Biomedical Engineering
生醫工程

Jerry Tai
戴立嘉

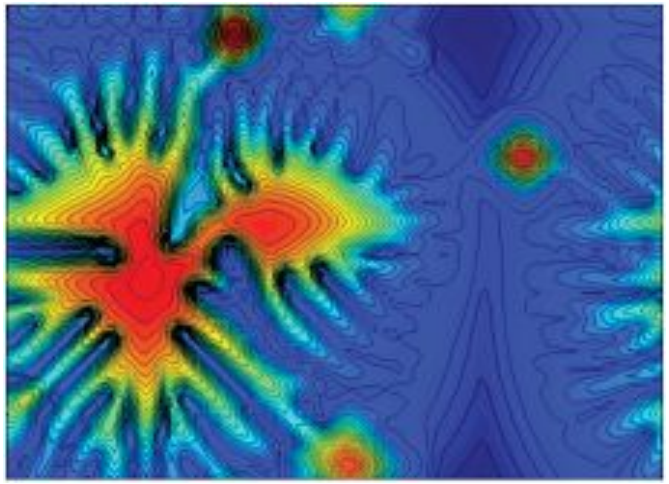
Spring 2024

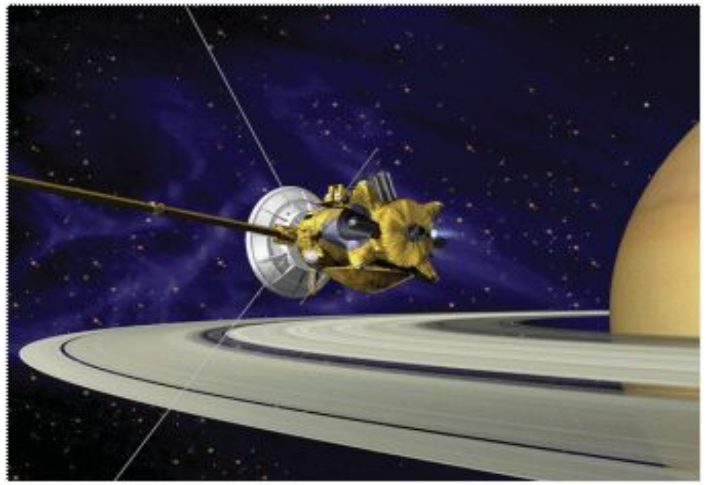
Welcome!

陽明交大
NYCU

- Instructor: Jerry Tai
  - Lecture: Monday 9:00 - 12:00 pm
  - Classroom: EE220
  - Email: j.tai@nycu.edu.tw
- TAs:

Huan-Chia Hsu (許桓嘉), jordan890415.ee11@nycu.edu.tw





陽明交大
NYCU

Course Material

- Lecture Notes
- Handouts
- Google Colab - need a computer

Google Colaboratory

Course Website

https://e3.nycu.edu.tw/

- Exams Grades will be posted
- Announcements will be posted there too
- For any other issue, please email me

Grading Policy

- 25% - Midterm I
- 25% - Midterm II
- 50% - Final

- The Final will be cumulative, including but not limited to materials from Midterm I and Midterm II
- The final grades will be curved. However, if everyone does well in the class (>90%), then the grades will not be curved.
- Help each other do well in the class!
- Alternative grading scheme

