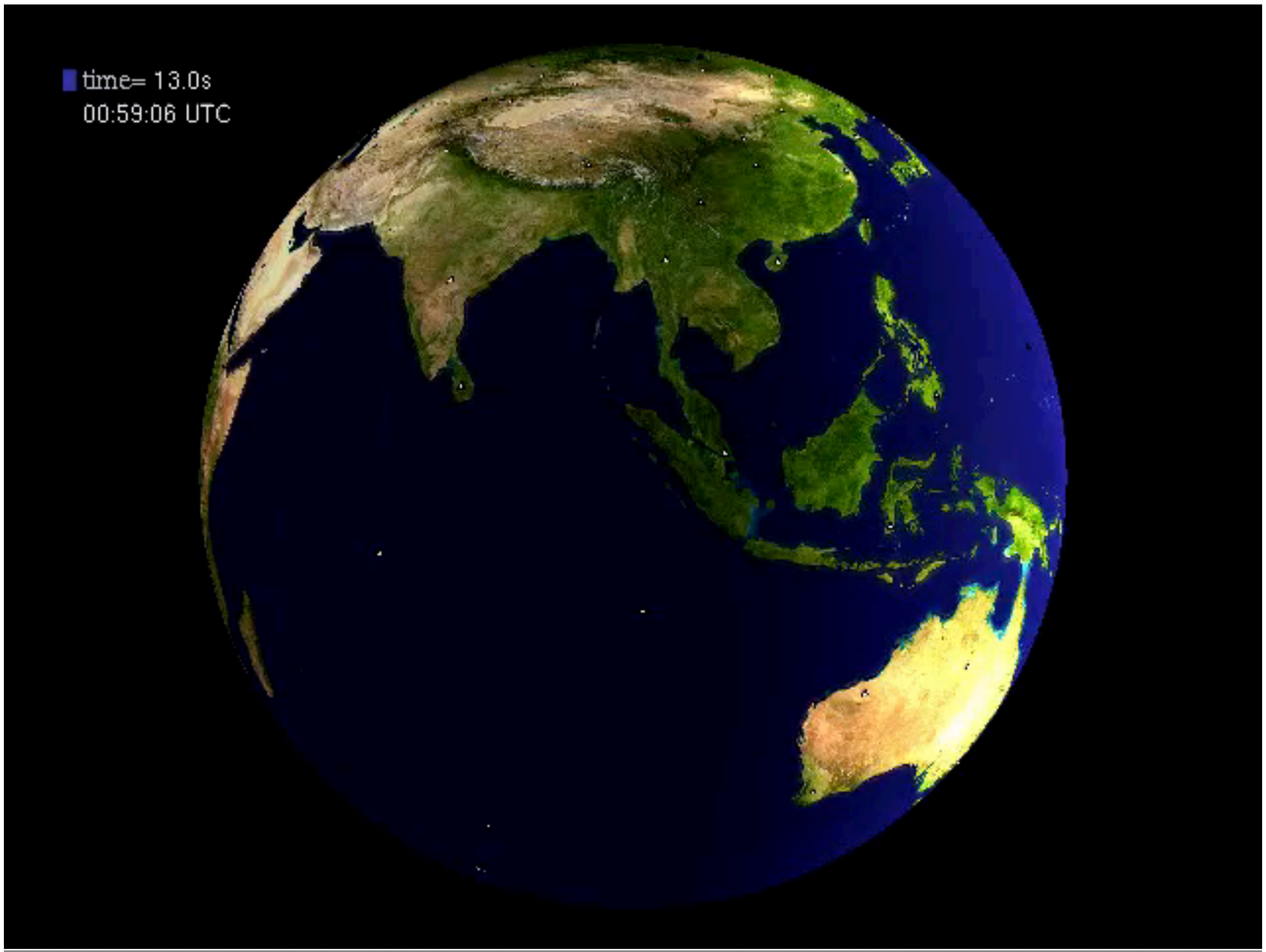
Computational Geophysics
ErSE 326



Computational Geophysics - ErSE 326

Fall Semester 2020

Lectures: - This class will be given as a full semester course
- Language of instruction: English
- Wed/Thu, 8:30 – 10:00, remote teaching
- Lecture material available

Objectives:

An introduction to finite-difference, pseudo-spectral, finite-element, and spectral-element methods will be presented and applied to basic geophysical problems including heat flow and wave propagation. The course offers hands-on lab experience in numerically solving partial differential equations relevant to geophysics.

