Houston, The Eagle Has Landed!

TRCS

BOUNDING GHG CLIMATE SENSITIVITY FOR USE IN REGULATORY DECISIONS

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Presentation to DDP-32 Knoxville Tennessee July 26, 2014

A Report of The Right Climate Stuff Research Team

"The Technology of the Apollo Flights and the Study of Climate Change"

Presented by James M. (Jim) Peacock Aerospace Engineer

Retired NASA / Johnson Space Center, Houston, Texas

http://www.therightclimatestuff.com e-mail: jim@seadiver.com

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This TRCS report can be found at the TRCS website:

www.therightclimatestuff.com

Executive Summary Feb 2014 13 Pages

Full Report with Annotated References 84 Pages

Lead Author: Harold H. Doiron, PhD

Contact us Through Website

Questions & Critique Welcome

No un-validated Opinions or Comments, Please

"In God we trust, all others bring data."

My Preparation:

- Texas A & M University BS in Mechanical Engineering

- 4 years as Project Officer, USAF Research & Development, Kirtland AFB N.M., Nuclear Armament for 5 Fighter & Bomber Aircraft

- 21 years as Aerospace Engineer at NASA Johnson Space Center, Houston Texas. Apollo, Skylab, Space Shuttle Programs.

Who is TRCS ?

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.**Volunteer group** of more than 25 retired Apollo Program veterans (NASA / Houston, Texas)

• Formed February 2012. **Initial seminars included proponents and skeptics of the AGW theory.**

• The TRCS research team has capability for assessing complex technical issues.

• Highly trained and **experienced in making critical decisions on complex issues where human safety is involved.**

• Have the requisite education and experience to analyze the critical issues in AGW research.

• Our Goal: Perform an **objective, independent** study of scientific claims of significant Anthropogenic (Man-Made) Global Warming

TRCS Approach to AGW Issue

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- We approached the AGW issue independently and objectively with some “out of the box” thinking.
- Climate Sensitivity to CO2 can be treated as a simple STATICS PROBLEM, not a complex DYNAMICS PROBLEM.
- Our simple AGW climate model, based analysis of actual data analysis, is much more accurate with much less uncertainty, than predictions of complex climate dynamics simulation models.
- When available models are un-validated, we base critical decisions on a careful analysis of available physical data.

Last, but not least:

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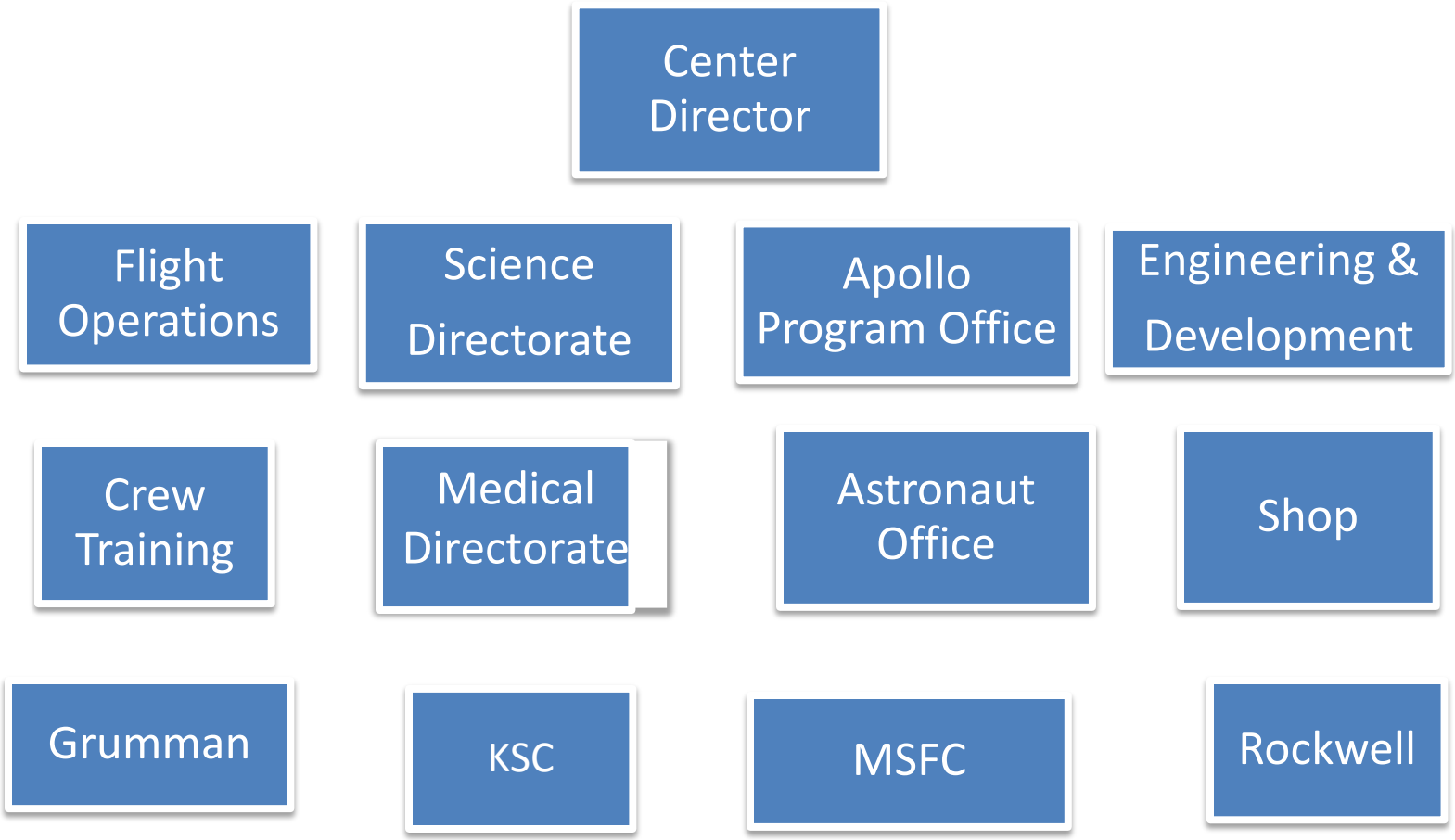
- During the Apollo Program we knew that our success would depend on adherence to **scientific discipline, personal honesty and integrity**, and a lot of stressful hard work.
- **Then as now, we grade (ourselves and others) on performance, not credentials. Our motto and the way we do our work was and is:**

"In God we trust, all others bring data."