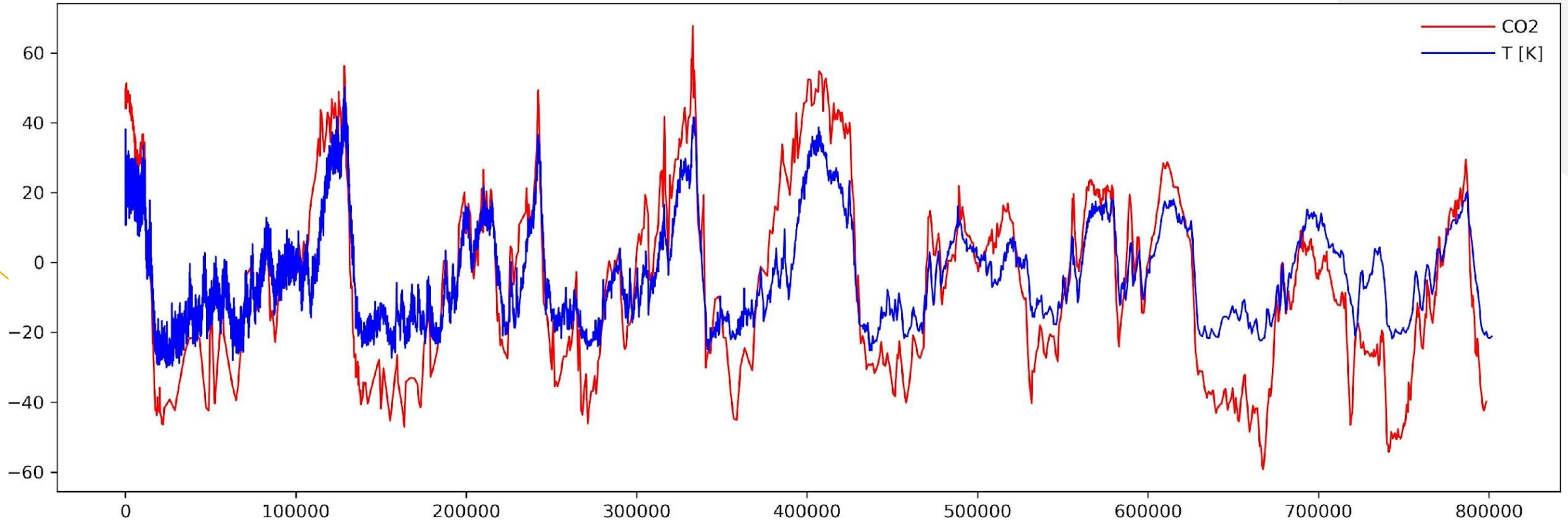
Midterm and Final Exams

- If you miss Midterm I due to valid reasons (family emergency, medical reasons, etc.), your Midterm II will count for 50%
- If you miss Midterm II due to valid reasons (family emergency, medical reasons, etc.), your Final will count for 75%
- You cannot miss Final Exam, unless under extraordinary circumstances. We'll discuss that case by case

Animation Demo

https://colab.research.google.com/drive/1LjZ1nJFCJcQMBrDacGXA-qM_ZdObZBS4?authuser=2#scrollTo=TUQdkXBm2CDJ

