

A. Physical Oceanography

A.1. Master track: METEOROLOGY, PHYSICAL OCEANOGRAPHY AND CLIMATE (MPOC);

Utrecht University, Faculty of Science, Dept. Physics and Astronomy
Code:4.5.3; Level 400/500; ECT's: 120; Coord.: Prof. W.P.M. de Ruijter;
Website: <http://www1phys.uu.nl/masters/meteoromaster/>

Introduction

The understanding of physical and chemical processes controlling the changes in the state of the atmosphere and hydrosphere (ocean and ice) has increased enormously over the last decades. The role of clouds and atmospheric composition on the radiation balance, the effect of changes in ocean circulation on the meridional heat transport, and the causes of sea-level changes and their impact on coastal systems are now widely studied. This knowledge is crucial to make reliable predictions of the future climate and hence highly relevant for society. In this area of scientific exploration, meteorologists, atmospheric chemists, physical oceanographers and glaciologists strongly co-operate, each contributing their specific expertise. Research activities include theory development, numerical modelling, and both laboratory and field measurements, the latter usually within a framework of international collaboration.

The program Meteorology, Physical Oceanography and Climate seeks to offer students a solid education in both the broad range of theoretical physical principles, and the experimental and modelling techniques used to study the behaviour of the different components of the climate system. It also provides an entrance to the state-of-the-art in current research in a broad range of topics in the field.

The program seeks to achieve its educational goals in two years of training, teaching and research. Students that have shown academic promise in meteorology, oceanography, physics, mathematics, or any other discipline considered appropriate by the selection committee, will be eligible to apply. In total about 15 students are expected to enrol every academic year.

ORIENTATION OF THE MASTER'S PROGRAM

The Master's program in Meteorology, Physical Oceanography and is supported by the Faculty of Physics and Astronomy. It emphasizes the physical aspects of the climate system, including the effect of chemicals in the atmosphere through their interaction with the radiative balance of the earth system. Fundamental fluid-dynamical aspects are coupled with thermodynamics and atmospheric chemistry to unravel the extremely complex processes in the climate system, either by studying the system as a whole, or parts of this system in isolation. The courses and the research have an analytical, numerical and experimental character. The students have one full year of training in the basics of and interaction between the different components of the climate system, with emphasis on the fundamentals. This is apparent from the high level of mathematics that is needed at the start and that is developed further in the Master's courses. Students can either specialize in meteorology, in the dynamics of ice caps and glaciers, in physical oceanography, in atmospheric chemistry or in combinations of these. Interdisciplinary courses ensure that the students obtain a broad overview of the physical and chemical components of the climate system.

AIMS AND GOALS

Upon completion of the Master's in Meteorology, Physical Oceanography and Climate, the student will be able to:

- have a broad overview of the physical and chemical processes which determine the state of the atmosphere, ocean and cryosphere.
- give a concise summary of the relevant observations, the observational techniques used and the theoretical challenges posed by these observations.
- have developed a sound judgement and a critical attitude on the interpretation of observational and model data based on fundamental chemical and physical principles, and statistical and numerical skills.
- Execute a research project and present the results of this project both in an oral presentation and in writing.
- Independently formulate a scientific hypothesis, or develop a consistent model, as an explanation of an observed phenomenon or results of a numerical model.

General structure of the MSc program

The Master's program in Meteorology, Physical Oceanography and Climate takes two years. The program is split equally into a taught part and a research part. The credits for each course are expressed in study points (ECTS), where 1.5 ECTS is equivalent with 40 hours of work. Within the taught part (the first year) 4 courses (30 ECTS) are compulsory, while another 4 courses (30 ECTS) must be chosen from a predefined list of courses related to the discipline. The list of the courses is given below followed by a description of these courses.

Taught part (60 ECTS)

Required (30 ECTS)

Course name/subject	Course #	ECTS	% Marine
Dynamical Oceanography (level 400)	NS-MO401	7.5	
Turbulence, Mixing and Boundary Layers (level 400)	NS-MO403	7.5	

Optional (30 ECTS)

Course name/subject	Course #	ECTS	% Marine
Coastal Zone Physics	NS-MO426	7.5	
Ocean Waves	NS-MO428	7.5	
Climate Dynamics	NS-MO429	7.5	
Participation in Expeditions (Ice caps, Glaciers, Ocean)			

Deficiencies

No more than 15 ECTS s.p. of the optional courses can be taken from the level 3 courses of the Bachelors Program.

