The course work requirements for Physical Oceanography graduate students are outlined below. As an individual student's program must also reflect their background and areas of interest, waivers for School requirements should be referred to the Graduate Program Coordinator, and waivers to Physical Oceanography requirements may be granted by the faculty adviser.

PHYSICAL OCEANOGRAPHY COURSES

Physical Oceanography graduate students are expected to complete the following courses:

OCEAN 510 PHYSICS OF OCEAN CIRCULATION (3) Structure of ocean basins; physical properties of seawater and the equation of state; heat, salt, and fresh water budgets; Coriolis effect and geostrophic balance; major current systems and water masses; mixing and stirring in the ocean; modern experimental methods in physical oceanography.

OCEAN 511 PHYSICAL FLUID DYNAMICS (3) Eulerian equations for mass-motion; Navier-Stokes equation for viscous fluids, Cartesian tensors, stress-strain relations; Kelvin's theorem, vortex dynamics; potential flows, flows with high-low Reynolds numbers; boundary layers, introduction to singular perturbation techniques; water waves; linear instability theory. Prerequisite: AMATH 403 or permission of instructor. Offered: jointly with AMATH/ATM S 505


OCEAN 513 GEOPHYSICAL FLUID DYNAMICS II (3) Theories, models of large-scale dynamics of oceans, atmospheres. Potential vorticity, Q principles; Rossby waves, ray tracing, Green's function, setup of general circulation; atmospheric "channels" versus ocean "basins"; wave-mean flow interaction, mountain drag, internal momentum flux; "Lagrangian" motion of particles, tracers; cascades, eddy flux of heat, moisture, Q. Prerequisite: OCEAN 512.

OCEAN 514 WAVES (3) Application of marine hydrodynamics principles to wave motion in oceans. Prerequisite: OCEAN 512.

OCEAN 515 OCEAN CIRCULATION: OBSERVATIONS (3) Modern large- and mesoscale ocean observations, interpreted in terms of contemporary circulation theories. Spectrum of temporal variability; eddies and eddy fluxes; ventilation; advection and diffusion in the abyss; transports of heat and salt; climatic scale of variability; modern methods for determining circulation. Prerequisite: OCEAN 510 or permission of instructor.

OCEAN 517 METHODS & MEASUREMENTS IN PHYSICAL OCEANOGRAPHY (2) The principal instruments and experimental methods of modern Physical Oceanography. Devices and systems to measure pressure, temperature, electrical conductivity, sea state and velocity will be discussed in the classroom, and complete systems will be examined/operated in the laboratory. Students can substitute CEWA 599, FIELD MEASUREMENT FOR HYDRODYNAMICS (3)

APPLIED MATHEMATICS AND DATA ANALYSIS COURSES

Physical Oceanography graduate students are expected to take three courses in Applied Mathematics, Statistics, and/or Data Analysis. These courses should be chosen in consultation with the student’s committee who should take into account undergraduate courses taken as well as the student’s area of research. We recommend one course on differential equations, one course on numerical methods for solving partial differential equations, and one course on data analysis methods.
AMATH 501 Vector Calculation and Complex Variables (5)
AMATH 502 Introduction to Dynamical Systems and Chaos (5)
AMATH 503 Methods for Partial Differential Equations (5)
AMATH 506 Applied Probability and Statistics (5)
AMATH 567 Applied Complex Analysis (5)
AMATH 568 Advanced Methods for Ordinary Differential Equations (5)
AMATH 569 Advanced Methods for Partial Differential Equations (5)
AMATH 581 Scientific computing (5)
AMATH 582 Computational Methods for Data Analysis (5)
AMATH 584/MATH 584 Applied Linear Algebra and Introductory Numerical Analysis (5)
ATM S 552 Objective Analysis (3)
ATM S 581/AMATH 586/MATH 586 Numerical Analysis of Time Dependent Problems (5)
OCEAN 569 Oceanographic Data Analysis (3)
STAT/EE 520 Spectral Analysis of Time Series (3)
STAT 530/EE 524 Wavelets: Data Analysis, Algorithms and Theory (3)
CEWA 472 Numerical Modeling of Hydrodynamics (3)

An introductory course on probability and statistics would also be beneficial for many students, such as
STAT 481 Introduction to Mathematical Statistics (5)

Other courses in AMATH, ATM S, STAT, or EE, depending on the background and interests of the student, can also be taken in lieu of any of the above courses. For students who need more background in applied mathematics before beginning the more advanced courses, courses that can be taken the summer before starting graduate school are AMATH 351 Introduction to Differential Equations and Applications (3), or AMATH 301 Beginning Scientific Computing (4).

OTHER COURSES

Other courses are available that could give students a wide perspective on many specialized facets of the practice of physical oceanography and related fields both within and outside of the School of Oceanography. Examples of additional courses that are occasionally offered are listed below

OCEAN 569 Satellite Oceanography (3)  OCEAN 569 Fjord and Estuary Circulation (3)
OCEAN 569 Climate Dynamics (3)  OCEAN 558/ATM S 559 Climate Modeling (3)
OCEAN/ATM S/ESS 558 The Global Carbon Cycle and Climate (3)  OCEAN/ATM S/ESS 559 Paleoclimatology: Data Modeling and Theory (3)
ATM S 571 Advanced Physical Climatology

THE SCHOOL OUT-OF-OPTION REQUIREMENTS

Every graduate student is required to take a minimum of one 3-credit, numerically-graded, 500-level course from each option outside their own for a total of three courses and 9 credits. Each option will provide a list of courses (see http://www.ocean.washington.edu/academics/grad-req.html) that can be taken to fulfill this requirement. The student is expected to complete this breadth requirement prior to receiving an MS degree. Normally, physical oceanography students should plan to take OCEAN 520 Marine Chemistry, OCEAN 535 Biological Oceanography, and OCEAN 540 Marine Geology and Geophysics. A Graduate Student Affairs committee, chaired by the Graduate Program Coordinator, will address any requests for waivers.

CONCURRENT DEGREES and OTHER OPPORTUNITIES

Graduate students can also choose, in consultation with their committee, to complete concurrent degrees at the University of Washington. Graduate students in physical oceanography have completed the following concurrent degrees:
Graduate Certificate in Climate Science: https://pcc.uw.edu/education/graduate-certificate/
Or students can enroll in the Advanced Data Science Option https://escience.washington.edu/education/phd/advanced-phd-data-science-option/.
For more information about other opportunities in graduate study at UW see https://www.ocean.washington.edu/story/Other_opportunities_in_Graduate_Studies