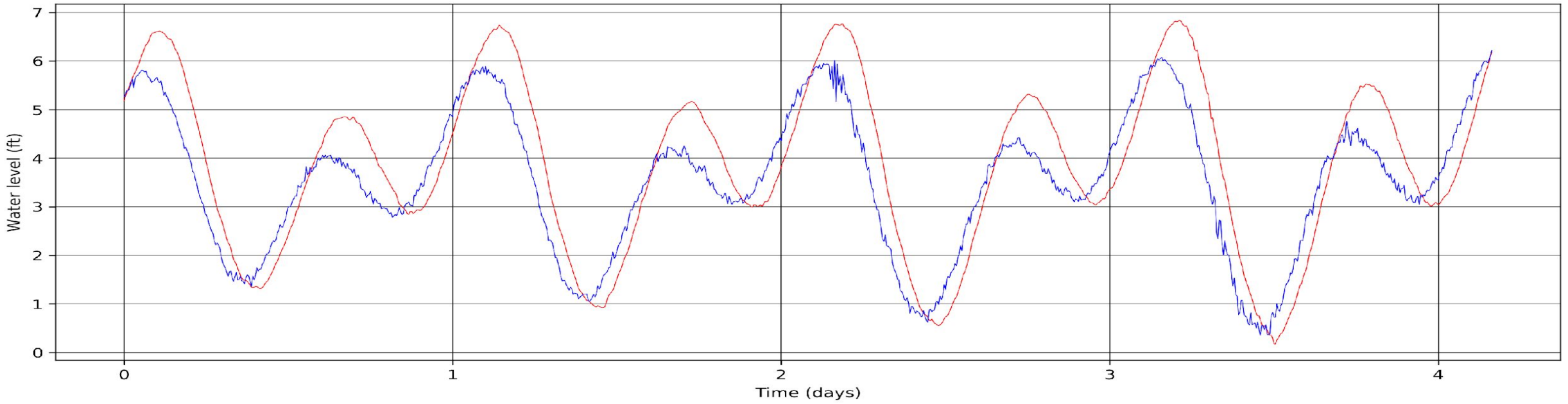
Course Starts with Data Processing



Years before today

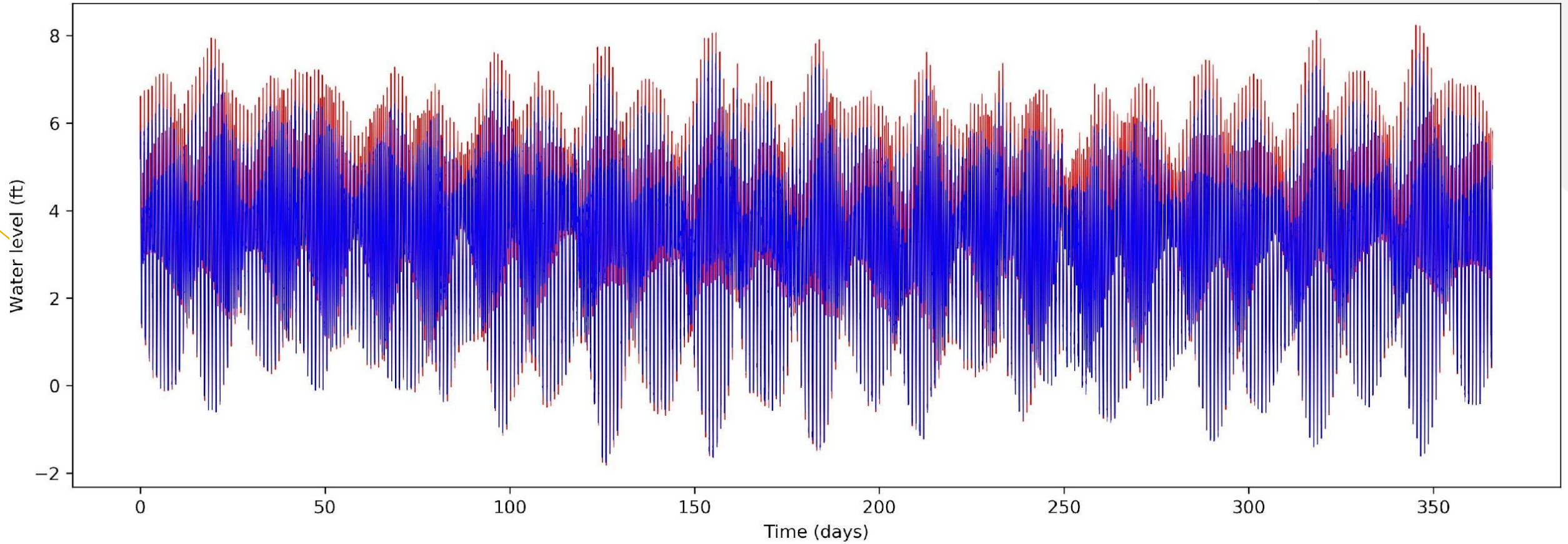
