GEOG 8901: Problems in Climatology: Ocean and Climate

Fall, 2022 (Aug. 23 – Dec. 7)

Course Syllabus

Class Meetings: Th 3:00 - 5:48 pm
Classroom: Derby Hall 1186
Instructor: Prof. Zhengyu Liu
Office: Room 1106 Derby Hall
Office phone: 614-292-7948
Office hours: Email appointment over zoom
Email: liu.7022@osu.edu

Course Prerequisites
No prerequisites

Course Objectives
For this year, this course will be an introduction of physical oceanography as a part of the basic knowledge on Ocean and Climate. More specifically, we will study Physical Oceanography, including ocean water properties, ocean circulation, and its impact on climate.

Course Structure
The class will meet once for two classes on Thursday. The class will be a combination of lectures from the instructor and students, with the major lectures given by the students.

Textbook

Talley L.D., Pickard G.L., Emery W.J., Swift J.H., 2011. Descriptive Physical Oceanography: An Introduction (Sixth Edition), Elsevier, Boston, 560 pp.

Author :L Talley
Release Date:06 Apr 2011
Imprint: Academic Press
Print Book ISBN :9780750645522
eBook ISBN :9780080939117
Pages:560
Dimensions:240 X 197

Syllabus

Ch.1: Introduction

- 1.1: Why physical oceanography ?
- 1.2: Ocean and Climate
- 1.3: What is physical oceanography ?
- 1.4: Ocean dimension, shape and bottom.

Ch.2: Physical Properties of Sea Water

- 2.1: Temperature
- 2.2: Salinity
- 2.3: Density
- 2.4: Sound

Ch.3: Ocean Climatology

- 3.1: Water mass
- 3.2: Temperature
- 3.3: Potential temperature
- 3.4: Salinity
- 3.5: Density
- 3.6: Dissolved oxygen
- 3.7: Other tracers

Ch.4: Water, Salt and Heat Budget

- 4.1: Water mass and salt conservation ?
- 4.2: Heat conservation

Ch.5: Instruments and Methods

- 5.1: What is the difficulty ?
- 5.2: Instruments
- 5.3: Dynamical method

Ch.6: Circulation and Water Masses of the Oceans

- 6.1: Driving forces for the ocean circulation
- 6.2: Ekman layer, Ekman flow and Ekman pumping
- 6.3: Upper ocean and wind-driven circulation (2weeks)
    1. Wind-driven flow and upper ocean circulation.
    2. Sverdrup flow: for the interior ocean
    3. Western boundary currents: Gulf Stream/Kuroshio
    4. Stommel's model: for the western boundary current
    5. Thermocline and upper ocean water masses
    6. Ventilated thermocline and recirculation thermocline
- 6.4: Deep ocean and buoyancy-driven circulation
    1. Atlantic deep water masses
    2. Adjacent seas
    3. Pacific deep water masses
    4. Deep western boundary currents
    5. Stommel-Arons model
    6. Deep water, Convelt belt and paleo-climate
    7. thermohaline instability

6.5: Equatorial ocean
    1. Pacific upper ocean circulation
    2. The equatorial undercurrent
    3. El Nina and Southern Oscillation
    4. Ocean-Atmosphere interaction
    5. Indian/Atlantic upper ocean circulation
    6. Deep equatorial jets
6.6: Southern ocean
    1. Southern ocean water masses
    2. Deep convection and water mass formation
    3. Antarctic Circumploar Current
    4. Deacon cell
6.7: Summary: world ocean water masses