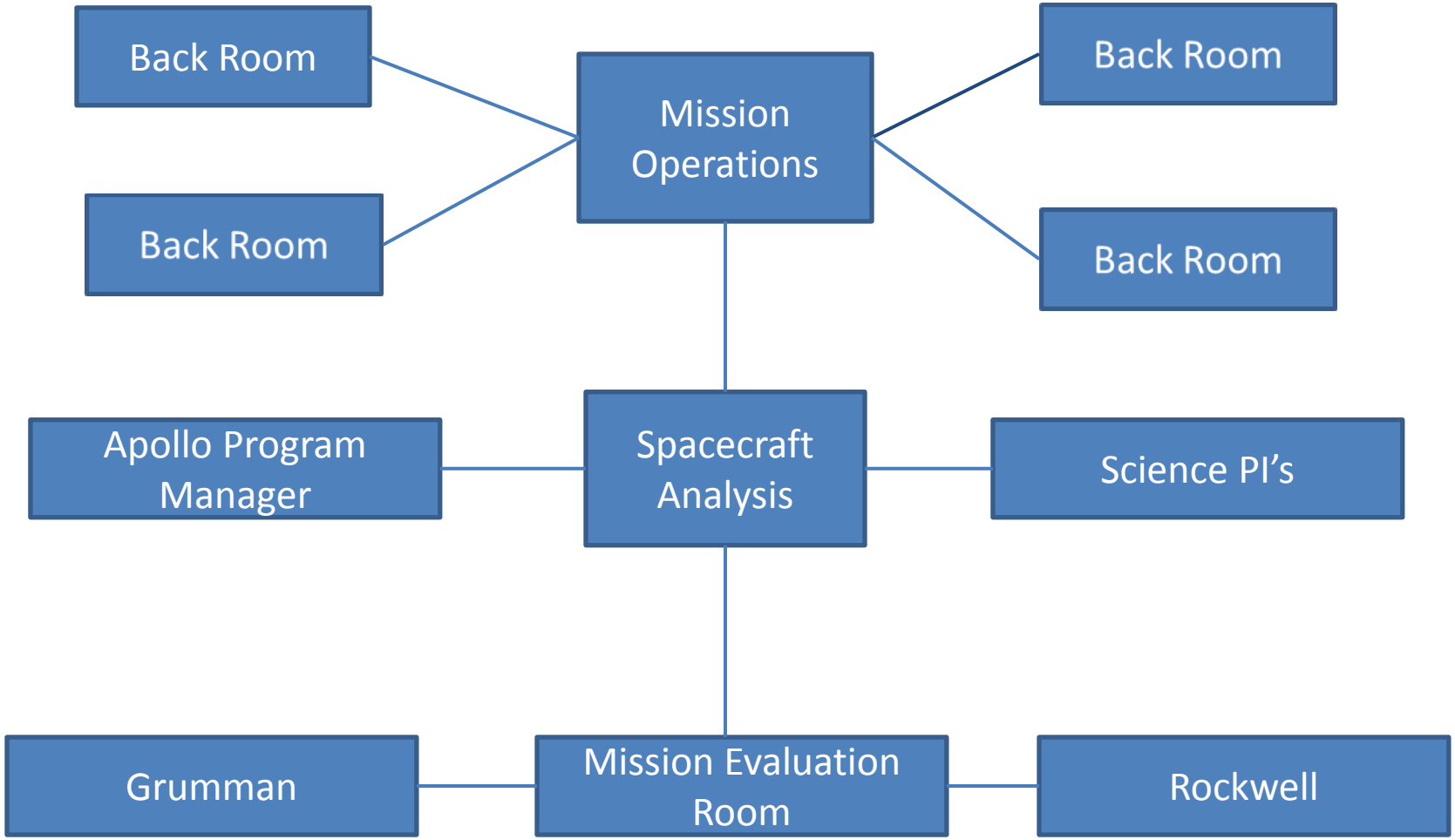
Johnson Space Center, Houston



General functional organization during the Apollo era

Flight Operations or Simulations

General functional organization during the Apollo era



Design Responsibility 1962-1967

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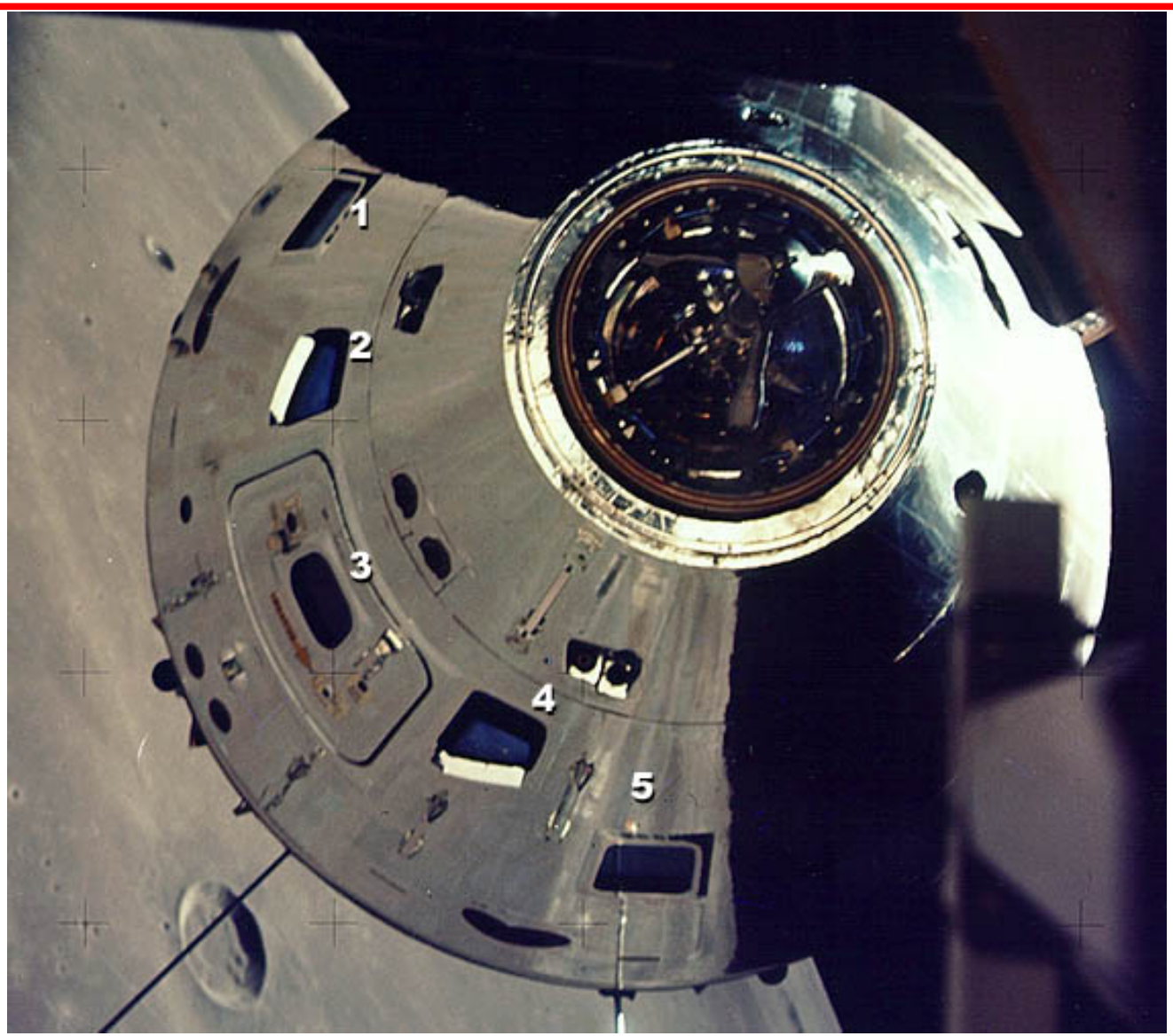
- Docking system (Established original design criteria)
- Side Hatch (Original design philosophy prevented escape)
- Windows (Deleted window covers 1962)
  (Unilateral change that saved the program)
- Crew couch & shock attenuation struts (JSC redesign)
- Land Landing survivability development (Abort area problem)
- Water landing survivability (Full Scale Test, Landing model)
- Water Landing Uprighting System (success story)
- Recovery radio beacon antennas (success story)

Apollo Command Module Docking



Simplified POGO Model

Show POGO Video

Dr. Hal Doiron's Experience (partial list)

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- **Lunar Landing Dynamics Model**
  - **Hal Predicted LM tip over conditions**
  - **Hal Optimized Engine Cut-off Timing**

- **Pogo problems & suppression at Launch**
  - **All manned space vehicles had POGO conditions prior to Space Shuttle. (Apollo 13)**
  - **Hal led the team that designed the Shuttle to be POGO-Free**

- **All Models Validated by Test Data**

The Earth's Complex Climate System

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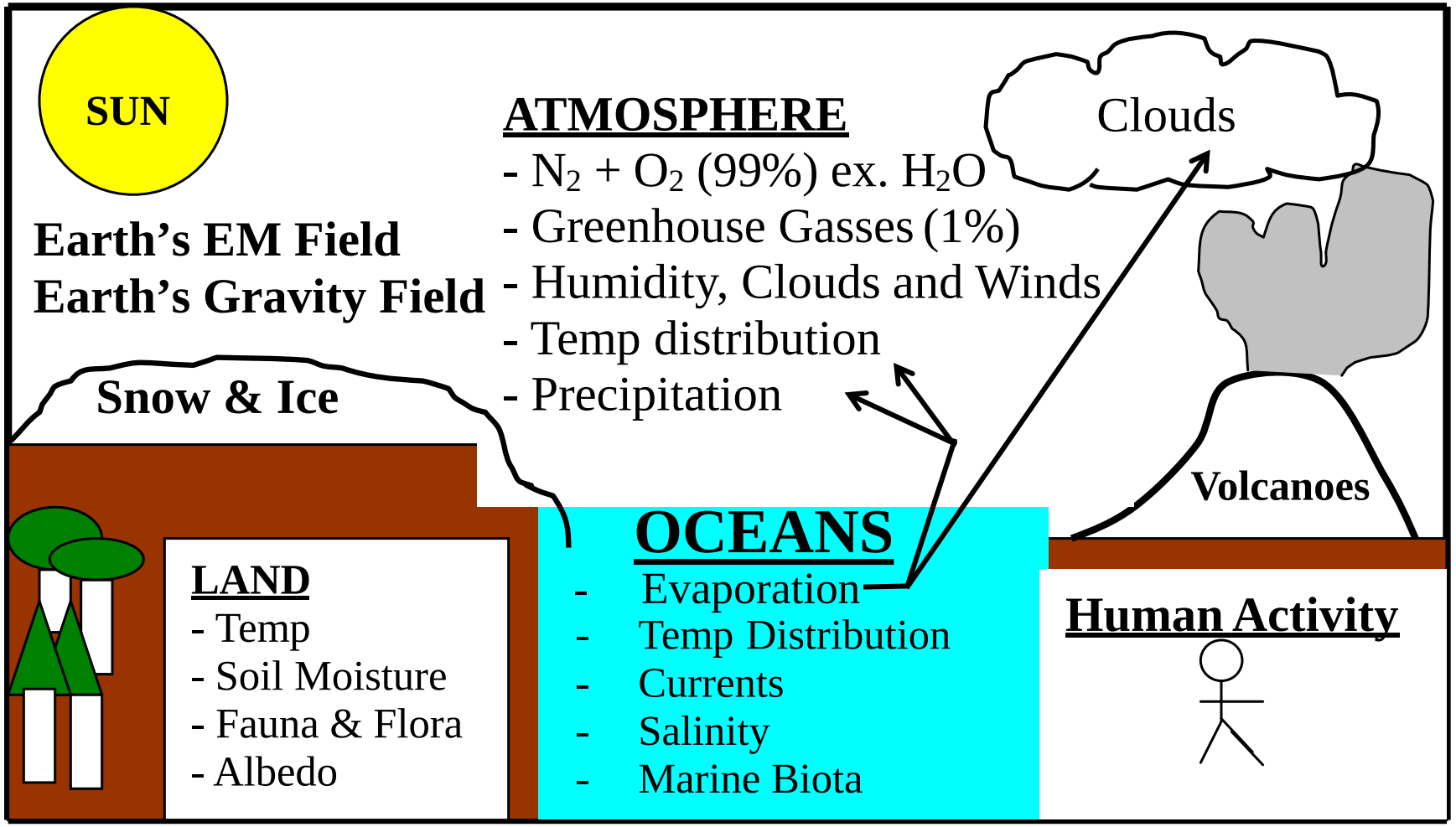

