



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DEPARTMENT OF GEOGRAPHY, GEOINFORMATICS AND METEOROLOGY

BScHons Meteorology

2023

This information brochure is a guide only. For the latest on the chosen degree please visit the UP website at www.up.ac.za.

1. METEOROLOGY

Meteorology is the study of atmospheric phenomena. This covers the physics, chemistry, and dynamics of the atmosphere, but extends to include many direct effects of the atmosphere on the earth's surface, the oceans, and life in general. Weather and climate are fundamental in people's lives; everyday activities like farming, travel and construction are highly affected by them but severe weather events may cause loss of life and widespread destruction to infrastructure that is worth hundreds of millions of Rands. In the long term, changes in the climate system may even determine whether humankind survives or not.

Our graduates aim to have a complete understanding of atmospheric processes, which enables accurate prediction of atmospheric conditions at several different time scales. These include nowcasting on a short time scale (minutes to hours ahead) to seasonal and climate prediction on the longer time scales. Meteorologists are employed by institutions involved in the study, interpretation, and prediction of weather and phenomena relating to the climate. As the climate changes, and we understand the damages from extreme weather events better, other large industries like manufacturing, logistics, insurance, and engineering increasingly use the services of meteorologists in impact assessments.

2. JOB OPPORTUNITIES

A BSc in Meteorology provides promising career opportunities along with the chance to understand and solve social and environmental issues that help contribute to society at large. Professional meteorologists work as weather forecasters, researchers, climatologists, and lecturers. Meteorologists are employed by institutions involved in the study, interpretation, and prediction of weather and phenomena relating to the climate. The South African Weather Service (SAWS), the Council for Scientific and Industrial Research (CSIR), some universities, agricultural institutions, municipalities, and industries employ meteorologists who mainly practice as specialists. Graduates from our program can work in the following capacities:

- **Researchers:** All aspects of weather and climate are researched to improve our understanding of atmospheric phenomena. Atmospheric modellers use supercomputers to simplify and solve complex flow dynamic equations of the atmosphere. Air quality and the effect of air pollution on society are constantly monitored, and the impact of climate change receives increasing attention.
- **Weather forecasters:** They analyse data and predict the weather by using models run on supercomputers. Weather forecasts are issued on different time scales, from very short-range forecasting to forecasts that are valid for months ahead, as well as seasonal forecasts. Some private positions, such as presenting the weather forecast on television, are available.
- **Climatologists:** They manage important data sets that contain large volumes of information gathered by SAWS and other organisations.
- **Meteorologists:** They work as consultants in the private sector and at universities to provide specialised research services.
- **Academic positions:** These are available at some South African universities for candidates who have completed a master's or doctoral degree in Meteorology. Academics ensure that the training of meteorologists meets international standards.

3. ACCREDITATION

Students who successfully complete the BSc Meteorology and BSc (Hons) Meteorology programs conform to all the requirements for a meteorologist according to the definition of the World Meteorological Organization (WMO) Technical Regulations. Our graduates are able to professionally apply, develop, and communicate meteorological science for the benefit of society. A BScHons Meteorology graduate can work anywhere in the world as a meteorologist.

4. APPLICATION, SELECTION AND ADMISSION REQUIREMENTS

Admission into BScHons Meteorology is a BSc in Meteorology or equivalent BSc degree that meets the prerequisites of the Honours modules. Prospective students may be required to do additional modules to enable them to reach the desired level of study.

A prospective student must have an average of 60% or more in the major relevant subjects in the final year of the bachelor's degree. Selection takes place before admission and the number of places is limited. Acceptance is conditional on the final marks obtained for the undergraduate bachelor's degree. The prospective student's academic record is evaluated, and one of four selection outcomes is possible:

1. Accepted to BScHons Meteorology.
2. Accepted to BScHons Meteorology on the condition that several prescribed modules are completed successfully for non-degree purposes simultaneously with the Honours program.
3. Not accepted to BScHons Meteorology. Accepted to BSc Natural Sciences Undergraduate Special. The student must successfully complete several prescribed undergraduate modules in a bridging year. **Note that undergraduate lectures and practicals are presented during the day on the Hatfield campus.** If the student achieves an average of 65% in these modules, he/she may re-apply for BScHons Meteorology in the following year. Note that the bridging modules cannot be completed over more than one year.
4. Not accepted. The applicant does not comply with the admission requirements.

