# Climate Change Computer

# Models

## The Good, The Bad, & The Ugly

*— Revision 8/1/20 —*

**This is a Fundamental Question**
**about Climate Change Computer Models:**

# How Accurate are Computer Models:

## 1) for an Extremely Complex Situation, *and*

## 2) for a Long Time into the Future?

**An excellent way to answer this important question is to look at the accuracy of computer models for *moderately* complex, *short-term* matters.**

1) **If computer models for moderately complex, short-term matters are reliably very accurate, then maybe we can extrapolate that success into creating computer models for more complex, longer-term matters.**
2) **On the other hand, if computer models for moderately complex, short-term issues are NOT reliably very accurate, then it makes no sense to assume that more complex, longer-term matters can be accurately modeled.**

**Tracking Hurricanes is a superior test of a computer's ability to accurately model a moderately complex, short-term scenario.**

*Additionally, it's a good test as:*

1) **Due to the major life-and-death consequences of accurately knowing a hurricane's path, a significant amount of time, effort, research, expertise, and money has been expended in creating computer models for this situation.**

2) **Also due to the enormous impacts, these computer models are run on the most powerful computer hardware we have.**

3) **This is a short-term situation, so we know the accuracy of the model within a few days. We don't have to wait 50 years.**

**So let's look at a recent major US hurricane, and see how accurate computer models were for this moderately complex, short-term scenario.**

**Hurricane Matthew (2016) is used as an example. This was a very strong category 5 hurricane, so it was given a LOT of attention.**

(For more details about hurricane Matthew see: <https://www.weather.gov/ilm/Matthew>.)

# National Hurricane Center: Matthew strengthens to Category 5 hurricane

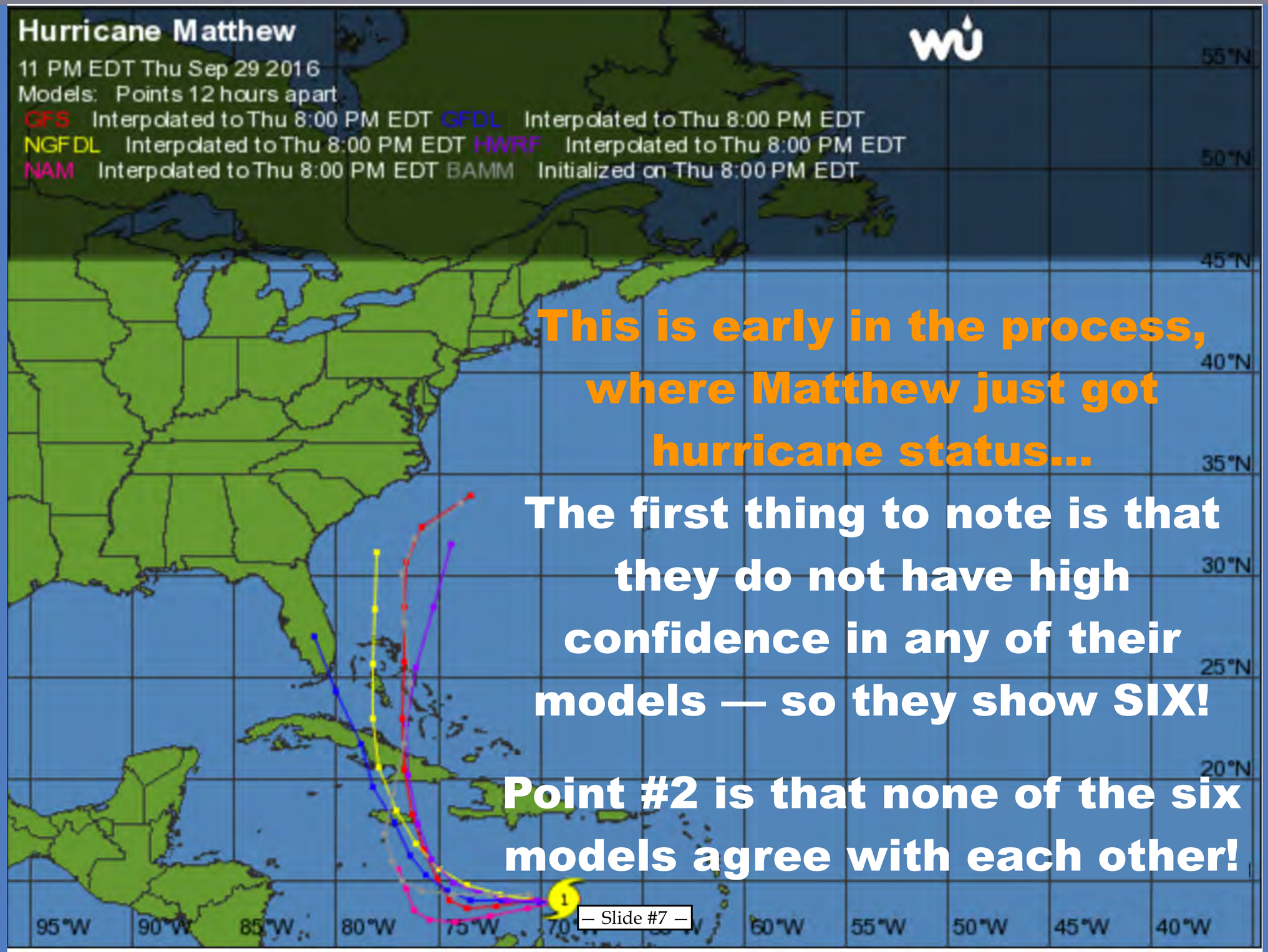
**Published** September 30, 2016 | Associated Press

