There is little disagreement that the planet on which we live is the only resource for human existence. Current changes in the ‘system Earth’ will have a profound impact on our future standard of living. Most prominently, the themes of climate and energy are of great and immediate concern, with bifurcations in a number of fields such as the availability of water and food, global warming and its effects on sea level and weather intensity, but also in terms of the most effective means of exploring and exploiting Earth’s resources. In all these fields, it is evident that Earth is a system in which oceans, solid earth, atmosphere, land cover and cryosphere interact in complex ways and on many different scale levels. There is interaction from micro to global 3D spatial scales and from real-time to geological time scales. The only way in which this system can be properly understood, predicted and exploited is to focus on this interaction via observations and modelling.

Programme
The Geoscience and Remote Sensing MSc track at TU Delft is based on the question of how advanced observation technology – in combination with innovative data processing and modelling techniques – can provide us with adequate information on the system Earth. These empirical results and their interpretation are crucial to making the right decisions for the future of our planet. If you are interested in atmospheric sciences, geophysics, climate change, Earth observation, satellite technology, geodesy and other topics related to geoscience, this is the MSc track for you. An important feature of the track is its high level of flexibility, which enables each individual student to design a personal programme. This flexibility is achieved by providing a core programme comprising fundamental courses on observation theory, understanding the system Earth and geodata acquisition. In addition to this core programme, students choose a personalised curriculum, selecting courses suited to their personal and career interests.
Curriculum Geoscience and Remote Sensing

This track enabled me to design my own study within the programme. I selected mostly remote sensing courses. After completing the courses, I started my thesis in the field of Mathematical Geodesy and Positioning. The topic of my thesis is the estimation of tidal parameters using GPS observations on a buoy. For this multidisciplinary research, we cooperated with the Water Management department of the Faculty of Civil Engineering & Geosciences. I gained knowledge about tidal propagation, probability and estimation theory and GPS. However, the research was not limited to theory: several measurement campaigns were conducted on the Schelde Estuary, creating a nice balance between theoretical and practical work. This balance is, in my view, the most important and fun aspect of working as a geoscience engineer. But, now for the most important question: what are the career opportunities? Well, I was pleasantly surprised. I have worked as a consultant for the oil and gas industry on the topics of geodesy and hydrography, and travelled around the world working on large international projects.

### Programme specialisation

- **Geophysics** focuses on understanding how the system Earth works, analysing results of the latest satellite/groundbased missions and analysing natural hazards, such as earthquakes and volcanoes.
- **Atmospheric sciences** focuses on weather, atmospheric chemistry, clouds and radiation, air quality and aerosols, and climate change.
- **Geodesy and remote sensing** covers surveying, GPS for positioning and navigation, remote sensing, acquiring and analysing geo-data in order to observe the Earth, and monitoring and surveying civil infrastructure.

### Examples of graduation projects

- Precipitation estimation from infrared satellite imagery
- Radar-based rainfall-rate estimation
- Air pollution measurements with a smartphone camera
- Long-term record of Arctic and Antarctic sea ice extents.
- Imaging interseismic motion on the San Andreas fault with space-borne radar

### Master introduction week #

*) or internship upon request

# compulsory

### Theme-electives *)

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<tr>
<th>CIE4603 - Advanced project on GRS</th>
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### Research seminar GRS I

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<th>CIE5601 - Journal club</th>
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### Free electives CIE, AES

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<th>CIE4615 - Fieldwork ‘Iceland’ #</th>
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### Programme specialisation

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<thead>
<tr>
<th>CIE4608</th>
<th>Atmospheric observation</th>
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<tr>
<td>CIE4609</td>
<td>Geodesy and natural hazards</td>
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<tr>
<td>CIE4610</td>
<td>Mass transport n the Earth system</td>
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<tr>
<td>CIE4612</td>
<td>GPS for Civil Engineering &amp; Geosciences</td>
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<tr>
<td>CIE4607</td>
<td>Oceans, sea level and bathymetry</td>
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<td>CIE4608</td>
<td>Ice, snow and climate change</td>
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<tr>
<td>CIE4609</td>
<td>Atmospheric science</td>
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<tr>
<td>CIE4610</td>
<td>Simulation &amp; visualization</td>
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<tr>
<td>CIE4611</td>
<td>Climate change science and ethics</td>
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<tr>
<td>CIE4606</td>
<td>Geo-signal analysis</td>
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<tr>
<td>CIE4607</td>
<td>Geodesy &amp; Remote Sensing #</td>
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<tr>
<td>CIE4608</td>
<td>Physics of the Earth and atmosphere #</td>
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### Examples of graduation projects

- Precipitation estimation from infrared satellite imagery
- Radar-based rainfall-rate estimation
- Air pollution measurements with a smartphone camera
- Long-term record of Arctic and Antarctic sea ice extents.
- Imaging interseismic motion on the San Andreas fault with space-borne radar
Modelling the impact of the last glaciation on vertical movements

