



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Physics of The Sea

2324-1-F7401Q097

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#### Aims

Provide basic knowledge of the physics of the oceans. Show the usefulness of mathematical and physical models for the description and the understanding of geophysical fluid dynamics.

#### Contents

In the first part of the course fundamental physical properties of the ocean will be introduced. The second part will be basic geophysical fluid dynamics, with the discussion of solutions to approximations relevant for the description of the ocean circulation and waves. In the laboratory sessions, hands on experiments will be presented to better visualise and understand the main topics of the course.

#### Detailed program

*Ocean Physics:* Light and sound propagation. Temperature and salinity. Equation of state. Mixed layer and stratification. Tracer distribution. Heat fluxes. Water masses. T-S diagrams.

*Oceanic Dynamics:* Navier-Stokes equation. Mass conservation. Hydrostatic approximation. Geostrophic flow. Ekman transport. Upwelling and downwelling. Vorticity. Large scale circulation and winds. Subtropical and subpolar gyres. Western boundary currents. Gravity waves. Rossby and Kelvin waves. Turbulent fluxes.

*Laboratory sessions:* Geophysical fluid dynamical experiments.

## **Prerequisites**

None

## **Teaching form**

Online frontal lecture

Lab

## **Textbook and teaching resource**

Vallis "Essential of Atmospheric and Oceanic Dynamics", Cambridge Univ. Press (2019)

Stewart, "Introduction to Physical Oceanography", freely available on line.

Marshall and Plumb "Atmosphere, Ocean, and Climate Dynamics", Academic Press (2008)

## **Semester**

Second

## **Assessment method**

Oral exam: candidates will be asked questions regarding the topics discussed in class. Each student will discuss a couple of topics chosen by the instructors, deciding what mathematical level to use. Attention will be paid to the precision of the used language (mathematical or not). Typical duration of the exam is about 15 minutes, but large deviations are possible depending on how the exam goes.

## **Office hours**

Contact the instructor

## **Sustainable Development Goals**

QUALITY EDUCATION