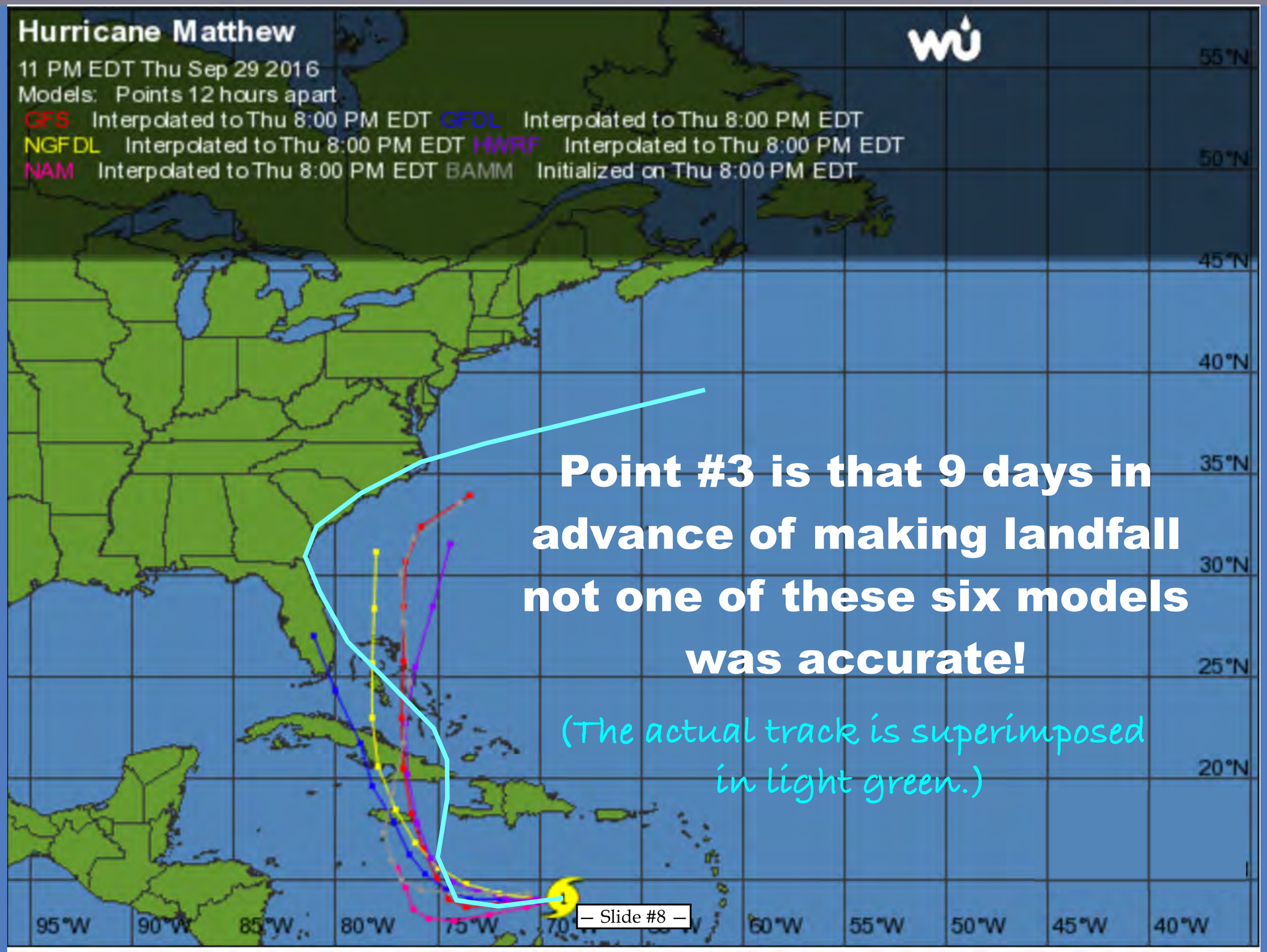
WEATHER UNDERGROUND

# Matthew Becomes the Atlantic's First Category 5 Hurricane in Nine Years

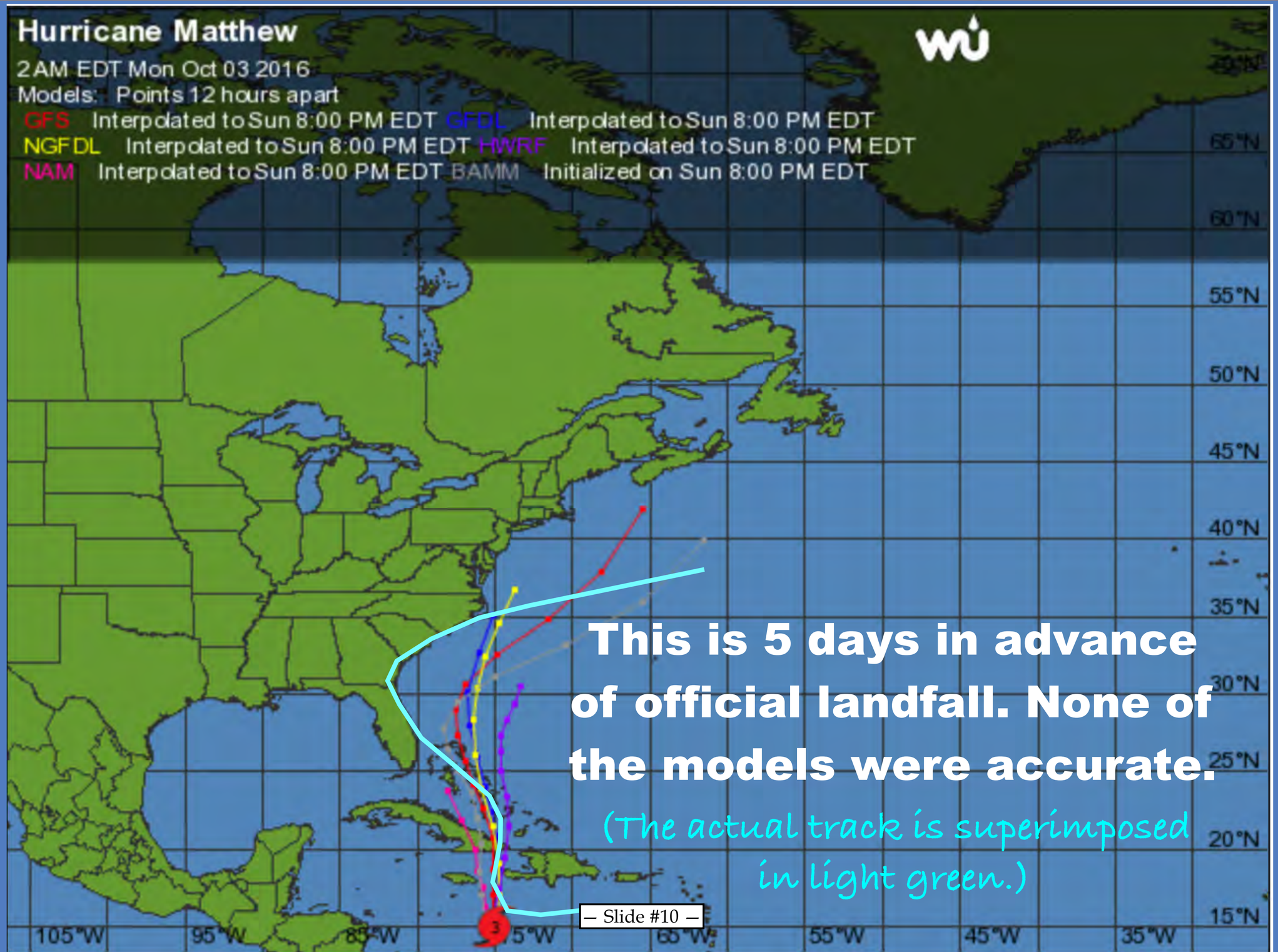
By: Bob Henson and Jeff Masters 4:01 AM GMT on October 01, 2016

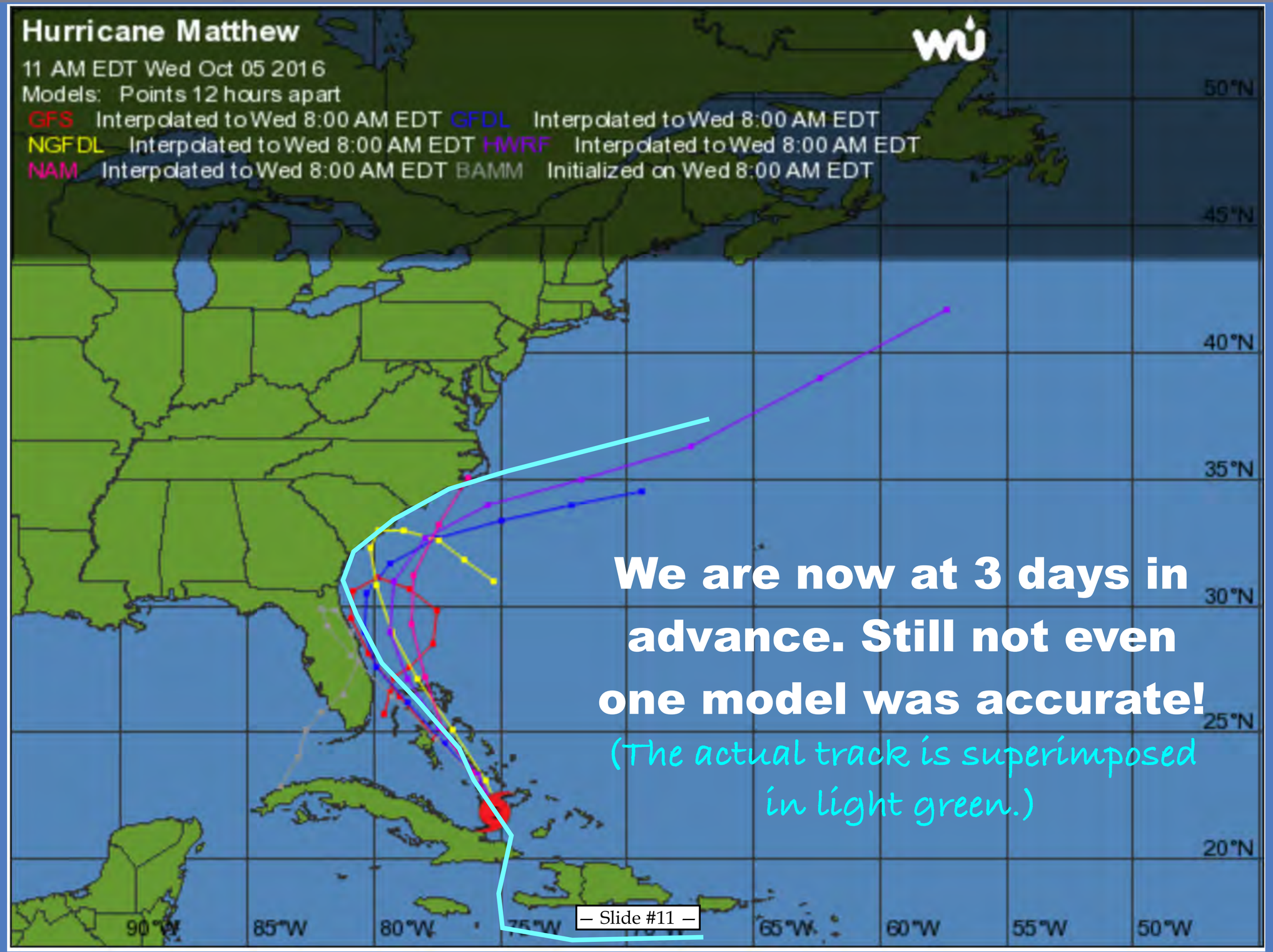
(Note date, etc.)

