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Lionel Arteaga

Research Overview

The focus of my scientific research is on ocean biogeochemical cycles, with particular interest in the connection between the global carbon cycle, marine ecosystems, and climate. I specialize in the use of numerical models, satellite observations, and autonomous profiling platforms, to understand and quantify how marine biological productivity affects changes in the concentration and turnover of chemical elements in the ocean, and its potential feedbacks on the climate system.

Education

- **Ph.D Ocean Biogeochemistry**. 2015. GEOMAR | University of Kiel (Germany).
  Thesis title: *Combining model and satellite analyses to describe phytoplankton growth.*
  Supervisors: Prof. Dr. Andreas Oschlies, Dr. Markus Pahlow.
  Honor distinction: *Summa Cum Laude.*

  Research Visit. March – September, 2014. Climate Change Research Center
  University of New South of Wales (Australia).
  Project: *Adaptation of an optimality-based phytoplankton model into a global circulation earth-system climate model.*
  Supervisor: Ass. Prof. Katrin Meissner.

- **M.Sc. Biological Oceanography**. 2011. IFM-GEOMAR | University of Kiel (Germany).
  Thesis title: *Evaluation of regional patterns of light and nutrient colimitation in the global ocean. A modelling approach.*

- **Lic. Biology**. 2008. Universidad Simón Bolívar (Venezuela).
  Thesis title: *Description of the Venezuelan gulf upwelling system through satellite data.*
  Honor distinction: Outstanding licenciatura dissertation.

Awards

- 2019 Visiting Scholarship at the Institute of Marine and Antarctic Studies (IMAS), University of Tasmania, Australia.
- NASA ROSES-2016 A.5 Carbon Cycle Science (2017): *Determination of the relationship between primary production and net community production in the Southern Ocean through the use of profiling floats, satellite data, and ecosystem models.*
- Prof. Dr. Werner Petersen-Stiftung prize for outstanding doctoral thesis 2014/2015.
- ISOS Integrated School of Ocean Sciences Kiel PhD miniproposal award 2014: *Ocean Biogeochemistry under Changing Climate with a Phytoplankton Optimality-based model.*

Research Experience

- 2018 - present: **Associate Research Scholar. Princeton University:** Assessment of biological export and primary production in the Southern Ocean using biogeochemical profiling floats and satellite lidar as part of the Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM) program, https://soccom.princeton.edu).
- 2015 - 2018: **Postdoctoral Research Associate. Princeton University:** Development of empirical models and ecological theories to explain the regulation of the carbon cycle in the Southern Ocean. Analysis of satellite data and autonomous profiling systems (SOCCOM program).
- 2011 - 2015: **Research Assistant. GEOMAR Helmholtz Centre for Ocean Research Kiel (Germany):** Analysis of numerical models to evaluate the limitation of organic carbon productivity in the global ocean. Development of algorithms to predict surface ocean nutrients from satellite observations.
- 2014, Mar-Sep: **Visiting Scientist. Climate Change Research Center, UNSW (Australia):** Improvement of an Earth-sytem climate model through the incorporation of an adaptable, optimality-based marine biogeochemical model.
- 2008 - 2009: **Research Scientist. Oceanographic Digital Observatory, Universidad Simón Bolívar (Venezuela)**: Time-series analysis of satellite temperature and chlorophyll to understand changes in upwelling-driven biological productivity in the Caribbean Sea. http://ood.cbm.usb.ve/wiki/surgencia_golfo_vzla

Teaching Experience

- Summer, 2018 and 2019: **Supervisor of summer interns for the Princeton Environmental Institue (PEI) internship program. Princeton University**. Scientific mentoring of the project: *Correlations between surface ocean pCO_2 and lidar-based phytoplankton biomass estimates* (2018) and *Interannual variation in Southern Ocean phytoplankton inferred from space-based lidar* (2019).
- 2017 – Present: **Coordinator of the PEI internship program for the Sarmiento group. Princeton University**. Recruitment and coordination of summer students for the Sarmiento group in the Atmospheric and Oceanic Sciences program.
- Spring, 2017: **Teaching assistant. Princeton University**. Grader and assistant of the course *Geo-202: Ocean, Atmosphere and Climate*, dictated by Prof. Jorge L. Sarmiento.
- Spring, 2013: **Teaching assistant. University of Kiel (Germany)**. Assistant of the course *MNF-bioc-335 : Biogeochemical Modeling*, dictated by Prof. Andreas Oschlies and Dr. Markus Pahlow.
- 2007 - 2008: **Teaching assistant. Universidad Simón Bolívar (Venezuela)**. Teaching and support activities on expeditions of the practical course of *Ecology II*, within the curriculum in *Biology*.