Purpose and Goal

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PURPOSE:

- **Perform an objective, independent study of scientific claims of significant Anthropogenic Man Made Global Warming (AGW).**

- **Resolving <u>all unanswered questions</u> related to climate change is outside the scope of our capability as an all voluntary organization.**

- **We chose as a reasonable goal:**

Determine to what extent human-related releases of CO2 into the atmosphere can cause earth surface temperature increases that would have unacceptably harmful effects.

Why we chose this goal

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- We chose this goal of studying CO2, because this is **the part of climate change on which our government is spending a preposterous** amount of **our money**. The cost of implementing the current government policies to limit CO2 emissions will have an **imminent and devastating effect** on the U. S. economy.

Federal Climate Change Funding

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Obama's FY2014 Budget $11.6 billion

http://fas.org/sgp/crs/misc/R43227.pdf

23% for science,

68% for energy technology development and deployment

8% for international assistance

1% for adapting to climate change.

National Climate Change Funding

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$22 billion = $1.8 Billion per Month TAXPAYER'S MONEY

Plus Cost of Industry Complying

Plus Market Distribution Cost Increase

Plus Consumer Cost Increase

Plus

UNFORSEEN COSTS

from John Christy Univ. of Alabama

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Without energy, life is brutal and short.

However, the length and quality of human life is directly proportional to the availability of affordable energy, which today is about 85 percent carbon-based.

What's more, it's economic development that creates the cleanest environments we have. You don't find clean rivers or clean air in the poorest countries.

The Northern Hemisphere

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Photo from John Kehr's Book: The Inconvenient Skeptic
Earth has 71% ocean coverage total, but NH and SH markedly different

Northern Hemisphere (NH) has 41% land coverage

North Pole is ocean covered with ice and surrounded by land

NH heats up more quickly in Summer season compared to SH due to its higher % land coverage

The Southern Hemisphere

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Photo from John Kehr's Book: The Inconvenient Skeptic

Southern Hemisphere only has 19% land coverage – much of that is Antarctica land mass covered with ice and always below 0 deg C

Southern Hemisphere responds much differently to its seasons than the NH because of its 81% ocean coverage

Global Average Temp – Fairly Constant

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- **The earth and its atmosphere maintain a fairly constant Global Yearly Average Surface Temperature by radiating to deep space almost all of the energy received from the Sun in each 24 hour period**

Yearly Global average earth surface temps within +/- 2 deg C and mostly within +/- 1 deg C variation for 10,000 years!!!

- **Higher atmospheric CO2 levels are predicted to heat up the atmosphere and "slow down" the earth's net heat rejection to deep space by radiation, causing surface temp rise…….But by How Much?**

Greenland - GISP2 Ice Core Data

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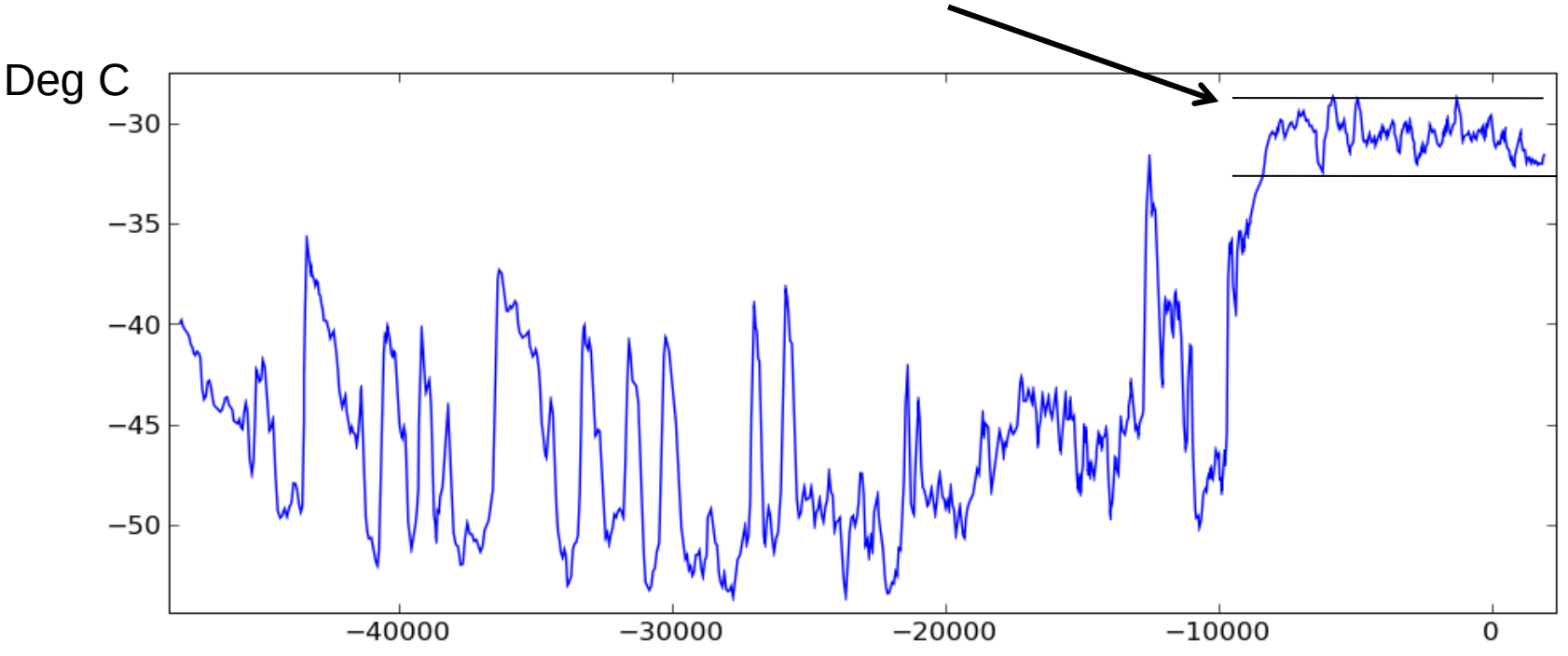
A major concern of a warming climate is melting of the Greenland Ice Sheet and resulting sea level rise