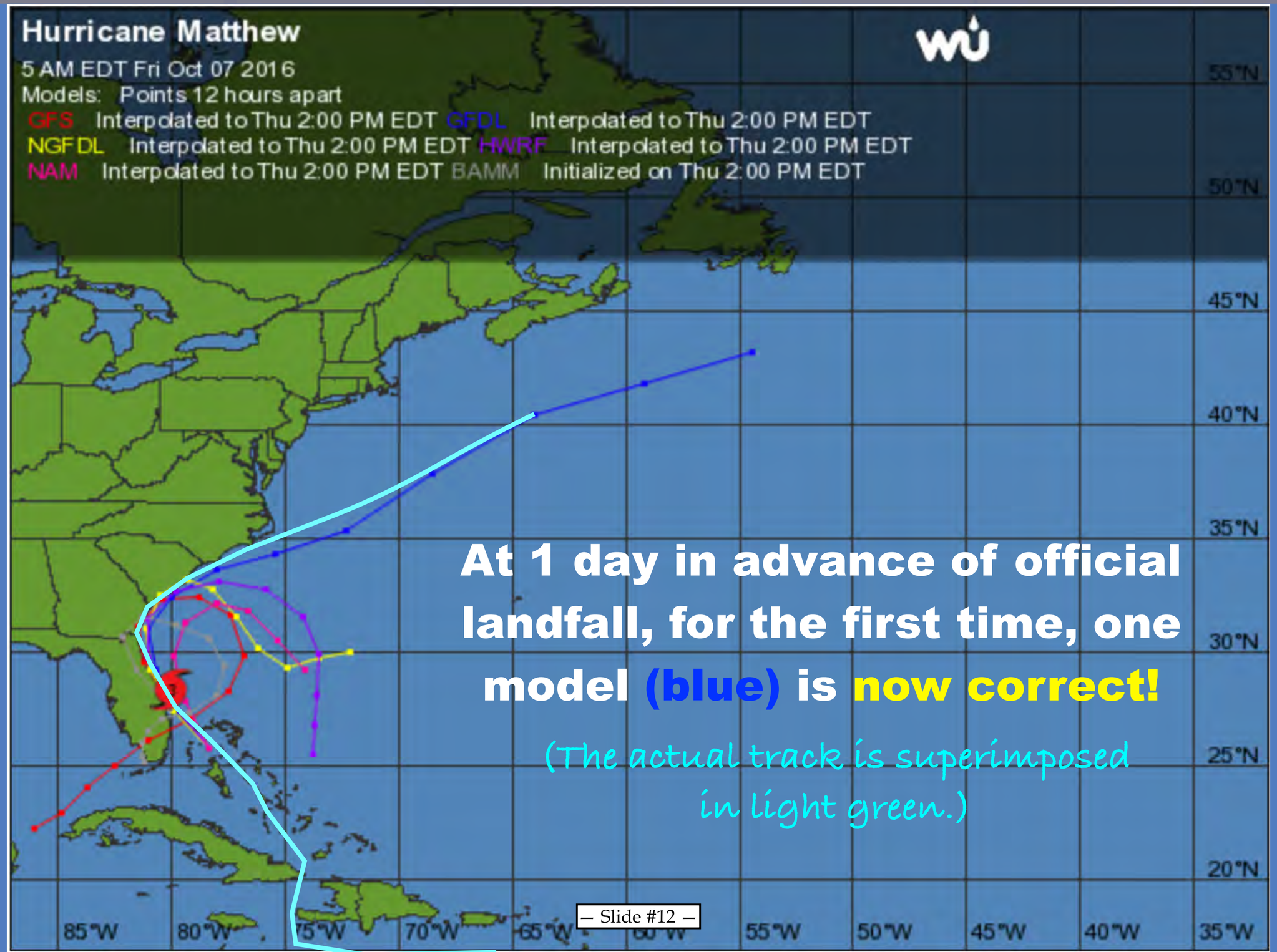


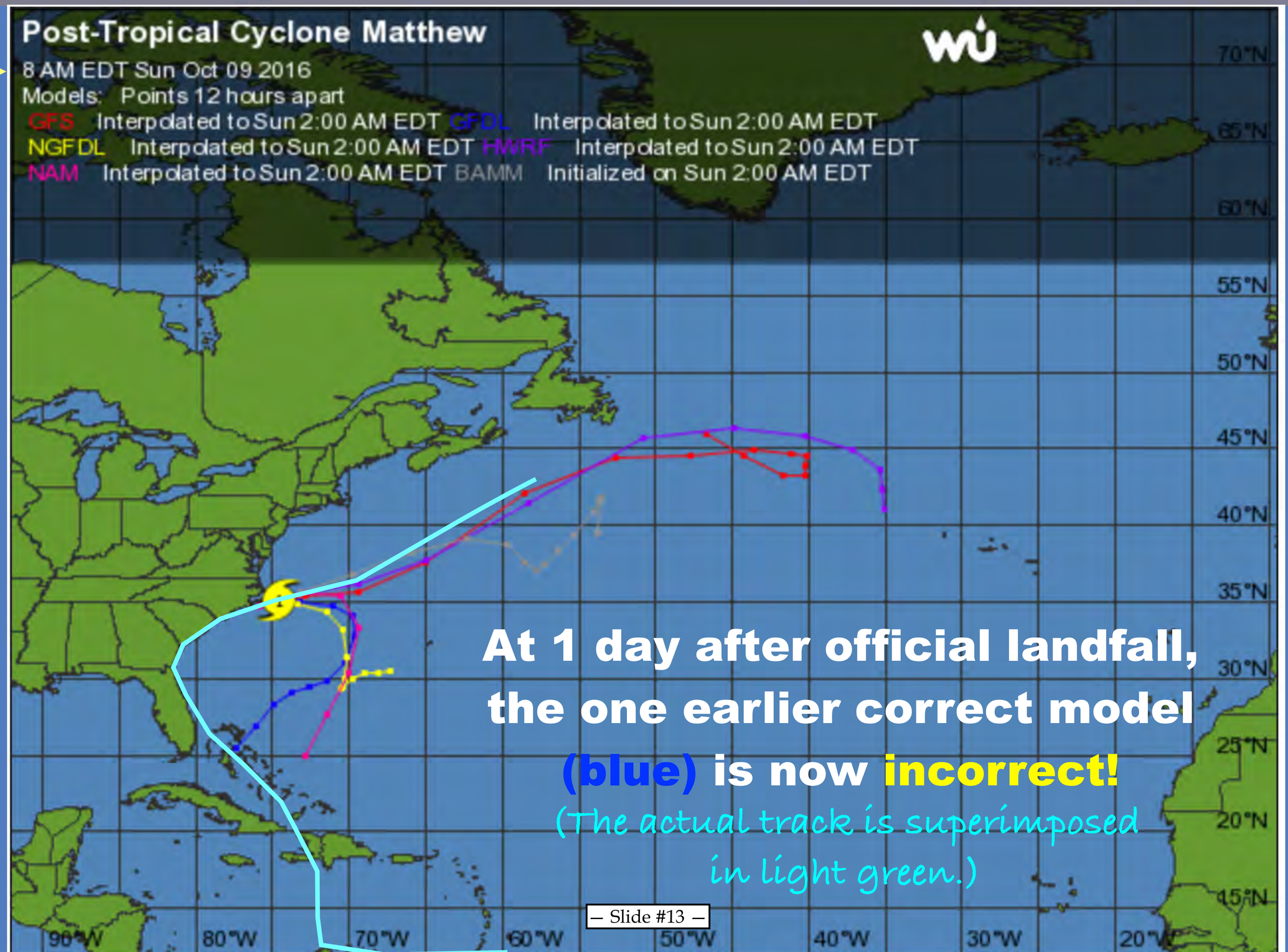

Hurricane Matthew
11 PM EDT Thu Sep 29 2016
Models: Points 12 hours apart
GFS Interpolated to Thu 8:00 PM EDT GFDL Interpolated to Thu 8:00 PM EDT
NGFDL Interpolated to Thu 8:00 PM EDT HWRF Interpolated to Thu 8:00 PM EDT
NAM Interpolated to Thu 8:00 PM EDT BAMM Initialized on Thu 8:00 PM EDT
55°N
50°N
45°N
40°N
35°N
30°N
25°N
20°N
95°W
90°W
85°W
80°W
75°W
60°W
55°W
50°W
45°W
40°W
Point #3 is that 9 days in advance of making landfall not one of these six models was accurate!
(The actual track is superimposed in light green.)


Hurricane Matthew
11 PM EDT Sat Oct 01 2016
Models: Points 12 hours apart
GFS Interpolated to Sat 8:00 PM EDT GFDL Interpolated to Sat 8:00 PM EDT
NGFDL Interpolated to Sat 8:00 PM EDT HWRF Interpolated to Sat 8:00 PM EDT
NAM Interpolated to Sat 8:00 PM EDT BAMM Initialized on Sat 8:00 PM EDT
60°N
55°N
50°N
45°N
40°N
35°N
30°N
25°N
20°N
15°N
90°W
85°W
80°W
70°W
65°W
55°W
50°W
45°W
40°W
35°W
30°W
This was 7 days in advance of landfall. Still not one of these models was correct...
(The actual track is superimposed in light green.)


Hurricane Matthew
2 AM EDT Mon Oct 03 2016
Models: Points 12 hours apart
GFS Interpolated to Sun 8:00 PM EDT GFDL Interpolated to Sun 8:00 PM EDT
NGFDL Interpolated to Sun 8:00 PM EDT HWRF Interpolated to Sun 8:00 PM EDT
NAM Interpolated to Sun 8:00 PM EDT BAMM Initialized on Sun 8:00 PM EDT
65°N
60°N
55°N
50°N
45°N
40°N
35°N
30°N
25°N
20°N
15°N
105°W
95°W
85°W
75°W
65°W
55°W
45°W
35°W
This is 5 days in advance of official landfall. None of the models were accurate.
(The actual track is superimposed in light green.)


Hurricane Matthew
11 AM EDT Wed Oct 05 2016
Models: Points 12 hours apart
GFS Interpolated to Wed 8:00 AM EDT GFDL Interpolated to Wed 8:00 AM EDT
NGFDL Interpolated to Wed 8:00 AM EDT HWRF Interpolated to Wed 8:00 AM EDT
