

# Earth System Modeling

2022

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## 1. Introduction

- a) *Scope of the class*
- b) *ESM components*
- c) *Couplers*
- d) *Synergy with high-performance computing*
- e) *Some current models*

## 2. Atmosphere models

- a) *History*
- b) *Overview of some current models*
- c) *Dynamical cores*
- d) *Physical parameterizations*
- e) *Current issues*

## 3. Ocean models

- a) *Overview of some current models*
- b) *Dynamical cores*
- c) *Physical parameterizations*
- d) *Current issues*

## 4. Land-surface models

- a) *History*
- b) *Current issues*

## 5. Sea ice models

- a) *History*
- b) *Sea ice dynamics*
- c) *Sea ice physics*
- d) *Current issues*

## **6. Ice sheet models**

- a) *History*
- b) *Ice sheet dynamics*
- c) *Ice sheet physics*
- d) *Current issues*

## **7. Tuning**

- a) *Definition and history*
- b) *Current issues*

## **8. Software engineering**

- a) *Couplers/mediators*
- b) *Workflows*
- a) *Community models*

## **9. Computational performance**

- a) *History*
- b) *Current issues*

## **10. Diagnostics**

- a) *History*
- b) *Current issues*

## **11. Applications of ESMs in analysis and forecasting**

- a) *History*
- b) *Data assimilation*
- c) *Seasonal and inter-annual forecasting*

## **12. Applications of ESMs in climate simulation and climate change prediction**

- a) *History*
- b) *Current issues*

## **13. Including societal processes in ESMs**

- a) *History*
- b) *Current issues*

## **14. Applications of ESMs to inform policy decisions**

- a) *History*
- b) *Current issues*

## Course mechanics

The updated version of AT745 to be offered this fall semester will deal with “*Earth System Models*” (ESMs), which include representations of the atmosphere, the ocean, the land surface, sea ice, and continental ice sheets. The nature, scope and history and applications of ESMs will be covered in general terms, and we will also examine in detail a few of the most interesting current ESMs. Discussion will cover both the formulations and key results produced by each model, and of course we will also compare the models with each other. Some guest lectures will be arranged.

Each student will “adopt” a current ESM for detailed examination during the semester. Students will give several presentations during the semester, typically about 20 minutes in length. The presentations will deal with selected aspects of the students’ adopted ESM, including both formulation and results.