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FALL 2024

MEETING #1

Computational Modeling in Engineering and the Sciences
Computer Science Undergraduate Directed Reading Program

ASHTON COLE
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AGENDA

- Introductions
- My background
- Topic overview
- Goals
- Survey
- Demo: set up Python and NumPy

Assignment: Research applications of “computational modeling” and find an interesting example to tell us about. What modeling techniques does it use? We’ll discuss next week.

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INTRODUCTIONS

- Name
- Where you're from
- Something cool you did this summer
- Academic or professional interests (it's OK if you're not sure)

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Ashton Cole

- BS Computational Engineering, University of Texas at Austin (spring 2024)
- First-year in CSEM PhD program at Oden
- Member of Computational Hydraulics Group (coastal flood modeling)
- Programming: C, C++, Python, MATLAB, Julia, R
  - MPI (parallel programming in C)
  - Rusty: FORTRAN, Java, HTML, CSS, PHP, SQL
- Hobbies: tennis, hiking, reading

INTRODUCING COMPUTATIONAL MODELING

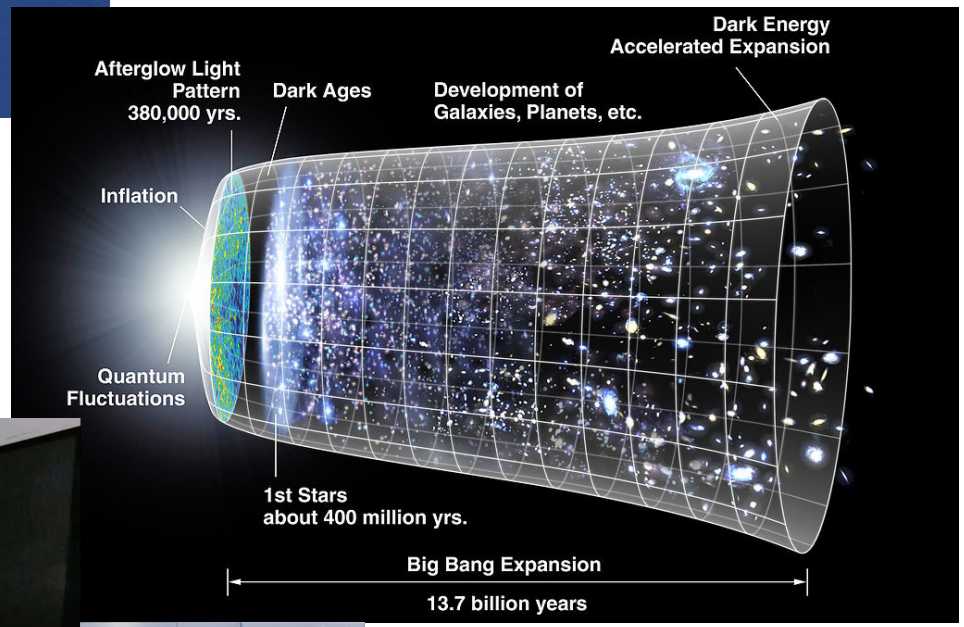
modeling

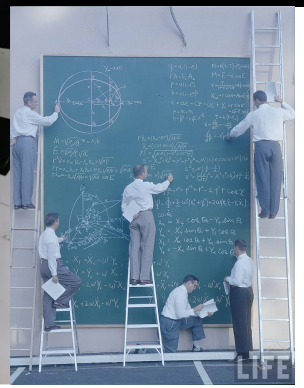
creating a conceptual representation of a system, situation, or process, which is used to understand or predict that thing

