GEOPHYSICAL FLUID DYNAMICS

Fall 2021, MATH-GA.3001
Tuesdays, 9-10:50am, room 517 WWH

Instructor:

Oliver Bühler, room 1013/1129 WWH
(I am moving offices this semester).
obuhler@cims.nyu.edu

Prerequisites: undergraduate ordinary and partial differential equations, a course in fluid dynamics.

A graduate course on GFD, which is the study of fluid dynamics under the strong influence of rotation, stratification, and curvature. This is the basis for studying the motion of the atmosphere and oceans.

GFD is a regular lecture class, with homework sets and a final project forming the class grade.

There is no assigned textbook for this class but the following are useful books:

- Geoff Vallis: Essentials of Atmospheric and Oceanic Dynamics, Cambridge University Press, 2019.
- Rick Salmon: Lectures on Geophysical Fluid dynamics, Oxford University Press, 1998.
- James McWilliams: Fundamentals of Geophysical Fluid Dynamics, Cambridge University Press, 2011.
- Oliver Bühler: Waves and Mean Flows 2nd edition, Cambridge University Press, 2014.

Topics include: fundamentals of rotation and stratification, Taylor—Proudman columns, shallow water model, potential vorticity, inertia-gravity waves, Rossby adjustment problem, quasi-geostrophic (QG) dynamics, beta effect, Rossby waves, two-layer QG flow, baroclinic instability, two-dimensional turbulence, energy-enstrophy theory, Boussinesq system, linear dispersive waves, WKB/ray theory for slowly varying waves, wave action, wave—mean interaction theory in simple geometry, forced Rossby waves, mountain waves, caustics and critical layers.