Analysis of Tidal Records

陽明交大
NYCU

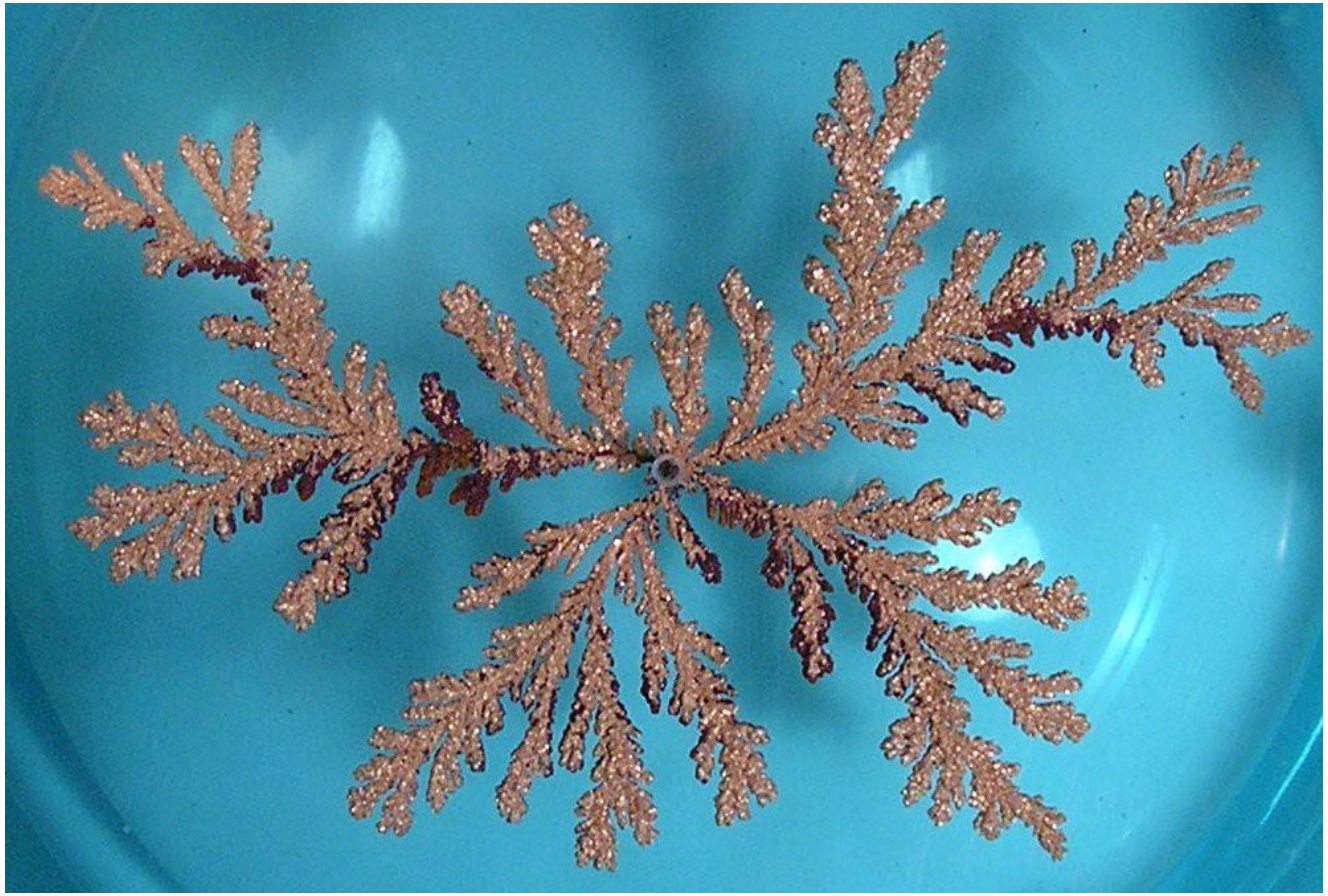


Analysis of Tidal Records

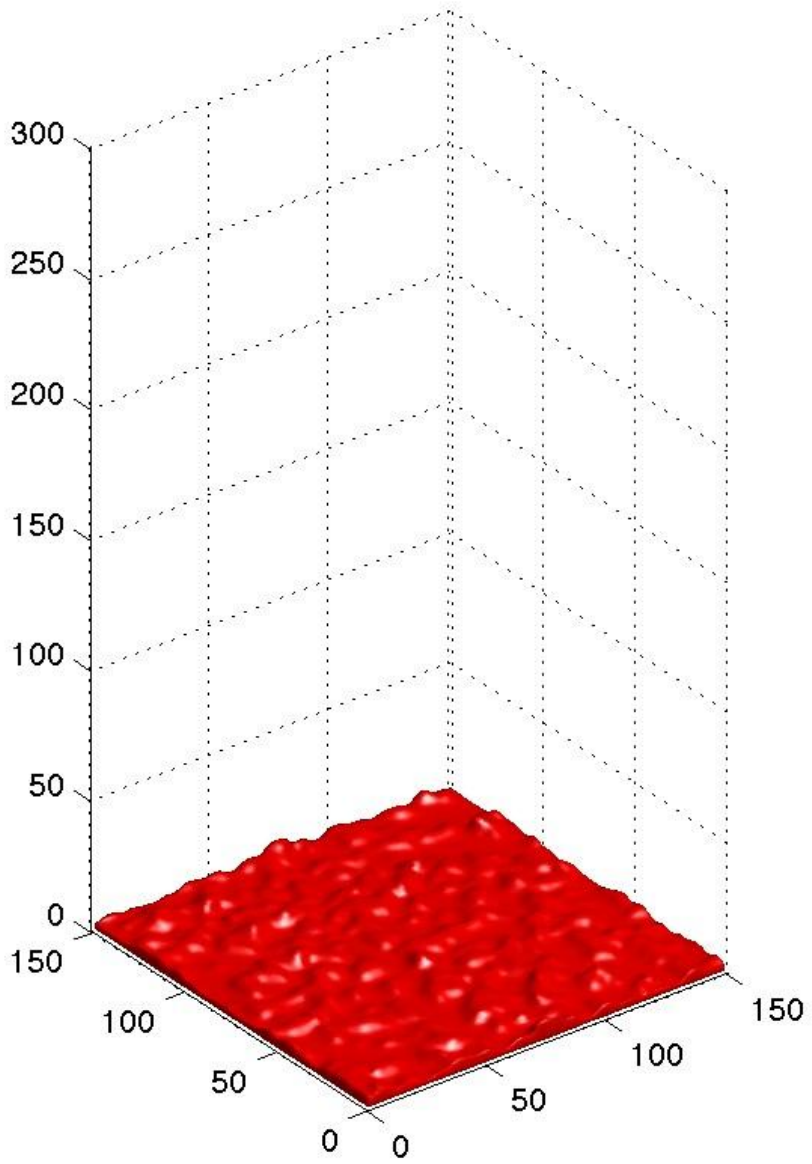
