

Faculty of Science and Engineering

Profile report: *Marine organic carbon cycle*
Mariene organische koolstofcyclus

- Discipline: *Marine Biology*
- Level: *Assistant professor*
- Fte: *0.8-1.0*

1. Scientific discipline

Within the discipline of marine biology, the research emphasis of this position will be on marine organic carbon cycling, with emphasis on the open oceans, and specific focus on the primary producers, its interactions with the inorganic cycle, and its evolving interactions with a changing climate.

2. Vacancy

This position is opened by the Board of the Faculty (*PT/gl/21/00239*) and will be embedded in the Energy & Sustainability Research Institute Groningen (ESRIG), base unit CIO / CIO-oceans. The position falls within the framework of the faculty's career system [Career Paths in Science and Engineering](#). As the focus domain of the position is research, the criteria of the career path with a focus on research apply. Please see the link for more information.

3. Selection committee (BAC)

- (M) Prof. H. A.J. Meijer (CIO, chair)
- (M) Prof. B.D.H.K. Eriksson (director Marine Biology program)
- (M) Prof. R. Bintanja (CIO working group oceans, and KNMI)
- (M) Dr. E.J. Stamhuis (director of education, ESRIG)
- (F) Prof. C.P.D. Brussaard (NIOZ, and UvA)
- (M) Prof. G.-J. Reichart (NIOZ, and UU)
- (F) Prof. J. Falcao Salles (Gelifes)
- M.Sc. student marine biology

expert advisor: (M) Dr. W.H. van de Poll (CIO working group oceans)

HR advisor: (F) D. Smit

4. Area of expertise

The oceans play a crucial role in the global carbon cycle, containing by far the largest reservoir of active carbon on Earth. Terrestrial carbon (organic as well as inorganic) enters the oceans and carbon is exchanged with the atmosphere. This dynamical equilibrium is currently disturbed by anthropogenic carbon emissions, with strong repercussions for climate change. Of the anthropogenic CO₂ emissions into the atmosphere, over 25% is taken up by the oceans. Organic matter plays a crucial role in governing the marine carbon cycle. It primarily originates from the assimilation and fixation of inorganic carbon by phytoplankton, collectively responsible for about 50% of the global primary production. Most of the organic matter undergoes microbial breakdown and only a small portion makes its way to the deeper ocean where it can remain stored for extended period.

Changes in the oceanic carbon cycle will affect the global climate response and climate sensitivity. There is urgent need for an improved (quantitative) understanding of the oceanic carbon cycle and climate feedbacks to this cycle. Improvement of the physical-chemical-biological ocean components in large scale Earth System Models, and validation by observations and laboratory studies are indispensable for this.

The present position aims to advance research on the marine organic carbon cycle, and its main players, drivers and interactions with climate. The rather recent embedding of the Ocean Group in the Centre for Isotope Research (CIO) leads to extensive possibilities to apply stable isotope techniques (and radiocarbon).

5. Embedding: institute (and base unit)

The position is embedded in the Energy & Sustainability Research Institute Groningen (ESRIG). The institute comprises of 6 groups ("base units") with a total around 130 staff (of which \approx 85 PhD students). These groups are CIO (greenhouse gases, carbon cycle and climate, radiocarbon), Geo-Energy (role of the subsurface in energy-related questions), IREES (energy transition, analysis and modelling of energy and resource systems and the relation between science and society), Biomimetics (using evolutionary optimization for technology), Nuclear Energy (new types of nuclear power plants), and the Energy Conversion group (hydrogen, fuel cells, combustion).

The position will be part of the working group oceans of base-unit CIO. "**Global carbon cycle and climate**" is defined as one of the three main research themes within ESRIG. CIO research encompasses, next to oceanic, also the atmospheric and terrestrial compartments of the carbon cycle, with laboratory experiment and field studies, as well as Global Earth System and climate modelling. Laboratory and analytical facilities are and can be made available, including instrumentation for tracer use (atmospheric oxygen, stable isotopes, radiocarbon), as well as climate cabinets, a phytoplankton culture collection, HPLC and basic lab equipment.