INTRODUCING COMPUTATIONAL MODELING

Maybe you want to predict the future

Or understand something that you can't easily test in a lab





Traditionally, your options were relatively limited

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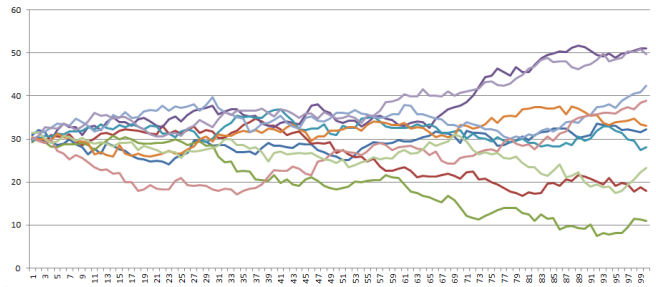
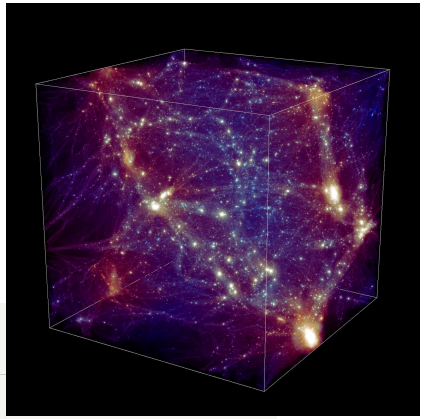
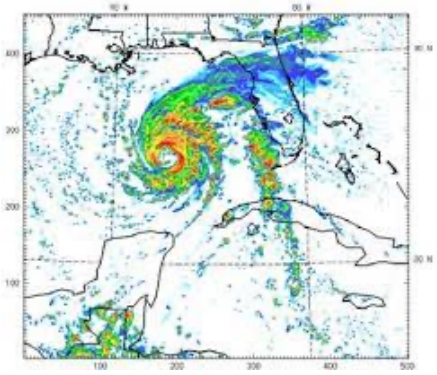
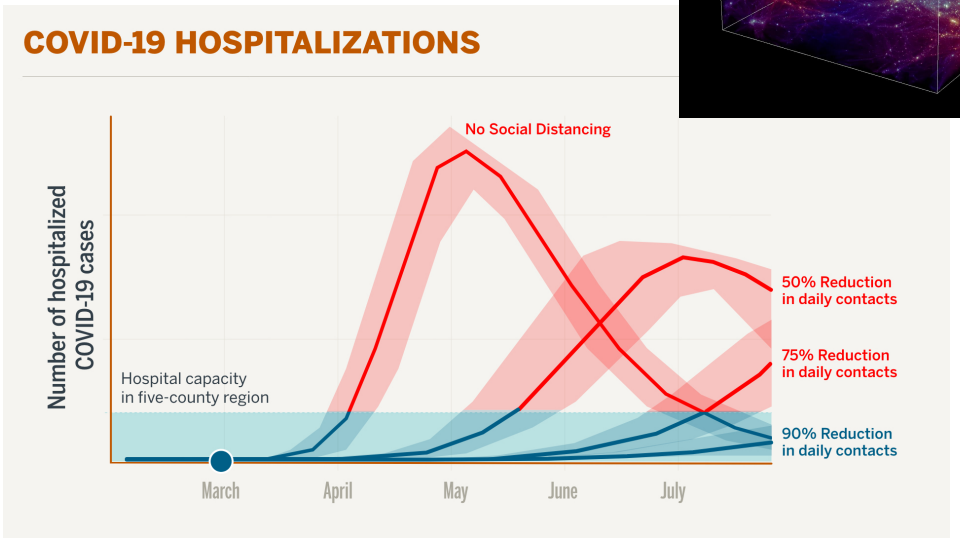
INTRODUCING COMPUTATIONAL MODELING