陽明交大
NYCU



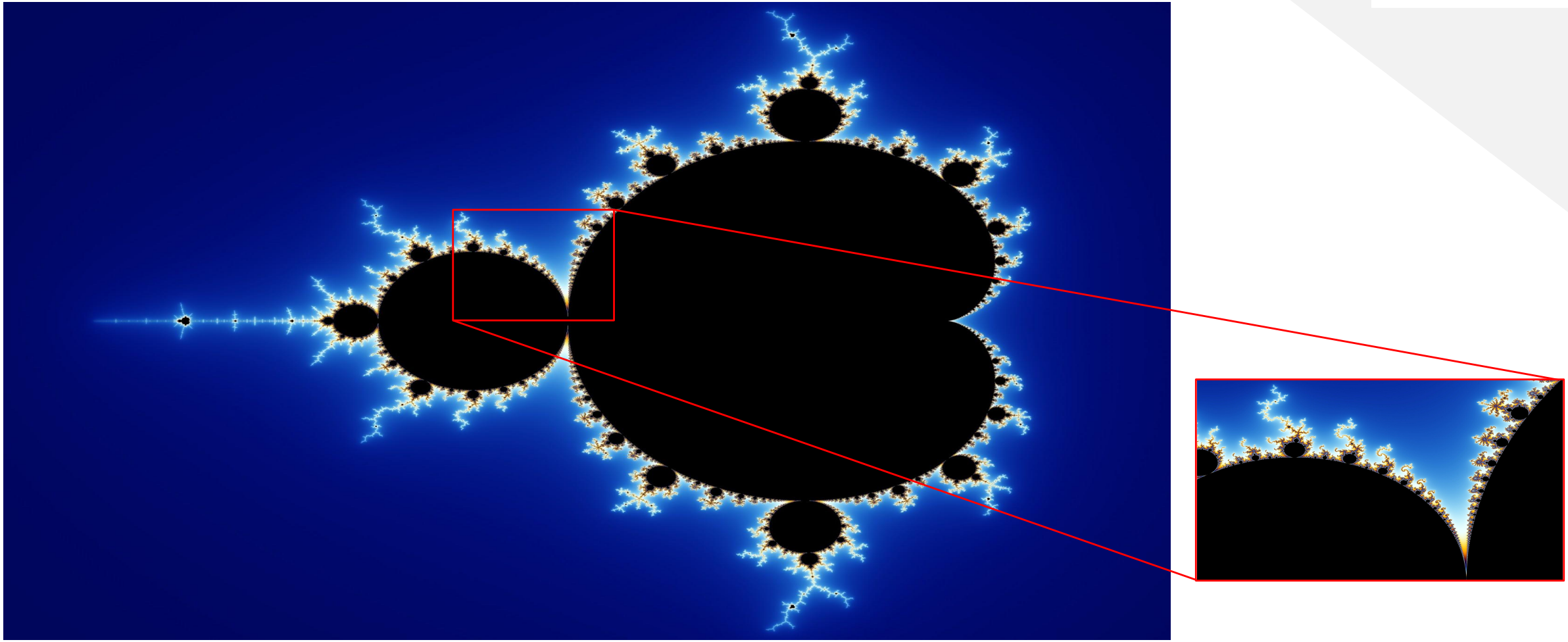
Fractals in nature made by diffusion limited aggregation (DLA)