Connection to Bachelors Program

Undergraduate students with a strong interest in enrolling for the Master's in Meteorology, Physical Oceanography and Climate are advised to take the following courses.

Course name/subject	Course #	BSc level	ECTS	% Marine
Hydrodynamics and Turbulence	NS-254B	200	7.5	
Computational Fluid Dynamics	NS-256B	300	7.5	
Geophysical Fluid Dynamics	NS-353B	300	7.5	
Climate Physics and Chemistry	NS-255B	300	7.5	

Research part (60 ECTS)

The research part of the Masters program will consist of 9 months of research under the supervision of a staff member of the Institute for Marine and Atmospheric Research or adjunct faculty. This research is concluded with a written Masters thesis which is graded by the supervisor, together with another independent staff member.

A.1.1 BSc courses for Marine Science Master Program.

Course name/subject	Course #	BSc level	ECTS	% Marine
Physical Oceanography	NS-153B	100	7.5	
Hydrodynamics and Turbulence	NS-254B	200	7.5	
Geophysical Fluid Dynamics	NS-353B	300	7.5	

A.2. Master track: COASTAL AND FLUVIAL SYSTEMS

Utrecht University, Faculty of Geosciences, Dept. Physical Geography

Level: 400/500; ECT's: 120; Coord.: Prof. P. Hoekstra;

Website: www.coastalresearch.nl > MSc course

Introduction.

This track is part of the MSc program Earth Sciences and is dedicated to the study of processes and phenomena that determine the morphodynamic behaviour of coastal and river systems and their interface (e.g. in case of deltas and estuaries). The focus can be on coasts or rivers or both.

General structure of the MSc program

It is a two-year program, equivalent to 120 ects. It comprises 6 taught course units on theory (45 ects), a research project and thesis (including an excursion; in total 45 ects) and an individual program (30 ects, traineeships, extension of research, additional courses). The MSc program is open to students with a Bachelor's degree or equivalent in Earth Sciences, Natural Sciences or Civil Engineering. The starting date is 1 September every year.

Admittance:

For the Program Coastal and Fluvial systems, two out of three BSc Earth Sciences level 3 courses (each 7.5 ECT's) are mandatory: see Table A2.1 BSc courses for Marine Sciences Program. External candidates should have an equivalent level of knowledge and academic skills).

Mandatory courses for the MSc program are presented in the following Table:

Mandatory courses MSc program Coastal and Fluvial systems

Course name/subject	Course #	ECTS	% Marine
Sedimentology	GEO4-4411	7.5	40
Coastal and River Modelling	GEO4-4402	7.5	60
Fluid Mechanics 2	GEO4-4421	7.5	100

In addition, for all tracks within the Physical Geography program the following parts are general and also mandatory:

General parts of MSc curriculum mandatory for all students

Course name/subject	Course #	ECTS	% Marine
Preparation MSc Research (incl. excursion)	GEO4-4422	15	100
MSc Research (actual field work)	GEO4-4410	15	100
MSc thesis	GEO4-4415	15	100
MSc individual program	GEO4-4416	30	100

The MSc individual program forms the last half year of the program and can be used for a traineeship (in the Netherlands or abroad; 50 % of the trainees generally goes abroad and stays at a foreign University or research institute), for additional courses and for extending the MSc research.

Elective courses are either existing courses that are part of the overall MSc Program Earth Sciences or are arranged individually; the list is not complete but those courses are included that are frequently selected:

Elective courses MSc program

Course name/subject	Course #	ECTS	% Marine
Advanced course in Coastal Systems	GEO4-4426	7.5	100
Advanced course in Remote Sensing	GEO4-4431	7.5	25
Coastal Zone and River Management	GEO4-4402	7.5	50
Hydrology and Climate	GEO4-4423	7.5	15
Sediment Transport Processes	GEO4-4424	7.5	50
Spatial analysis with GIS 2	GEO4-4412	7.5	10

In addition, courses of other MSc programs at Utrecht University or outside Utrecht may be selected. Obvious choices are, for example (IMAU):

- Ocean waves
- Coastal Zone Physics

A2.1 BSc Courses for Marine Sciences Program.

Course name/subject	Course #	BSc level	ECTS	% Marine
Fluid Mechanics 1	GEO3-4307	3		
Coastal Morphodynamics	GEO3-4306	3		
River Morphodynamics	GEO3-4305	3		