NAM Interpolated to Wed 8:00 AM EDT BAMM Initialized on Wed 8:00 AM EDT
50°N
45°N
40°N
35°N
30°N
25°N
20°N
90°W
85°W
80°W
75°W
65°W
60°W
55°W
50°W
We are now at 3 days in advance. Still not even one model was accurate!
(The actual track is superimposed in light green.)
– Slide #11 –


Hurricane Matthew
5 AM EDT Fri Oct 07 2016
Models: Points 12 hours apart
GFS Interpolated to Thu 2:00 PM EDT GFDL Interpolated to Thu 2:00 PM EDT
NGFDL Interpolated to Thu 2:00 PM EDT HWRF Interpolated to Thu 2:00 PM EDT
NAM Interpolated to Thu 2:00 PM EDT BAMM Initialized on Thu 2:00 PM EDT
55°N
50°N
45°N
40°N
35°N
30°N
25°N
20°N
85°W
80°W
75°W
70°W
65°W
55°W
50°W
45°W
40°W
35°W
At 1 day in advance of official landfall, for the first time, one model (blue) is now correct!
(The actual track is superimposed in light green.)


Post-Tropical Cyclone Matthew
8 AM EDT Sun Oct 09 2016
Models: Points 12 hours apart
GFS Interpolated to Sun 2:00 AM EDT GFDL Interpolated to Sun 2:00 AM EDT
NGFDL Interpolated to Sun 2:00 AM EDT HWRF Interpolated to Sun 2:00 AM EDT
NAM Interpolated to Sun 2:00 AM EDT BAMM Initialized on Sun 2:00 AM EDT
70°N
65°N
60°N
55°N
50°N
45°N
40°N
35°N
30°N
25°N
20°N
15°N
90°W
80°W
70°W
60°W
50°W
40°W
30°W
20°W
At 1 day after official landfall,
the one earlier correct model
(blue) is now incorrect!
(The actual track is superimposed
in light green.)


**This is the full actual path taken by Hurricane Matthew...**

**Not a single one of the top computer models was remotely accurate!**

# CONCLUSION

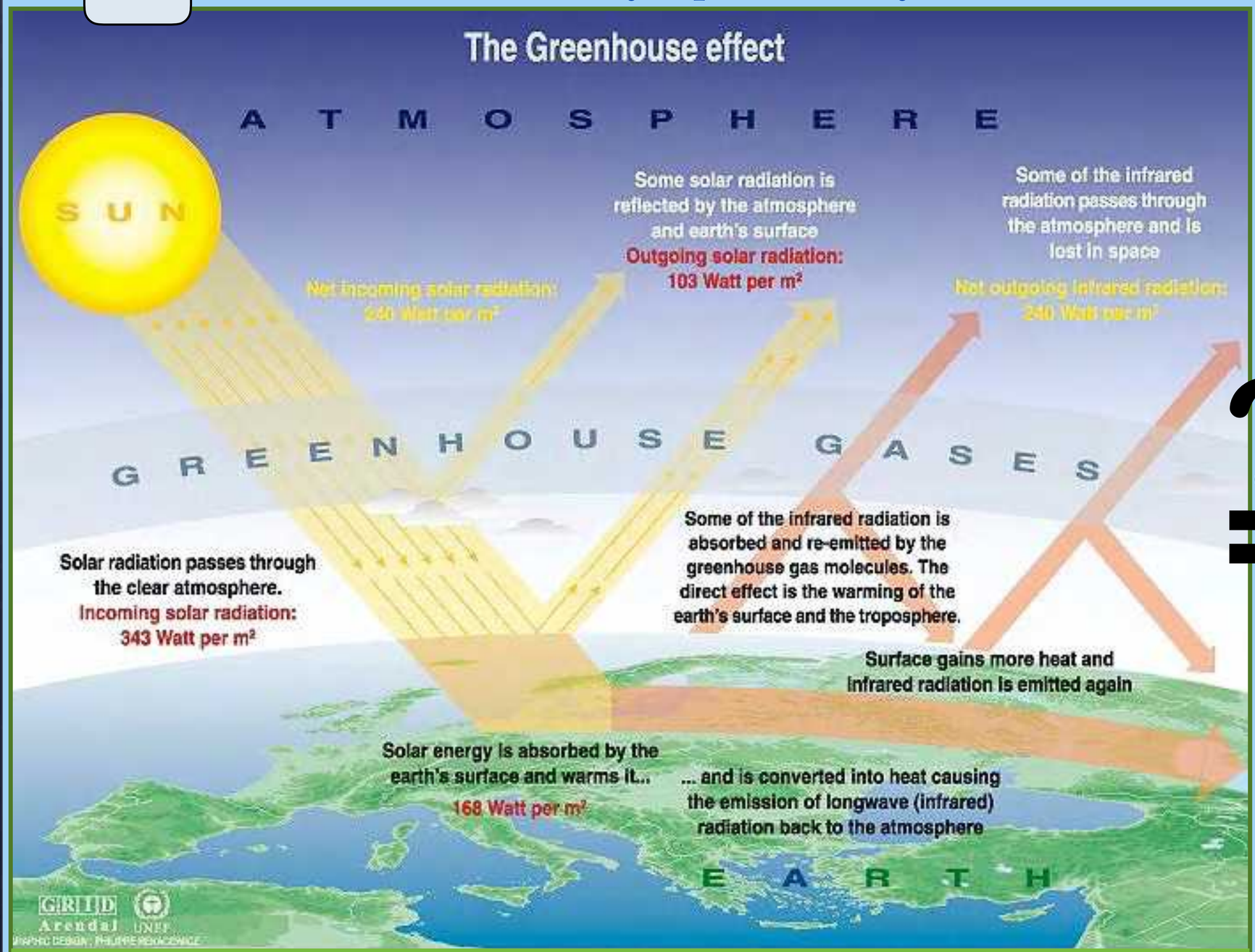
**Despite spending a significant amount of time, effort, research, expertise, and money on modeling, and despite running these models on the most powerful computer hardware we have, the inescapable conclusion is that computer modeling is NOT a proven, reliable methodology for getting an accurate projection of a *moderately* complex, *short-term* scenario.**

