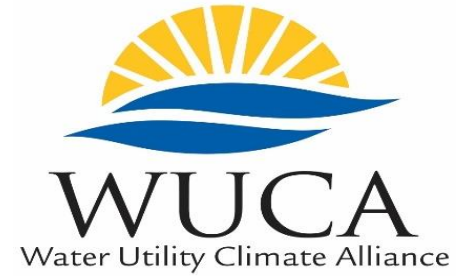


**Building Resilience to a Changing Climate:
A Technical Training in Water Sector
Utility Decision Support**



Modeling 101

Abby Sullivan - Philadelphia Water Department / WUCA





What is a model?



“A simplification of reality that is constructed to gain insights into select attributes of a... system. A formal representation of the behavior of system processes, often in mathematical or statistical terms...”

-US EPA

In the 1940s, before computers were up to the task, when engineers needed to model a complex system, they would do just that, literally “model it,” by building amazingly elaborate scale models.

The US Army Corps of Engineers built many of these physical, scaled models. One of largest they ever built was a model of the Mississippi River watershed. It was a large-scale hydraulic model of the entire Mississippi River basin.



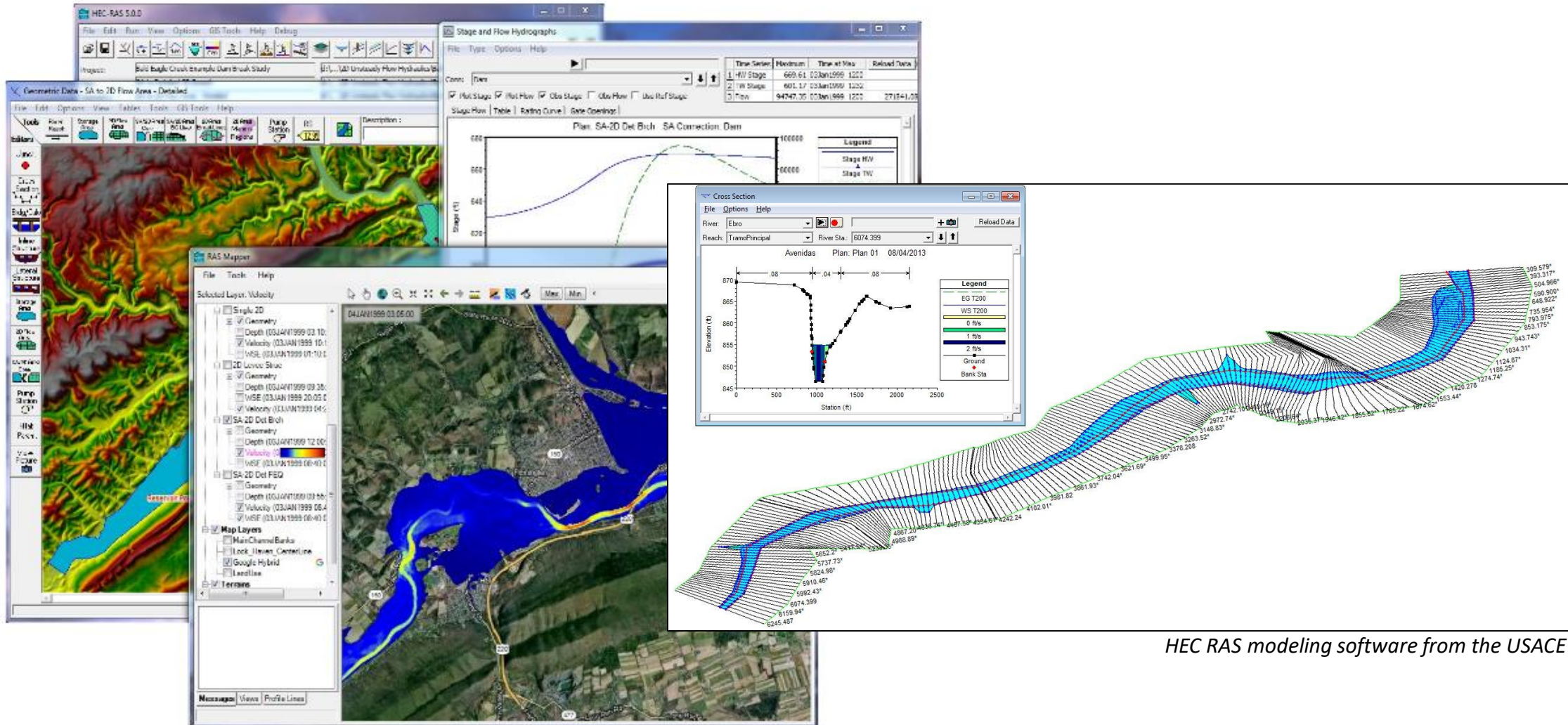


Image Source: Atlas Obscura



Image Source: US Army Corps of Engineers

Today, physical models are not necessary -- computers are now used for the same purpose. Mathematical calculations and statistical formulas are used to represent physical principles and phenomena and the real world is simulated with help of software and computer systems.