The candidate is intended to have a close collaboration with the other ESRIG researchers and expected to contribute to active cooperation with researchers at the NIOZ. Two NIOZ researchers are honorary professors in CIO oceans on the research topics of trace metals chemistry and inorganic carbon cycle. Collaboration with the

NIOZ and KNMI (connected through a part-time professorship at ESRIG) make a high-quality team with internationally leading aspirations. Further national and international collaboration, also for co-use of research vessels, (polar) stations and model infrastructure, is desired.

6. Local and (inter)national position

Within the faculty, marine science is a subject shared with the institute GELIFES, with which collaboration takes place mainly in education. There is a decennia-long and diverse history of collaboration with NIOZ, resulting in many joint projects and publications. A "Roadmap for intensifying collaboration" has been formulated for further strengthening the NIOZ-RUG collaboration, with ESRIG-NIOZ collaboration specifically focusing on the open ocean.

Other national collaboration in the field of carbon cycle research is with the KNMI (including the international EC-Earth System model developing team), the WUR, and other partners in the Ruisdael large scale infrastructure program. This land-based program might well be expanded by a "Ruisdael at sea" proposal for large scale infrastructure. In addition, NIOZ is taking the lead in planning for a proposal for a permanent open ocean observatory.

International collaboration exists with several partners in the European ICOS consortium (especially the UEA and the MPI-BGC), and with the AWI and the BAS, as for the latter two in large oceanographic cruises or in polar programs (Spitsbergen, and Rothera station on Antarctica).

7. Expected contributions to research

The candidate is expected to progress the research within ESRIG on the marine organic carbon cycle and its interaction with climate change (preferably with a focus on primary producers), using observations and models. She is expected to develop her own research line and with time, spearhead her cutting-edge research in the marine organic carbon cycle.

We especially welcome research that includes the photosynthetic primary producers, impacting the structure of the food web, the trophic transfer efficiency and the biological carbon pump. The strength of the impact is crucial for the resilience of marine ecosystems at large, and the role of the ocean in the global (organic) carbon cycle. The largest effects are expected in the (sub)polar regions. We appreciate willingness to continue research in the high latitude seas and oceans. The candidate is expected to drive advancement and ideally, the existing isotope analysis infrastructure of the CIO group can be used and expanded (for example in the direction of compound-specific analysis). Innovative research directions, for example the interplay of viral ecology and primary producers, will be appreciated.

The research programme should mainly be based on extramural funding, which will among others be used to finance PhD students, whom the candidate will supervise. The candidate's efforts will lead to world class, original contributions for this research, and preferably also have a strong societal impact component ("outreach").

8. Expected contributions to education

The candidate is expected to actively contribute to the university teaching programs (30% of her time), first and foremost in the master program Marine Biology, teamed up with the other staff and the honorary professors of ESRIG (who will also connect NIOZ and RUG in teaching). Logical contributions would be to the MSc courses Polar Ecosystems and Principles of Biological Oceanography. Furthermore, the candidate is expected to supervise MSc projects. Continuation of creating the opportunity for students to execute an MSc project by participating in large oceanographic cruises, in collaboration with international partners, is appreciated (as such oceanographic and polar possibilities are crucial for a complete marine biology master program). Further educational activities are in the master program Energy and Environmental Sciences (for example contributions to MSc courses "Climate modelling" and "Sustainable Use of Ecosystems", and MSc projects).

9. Expected contributions to the organization

The candidate is expected to have an active interest and to provide a positive contribution to the management and organizational tasks of the institute. At the level of the Faculty of Science and Engineering, the candidate will contribute to the organization of the faculty, for example by participating in working groups and committees, in the fields of teaching, research and management. The candidate will participate in relevant national and international organizations.