CI9-FM-05 Buoyancy-driven Flows

Course leader: Prof Graham Hughes
Other contributors: TBC
Module status: Core
Pre- or co-requisites: CI9-FM-01, CI9-FM-02, CI9-FM-06
Term: Autumn
Contact hours: 30
ECTS units: 5
FHEQ Level: 7
Assessment: Coursework and written examination

1.0 Aims

- To provide a fundamental understanding of the role of buoyancy in fluid mechanics.
- To examine canonical buoyancy-driven flows that are relevant in engineering practice.
- To establish and analyse the ways in which buoyancy can result in the mixing of fluids.
- To apply simplified models of buoyancy-driven flow to problems in building physics.

2.0 Syllabus

This module will cover the following topics:

- Equation of state.
- Boussinesq approximation.
- Stratified environments.
- Monin-Obukhov theory.
- Plumes.
- Fountains.
- Gravity currents.
- Mixing and energetics.
- Internal gravity waves.
- Ocean and reservoir mixing.
- Particle-laden flow.
- Pollution dispersion.
- Natural ventilation.
3.0 Intended learning outcomes

On successfully completing this module, students will be able to:

- Understand fluid motion driven by (small) density differences and the resulting transport of mass, momentum and energy.
- Model plumes, fountains and gravity currents.
- Use bulk models for the temperature structure and (natural) ventilation of buildings.

4.0 Teaching methods

The module will be taught using a series of lectures and tutorials. There will be printed notes and example calculations during lectures. Tutorials involve helping students individually and occasionally working problems on the board.

5.0 Assessment

Assessment information will be provided separately.

6.0 Recommended textbooks

Category as defined by Central Library: C = Core, S = Supplementary

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