Last 10,000 years of stable climate data from GISP2



Current Climate Models Not-Validated

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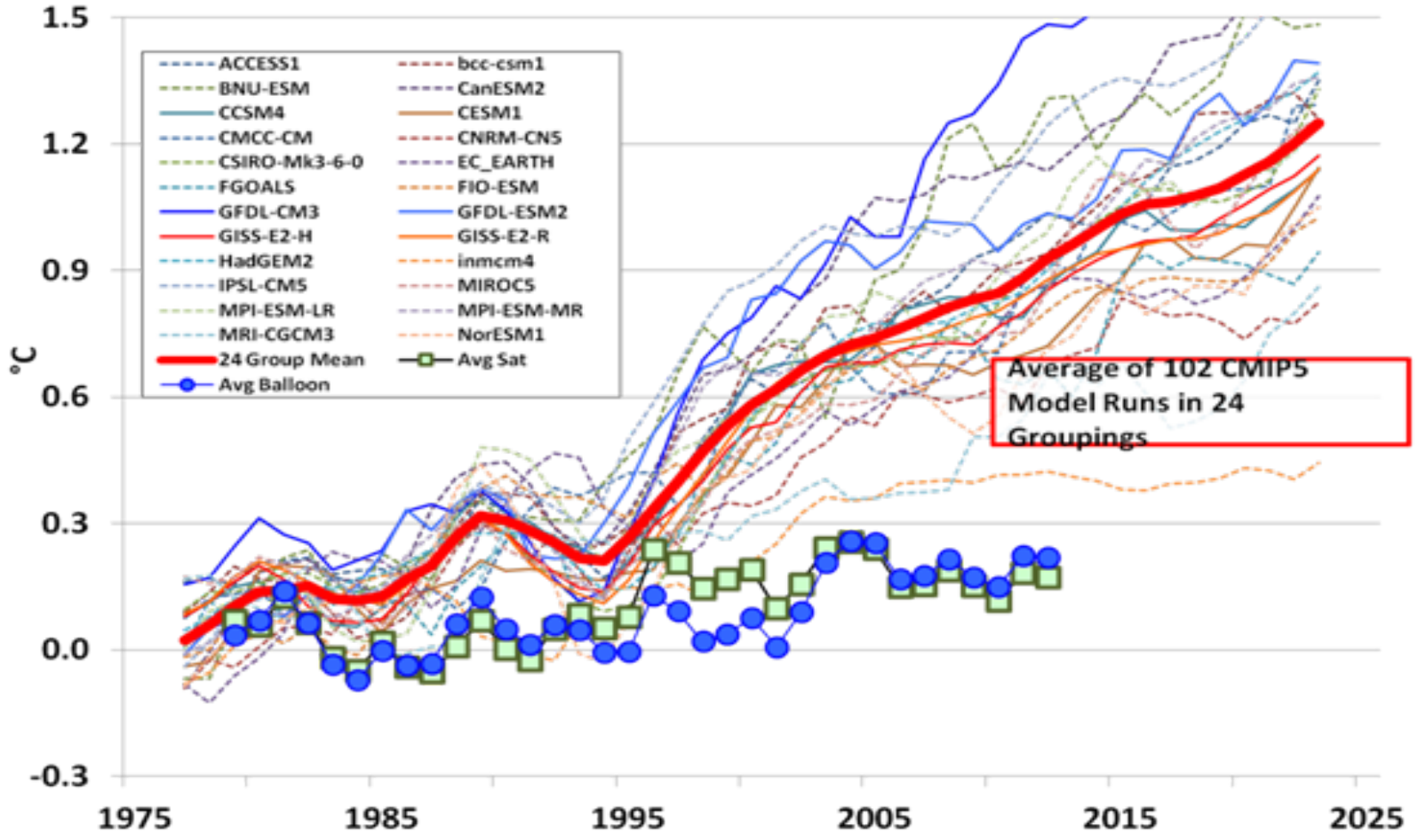

From John Christy testimony to Congress Dec 2013

I agree with Feynman

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It doesn't matter how beautiful your theory is, it doesn't matter how smart you are. If it doesn't agree with experiment, it's wrong.

Richard Feynman 1918-1988

Seems clear to me

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How can the EPA and Congress ignore this data?

Dr. Christy gave this chart testimony to Congress in Dec 2013, and it has been well published since then with no rebuttal of which I am aware.

IPCC Building

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Ljungqvist NH Temp Reconstruction

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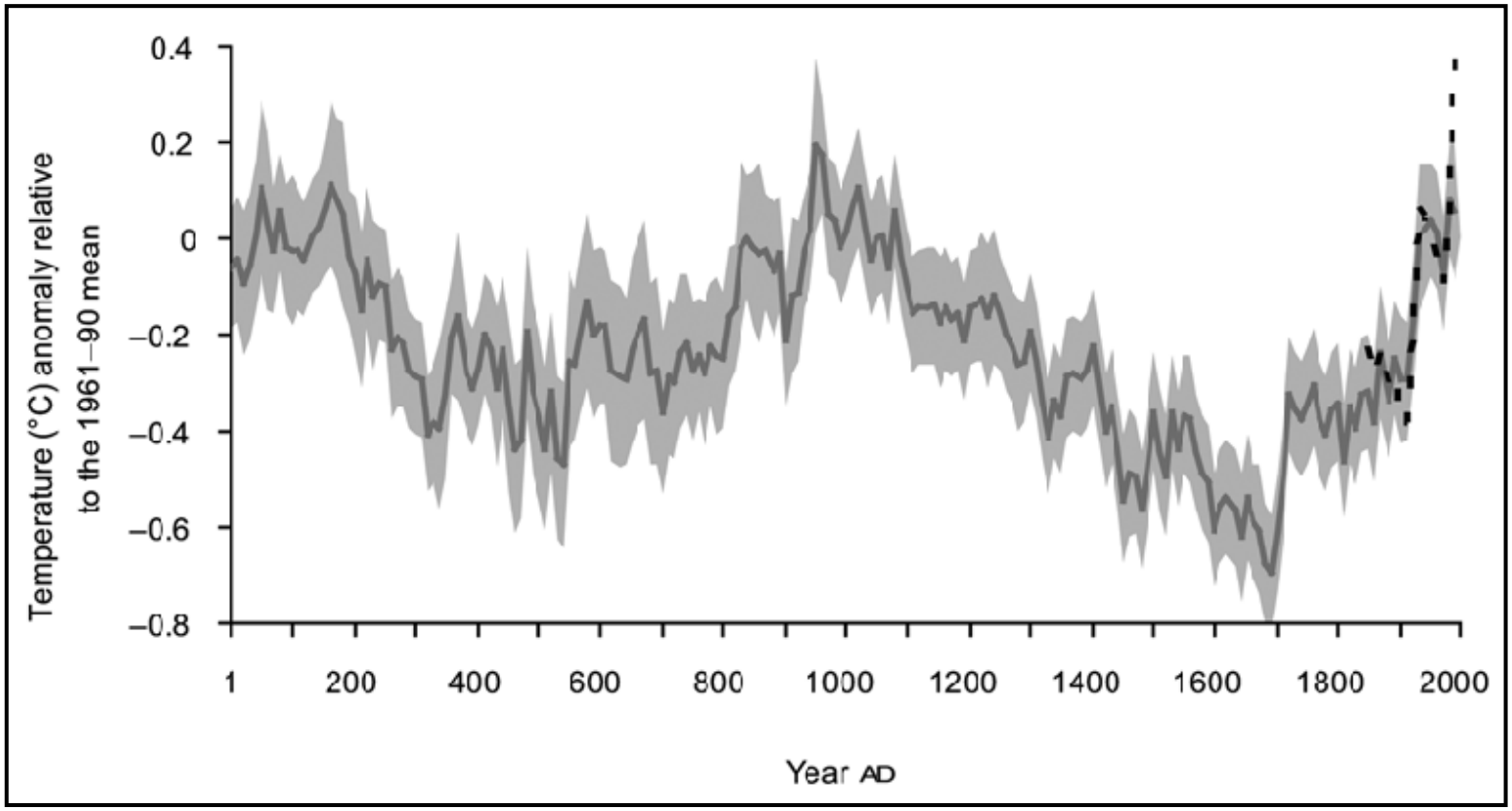

Ref: Ljungqvist, F.C. 2010. A new reconstruction of temperature variability in the extra-tropical northern hemisphere during the last two millenia. *Geografiska Annaler* 92A(3):339-351).