**For a HIGHLY complex, LONG-TERM scenario, it stands to reason that the accuracy and reliability of models would be orders of magnitude less.**

# *Seven (7) Other Perspectives on the Accuracy of Computer Models...*

**1**

## Is it realistic to assume that a situation of this extreme complexity can be accurately represented by a collections of ones and zeros?




Ref: <http://www.dnrec.delaware.gov/ClimateChange/Pages/Greenhouse%20Effect.aspx>



1011011110011011
0100101000010000
1010001000101000
1000100011011110
0101010001110101
0100010111001001
0010101010001010
0011101001001111
0010110010010101
0100001010101000
1010100100101010
1000111101010101
0000001010101011
1000010101010100
1010001010100010
1000101001000...

?

=

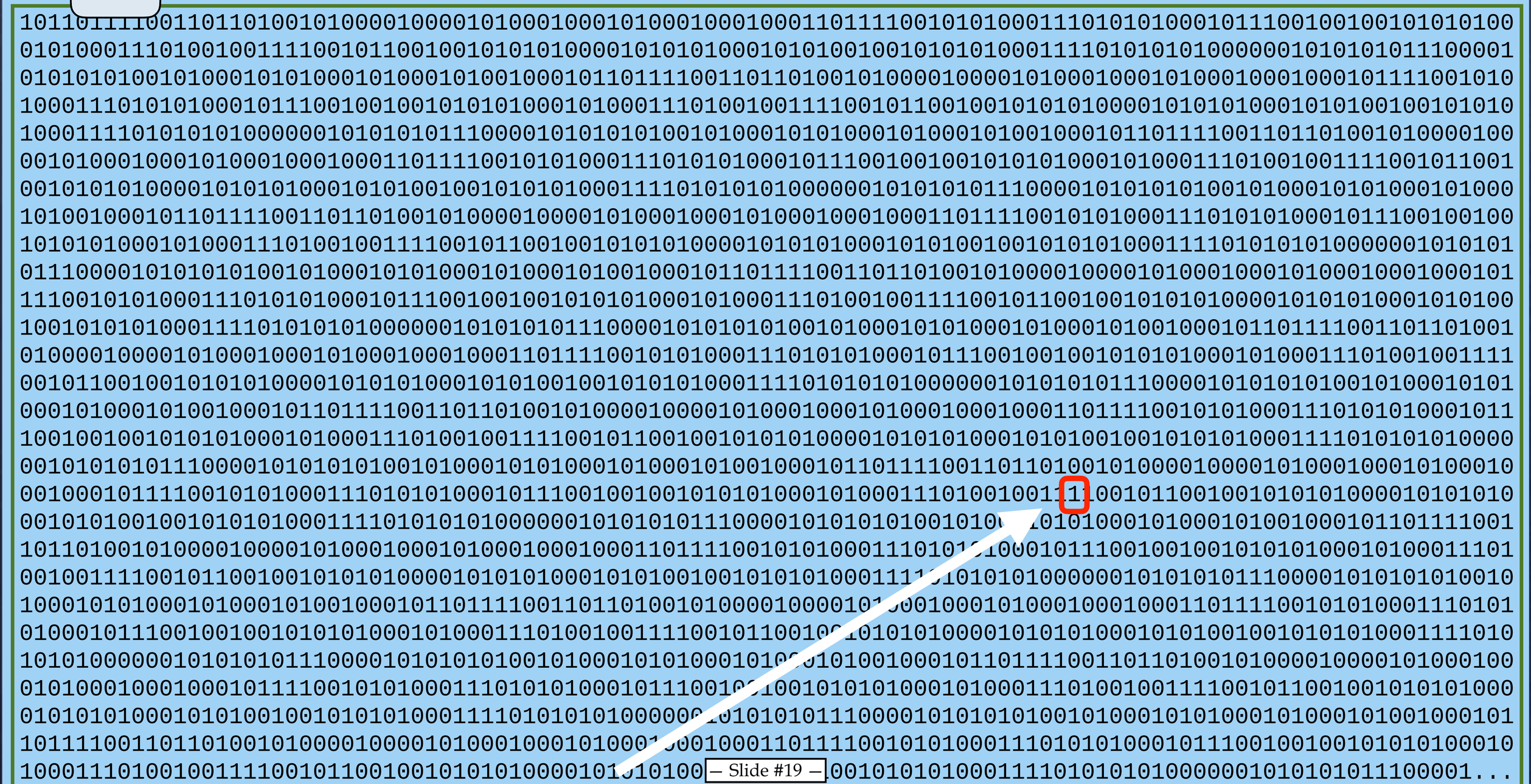
1

## Is it realistic to assume that a situation of this extreme complexity can be accurately represented by a collections of ones and zeros?


**This is just the one page of THOUSANDS of pages of computer code!**

**1**

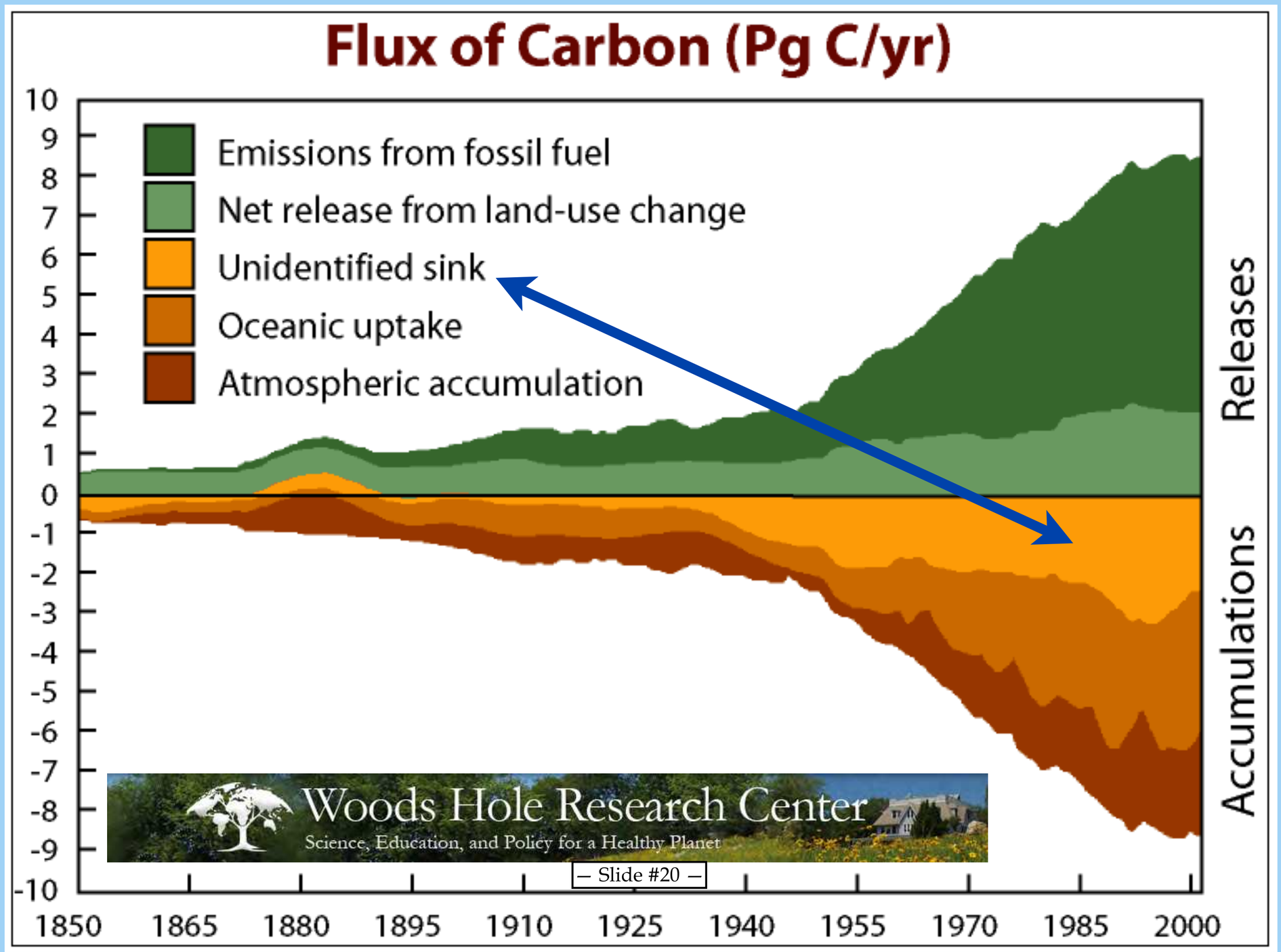
## Is it realistic to assume that a situation of this extreme complexity can be accurately represented by a collections of ones and zeros?