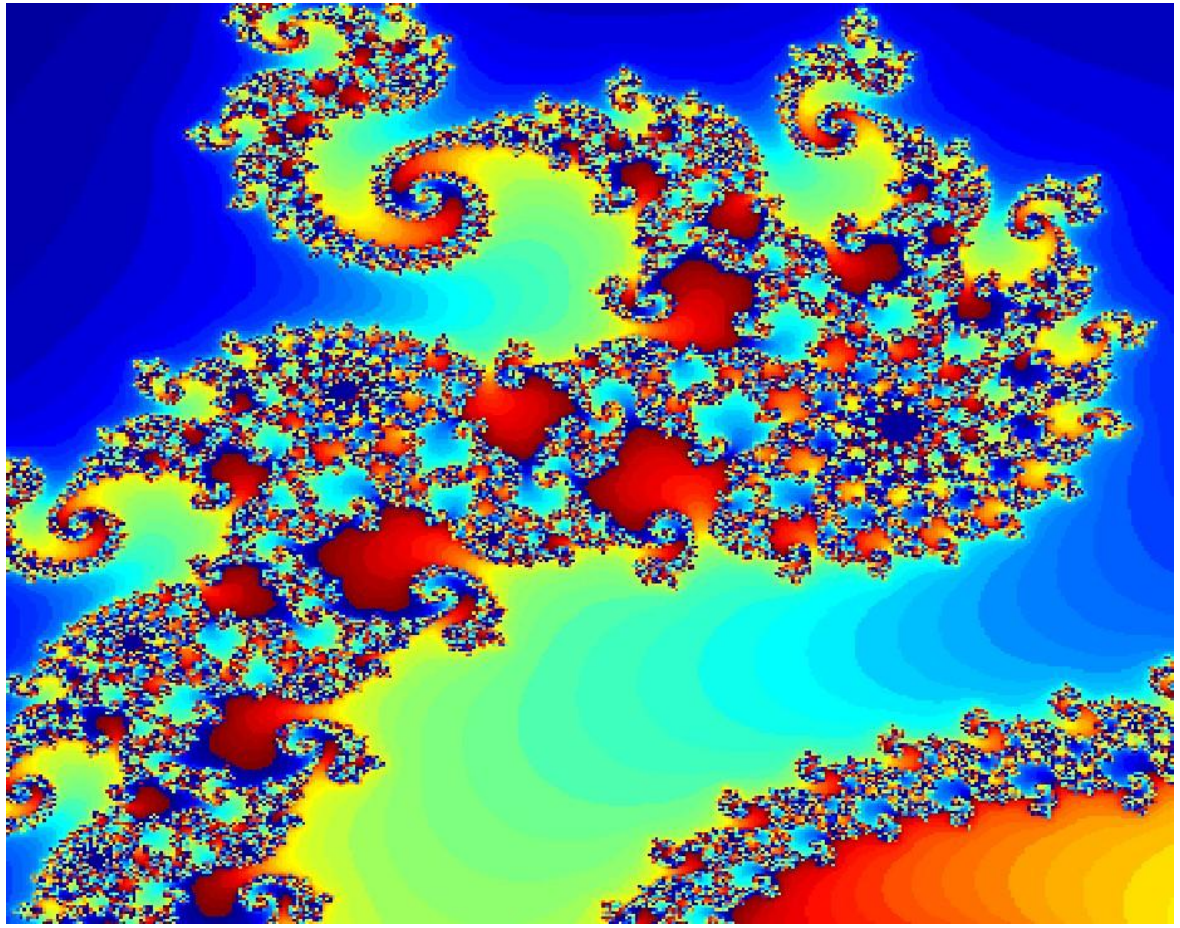
Diffusion Limited Aggregation in 3D



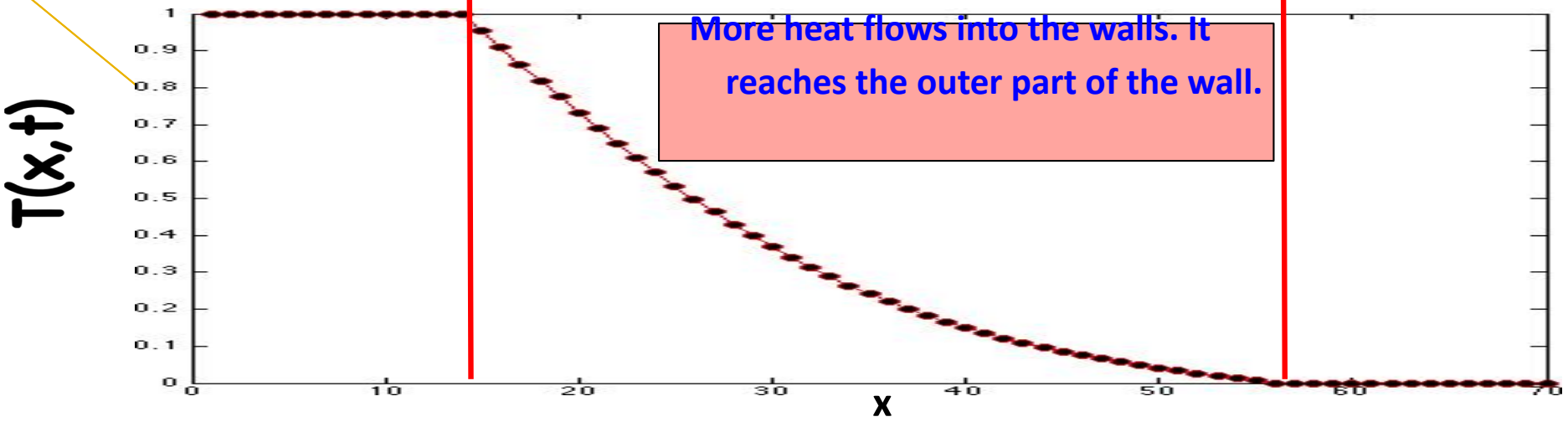
Mandelbrot Set: Zoom level 1



Mandelbrot Set

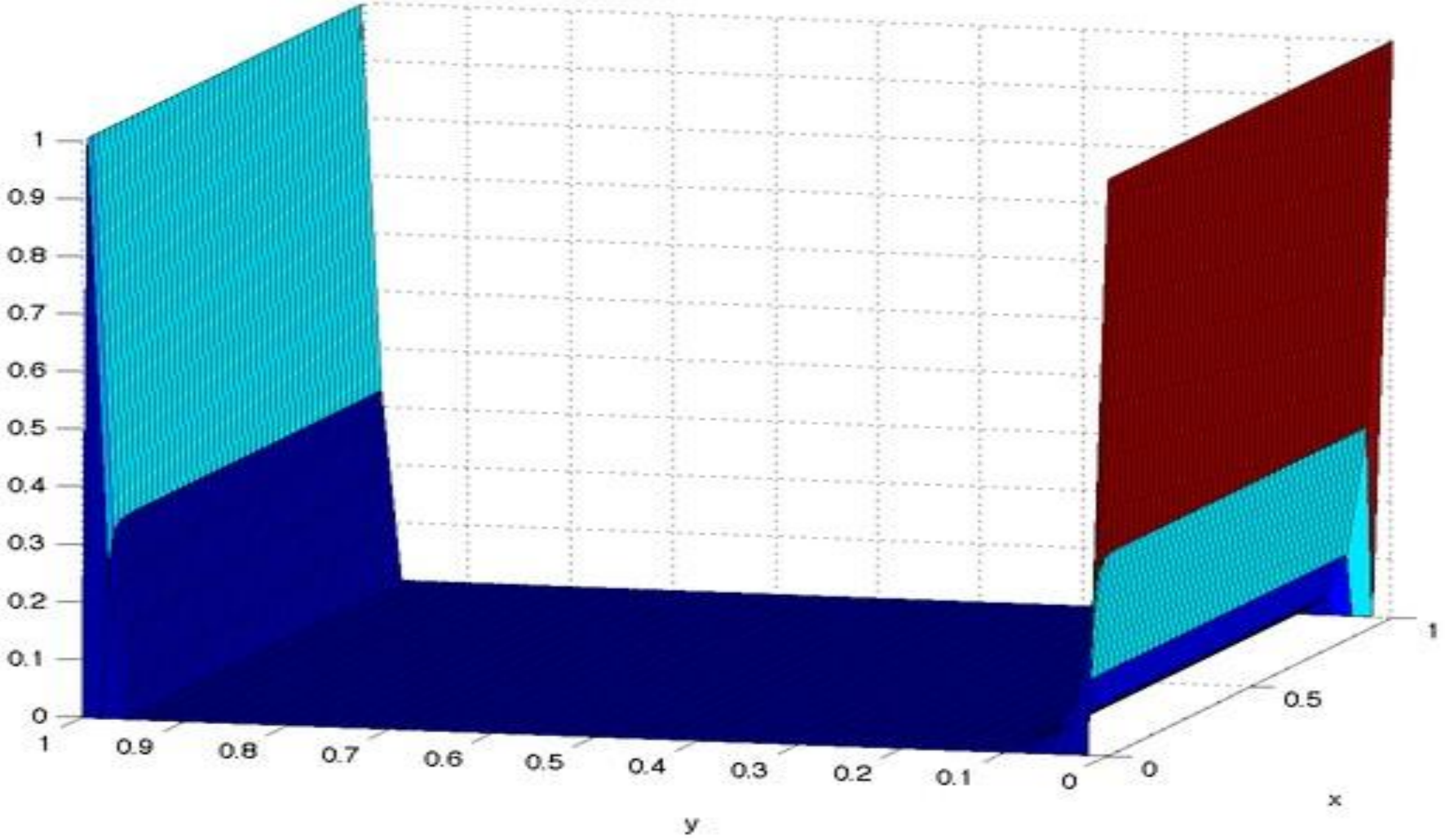