Recent Global Average Temp Variation

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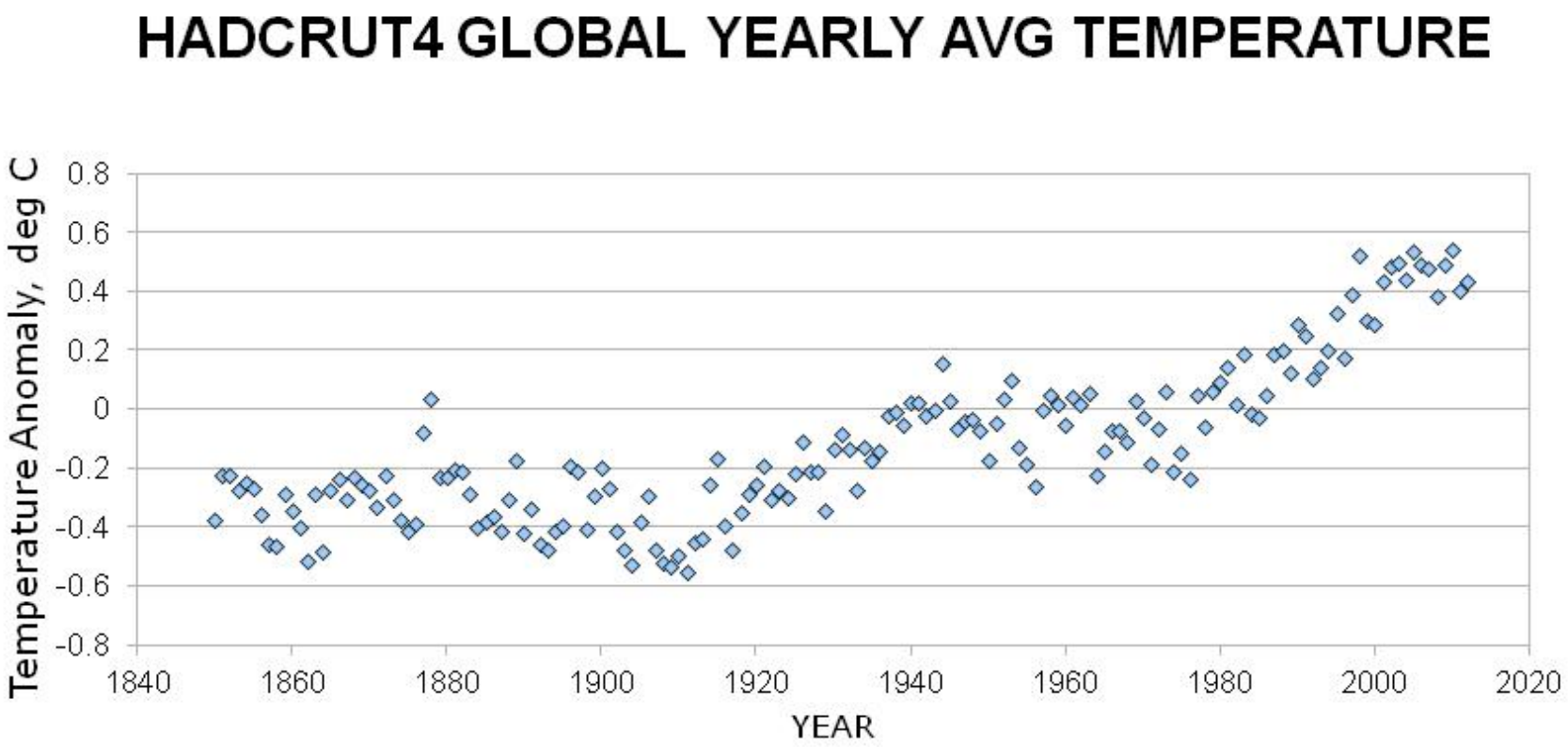

CO2 Level In Atmosphere

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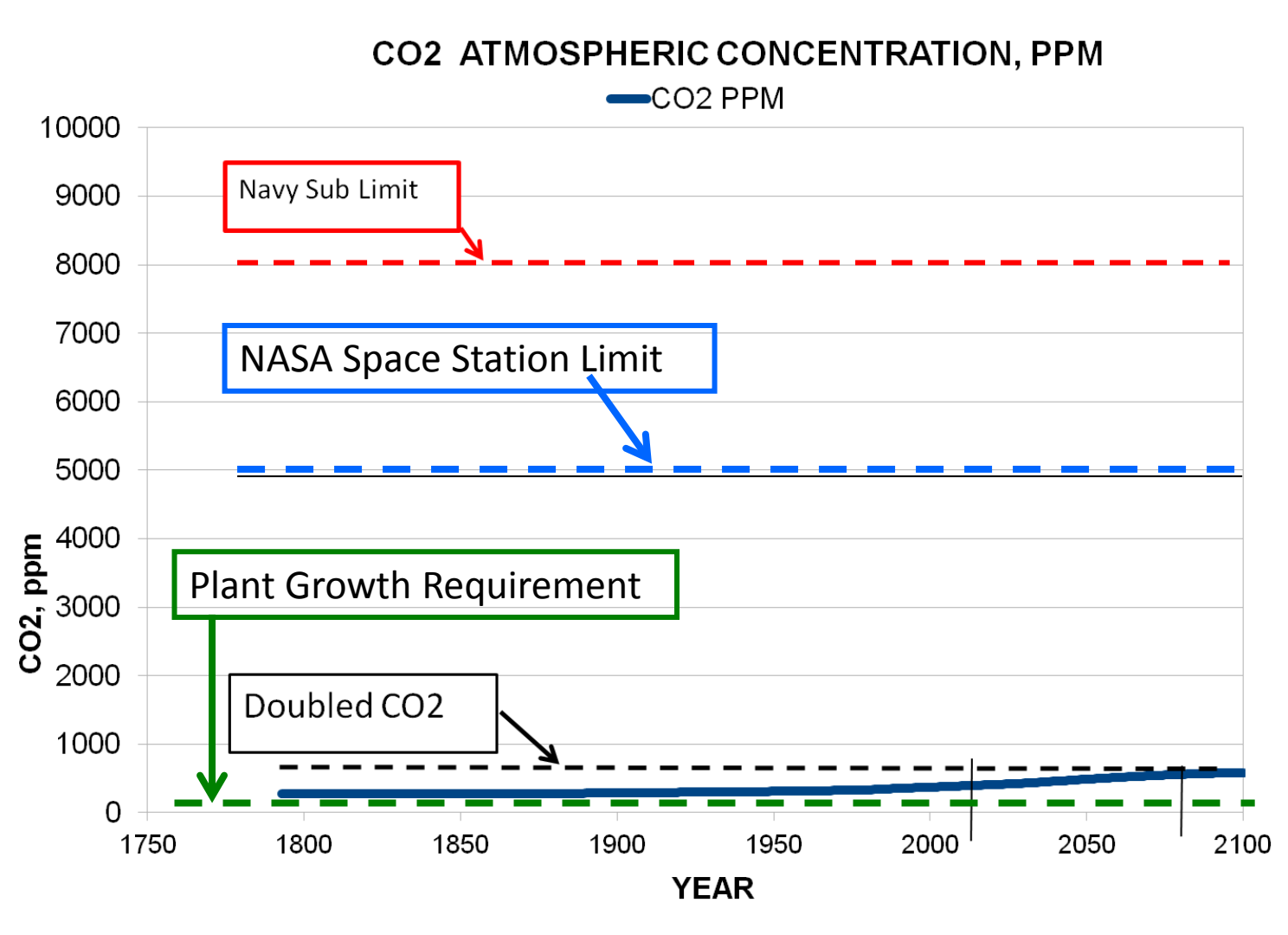

CO2 TRENDS IN ATMOSPHERE

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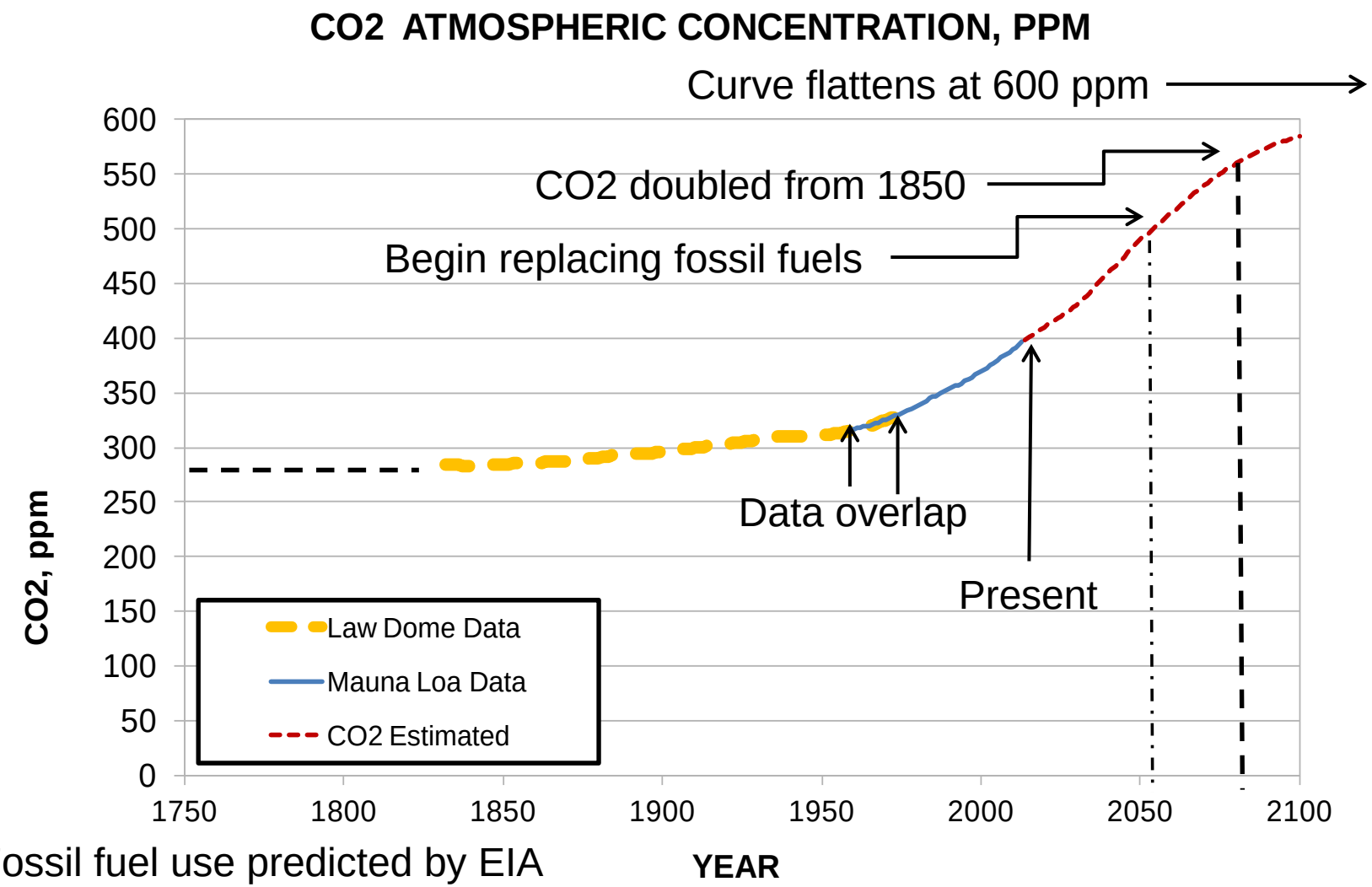