**Did you note the error?? A 1 should have been a 0, which completely changes the end result!**

2

**How can any model be accurate when there are large unknowns, e.g.**



2

**How can any model be accurate when there are large unknowns, e.g.**

## Cloud Climatology: Computer Climate Models

Because there are so many possibilities for change, climatologists must know how clouds over the entire Earth will respond. Determining that response calls for computer models of the global climate that can explore changing conditions. Climate models are sets of mathematical equations that describe the properties of Earth's atmosphere at discrete places and times, along with the ways such properties can change. The challenge for climate models is to account for the most important physical processes, including cloud microphysics and cloud dynamics, and their complex interactions accurately enough to carry climatic predictions tens of years into the future. When contemporary models are given information about Earth's present condition — the size, shape and topography of the continents; the composition of the atmosphere; the amount of sunlight striking the globe — they create artificial climates that mathematically resemble the real one: their temperatures and winds are accurate to within about 5%, but their clouds and rainfall are only accurate to within about 25-35%. Such models can also accurately forecast the temperatures and winds of the weather many days ahead when given information about current conditions.

Unfortunately, such a margin of error is much too large for making a reliable forecast about climate changes, such as the global warming will result from increasing abundances of greenhouse gases in the atmosphere. A doubling in atmospheric carbon dioxide ($CO_2$), predicted to take place in the next 50 to 100 years, is expected to change the radiation balance at the surface by only about 2 percent. Yet according to current climate models, such a small change could raise global mean surface temperatures by between 2-5°C (4-9°F), with potentially dramatic consequences. If a 2 percent change is that important, then a climate model to be useful must be accurate to something like 0.25%. Thus today's models must be improved by about a hundredfold in accuracy, a very challenging task. To develop a much better understanding of clouds, radiation and precipitation, as well as many other climate processes, we need much better observations.



Ref: <isccp.giss.nasa.gov/role.html#COMP_MODS>

2

**How can any model be accurate when there are large unknowns, e.g.**

*Did you see what that NASA report concluded?*

"For Climate computer models to be reasonably accurate they need to improve their accuracy

**ABOUT A HUNDREDFOLD!!!**"

3

**Here are a simple set of equations that make up a basic climate model.**
**How can any model (with so many variables) be accurate 50± years from now?**

$$\frac{Du}{Dt} + 2f \times u = -\frac{1}{\rho}\nabla P + g + v\nabla^2 u,$$

$$C\frac{DT}{Dt} - \frac{RT}{\rho}\frac{D\rho}{Dt} = \kappa_h \nabla^2 T + S_h + LP$$

$$\frac{\partial \rho}{\partial t} + \nabla.(\rho u) = 0,$$

$$\frac{Dq}{Dt} = \kappa_q \nabla^2 q + S_q - P,$$

$$p = \rho RT.$$

The symbols denote

$t$ = time
$u$ = velocity of the air
$T$ = air temperature
$p$ = air pressure
$\rho$ = air density
$q$ = moisture content
$S_h$ = solar heating
$f$ = coriolis parameter (due to the Earth's rotation)
$v$ = viscosity of the air
$g$ = acceleration due to gravity
$C$ = specific heat of the air
$R$ = universal gas constant
$L$ = latent heat of water
$\kappa_h$ and $\kappa_q$ are the diffusivities of air and water
$S_g$ = heat available for heating water vapour.



Ref: <plus.maths.org/content/climate-change-does-it-all-add>

3

**Here are some of the factors that go into a basic climate model (GCMs and ESMs). How can any model (with so many conditions) be accurate 50± years from now?**

**Greenhouse Effect**
**Milankovic Cycles**
**Lorenz Butterfly**
**Dynamical Systems**
**Systems of Differential Equations**
**Quadratic Equations**
**Vector Fields**
**Algebraic Bifurcation**
**Hysteresis**
**Intrinsic Dynamics**
**Fast/Slow Dynamics**
**Stommel's Circulation Model**
**Mixed-mode Oscillations**
**Land-atmosphere carbon flux**
**Ocean-atmosphere carbon flux**
**ENSO: Upwelling feedback**
**ENSO: Thermocline adjustment**
**ENSO: Advection**



Ref: <www.math.cornell.edu/files/Community/5080/2014nov/roberts-climate.pdf>

3

**A related major consideration of climate computer models.**

Computer models with a high quantity of variables are necessarily inflicted with Error Propagation.

*The layman's translation of this is:*
the **uncertainty** of a calculation with multiple variables, quickly becomes **VERY high**.

[*For more discussion on the significant matter of **Error Propagation**, see*
Harvard: <http://ipl.physics.harvard.edu/wp-uploads/2013/03/PS3_Error_Propagation_sp13.pdf>
MIT: <http://web.mit.edu/fluids-modules/www/exper_techniques/2.Propagation_of_Uncertaint.pdf>]

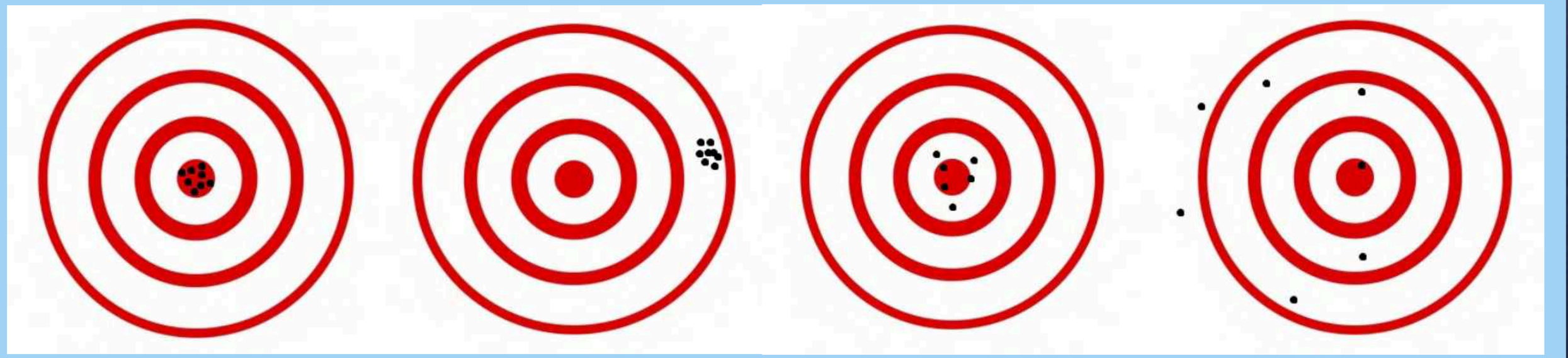
**4**

*Here is a subtle — but exceptionally significant — statistical fact about computer models*

The **calculation precision** of computer models
is completely different from
the **physical accuracy** of their projections.

