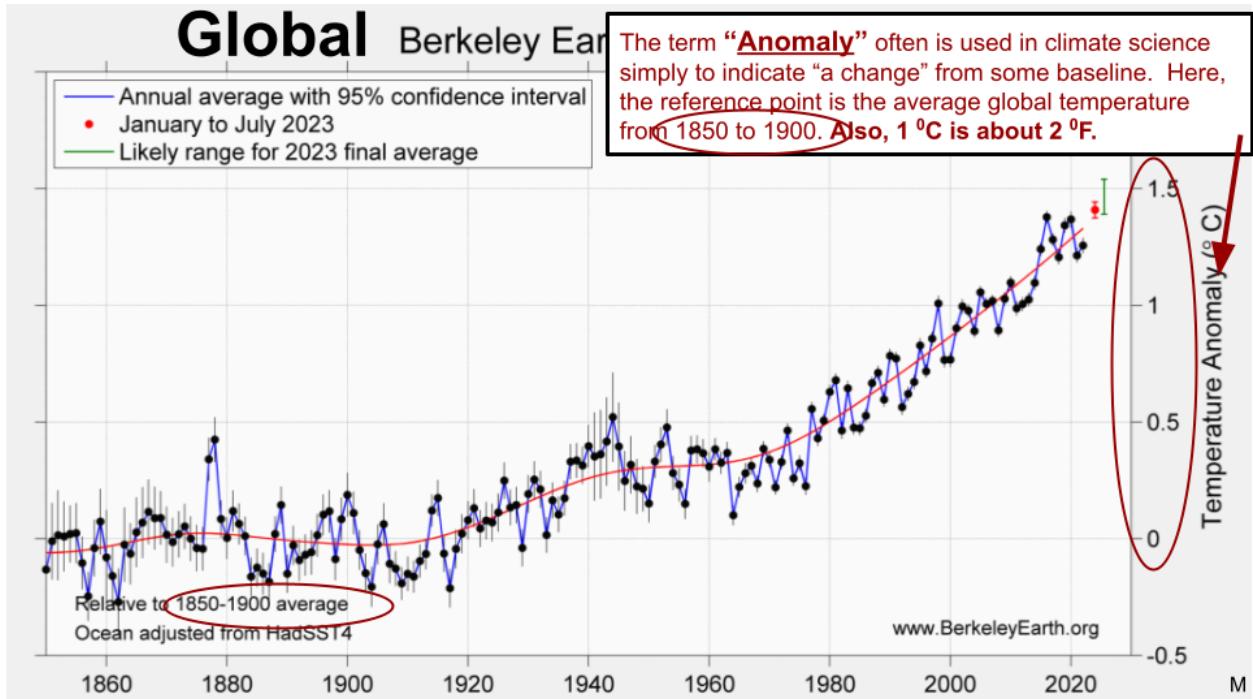


and has been for decades

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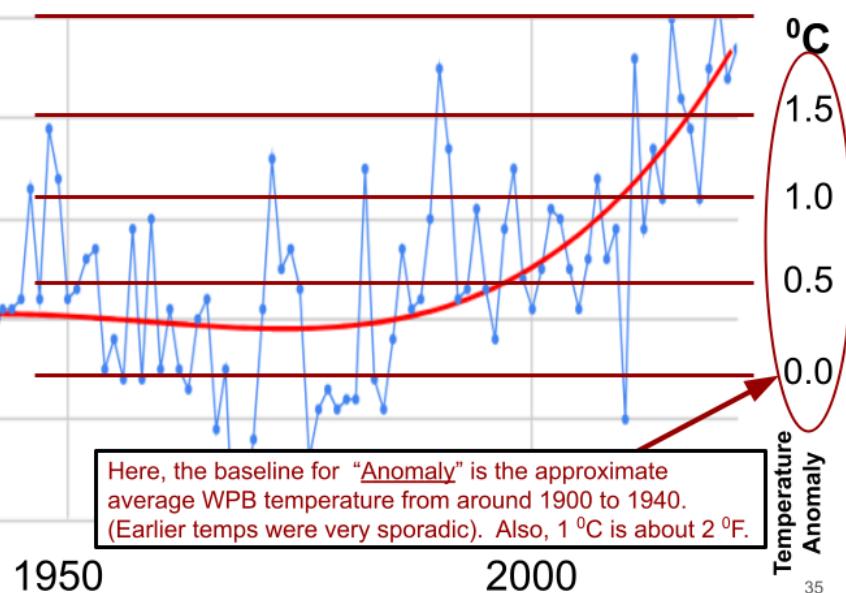


We ask REAL
Questions:

**Is there any
sign of
Warming in
WPB?**

Answer: Yes

and temps now trending up more rapidly. 30-year “climate” also trending up. Consistent with global data. Must discuss heat island relevance.