Fossil fuel use predicted by EIA Energy Information Administration

Functions Used In HadCRUT4 Data Fit

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HadCRUT4(Year) = (1850 value)

1000 year cycle

+ $\mathbf{A_L}$Sin[2π(Year-**1850**)/$\mathbf{P_L}$]

62 year cycle

+ $\mathbf{A_S}$Sin[2π(Year-**1988**)/$\mathbf{P_S}$]

Surface Heating by CO2 increase

+ **TCS**{Log[CO2Level(year)/284.7]/Log[2]}

CO2 Sensitivity Functions

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ECS Equilibrium Climate Sensitivity –
IPCC AR5 report, ECS is defined as: "the change in global mean surface temperature at equilibrium that is caused by a doubling of the atmospheric CO2 concentration."
TCR –Transient Climate Response –IPCC AR4 report is: "TCR refers to the global mean temperature change that is realized at the time of CO2 doubling under an idealized scenario in which CO2 concentrations increase by 1% per year.
TCS –Transient Climate Sensitivity – Defined by TRCS
The actual rise in Global Average Surface Temperature (GAST) caused by actual increases in atmospheric CO2 levels in the year that atmospheric CO2 concentration reaches 560 ppm, thereby doubling the pre-industrial CO2 atmospheric concentration of 280 ppm.

Differences In ECS, TCR & TCS

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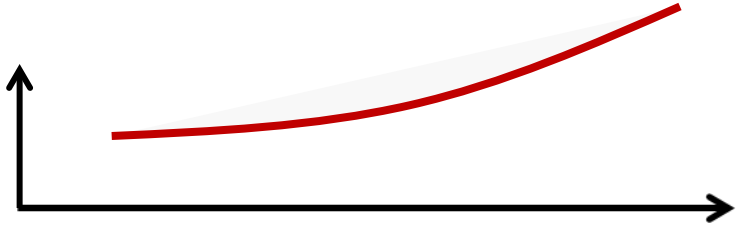
ECS FORCING FUNCTION

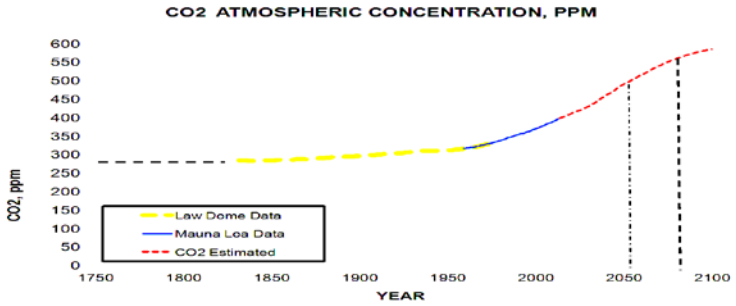
100% First Year
Modeled to 1000 yrs
to get long term
Feed back

TCR FORCING FUNCTION



1% Each Year

TCS FORCING FUNCTION



Actual Amount
Each Year

ECS / TCR / TCS

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- ECS & TCR derived from climate models
- TCS derived from actual climate data

TCS can be verified by actual data!

TCR approx. equal to TCS

ECS **fuhgeddaboudit**

TRCS Excel worksheet calculations

Delta T= TCS{Log[$CO2_2$ / $CO2_1$] /Log[2]}

Delta T = 1.5{Log[640/284.7]/Log[2]} = 1.75 deg C

	Input		Calculations					input		Final
year	ppm2	ppm1	ppm2/ppm1	Log (p2/p1)	A3	Log A3	Log (p2/p1)/Log A3	TCS	delta °C	T °C
1850	284.7	284.7	1	0	2	0.301	0	1.5	0.00	-0.2
1900	295.8	284.7	1.038988	0.01661	2	0.301	0.055179559	1.5	0.08	0.28
1950	310.7	284.7	1.091324	0.03795	2	0.301	0.126079748	1.5	0.19	0.39
2000	369.5	284.7	1.297928	0.11325	2	0.301	0.376209958	1.5	0.56	0.76
2050	490.0	284.7	1.72111	0.23581	2	0.301	0.783339256	1.5	1.18	1.38
2100	585.0	284.7	2.054795	0.31277	2	0.301	1.038994132	1.5	1.56	1.76
Doubled	640.0	284.7	2.24798	0.35179	2	0.301	1.168629412	1.5	1.75	1.95

Data Fit – No 1000 Year Climate Cycle

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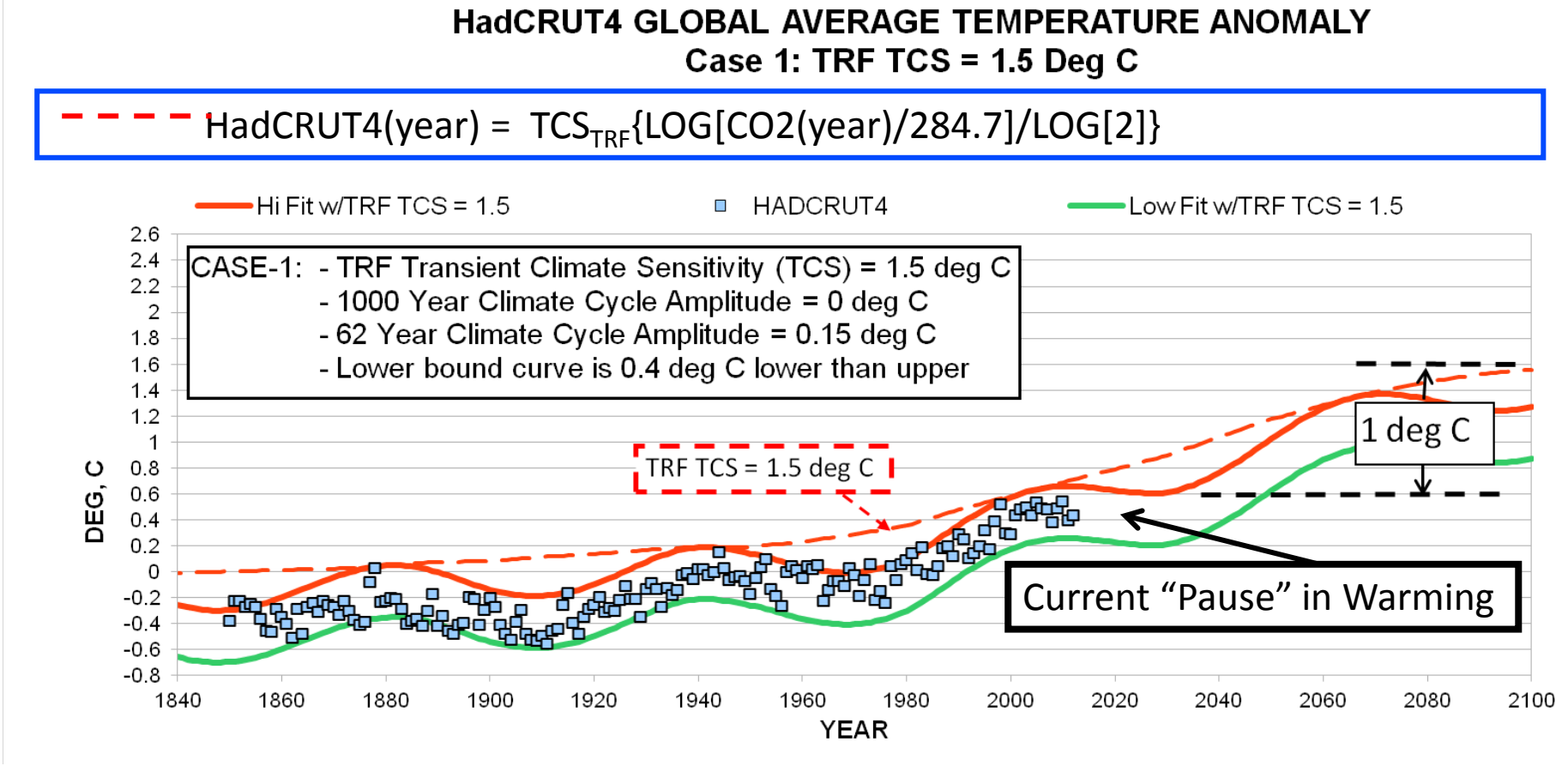