**4**

## *Here is a subtle — but exceptionally significant — statistical fact about computer models*



| **Accurate and Precise** | **Precise but not Accurate** | **Accurate but not Precise** | **Neither Accurate nor Precise** |
|---|---|---|---|

[*For more discussion on the important difference between* ***Precision*** *and* ***Accuracy****, see:*
<https://blog.minitab.com/blog/real-world-quality-improvement/accuracy-vs-precision-whats-the-difference>]

4

*Here is a subtle — but exceptionally significant — statistical fact about computer models*

When a "high confidence level" is claimed for a computer model, it's referring to the **calculation precision.**

It has *nothing* to do with
the actual **physical accuracy** of the computer projection.

[*Please read "A Climate of Belief" for more details*
<https://www.skeptic.com/reading_room/a-climate-of-belief/>.]

5

## *The Results of Any Computer Model are Limited by the Data Used*

A 2019 study by an independent scientist,
found enormous data deficiencies in the HadCRUT4 data
(the primary data used by AGW models).

***More than 70 different problems were identified, e.g.:***

— Over 25% of the global data stations don't meet the quality criteria
for their data to be included,
— Mistakes in longitude and latitude,
— Fahrenheit temps recorded as Celsius,
—Large gaps where there is no data,
— One Columbian site recorded 3 months of over 80°C, etc.

[*Reference:* <www.breitbart.com/politics/2018/10/07/damning-audit-climate-change-scare-based-on-unreliable-data/>]

6

*Let's look at computer models from a "Machine" perspective…*

A computer is basically a machine.

The technical definition of a **machine**:

"an apparatus using or applying electrical/mechanical power and having several parts, each with a definite function and together performing a particular task."

6

*(More from a "Machine" perspective…)*

The purpose of a machine is to:

1) take a human activity, *and*
2) do it better*.

*Better = faster, higher quality, extended range, safer, less expensively, etc.

6

*(More from a "Machine" perspective…)*

A computer has superior computational and processing power than a human does — although not by that much. (Consider the Jeopardy human *vs* computer challenge.)

Let's assume that a computer has 2x the computational and processing power of a human. How does that translate to **accurately** predicting the future?

Simple Test: throw a tennis ball into an audience of 100± people. Can a computer accurately predict the result (i.e. what path the ball will take and where it will end up)?

**NO!**

7

*(More from a "Machine" perspective…)*

What's going on with computer models is really very similar to the man behind the screen on *The Wizard of Oz*.

Some *hidden people* are making numerous (undeclared and unproven) assumptions — and then simply declaring that this is what the Wizard (computer model) says is so.

This is an **Appeal to Authority**: don't ask any questions, and do NOT look behind the screen for any reason!

7

## *An example in another less-complicated situation, (financial projections) where computer models were an abject failure…*

SATURDAY, MARCH 7, 2009

### Computer models and cognitive failure

One of the more mordantly amusing aspects of the current credit crisis is the massive failure of relying on computer models for assessing risk. A failure that was quite comprehensive:

> In fact, most Wall Street computer models radically underestimated the risk of the complex mortgage securities … The people who ran the financial firms chose to program their risk-management systems with overly optimistic assumptions and to feed them oversimplified data. This kept them from sounding the alarm early enough.

7

## *(The failure of computer financial models, continued…)*

Financial institutions used highly sophisticated computer models, put together by highly-paid people using masses of data based on what was taken to the most up-to-date understanding of how things work. All of which gave the output of the models huge credibility.

The problem was precisely that they had such credibility. In particular, their output was treated as empirical evidence: as telling people about the state of their risk exposure.

They did nothing of the kind. All they did—all computer models can ever do—is tell you the consequences of your premises, both empirical and analytical/causal. They do not tell you about how the world *is*. They tell you about how you *think* the world is. One can then test your thinking about the world by comparing what your model(s) churn out to how the world turns out to be.

7

*Another example in much less-complicated situation, where computer models failed miserably…*

MIT Technology Review

# Prediction Models Gone Wild: Why Election Forecasts and Polls Were So Wrong

The polls had Clinton ahead, the real-time data said she'd walk it —here's what they missed.

# *Some Misc Observations on Computer Models...*

**When Evaluating the Legitimacy of Computer Models for Highly Complex, Long-Term Events, We Need to Consider Such Factors as the Following:**

Objectivity

Transparency

Validation

Accountability

# Objectivity

**We live in a time when many people have hidden agendas. Scientists are people too, and unfortunately they are not above such activism. When scientists fall into this unscientific situation it's called: *confirmation bias*.**

**This is when (contrary to Real Science) a scientist *starts* by deciding what they think the results will be. They then work backwards to put together a series of explanations (including computer models) that support their initial opinion.**

**Real Science is about *comprehensively* and *objectively* evaluating an issue, and letting the chips fall where they may.**

# Transparency

**The goal of Real Science is to get to the most accurate Truth possible about our reality.**

**Success in this quest depends on a clear acknowledgement that none of us have all the answers, on anything. It follows then, that a fundamental requirement for those genuinely searching for the Truth, is to actively and open-mindedly reach out to others for their perspective and insights.**

**There can only be meaningful collaboration if there is full transparency on all aspects of an investigation (from data through modeling). Unfortunately, some parties hide this key information behind such claims as "work product."**

# Validation

**A critical aspect of Real Science's journey to get to the most accurate Truth possible, is validation along the way.**

**Many people believe that most scientific advancements are quantum leaps of insights by brilliant minds—but that's rarely the case. Instead, almost all scientific progress is made through trial-and-error: *we learn from what works, and what does not*.**

**But what if: a) the situation is too complicated to do a controlled experiment on, *and* b) we won't know the accuracy of our hypothesis for many years to come? This translates to a major problem of verification. This is exactly the situation with long-term climate models: they are not validatable.**

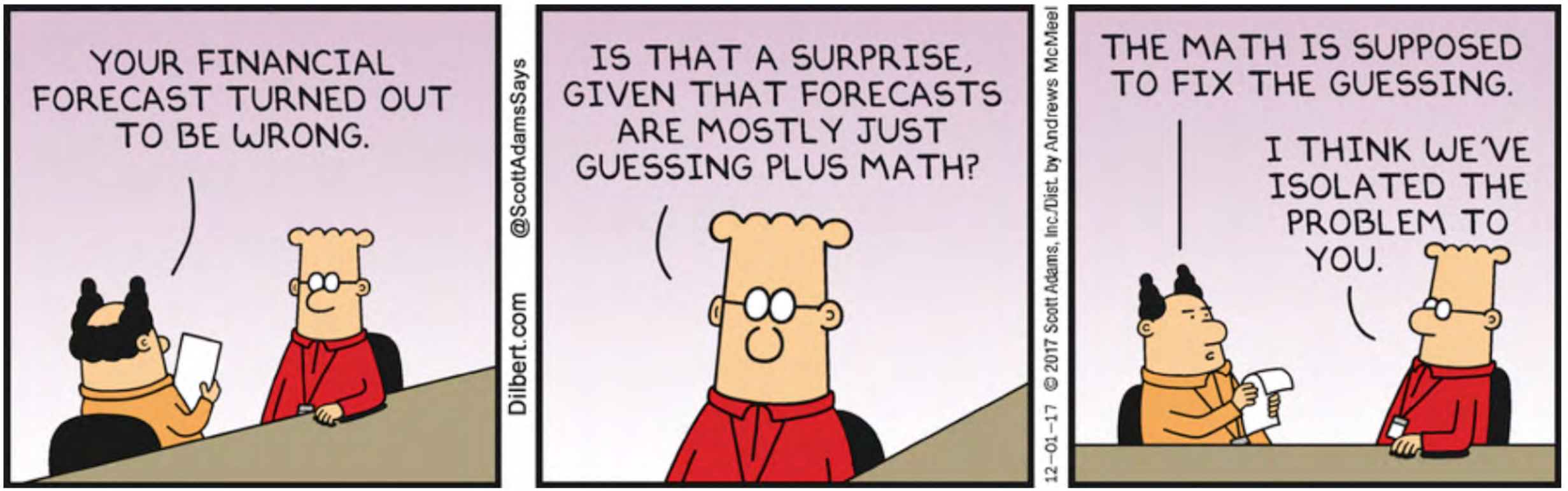
# Accountability

**When making long term computer models (e.g. Sea Level Rise in 2100), the people making these projections today are well aware that NONE of them will be alive in 2100.**

