

ATM338 Surface Water Waves (2020-2023)

HUOM! OPINTOJAKSOJEN TIETOJEN TÄYTTÄMISTÄ KOORDINOIVAT KOULUTUSSUUNNITTELIJAT HANNA-MARI PEURALA JA TIINA HASARI

- 1. Course title
- 2. Course code
- 3. Course status: optional
- 4. Course level (first-, second-, third-cycle/EQF levels 6, 7 and 8)
- 5. Recommended time/stage of studies for completion
- 6. Term/teaching period when the course will be offered
- 7. Scope of the course in credits
- 8. Teacher coordinating the course
- 9. Course learning outcomes
- 10. Course completion methods
- 12. Recommended optional studies
- 13. Course content
- 14. Recommended and required literature
- 15. Activities and teaching methods in support of learning
- 16. Assessment practices and criteria, grading scale
- 17. Teaching language

1. Course title

Veden pinta-aallot
Vattenvågor
Surface Water Waves

2. Course code

ATM338

Aikaisemmat leikkaavat opintojaksot 53548 Veden pinta-aallot, 5 op

3. Course status: optional

-Which degree programme is responsible for the course?
Master's Programme in Atmospheric Sciences

-Which module does the course belong to?
ATM300 Advanced Studies in Atmospheric Sciences (optional for Study Track in Geophysics of the Hydrosphere)

-Is the course available to students from other degree programmes?
Yes

4. Course level (first-, second-, third-cycle/EQF levels 6, 7 and 8)

Master's level, degree programmes in medicine, dentistry and veterinary medicine = secondcycle degree/EQF level 7
Doctoral level = third-cycle (doctoral) degree/EQF level 8

-Does the course belong to basic, intermediate or advanced studies (cf. Government Decree on University Degrees)?
Advanced studies

5. Recommended time/stage of studies for completion

-The recommended time for completion may be, e.g., after certain relevant courses have been completed.

6. Term/teaching period when the course will be offered

The course will be lectured every other year (odd years) in the I period.

7. Scope of the course in credits

5 cr

8. Teacher coordinating the course

Heidi Pettersson

9. Course learning outcomes

The student will learn

- the properties of the surface water waves and to derive and calculate them
- the properties of the wind-generated waves and the factors that affects the growth of them
- to make simplified wave forecasts

10. Course completion methods

Final exam.

11. Prerequisites

Basic Course in Oceanography, Fluid Phenomena and Mathematical methods (MAPU). Also the Timeseries analysis in Geophysics I is recommended to take before or at the same time as this course.

12. Recommended optional studies

The courses Hydrodynamics and Timeseries analysis in Geophysics is recommended. Also Turbulence course (Turbulenssioppi) is a good addition.

13. Course content

The course consists of two parts: linear (small amplitude) wave theory and wind-generated waves.

The following aspects of the linear wave theory are studied:

- the shape of the wave, celerity, group velocity, energy, orbital motion, velocity and pressure fields, the influence of the water depth, surface film, capillary wave, methods to solve higher order theories and Stokes' drift.

The following aspects of the wind-generated waves are studied:

- the irregular nature of the wind-generated waves and the usability of the linear wave theory, the wave spectrum, the generation of the waves by the wind, the growth of the waves and their dissipation, the factors determining the growth of the waves and the energy balance equation of wind-generated waves.

14. Recommended and required literature

Lecture notes and student's own notes.

Supplementary reading:

Hydrodynamics:

Lamb, H. 1932/1945: Hydrodynamics. Cambridge University Press

Landau-Lifshitz 1959: Fluid Mechanics. Pergamon Press

Wind-generated waves:

Holthuijsen, L.H. 2007: Waves in Oceanic and Coastal Waters. Cambridge University Press

Komen et. al 1994: Dynamics and modelling of ocean waves. Cambridge University Press

COST714 WG3 2005: Measuring and analysing the directional spectrum of ocean waves. EC. <http://bookshop.europa.eu/en/measuring-and-analysing-the-directional-spectra-of-ocean-waves-pbQSNA21367/> (Chapters 1 and 2, Directional wave spectrum). The chapters 1.2-1.3 and 2.1 -2.2 are part of the introductory lecture to wind-generated waves.

The following books are partly obsolete, but still worth of studying

Kinsman, B. 1965: Wind waves -their generation and propagation on the ocean surface. Prentice-Hall

Phillips O.M. 1977: Dynamics of upper ocean. Cambridge University Press

Kitaigorodskii, S.A.: The physics of air-sea interaction

15. Activities and teaching methods in support of learning

Weekly lectures and exercises (individual work). The assistant will keep a record on the tasks done: extra points will be given according to tasks completed. Total hours of the course is 135.

16. Assessment practices and criteria, grading scale

The grading scale is the standard scale in Physics.

17. Teaching language