# Climate Change Really Happening?

## Modeling to Predict the Future

- **Most phenomena behave "non-linearly"**
  Climate change, population growth, oil depletion, and many other phenomena change in complicated ways – non-linearly
- **We are naturally attuned to "linear" trends –expect them**
  We usually get the wrong answer when we apply our linear expectation to a non-linearly behaving phenomenon
- **Incorrect predictions of population growth and oil depletion**
  The earth's population by 1980 did not cause mass starvation[1]
  The world did not run short of oil after 1975[2]

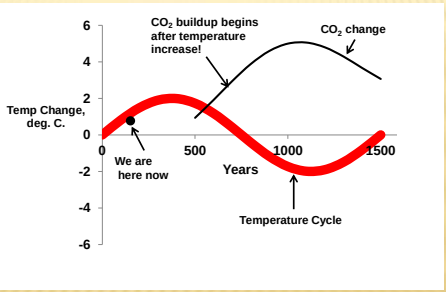
1 The Population Bomb by Paul Ehrlich
2 Energy from Fossil Fuels, M. King Hubbert, Science, 109,2823, Feb 4, 1949

## Climate Change Modeling

- **Climate change is occurring as it has for millions of years**
  It is naturally occurring driven by sun spot activity
  Temperatures cycle every 1,500 years up and down 2° C.
  The next two slides contain further detail about this cycle
- **Are any of the changes due to man's activities?**
  This maybe can be answered by detailed mathematical modeling of the earth's current climate including past history
- **Are the current UN climate models accurate future predictors?**
  NO, but in order to understand this answer we must first understand non-linear mathematical modeling.

## Climate Change is Happening as it has Since the Earth was Formed

*Many different sciences have measured about a 1,500 year cycle*




See:
*Unstoppable Global Warming Every 1,500 years* by Fred Singer and Dennis Avery

## The 1,500 Year Climate Cycle

1) Scientific evidence shows that the earth has experienced over 600 cyclical cooling and warming of about 1,500 years duration for at least the last 1 million years (variations of ± 2° C.) .
2) The 1,500 year cycle correlates with the activity and intensity of sun spots, not with $CO_2$ content of the atmosphere.
3) Increases in $CO_2$ actually lag the warming part of the cycle by about 800 years – they are the result, not the cause of warming!
4) Evidence of the 1,500 year cycle comes from studies of:
   a) Arctic and Antarctic ice cores
   b) Seabed sediment cores
   c) Coral reef composition
   d) Peat bog history
   e) Iron dust composition
   f) Tree ring analysis

## Mathematical Modeling Axioms

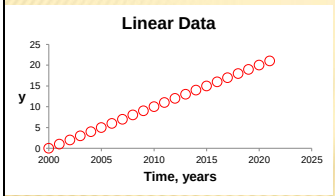
A) You must have DATA to validate a math model
   Without DATA your model is of no use for future predictions.
   To date NONE of the climate models predicting future calamity for the earth have been sufficiently validated with past climate DATA!
B) You must ensure the model's very close fit to the data.
   Even if to the "eye" the model fit to data appears to be good, extensive analyses need to be performed to ensure the quality of the fit. Then, and only then, will future predictions be valid.

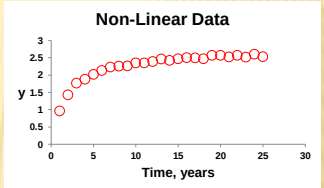
## Mathematical Model Types

1) Linear Models
   Simple, accurate, no question about future predictions

2) Non-linear Models
   Very complex, need to be VERY careful about future predictions
   ALL CLIMATE MODELS ARE HIGHLY NON-LINEAR!

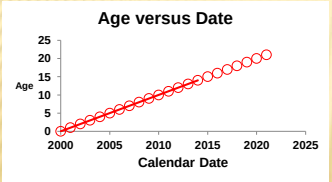
## Example - Types of Data



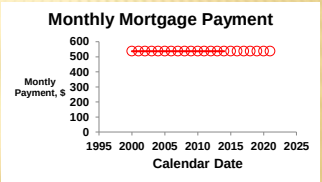




## Linear Model Examples

If you were born in 2000, in 2014 you would be 14 years old. Your future age would increase 1 year each year in the future.




If you borrowed $100,000 at 5% for 30 years in 2000, every month since you would have paid $536.82. Each month in the future you would pay the same.