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CSSG-2.1 Summary

The key concepts here were:

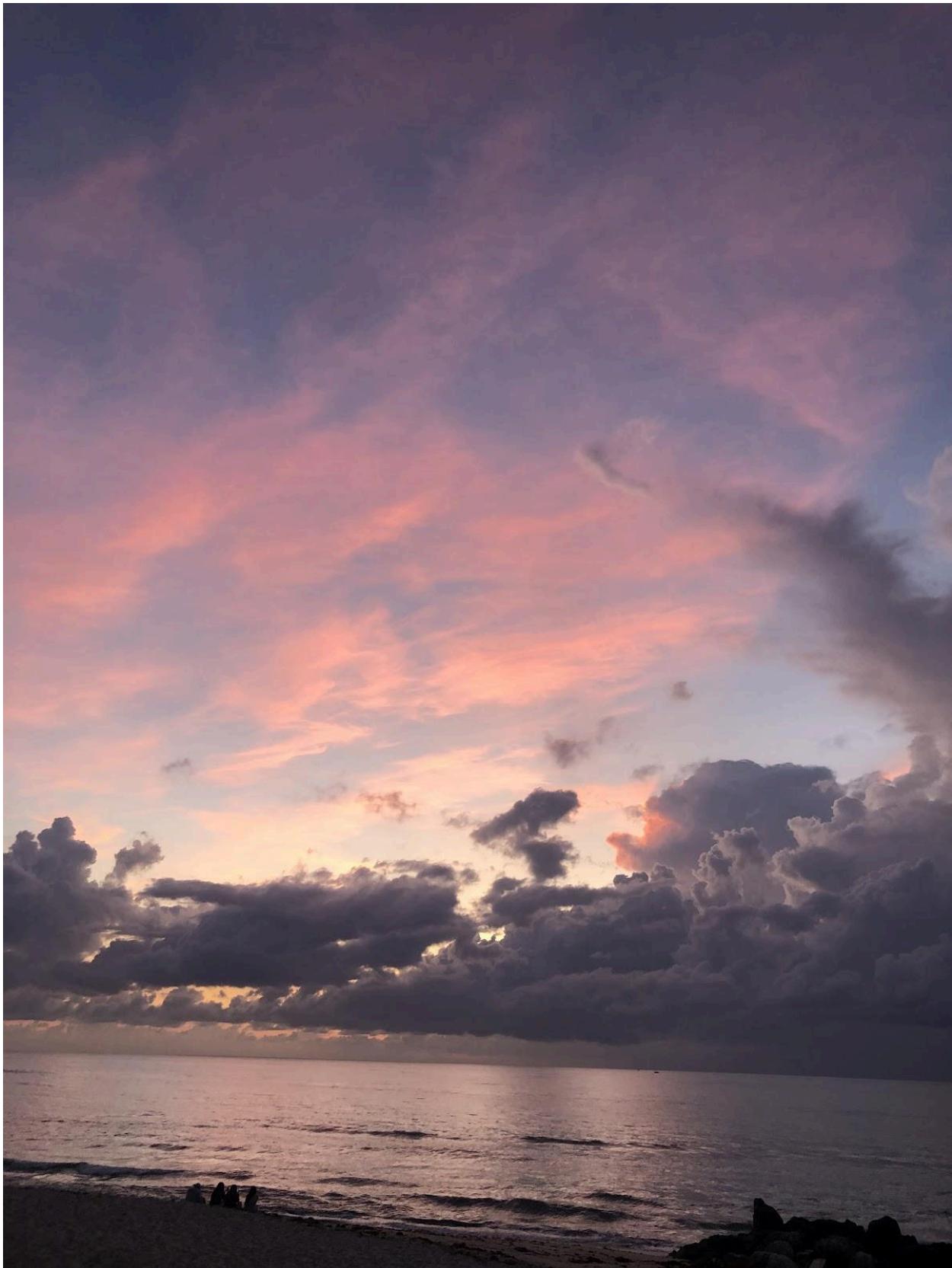
1. **Global Warming** occurs if Energy IN is greater than Energy OUT. This has been the case for many decades and it shows up in the rising global temperatures.
2. **West Palm Beach data** shows a similar temperature rise. It will be essential to assess whether that is from global warming or simply a heat island effect, or both.
3. **Earth's Energy Imbalance (EEI)** is a useful term for this. EXTRA NOTE: In climate science, the term “Radiative Forcing” is typically used for this concept, so we will need to use it occasionally. I did not cover it today because it is a less intuitive wording than “Earth's Energy Imbalance”!

