

Course title: Stability of Geophysical Flows

Course number: OC680

Credit hours: 4

Course Meeting Times: Winter 2016, MTWF 1000-1050 Wilk. 207

Instructor: Dr. William Smyth

A. Course description

Linear perturbation analysis applied to geophysical flows. These methods provide both quantitative and conceptual insight into the formative stages of turbulent flow. Emphasis is on practical numerical methods for the solution of differential eigenvalue problems. Examples are drawn from a wide range of geophysical flow instabilities, based in part upon student interests. Prerequisites: Multivariate calculus, matrix algebra, some matlab. Corequisite: OC670 or equivalent course in fluid dynamics.

B. Text

Online text will be provided.

Added reference (optional): Kundu, P.K., et al. "Fluid Mechanics", Academic Press.

C. Learning goals

Expected outcomes	Assessment method (via weekly homework assignments and a term project)
Students will: learn methods for the numerical solution of initial and boundary value problems	Compute numerical solutions of the perturbations equations describing flow evolution
become familiar with a wide array of fluid instability mechanisms	interpret numerical solutions in physical terms
prepare to use stability analysis in their own research	develop a toolbox of numerical codes

D. Assessment and grading

1. Weekly homework project (60%)
2. Term project (40%)

E. Schedule (subject to revision)

Week 1: Introduction to stability theory. Differentiation matrices.

Week 2: Convection

Week 3,4: Shear instability in parallel flow.

Week 5: Dynamic instability in viscous shear flow.

Week 6: Stratified shear flow

Week 7: Vortex instabilities

Week 8,9: Effects of planetary rotation: baroclinic instability, barotropic instability.

Week 10: Advanced topics as time permits: Double diffusive instabilities. Interleaving. Layer-forming instabilities. Optimal excitations, applications to observational data analysis. Advanced numerical methods: multiple shooting, spectral discretization, compact discretization.

F. Accountability and improvement

1. Course evaluations are reviewed annually for student perceptions of learning.
2. Peer review of teaching (every 5 years) covers teaching philosophy, effectiveness, and development.

G. Statement Regarding Students with Disabilities

"Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098."

H. Statement of Expectations for Student Conduct

<http://oregonstate.edu/admin/stucon/achon.htm>