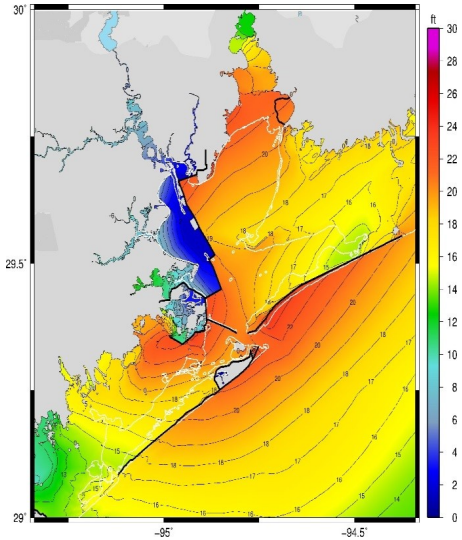
Computers enable bigger and more complicated models

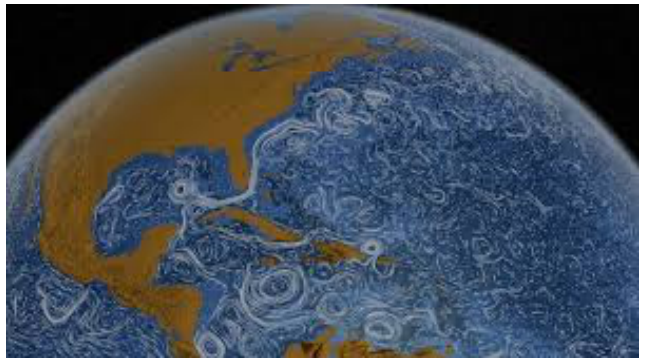


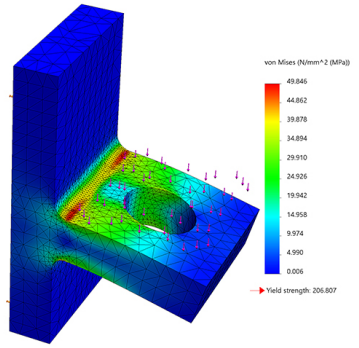


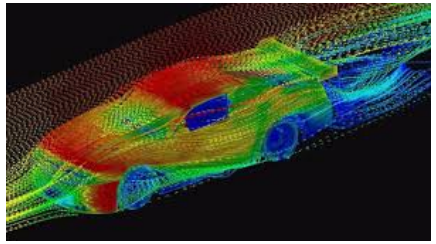












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INTRODUCING COMPUTATIONAL MODELING

Computational modeling is very **interdisciplinary**. Computer scientists play an important role in this field of research.

Domain Science
(understanding the thing itself)

Modeling Techniques
(linear algebra, calculus, differential equations, statistics, ML, etc.)

Computer Science
(making computers do big math fast)

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GOALS FOR THE SEMESTER

"DiRP is a program to help undergraduate students get involved with computer science research. Mentors can lead reading groups, project groups, or propose their own format."

- Learn about computational modeling
- Explore research and academia
- Build our own simple simulations of cool things
- "Leave things better than we found them"

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SURVEY

- Experience
  - Programming languages: Matlab, Python + NumPy
  - Calculus
  - Linear algebra and vectors
  - Differential equations
  - Numerical methods
  - GitHub

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SURVEY

- Format
  - 1 hr/wk meeting: present/discuss, then learn, then code
  - Outside: 1 paper/wk
  - Projects: coding simple simulations
    - 1st project is guided (2 and n body problems)
    - Future projects based on interest

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SURVEY

- What do y'all value most?
  - Learning?
  - Exposure to research?
  - Coding practice?
  - Presenting/public speaking?
  - Portfolio/resume padding?
- Send out a form?

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DEMO: SET UP PYTHON AND NUMPY

- Various options, all depends on your preferences
- I’m going to show how to use Conda

Demo time!

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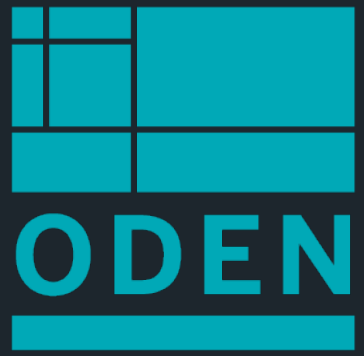

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