The following subjects should have been completed successfully for acceptance into BScHons Meteorology:

- GMA 220 Remote Sensing
- PHY 114 and 124
- WKD 155 Atmospheric structure and processes
- WKD 254 Programming in meteorology
- WKD 261 Physical meteorology
- WKD 351 Atmospheric balance laws
- WKD 352 Atmospheric vorticity and divergence
- WKD 361 Quasi-geostrophic analysis
- WKD 366 Fundamentals of weather forecasting
- WTW 256 Differential Equations*
- WTW 258 Calculus*
- WTW 263 Numerical methods*

*** or an equivalent qualification as approved by the head of the department**

Online application is available on www.up.ac.za, click on 'Study > Apply' in the top menu.

Applications for BScHons Meteorology close on 30 September.

The first meeting for Honours students is usually towards the end of January. The final date will be announced early in January via email by the Honours coordinator. Lectures usually commence a week after the first meeting.

The Honours program is designed for full-time study and classes are presented during the day. If you are working, it is advisable to do the program over two years, and in this case, you have to inform the academic advisor of this at the start of the year.

The University of Pretoria is a residential university, meaning that students should live close by to be able to attend classes and practicals on campus. Although we changed to online and hybrid contact sessions during the COVID-19 pandemic, from 2023 onwards, we expect that students will have to regularly attend classes and write examinations on campus in person.

5. MODULES AND CREDITS

The timetable is announced at the beginning of the year. All of the course work will be conducted at the University of Pretoria. Classes are usually scheduled during the week between 08:00 and 17:00. The timetable varies from year to year, depending on staff availability and student numbers. The lecturer in the different modules will supply more detail.

| Code | Module Name | Credits | Period |
|-----------------------------------|---|---------|----------|
| Core modules (compulsory): | | | |
| WKD 704 | Numerical modelling: Applications 704 | 12 | S1 |
| WKD 706 | Dynamic meteorology 706 | 16 | S1 or S2 |
| WKD 707 | Radar meteorology 707 | 12 | S1 or S2 |
| WKD 731 | Overview of tropical and mid-latitude meteorology 731 | 12 | S1 or S2 |
| WKD 733 | Satellite meteorology 733 | 12 | S1 or S2 |
| WKD 763 | Research project 763 | 35 | Y |
| Elective modules: | | | |
| WKD 703 | Seasonal climate modeling 703 | 12 | S1 or S2 |
| WKD 719 | Boundary layer meteorology 719 | 12 | S1 or S2 |
| WKD 734 | Mesoscale Meteorology 734 | 12 | S1 or S2 |
| WKD 736 | Selected Themes 736 | 12 | S1 or S2 |
| WKD 781 | Cloud dynamics 781 | 12 | S1 or S2 |

Special events will be arranged from time to time that you will be required to attend.

Minimum credits: 135

For detailed module descriptions, please consult the University's website *Study > Yearbooks*. Select *Faculty of Natural and Agricultural Sciences* on the left, click on *Honours* and then *BScHons Meteorology* on the right.

6. MODULE DESCRIPTIONS

WKD 703, Seasonal and climate modelling

Fundamentals of Seasonal Forecasting. The El Niño/Southern Oscillation. Empirical Orthogonal Functions. Canon Correlation Analysis. Empirical Forecast Models practical. Sea-Surface Temperature Models. Fully coupled and two-tiered general circulation modelling. Dynamical and empirical downscaling techniques. Significance Testing using Monte Carlo techniques. Modelling pitfalls. User application forecasting. Projections of decadal and multi-decadal climate anomalies.

WKD 704, Numerical modelling: Applications 704

Initial atmospheric state, observation network, data assimilation, initialization, parameterization, post-processing. Ensemble methods, probability forecasting, forecast verification. Global circulation models, limited-area and mesoscale models, variable resolution models, dispersion models. Seamless prediction. Practical applications.

WKD 706, Dynamic meteorology 706

Atmospheric Oscillations: Linear Perturbation Theory (sound waves, shallow water gravity waves, inertia gravity waves, Rossby waves). Baroclinic Instability. Two-layer model. Energetics of Baroclinic waves. Zonally averaged circulation. Angular Momentum Budget. Lorenz energy cycle. Scaling of tropical motions. Programming in meteorology.

WKD 707, Radar meteorology 707

Basic principles and characteristics of the weather radar. The influence of the atmosphere on the propagation of Electro-Magnetic waves. Weather radar equation. The influence of attenuation on observations. The measurement of precipitation with a radar. Doppler Radar. Convective storm analysis with radar.

WKD 719, Boundary layer meteorology 719

Introduction to, and the importance of the boundary layer. Structure of the boundary layer. Transfer of heat

(molecular and turbulent). Impacts of the turbulent nature of the boundary layer on the dynamics of atmospheric motions. Closure and boundary layer parameterisation. Applications to air pollution dispersion.

WKD 731, Overview of tropical and mid-latitude meteorology 731

An overview of the weather and climate of the tropics and the mid-latitudes. Air masses. Instability and cloud formation. Weather systems of the tropics and mid-latitudes. Analysis of weather systems by utilising remote sensed data.

