MATH0024 Geophysical Fluid Dynamics

Year:	2024–2025
Code:	MATH0024
Level:	6(UG)/7(PG)
Normal student group(s)	UG: Year 3 Maths degrees PG: MSc Mathematical Modelling
Value:	15 credits (= 7.5 ECTS credits)
Term:	2
Assessment:	90% examination, 10% coursework
Normal Pre-requisites:	MATH0015, MATH0016
Lecturer:	Prof ER Johnson

Course Description and Objectives

This course uses mathematics to discuss the global environment. Basic fluid dynamics and simple physics for the atmosphere and oceans are used to discuss some of the mechanisms involved in the dispersion of pollutants along coasts and the four-yearly (on average) El Nino oscillation in the equatorial Pacific, with its attendant Australia drought and blight of the Peruvian anchovy industry. Typical analysis involves the solution of linear partial differential equations for the velocity and density of the flows.

An idea of the methods and topics and level required can be obtained from the books (in order of relevance).

Recommended Texts

Geophysical Fluid Dyanamics

(i) *Geophysical Fluid Dynamics*, J Pedlosky, Springer-Verlag.

(ii) *Atmospheric and Oceanic Fluid Dynamics,* Geoffrey K. Vallis CUP

(iii) *Fundamentals of Geophysical Fluid Dynamics,* J. C. McWilliams CUP

(iv) *Geophysical Fluid Dynamics,* B. Cushman-Roisin Springer

Fluid Dynamics in general:

(i) *Waves in Fluids,* M.J. Lighthill CUP

(ii) *An Introduction to Fluid Dynamics,* G.K. Batchelor CUP

Detailed Syllabus

Wave in rotating flows: Poincaré waves, Kelvin waves. The spherical earth and Rossby waves. Viscous effects, the Ekman boundary layer and Ekman spiral. Stratified flows: internal waves and flow over mountain ridges. Ocean circulation: the Sverdrup and Stommel models.