Data Fit With 1000 Year Climate Cycle

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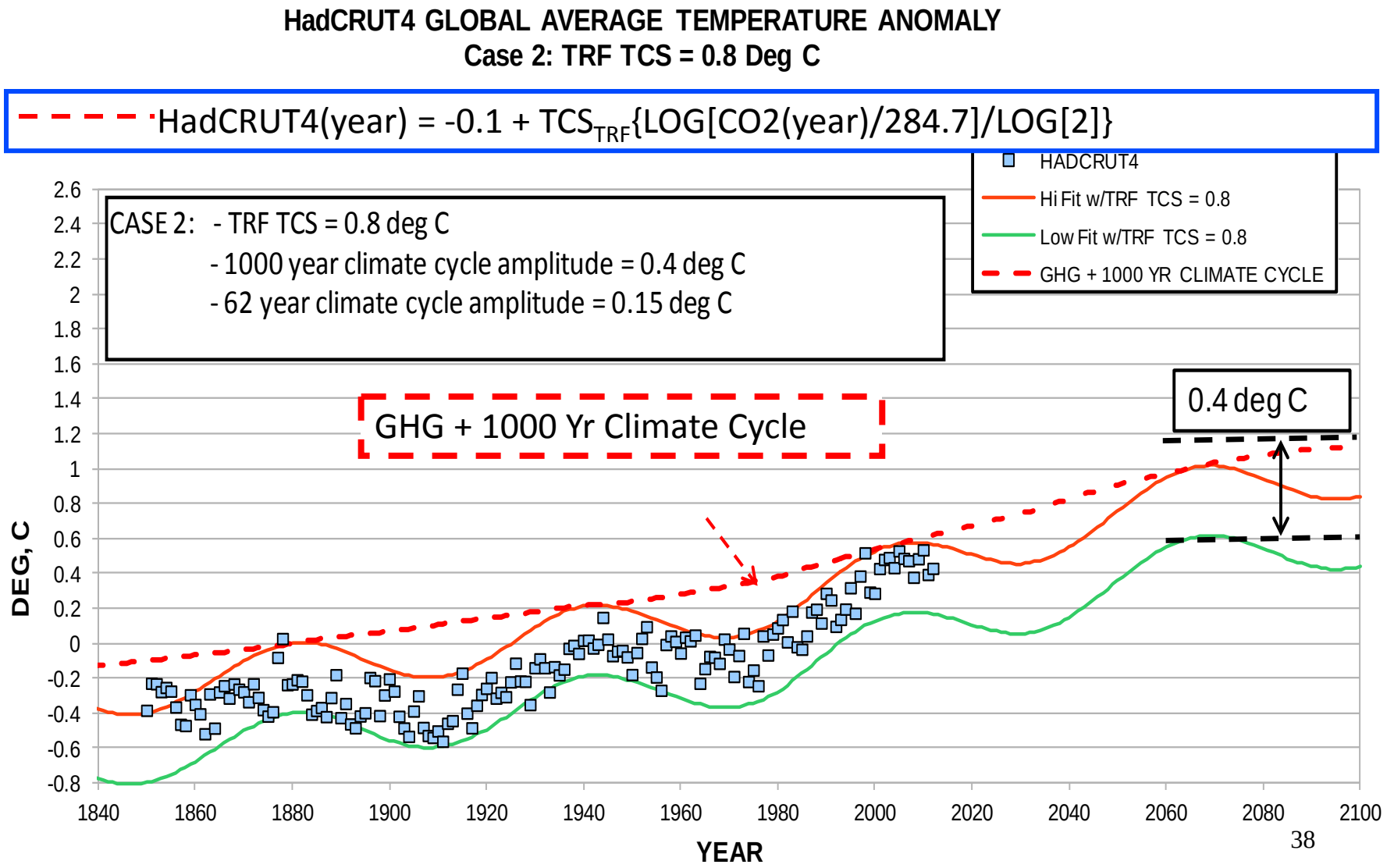

Extracting Most Conservative TCS Value

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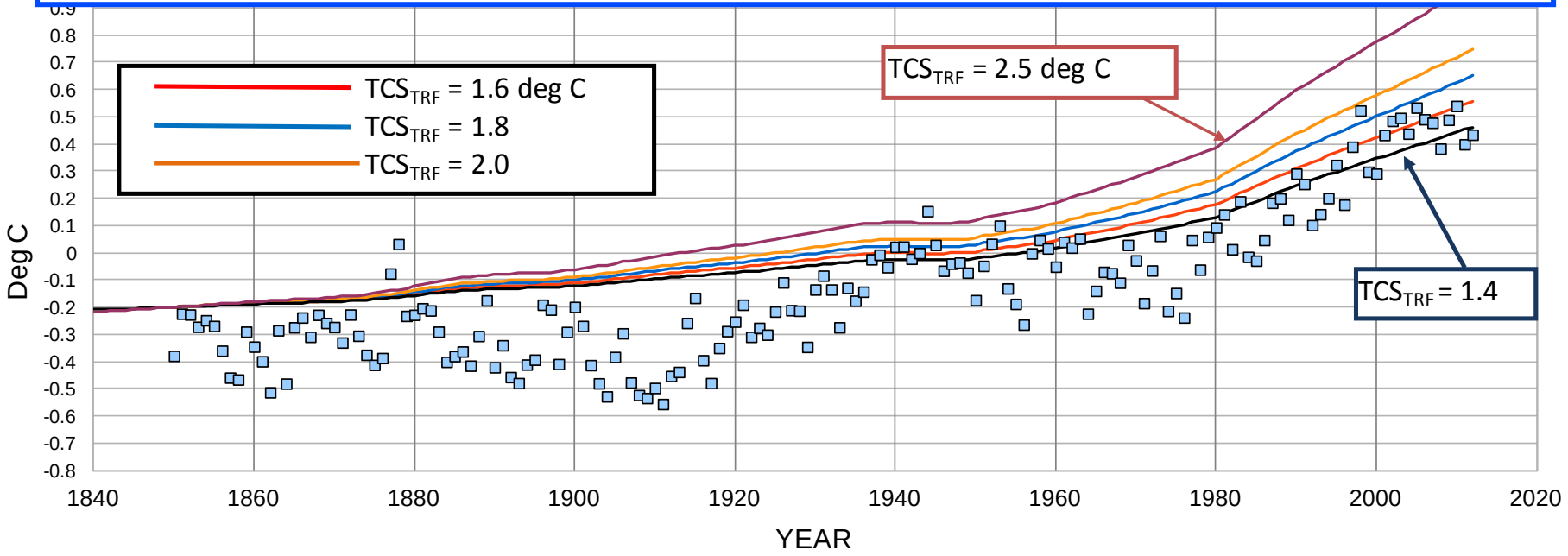
Bounding Total Radiative Force (TFR) Transient Climate Sensitivity (TCS) For HadCrut4 Global Average Temperature Anomaly