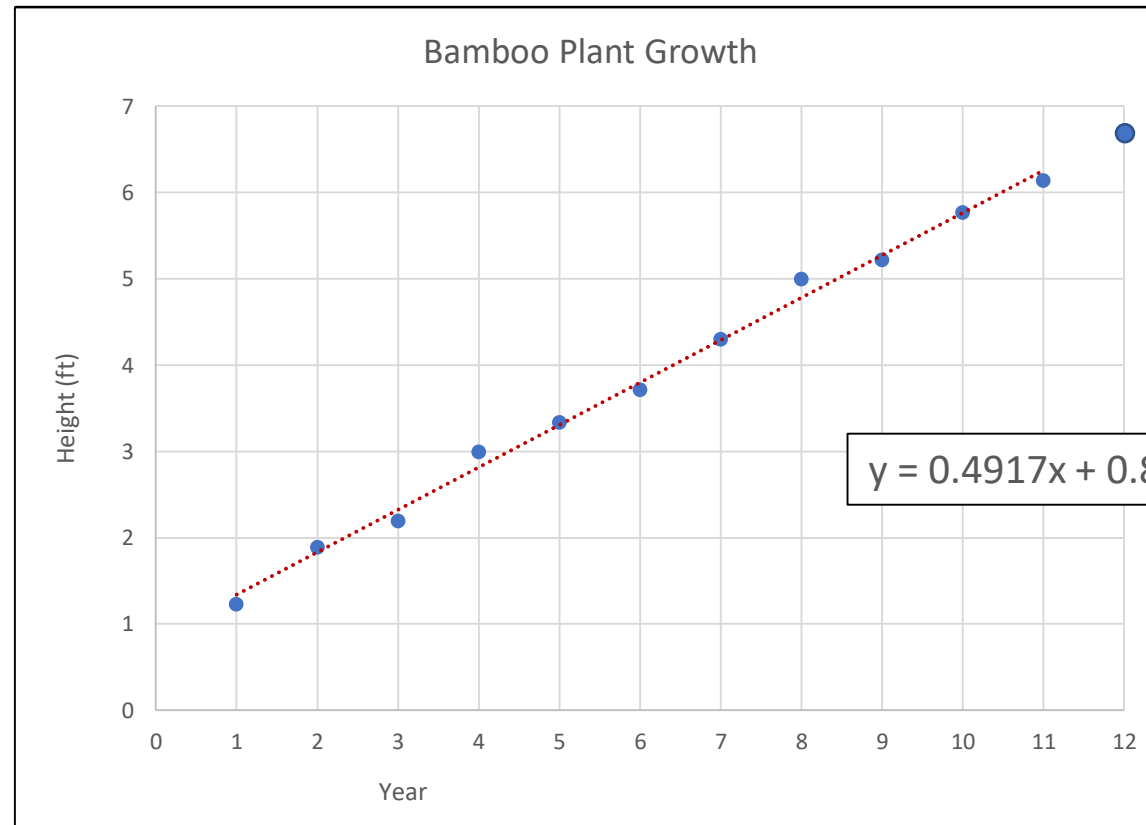


HEC RAS modeling software from the USACE

Today, physical models are not necessary -- computers are now used for the same purpose. **Mathematical calculations and statistical formulas are used to represent physical principles and phenomena** and the real world is simulated with help of software and computer systems.



Year	height (ft)
1	1.23
2	1.89
3	2.2
4	3
5	3.34
6	3.72
7	4.3
8	5
9	5.22
10	5.77
11	6.14