- Unmanned Aerial Vehicle (UAV) for Earth science and climate monitoring
- GPS navigation for advanced driver assistance systems

**Career prospects**

Graduates of the GRS programme have a wide choice of career paths. In the fields of geoscience and geo-information, there is a high demand for academic professionals in industry, governmental and institutional organisations and in academia. In industry, you can find graduates with a GRS-background in companies such as Fugro, ARCADIS, Sweco, Shell, NAM, Nuon, Antea Group and numerous small value-adding and surveying companies. Governmental organisations include Rijkswaterstaat, water management boards, provinces, ministries and government-related institutions such as KNMI, TNO, Deltares, NWO and ECN. Our close link with space technology opens the way to traineeships and future careers with the European Space Agency (ESA) and NASA. Our graduates advise on new missions and technology for Earth observation, navigation and space science. Some of our graduates choose an academic career and pursue a PhD degree, either at TU Delft or other universities. Internationally, our graduates can be found working at institutions such as Caltech, Stanford, ETH Zurich, MIT and Politecnico di Milano, to name just a few.

Prof. dr. ir. Herman Russchenberg, Professor Atmospheric Remote Sensing

Observation and modelling related to civil engineering and applied Earth science form the core of the GRS track, since both are prerequisites for understanding, predicting and exploiting the Earth system, and for monitoring and surveying civil infrastructure. Students gain knowledge and skills relevant to remote sensing techniques, analysis and visualization of remote sensing data, methods for modelling and simulation, and extraction of signals of interest for applications in engineering and geosciences.

Graduates from the GRS track serve the rapidly-growing market for accurate monitoring and mapping of our changing Earth, on different temporal and spatial scales, and of civil infrastructure. They are the professionals who understand the technical options available to these ends. They can process and analyse remote sensing data depending on the required application, link these data to models and provide observational evidence, and develop new and innovative applications of these data. For instance, governmental agencies may require the data to develop policy strategies and monitor compliance with environmental regulations; application-oriented businesses are seeking innovative monitoring solutions that use the latest data acquisition techniques; and software engineering companies need technical experts who can lead development programmes in this area.
Admission requirements and application procedures

Dutch BSc degree
If you hold a Dutch BSc degree closely related to the Master’s programme, you will be admitted directly. However, if your undergraduate programme is not closely related to the Master’s programme you will be required to take additional courses in what is called a bridging programme. This may be a standard programme or it may be tailored to your specific situation.

To see which Master’s programmes are open to you on completion of your Bachelor’s degree at a Dutch university, go to www.doorstroommatrix.nl.

Applications through Studielink: www.tudelft.studielink.nl.

Dutch HBO degree
An HBO Bachelor’s degree does not qualify you for direct admission to a TU Delft Master’s programme. You will first need to complete a supplementary programme in order to bring your knowledge to the required level. You can do this during your HBO programme by completing a bridging minor, or by means of a bridging programme after completing your HBO diploma.

Entrance requirements for Mathematics and English (some exceptions) apply to both the bridging minor and the bridging programme.

See www.hbodoorstroom.tudelft.nl for detailed information.

Applications through Studielink: www.tudelft.studielink.nl.

International applicants
To be considered for admission to an MSc programme you will need to meet TU Delft’s general admission requirements.

1. A University Bachelor’s degree (or proof that you have nearly completed a Bachelor’s programme) in a main subject closely related to the MSc programme to which you are applying, with good grades for the key courses.
2. A BSc Cumulative Grade Point Average (CGPA) of at least 75% of the scale maximum.
   • A TOEFL (Test of English as a Foreign Language) with an overall Band score of at least 90 and a minimum score of 21 for each section. Please note that we only accept the TOEFL internet-based test.
   • or an IELTS (academic version) with an overall Band score of at least 6.5 and a minimum of 6.0 for each section.
   • or proof that you have passed the University of Cambridge ‘Certificate of Proficiency in English’ or the University of Cambridge ‘Certificate in Advanced English’ with a minimum grade B.

For international students, the application period starts on 1 October and closes on 1 April. To start an MSc application, please complete the online application and pay the refundable application fee of €100. You will then receive an email with a link to upload the required documents.

For more information about the application procedure and studying at TU Delft in general, go to www.admissions.tudelft.nl.

Introduction week
All international students will be welcomed with the award-winning introduction programme. The introduction consists of a variety of workshops and projects, during which you will get to know other international students, visit the highlights of Delft and learn the ins and outs of the TU Delft campus. After this interesting and fun week, you will be introduced to the CEG faculty. You will receive helpful information about the Dutch education system and meet the fellow students from your programme in a variety of social and educational activities.

For further information
Please visit the webpage for all details, complete requirements, deadlines and contact information: www.tudelft.nl/msc/aes or www.tudelft.nl/msc/cive

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www.campus.tudelft.nl