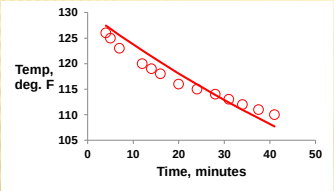


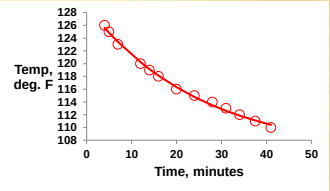

All linear models predict the future with perfect accuracy!

# Climate Change Really Happening?

## Non-Linear Model Example

In 1798 Count Rumford of Bavaria studied heat flow from a cannon that had been drilled out and allowed to cool. He measured temperature afterward.




$T = 70 + 60\ e^{-.009341t}$
Not a very good model

$T = 105.99 + 23.034\ e^{-.040149t}$
Seems to be a better model

## Non-linear Modeling Method

1) Gather the data to be analyzed
   For climate modeling it would be temperature versus time, location, and other parameters such as sun spot activity, etc.
2) Decide on the first-pass non-linear model to use
   Experience and intuition may lead to the first pass model. Current climate models piece together models for parts of the climate and ASSUME that together they model the whole climate
3) Force fit data to the model in a least squares difference manor
   Non-linear regression programs do this fit by finding the best fit values for some "constants" in the model that are not known

## Non-linear Modeling Method

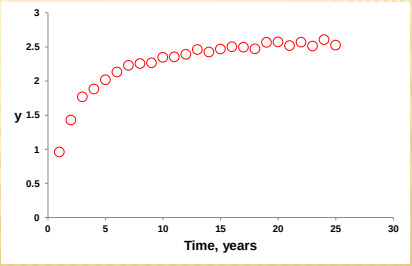
4) Analyze the "residuals" between model and data closely
   Residual = (Calculated – Observed)/Observed
   If any "regularity" in the residuals is seen, some parts of the non-linear model are inadequate
5) Modify the non-linear model to remove residual regularity
   Change some of the model's algebra and try again
6) Repeat steps 3) through 5) until the model is acceptable
   After each regression analyze residuals
7) Then, and only then, predict future behavior

## Non-linear Regression

1) With a proposed model and an initial guess of fit parameters
   Calculate the residuals $(y_{calculated}-y_{observed})/y_{observed}$ for each point
   Residuals are in this fractional form to equally value each point.
2) Square each residual and sum them
   The residuals are squared so that positive and negative ones do not cancel each other out.
3) Search for the best combination of fit parameters to minimize this sum of squares
   Non-linear regression programs follow different paths in the search for a minimum. Final results can depend sometimes on the initial guess. A full analysis of residual patterns and parameter sensitivity must be done in all cases.

## Non-linear Model Example

The data below show a general increase with time with a small amount of scatter that is in most real world data sets and is called RANDOM ERROR



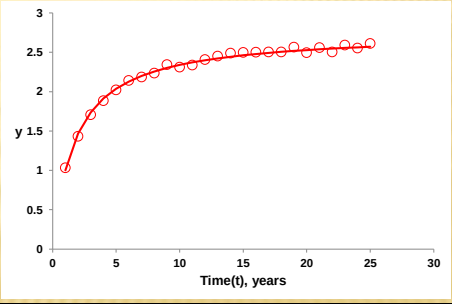

## Non-linear Model Fit #1

Let's fit these data to Model A using a non-linear regression program

**Model A**
$y=(At)/(B + t)$

**In this model:**
A, B are constants

**Fit Results:**
A = 2.762
B = 1.809



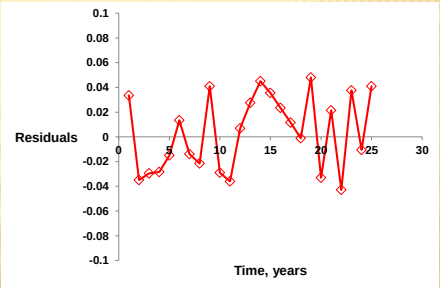

## Non-linear Model A Residuals

What do the residuals look like, are they random?

**Model A**
$y=(At)/(B + t)$

**Fit Results:**
A = 2.762
B = 1.809

The residuals look very good!
No discernible trend!