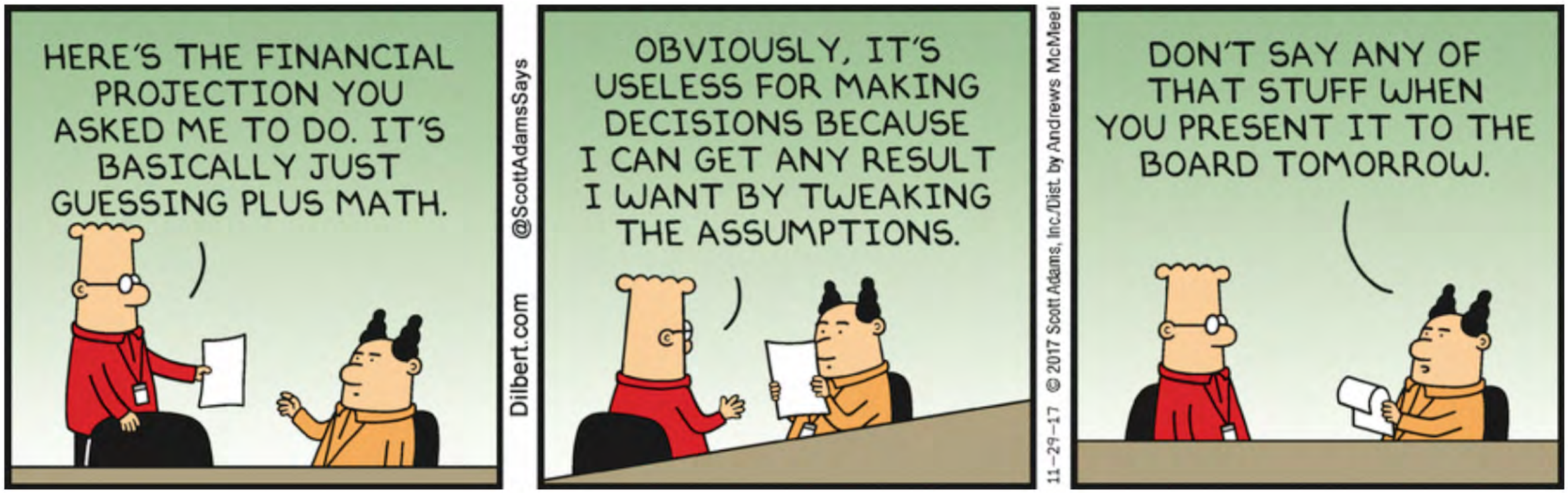
**What are the personal consequences to these people if they are significantly wrong? *Nothing*. Without any genuine personal responsibility, absolutely anyone can make wild speculations about the future — which is exactly what's happening.**

**To give their opinions the illusion of legitimacy, these are hidden behind the veneer of computer modeling. But they still are: unprovable musings, based on unidentified assumptions, from unaccountable people, who often have disguised agendas.**

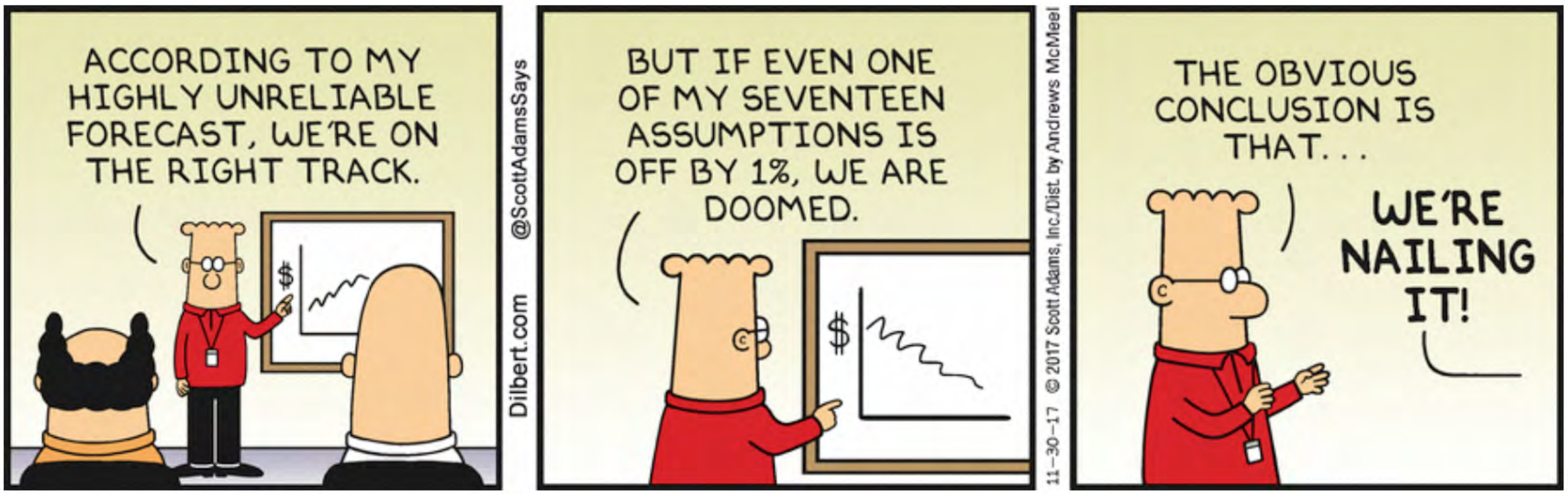
## *Dilbert Weighs in Regarding Computer Models: #1…*



## *Dilbert Weighs in Regarding Computer Models: #2…*



## *Dilbert Weighs in Regarding Computer Models: #3…*



*Some sample articles, reports and studies about climate computer models*

**Flawed Computer Models**
<<https://www.hoover.org/research/flawed-climate-models>>

**The Cold Truth About Global Warming**
<<https://thedailyconspiracy.com/2017/12/20/the-cold-truth-about-global-warming/>>

**Climate Models Overheat**
<<https://wattsupwiththat.com/2017/09/30/climate-models-overheat/>>

**Climate Scientists Manipulated Temperature Data to Fool Politicians and Public**
<<http://reason.com/blog/2017/02/06/climate-scientists-manipulated-temperatu>>

**We Must Rely on Forecasts by Computer Models. Are they Reliable?**
<<https://fabiusmaximus.com/2015/02/02/computer-models-forecasts-reliability-climate-77514/>>

**Assessing Climate Model Software Quality: a Defect Density Analysis**
<<https://www.geosci-model-dev.net/5/1009/2012/gmd-5-1009-2012.pdf>>

**On the Reliability of Computer-based Climate Models**
<<http://www.ijege.uniroma1.it/rivista/ijege-19/ijege-19-volume-01/on-the-reliability-of-computer-based-climate-models/>>

# CONCLUSION

**We ALL have an innate interest in the future. The popularity of horoscopes to palm-readers attests to this predisposition.**

**Who doesn't want to know what will happen tomorrow? Who doesn't want to be prepared for problematic future situations?**

**That said, there is no known gene (or other human ability we have) to be able to reliably forecast the future. None.**

**We can make very powerful machines — but we can not give them powers we do not possess. For example, every climate computer program is entirely dependent on humans accurately identifying ALL the variables, *and* then accurately specifying the role each of these variables plays, *and* then accurately defining all the inter-relationships of these variables.**

**Since there are great gaps in our understanding of climate change, all such computer models are no more reliable than consulting a fortune teller.**

# QUESTIONS?

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