

MAR 513: Numerical Methods in Ocean Sciences

Instructor: Changsheng Chen

Course Description:

This is an introductory course of numerical methods used in ocean sciences. It is aimed principally at (1) description of various finite-difference, finite-element, and finite-volume methods used in ocean modeling, (2) understanding of physics related to the numerical solutions of the governing equations of the ocean, and (3) synthesis of existing and new-development ocean models and their applications to global, regional and coastal oceans and estuaries.

The Class Schedule: Monday 1:00 to 3:30 PM, Room 103

According to the academic calendar for fall semester of 2018, the class will begin on Tuesday, September 4, 2024, and will end on Monday, December 10, 2024. No class will be on October 14 (Indigenous Peoples' Day), November 11 (Veterans Day) and November 28-December 1 (Thanksgiving recess). Counted by lecture hours, we should totally have 13 lectures, and each lecture is two hours.

Date	Lecture number	Contents
September 9	1 (2 hours)	Governing equations, boundary conditions and turbulence closures, classification of discretization methods, and key factors related to numerical computations.
September 16	2 (2 hours)	Finite-difference methods
September 23	3 (2 hours)	Finite-difference methods in multi-variable equations
September 30	4 (2 hours)	Open boundary conditions
October 7	5 (2 hours)	Finite-volume methods via finite-difference methods.
October 21	6 (2 hours)	Data assimilations: Nudging, OI and Adjoint methods.
October 28	7 (2 hours)	Data assimilations: Kalman filters, dynamics via assimilation.
November 4	8 (2 hours)	Non-hydrostatic discretization: projection methods, pressure correction methods, accuracy and mass conservation, algorithm validation.
November 18	9 (2 hour)	Numerical approach for resolving multi-scale dynamics: critical issues in one-way and two-way nesting methods.

November 20	10 (2 hours)	Pressure errors in terrain-following coordinates
November 25	11 (2 hours)	The surface wave modeling
December 2	12 (2 hours)	Marine ecosystem modeling
December 9	13 (2 hours)	Next generation FVCOM
December 12-18	Final Exam	Open book