Peer-reviewed Publications

In preparation

- Arteaga, L., A. Amatya, and J. L. Sarmiento (2019a), Interannual trends in polar antarctic phyoplankton inferred from satellite lidar, *In preparation*

- Arteaga, L., E. Boss, M. J. Behrenfeld, T. K. Westberry, and J. L. Sarmiento (2019b), The "Disturbance-Recovery" hypothesis explains phytoplankton bloom cycles in the Southern Ocean, *In preparation*
- Pahlow, M., C.-T. Chien, L. Arteaga, and A. Oschlies (2019), Optimality-Based Non-Redfield Plankton-Ecosystem Model in the UVic-ESCM. Part I: Implementation and Model Behaviour, *In preparation*

Published

- Arteaga, L. A., M. Pahlow, S. M. Bushinsky, and J. L. Sarmiento (2019c), Nutrient controls on export production in the southern ocean, *Global Biogeochemical Cycles*, *In press*, doi: 10.1029/2019GB006236
- Arteaga, L., N. Haeëntjens, E. Boss, K. S. Johnson, and J. L. Sarmiento (2018), Assessment of export efficiency equations in the Southern Ocean applied to satellite-based net primary production, *Journal of Geophysical Research: Oceans*, doi: 10.1002/2018JC013787
- Arteaga, L., M. Pahlow, and A. Oschlies (2016), Modeled Chl:C ratio and derived estimates of phytoplankton carbon biomass and its contribution to total particulate organic carbon in the global surface ocean, *Global Biogeochemical Cycles*, doi: 10.1002/2016GB005458, 2016GB005458
- Arteaga, L., M. Pahlow, and A. Oschlies (2015), Global monthly sea surface nitrate fields estimated from remotely sensed sea surface temperature, chlorophyll, and modeled mixed layer depth, *Geophysical Research Letters*, *42*(4), 1130–1138, doi: 10.1002/2014GL062937, 2014GL062937
- Arteaga, L., M. Pahlow, and A. Oschlies (2014), Global patterns of phytoplankton nutrient and light colimitation inferred from an optimality-based model, *Global Biogeochemical Cycles*, *28*(7), 648–661, doi: 10.1002/2013GB004668
- Kalvelage, T., G. Lavik, P. Lam, S. Contreras, L. Arteaga, C. R. Löscher, A. Oschlies, A. Paulmier, L. Stramma, and M. M. M. Kuypers (2013), Nitrogen cycling driven by organic matter export in the South Pacific oxygen minimum zone, *Nature Geoscience*, *6*(3), 228–234, doi: 10.1038/ngeo1739

Presentations at Scientific Conferences

- **Arteaga, L**, Pahlow, M, and Jorge Sarmiento. *Nutrient controls on export production in the Southern Ocean.* **Oral presentation** at the *SOCCOM annual meeting*, Princeton, USA. May, 2019.
- **Arteaga, L**, Pahlow, M, and Jorge Sarmiento. *Mesopelagic remineralization and surface nutrient limitation of export production in the Southern Ocean,.* **Poster presentation** at the *CMIP6 Workshop*, Washington, D.C., USA. December, 2018.
- **Arteaga, L**, Pahlow, M, and Jorge Sarmiento. *Estimation of Southern Ocean particle flux with SOCCOM floats.* **Oral presentation** at the *SOCCOM annual meeting*, Princeton, USA. June, 2018.
- **Arteaga, L**, Haëntjens, N., Boss, E., Johnson K., and Jorge Sarmiento. *Assessment of export efficiency equations in the southern ocean applied to satellite-based net primary production.* **Oral presentation** at the *Ocean Sciences Meeting*, Portland, USA. February, 2018.
- **Arteaga, L**, Pahlow, M and A. Oschlies. *Modeled chl:c ratio and derived estimates of phyto- plankton carbon biomass and its contribution to total particulate organic carbon in the global surface ocean.* **Poster presentation** at the *Advances in Marine Ecological Modelling*, Plymouth, England. July, 2017.