WKD 733, Satellite meteorology 733

Overview of the basic principles of satellite imagery. Types of meteorological satellites. Basic principles of radiation. The different images available, their resolution, and the advantages and limitations of each image. Image interpretation.

WKD 734, Mesoscale meteorology 734

An introduction to mesoscale meteorology. Surface mesoscale features, instability, severe storm classification and thunderstorms, flooding and flash flooding events.

WKD 736, Selected themes 736

A module on an aspect or aspects of meteorology not covered in the existing options with special emphasis in Cloud microphysics and Basic concepts of numerical modelling.

WKD 763, Research projects 763

Introduction to the philosophy of scientific research. Hypothesis testing. Reporting of scientific research. Identification of an appropriate research project. Compilation of a research proposal. Literature survey. Acquisition and manipulation of information. Introduction to innovative strategy and research management. Preparation of a research report (or paper). Presentation of research findings.

WKD 781, Cloud dynamics 781

Scaling and interpretation of equations of motion for mesoscale processes. The role of stability and other trigger actions on initial cloud formation and the evolution of clouds. Shallow and deep convective processes. Tropical and mid-latitude cloud generation processes and characteristics. Cloud splitting. Parameterisation of radiation and heat in atmospheric models. Microphysics parameterisations in numerical models.

7. FEES, FUNDING AND BURSARIES OPPORTUNITIES

For information about fees and funding (including scholarships and bursaries, visit the UP website, www.up.ac.za, click 'Study' menu, then 'Fees and Funding'. Also visit the South African Weather Service's website to check for bursary adverts (www.weathersa.co.za). Click on 'Careers', then 'Bursaries'. **Closing dates of the South African Weather Service and CSIR bursaries are usually towards the end of October and July, respectively.**

8. INFORMATION FOR INTERNATIONAL STUDENTS

The first step for international students is to have their existing academic qualifications evaluated by the South African Qualifications Authority (www.saqa.org.za). It is essential to attach the SAQA certificate to your online application.

Additional information for international students is available on the UP website, www.up.ac.za, click on 'Study' in the top menu, then on 'International Students'.

9. FREQUENTLY ASKED QUESTIONS

The weighted average for my final year was below 60%, will I still be considered for the BScHons Meteorology program?

The weighted average on a transcript is calculated for all the modules completed in that year. For admission to BScHons Meteorology, a prospective student must have an average of 60% or more in the major relevant subjects in the final year of the bachelor's degree.

I am currently completing my final year undergraduate studies, therefore the weighted average for my final year modules is not yet available. Can I still apply for next year?

Yes. Please provide your semester marks when you apply. The selection panel will consider those marks and if applicable, you will be accepted on the condition that your final weighted average is 60% or more.

I completed my B.Tech, will I be considered for the BScHons Meteorology program?

Unfortunately, admission to an Honours degree in the Faculty of Natural and Agricultural Sciences requires that you hold a BSc degree. You may consider applying for the BScHons Meteorology program to get into the bridging program. Alternatively, you could apply for the BSc Meteorology degree. The BSc Meteorology and BScHons Meteorology comply with the basic Instruction Manual for Meteorology as prescribed by the World Meteorology Organization.

I completed my BA degree, will I be considered for the BScHons Meteorology program?

Unfortunately, admission to an Honours degree in the Faculty of Natural and Agricultural Sciences requires that you hold a BSc degree. You could apply for the BSc Meteorology degree. The BSc Meteorology and BScHons Meteorology comply with the basic Instruction Manual for Meteorology as prescribed by the World Meteorology Organization.

I completed a BSc degree in a related field (not meteorology) and received a weighted average of above 60%. Will I qualify for the BScHons Meteorology program immediately?

Your selection for the program will depend on the meteorology-related modules that you completed during your undergraduate degree. The undergraduate modules must meet the admission requirements for the Honours modules listed in Section 5. Remember to attach your full transcripts and yearbook when you apply. The selection panel will then review your transcripts and determine if you meet the admission requirements or if you need to complete additional modules. Refer to Section 4.

How do I know whether the undergraduate modules that I completed meet the admission requirements for the Honours modules?

The prerequisite modules for Honours modules are listed in Section 6. Search for the code of a prerequisite module in the yearbook at <http://www.up.ac.za/yearbooks/home> to find its description. Compare this to the modules that you completed. However, the final decision lies with the selection panel.

10. CONTACT DETAILS

Please email any enquiries to:

Prof Liesl Dyson (academic advisor), liesl.dyson@up.ac.za

Website: <https://www.up.ac.za/ggm>, click on 'Study' > 'Our Programmes'.