$$HadCRUT4(year) = -0.2 + TCS_{TRF}\{LOG[CO2(year)/284.7]/LOG[2]\}$$



Bounding Future Warming

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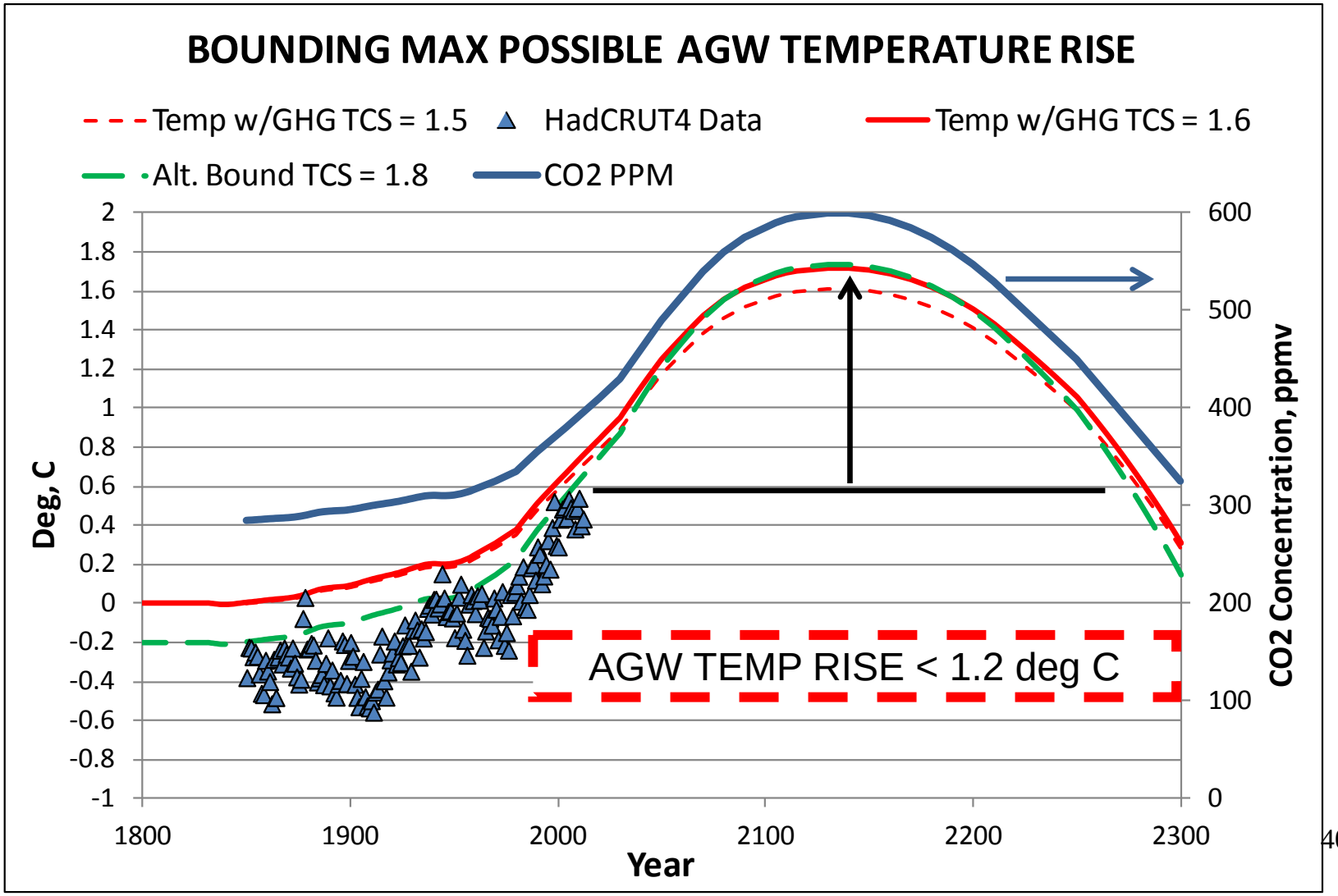

Our ECS Distribution Compared To EPA's

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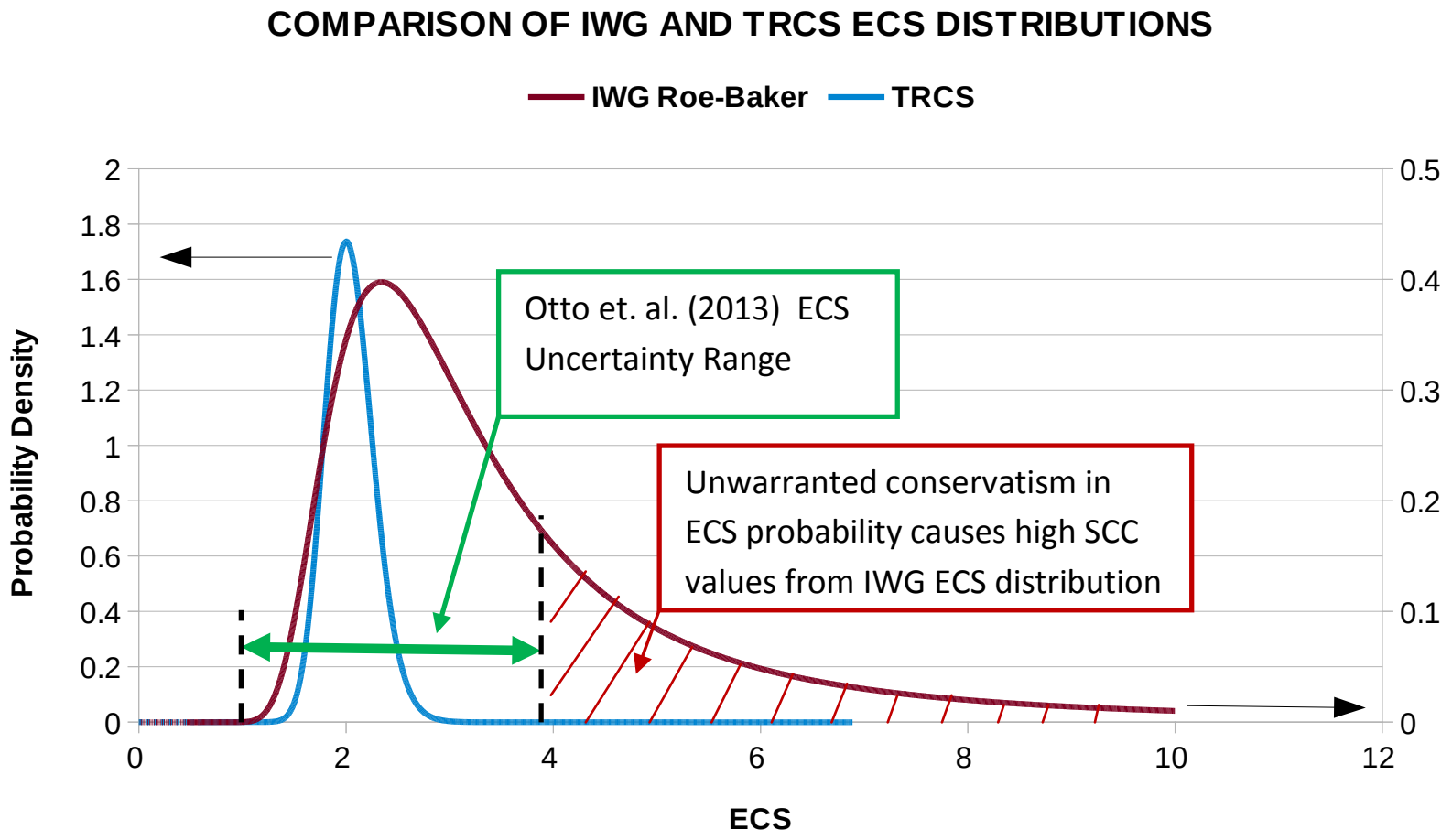

What Does Available Data Tell Us?

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- **Our TRCS team looked at actual data to see if we could:**
  - **Detect a Global Average Temperature Problem**
  - **Determine the maximum temp effect CO2 emissions can have**
- **Our conclusion is that**
  - **There is no current Problem**
    - **No harmful deviation outside of NORMAL LIMITS**
  - **The actual maximum possible CS is near the lowest value in the wide range of IPCC published uncertainty**
  - **TCS uncertainty range = 0.8 to 1.8 deg C**
  - **IPCC and NCA ECS Uncertainty Range = 1.5 to 4.5**

Summary of Initial TRCS Research Findings

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- The science that predicts the **extent** of Anthropogenic Global Warming (AGW) **is not settled science**
- **No convincing physical evidence** of catastrophic AGW
- **Computer models need to be validated** before being used for critical decision-making
- Because there is **no immediate threat** of global warming requiring swift corrective action,
  - **We have time to study global climate changes and improve our prediction accuracy**
- Our US government is **over-reacting** to concerns about AGW
- A **wider range of solution options** should be studied for **regional warming** or **cooling** threats from any credible cause

Current TRCS Activity

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- Continue to study most recent findings in climate science
  - IPCC AR5 Report
  - NIPCC Report Update
  - Blogs
  - Peer –Reviewed Published Literature
- Continue to hold workshops and seminars to review individual research of our TRCS members
- Provide comments to regulatory agencies during public comment periods
- Continue publishing reports on website
- Continue presentations to public, industry & government

Richard Feynman Advice

Remarks after Challenger accident investigation 1986

"For a successful technology, reality must take precedence over public relations, for nature cannot be fooled. "

END

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