A Practical Challenge:

In each picture (and as you look up at the sky each day), try to identify what's happening to the ENERGY. Is it all Energy IN? In some cases the sunbeams have quite a journey before they get captured or get sent back to space. Don't forget to look for energy going up into the atmosphere from the surface.

Meanwhile, enjoy the wonderful scenes around us everyday!

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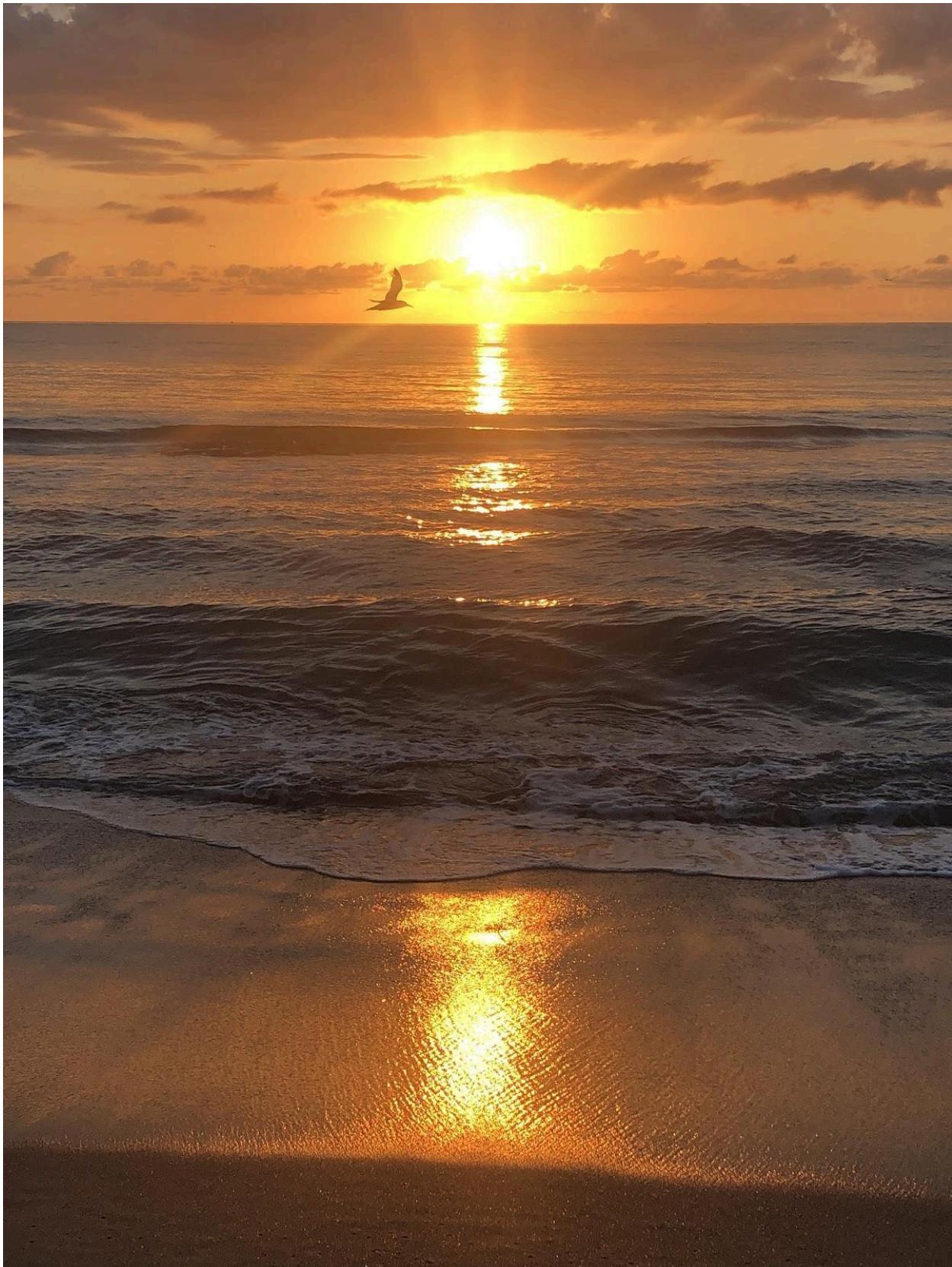
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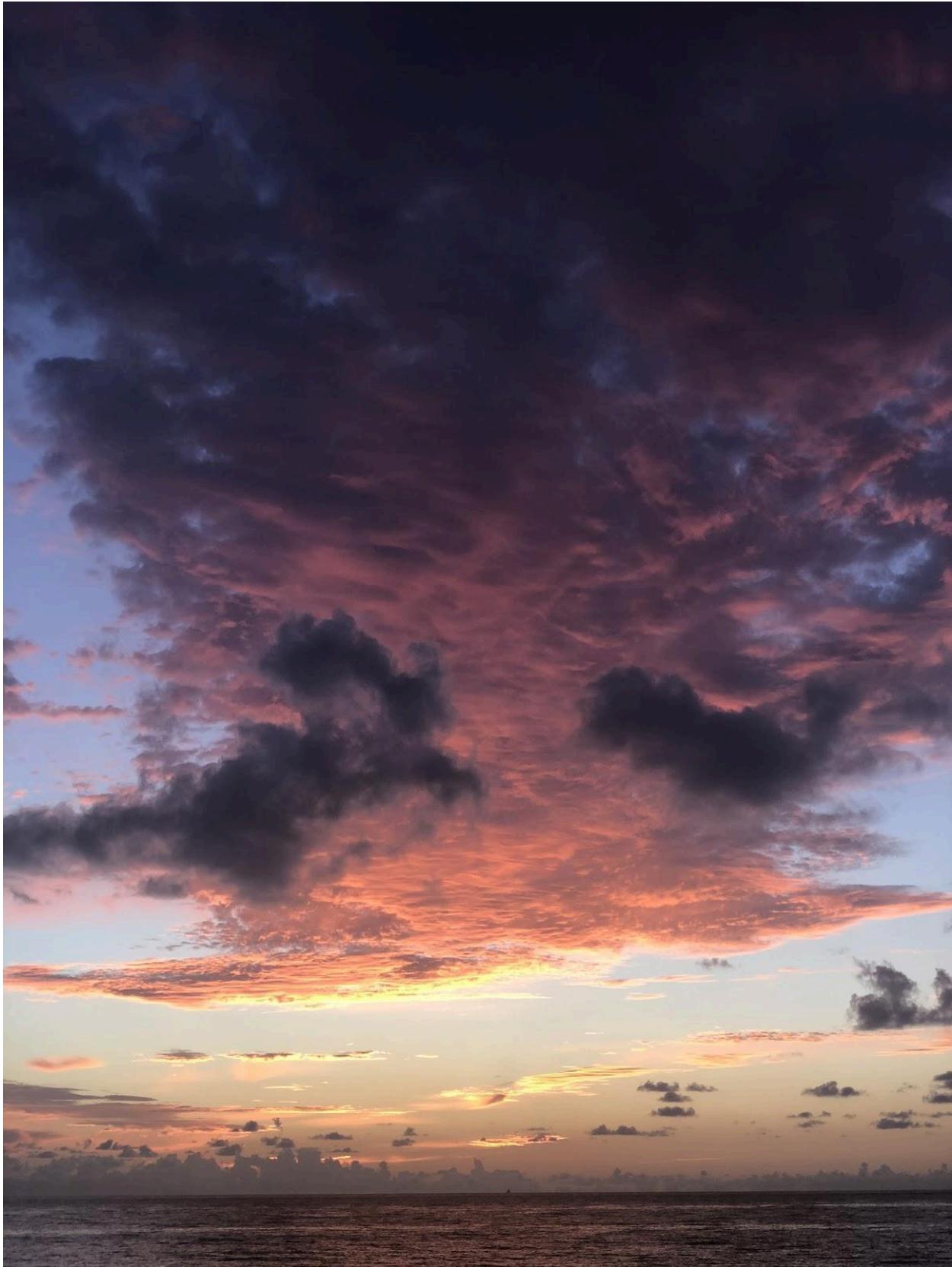
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