Students will acquire the skills to program different numerical methods relevant for solving geophysical problems, in particular for heat flow and wave progagation.

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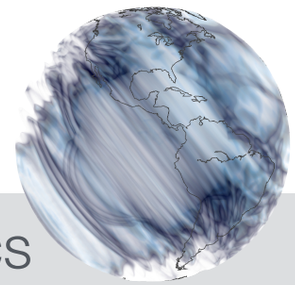

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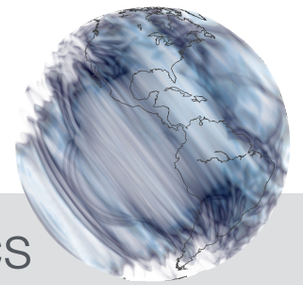
Fall Semester 2020

Schedule: (tentative)

week 1 Introduction to conservation laws for heat flow and wave propagation
week 2 Finite-differences method for heat flow
week 3 Finite-differences method for wave propagation
week 4 Higher-order Finite-differences method for tsunami waves
week 5 Introduction to Pseudo-spectral method
week 6 Pseudo-spectral method for wave propagation
week 7 Introduction to Finite-element method
week 8 Finite-element method for steady-state heat flow
week 9 Finite-element method for unsteady-state heat flow
week 10 Introduction to spectral-element method
week 11 Spectral-element method for heat flow
week 12 Spectral-element method for 1D wave propagation
week 13 Spectral-element method for 3D elastic wave propagation
week 14 Physics-based ground shaking simulations



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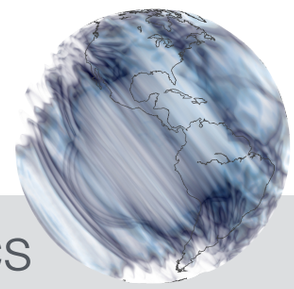
Fall Semester 2020

Student work:

Hands-on programming exercises and computer lab reports

Requirements:

- Attendance (highly recommended)
- Grades will be given as follow:
  80% lab reports, 20% quiz(zes)



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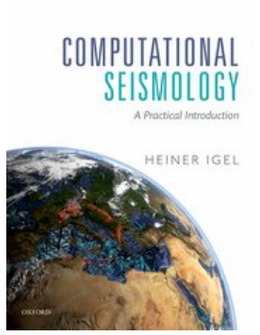
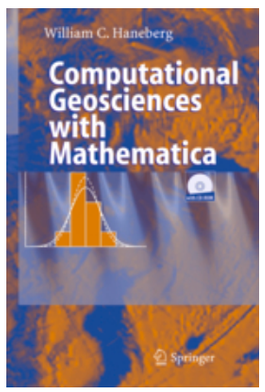
Fall Semester 2020

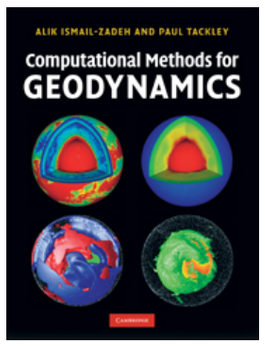
Reading material:



Igel, **H.** *Computational Seismology*
Oxford Press University, 2016.



Haneberg, W. *Computational Geosciences with Mathematica*
Springer, 2004.



Ismail-Zadeh, A. & Tackley, P., *Computational Methods for Geodynamics*
Cambridge University Press, 2010.