Temperature distribution in the wall of a house T(x,t)



More heat flows into the walls. It reaches the outer part of the wall.

Method 1: Jacobi Method



Generalization to 3D house T(x,y,z,t)

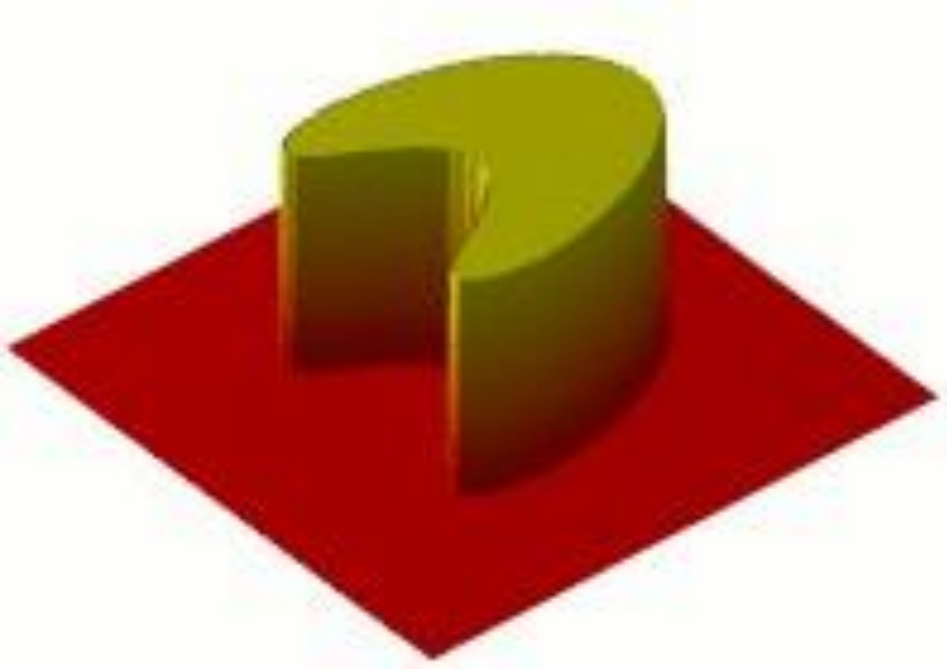
陽明交大
NYCU

Heat equation in 3D:

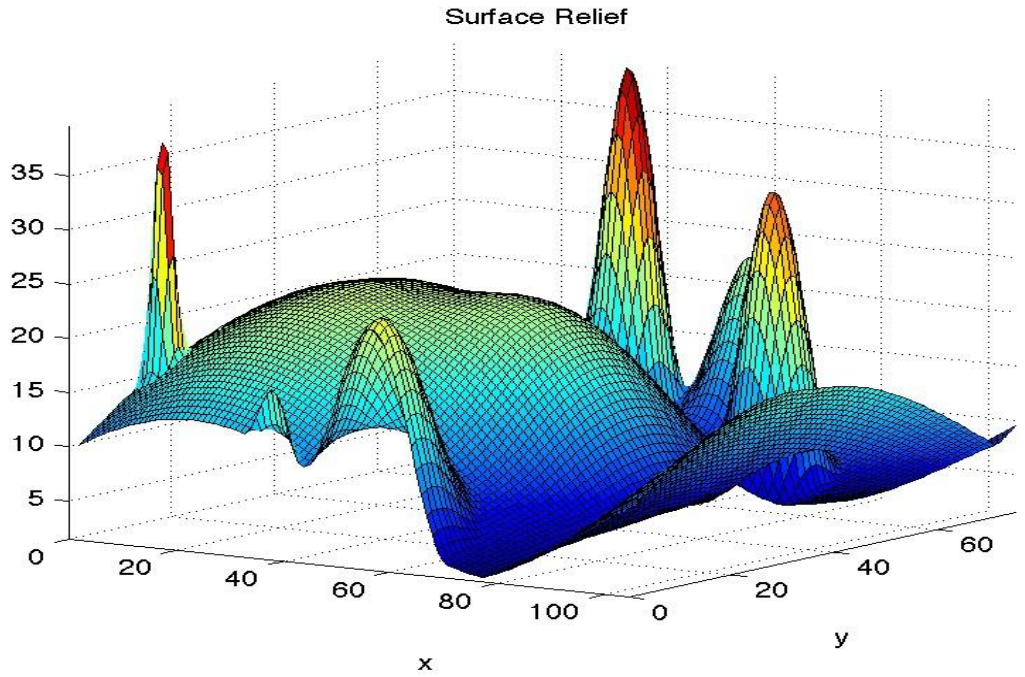
$$\frac{\partial T}{\partial t} = k\left[\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2}\right] = k\vec{\nabla}^2 T = k\,\Delta T$$

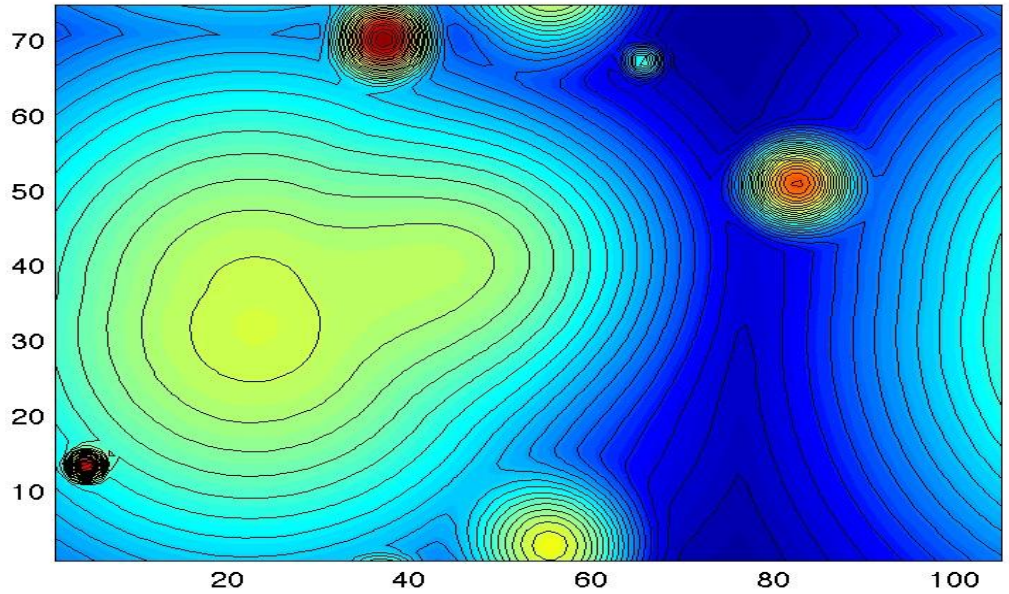
where Δ is the Laplace operator.

The heat equation and the diffusion equation are of identical form. In one case, particle diffuse, in the other case heat diffuses.



Landscape Evolution Models





Interesting Problems Using Simulations

https://www.myphysicslab.com/

Python

- It’s the new industry standard
- Useful tool to learn!

This Python

Not this Python

Before we begin!

There are a few things I hope to learn from you

Get to know your classmates better

Get into small groups to do the following:

- 1. What is your name? What are your major and year in school (freshman, sophomore, master's student year 1, etc.)?
- 2. What is your hobby?

Background and Anticipation

- 3. On a scale of 1-5, how comfortable do you feel about the topics covered in this course? (1 = Very uncomfortable, 5 = I could GSI the class!)

- 4. What do you want to get out of from this course?

Your Perspective and Questions

- 5. How do you feel you learn the best when taking a quantitative class?
- 6. Any questions for me?

In Summary…

Week 1 Questions

1. What is your name? What major are you in?
1. What is your hobby?
1. On a scale of 1-5, how comfortable do you feel about the topics covered in this course? (1 = Very uncomfortable, 5 = I could GSI the class!)
1. What do you want to get out of from this course?
1. How do you feel you learn the best when taking a quantitative class?
1. Any questions for me?