$$y = mx + b$$

Value we want

Slope

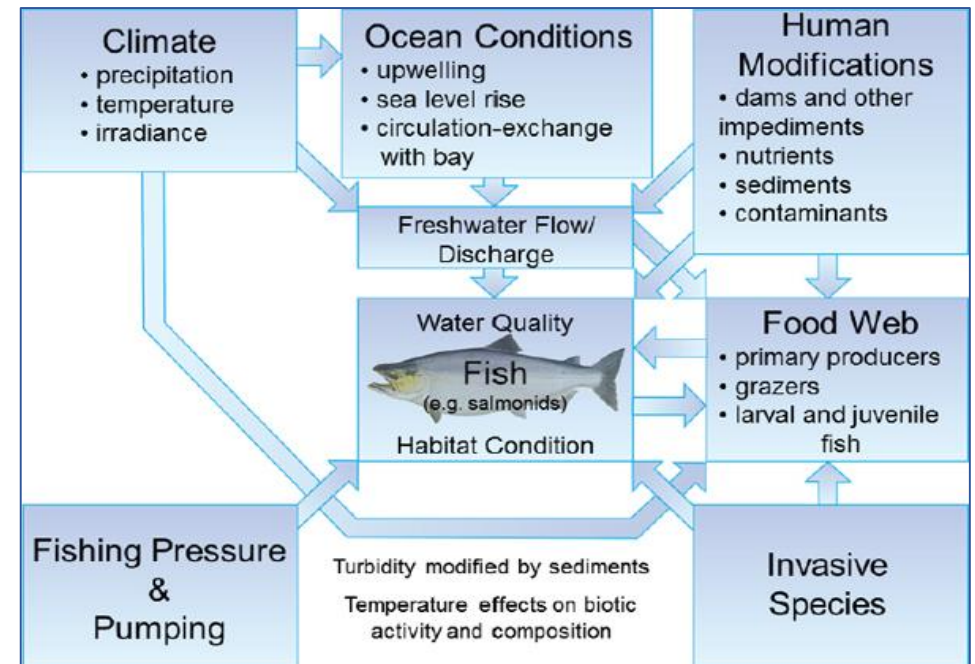
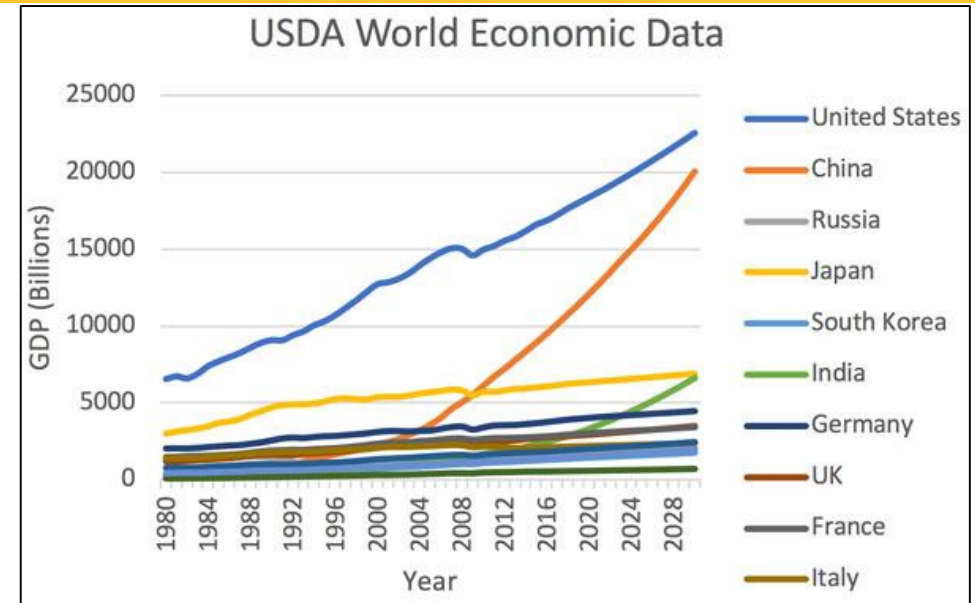
X axis value

Y axis intercept

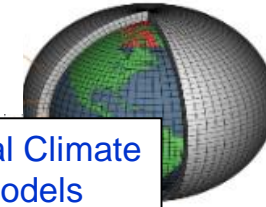
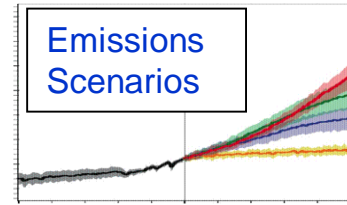
y = height of bamboo plant in year 12

$$0.4917 \times 12 + 0.8505 = 6.7509$$

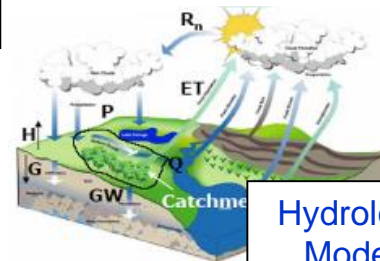
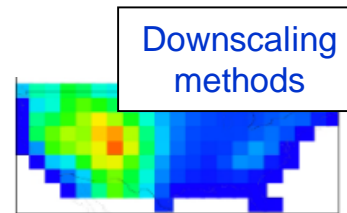
- Models can take many different forms
- The model chosen/developed will be shaped by the questions being asked.
- End users must wisely choose a model that balances needs against modeling complexity, required data and cost.



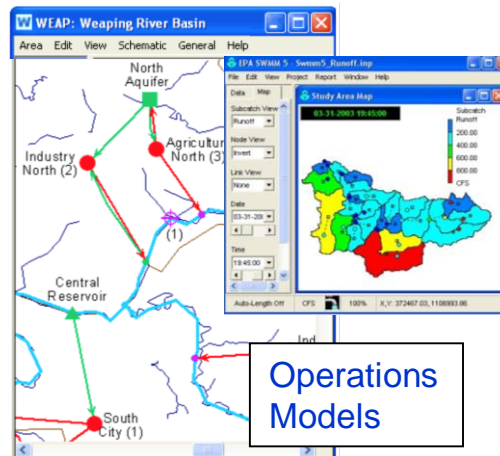
We use many different models to understand water systems. Today we are focused on climate and hydrology models...



Joel



Julie



Case studies