

Faculty of Science and Engineering

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

- Discipline: *Marine Biology*
- Level: *tenure-track assistant professor*
- Fte: *Full time (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. The position falls within the framework of 'Career Paths in Science 4' ('Bèta's in Banen 4'). Please see link for [criteria and conditions](#).

3. Selection committee (BAC)

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

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

HR advisor: D. Smit

4. Research area

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 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. There is urgent need for an improved understanding of the oceanic carbon cycle and climate feedbacks to this cycle. Research questions concentrate on marine primary productivity and/or 'the biological pump' and how these both affect, and are influenced by global climate change.

Changes in the oceanic carbon cycle will affect the global climate response and climate sensitivity. Therefore, more quantitative knowledge is crucial for accurate and reliable future CO₂ scenarios. 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 process of climate warming not only interacts with changes in the inorganic part of the carbon cycle (changes in solubility and pH), but also leads to changes in stratification, salinity, sea ice cover, availability of nutrients and light dynamics. These adjustments influence primary production, phytoplankton community structure and cell size, which in turn impacts the structure of the food web, the trophic transfer efficiency and the biological 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 carbon cycle. The largest effects are expected in the (sub)polar regions.

Focus of the present position will be the continuation of ESRIG research on the marine organic carbon cycle and its interactions with climate, with the main players of study being the primary producers. Excellent and intensifying collaboration with the NIOZ (e.g. trace metals dynamics and the inorganic carbon cycle) and KNMI (connected through a part-time professorship at ESRIG) make a high-quality team with internationally leading aspirations. In-house research done on the atmospheric and terrestrial parts of the carbon cycle (observational and modelling, in collaboration with the WUR) completes the picture.

5. Embedding: institute (and base unit)

The position will be embedded in the Energy & Sustainability Research Institute Groningen (ESRIG). The institute comprises of 6 groups ("base units") with a total of some 130 staff. These groups are Centre for Isotope Research (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. The **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 by global Earth System and climate modelling. Extensive laboratory and analytical facilities are available, including climate rooms, a phytoplankton culture collection, HPLC pigment analysis, PAM and FRRf, and instrumentation for using tracers (atmospheric oxygen, stable isotopes, radiocarbon). In addition, field work equipment is available.

6. Local and (inter)national position

The CIO working group Oceans (previously part of Ocean Ecosystems) focuses on marine primary productivity and polar research. 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 specifically focussing on 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. There are plans to expand this land-based program with a "Ruisdael at sea".

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 continue and extend the research within ESRIG on the marine organic carbon cycle. (S)he is supposed to focus on the interaction between the carbon cycle and climate change (in which the primary producers are key), using observations and models. The main area of research can continue to be the polar regions, but can also be broadened or shifted; this is up to the candidate. Ideally, the existing experimental infrastructure of the group (and of other laboratories within ESRIG) can continue to be put to effective use.

It is intended to have a close collaboration with the other ESRIG researchers and an active cooperation with researchers at the NIOZ is expected. National and international collaboration, also for co-use of research vessels, (polar) stations and model infrastructure, is desired. 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 teaching

The candidate is expected to be actively teaching (30% of her/his 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 a 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.