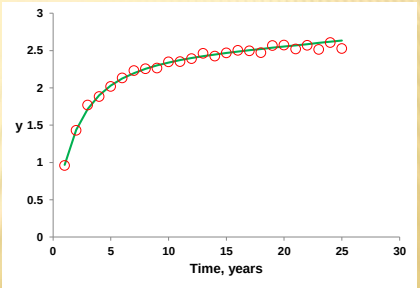

## Non-linear Model Fit #2

Let's fit the same data to Model B using a non-linear regression program

**Model B**
$y=(Ct^n)/(D + t)+Et^2$

**Non-linear regression**
C = 3.8696
D = 2.8146
E = .000322
n = .904

The fit looks reasonably good to the eye even though there is some problem near the end



# Climate Change Really Happening?

## Non-linear Model B Residuals

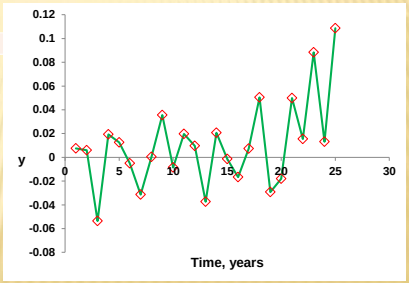
What do the residuals look like, are they random?

**Model B**

$y=(Ct^n)/(D + t)+Et^2$

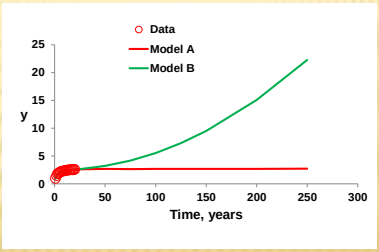
**Non-linear regression**
C = 3.8696
D = 2.8146
E = .000322
n = .904

The residuals look random Until about 20 years. The trend after 20 years means the model is inadequate and needs changes.




## Future Predictions of Models A and B

The models predict drastically different values for the future! If residuals were not carefully analyzed, Model B might have been selected as acceptable.




**Model A is the correct model to project into the future based on good science!**

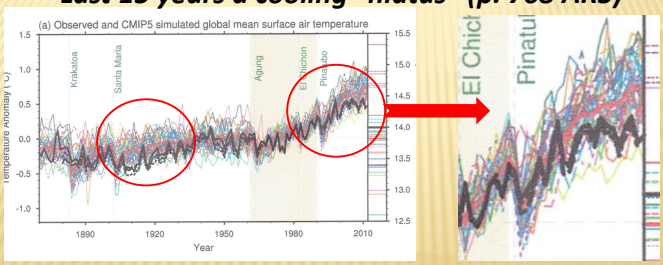
## UN Climate Panel Modeling Results

*Last 15 year cooling "hiatus"*

- For the last 15 years the earth has had a "cooling hiatus" with earth temperatures rising significantly less than previously predicted
- The UN is ready to release their 5th Climate Change Report in October 2014 which does not model the "cooling hiatus"
- The residuals during the "cooling hiatus" looks much like the Model B plot you have just seen.
- The UN model must be brought into agreement with ALL earth temperature data before any future predictions can be believed!

## UN Climate Panel Modeling Results

*Last 15 years a cooling "hiatus" (p. 768 AR5)*

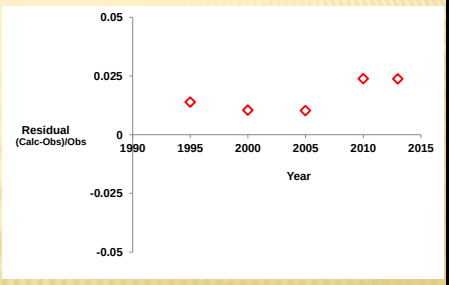



Earth temperature (thick black curve) much below models 1900-1930 and 1998-2013

## UN Climate Panel Modeling Residuals

*Approximate residuals from Figure 9.8 in the UN IPCC AR5 draft report (p. 768).*

*Note that for the past 15 years or so the average of the models predicts too much warming. Such regularity in residuals indicates that the model needs modification.*




## UN Climate Change Models Are Not Yet Believable

- UN models have significantly over predicted warming for the past 15 years (as well as 1900-1930)
- The models must be brought into agreement with the data before any forward predictions can be trusted. Analysis must include complete residual and sensitivity evaluation
- Climate modeling scientists need to honor the Socratic Principle of Science which is to:

**"FOLLOW THE DATA WHERE EVER IT MAY LEAD"**

For more information on UN IPCC problems see:
***Unstoppable Global Warming Every 1,500 years*** by F. Singer and D. Avery
***Global Warming and Other Eco-Myths*** edited by Ronald Bailey