- **Arteaga, L**, Haëntjens, N., Boss, E., Johnson K., and Jorge Sarmiento. *Float and satellite-based assessment of export production in the Southern Ocean* . **Poster presentation** at the *Third Internation Ocean Colour Science Meeting*, Lisbon, Portugal. May, 2017.
- **Arteaga, L**, Haëntjens, N., Boss, E., Johnson K., and Jorge Sarmiento. *Float and satellite-based assessment of export production in the Southern Ocean* . **Oral presentation** at the *SOCCOM annual meeting*, Princeton, USA. May, 2017.
- **Arteaga, L**, Pahlow, M and A. Oschlies. *Global Chl:C ratio and primary production: Combining satellite and mechanistic models of phytoplankton growth* . **Poster presentation** at the *Ocean Carbon and Biogeochemistry Workshop*, Woods Hole, USA. July, 2016.
- **Arteaga, L**. *Global Chl:C ratio and optically-derived NCP in the Southern Ocean.* **Oral presentation** at the *SOCCOM annual meeting*, San Diego, USA. May, 2016.
- **Arteaga, L**, Pahlow, M and A. Oschlies. *Global Chl:C ratio and primary production: Combining satellite and mechanistic models of phytoplankton growth* . **Poster presentation** at the *Ocean Sciences Meeting*, New Orleans, USA. February, 2016.
- **Arteaga, L**, Pahlow, M and A. Oschlies. *Changes in phytoplankton stoichiometry inferred optimality-based model.* **Oral presentation** at the *Aquatic Sciences Meeting*, Granada, Spain. February, 2015.
- **Arteaga, L**, Pahlow, M and A. Oschlies. *Global patterns of phytoplankton nutrient and light colimitation inferred from an optimality-based model.* **Poster presentation** at the *Ocean Sciences Meeting*, Honolulu, Hawaii. February, 2014.
- **Arteaga, L**, Pahlow, M and A. Oschlies. *Satellite-derived ocean primary production inferred from an optimality-based phytoplankton model.* **Oral presentation** at the 45^{th} *International Liège Colloquium: Primary production in the ocean: from the synoptic to the global scale*, Liège, Belgium. May, 2013.
- **Arteaga, L**, Pahlow, M and A. Oschlies. *Satellite-derived ocean primary production inferred from an optimality-based phytoplankton model.* **Poster presentation** at the *International Ocean Colour Science Meeting*, Darmstadt, Germany. May, 2013.
- **Arteaga, L**, Pahlow, M and A. Oschlies. *Light and Nutrient Colimitation in the Global Ocean.* **Oral presentation** at the *Ocean Strategic Services Services beyond 2015 (OSS2015) progress meeting*, Centre for Maritime Research and Experimentation, La Spezia, Italy. July, 2012.
- **Arteaga, L**, Pahlow, M and A. Oschlies. *Light and Nutrient Colimitation in the Global Ocean.* **Poster presentation** at the *European Geosciences Union General Assembly*, Vienna, Austria. April, 2012.
- Klein, E, Chollet I, Romero C, and **L. Arteaga**. *On the Size of Upwelling systems.* **Poster presentation** at the *Dynamics of Eastern Boundary Upwelling Ecosystems Symposium*, Las Palmas, Gran Canaria, Spain. June, 2008.

Attended Special Courses and Summer Schools

- NASA *Calibration and Validation of Ocean Color Remote Sensing 2017.* Darling Marine Center, Maine. 10 July – 5 August, 2017.
- ARC Climate System Science Winter School *Geophysical Fluid Dynamics.* Canberra, Australia. 16 – 20 June, 2014.

- SFB 754 Summer School *Climate-Biogeochemistry Interactions in the Tropical Ocean.* Kristineberg, Sweden. 18 – 30 August, 2013.
- GreenSeas Summer School *Global plankton data: ecosystems, monitoring and modelling in an era of global warming.* Cape Town, South Africa. 27 January – 3 February, 2013.
- *European Earth System and Climate Modelling School* (Organized by the Max Planck Institute for Meteorology -Hamburg- and the National Centre for Atmospheric Science -Reading-). Kos, Greece. 1 – 11 June, 2012.
- *Fortran for Scientific Computing.* High Performance Computing Center Stuttgart (HLRS), Stuttgart, Germany. 5 – 9 March, 2012.
- MEECE Summer School *Marine Ecosystem Evolution in a Changing Environment.* Ankara, Turkey. 7 – 14 September, 2011.
- 6^{th} Sino-German Summer School, *Responses of Ocean Biogeochemistry to Global Change.* Kiel, Bremen and Bremerhaven, Germany. 26 July – 6 August, 2010.

Oceanographic Cruises

- Benthic and biogeochemical sampling along the western Baltic Sea, on the German vessel *Alkor.* October, 2010.

Software Skills

- Numerical computing: MATLAB, Fortran, Python.
- Operative Systems: Unix (Mac), Linux, Windows.
- General: LaTex, Microsoft office (Word, Power Point, Excel).

Languages

- Spanish: Mother tongue.
- English: Excellent.
- German: Level B1 (Intermediate).
- Italian: Basic/Conversational.

Academic References

- Prof. Dr. Jorge L. Sarmiento (Postdoc supervisor, Princeton University, jls@princeton.edu)
- Prof. Dr. Andreas Oschlies (PhD and Master supervisor, GEOMAR | University of Kiel, aoschlies@geomar.de)
- Dr. Habil. Markus Pahlow (PhD and Master co-supervisor, GEOMAR | University of Kiel, mpahlow@geomar.de)
- Ass. Prof. Katrin Meissner (PhD co-supervisor, CCRC | University of New South of Wales, k.meissner@unsw.edu.au)