Benoît Pasquier

Affiliation

Department of Earth System Science
University of California, Irvine
California, CA, 92697
USA

pasquieb@uci.edu
briochemc@gmail.com
+1 949 558 1022 / briochemc
briochemc / benoitpasquier

Research Interests

A fascinating consequence of the fluid nature of open-ocean ecosystems and nutrient cycles is that perturbations in one part of the ocean can influence biological production on the other side of the world. My focus has been on this interplay between the ocean's circulation and biology on the global scale.

During my PhD, I investigated fundamental scientific questions of global ocean biogeochemical cycles using cutting-edge mathematical tools. Specifically, I explored the teleconnections of the global biological pump by developing and using state-of-the-art inverse models of the phosphorus, silicon, and iron cycles. More recently, through my postdoctoral appointment, I have been developing tools to improve standard forward biogeochemistry models via offline optimization strategies. I have also developed novel Green-function-based diagnostics to investigate the marine iron cycle with more detail than ever before, and I plan to leverage the potential of these new diagnostics by applying them to other global biogeochemical cycles.

There is a need to improve the current representation of biogeochemical processes in models. There is also ample room to develop new models that are simultaneously simple to use and understand, efficient and fast to run, and suitable for the novel diagnostics I have become familiar with. By providing clear quantitative answers, these tools help decipher complex global interactions of the oceanic nutrient cycles. In addition, I strive to push our scientific community towards more openness, to facilitate collaboration, code review, and reproducibility.

Education

2013—2017 **PhD in Applied Mathematics** University of New South Wales, Sydney, Australia

Supervisor: **Mark Holzer**. Modeling and diagnosing ocean biogeochemical cycles.
Thesis title: *The Ocean's Global Iron, Phosphorus, and Silicon Cycles: Inverse Modelling and Novel Diagnostics.*

- Global Biogeochemical Cycles, Global Biological Pump
- Ecosystem Modeling & Biogenic Transport Modeling
- Green Functions Techniques (Path Densities, Flow Rates, Time Scales)
- Inverse Modeling (Newton's Method for Root Finding and Optimization)
- Iron Control on the Global Biological Pump
- Southern Ocean Nutrient Trapping

2010 **MSc in Environmental Science** University of New South Wales, Sydney, Australia

Study of the nature of environmental problems and the methodology of their evaluation and management.

- Geophysical Fluid Dynamics (taught by **Mark Holzer**)
- Oceanography (**Katrin Meissner**)
- Project Management, Environmental Risk Management

2007—2008 **MSc in Finance Mathematics** Paris Dauphine + ENSAE ParisTech, Paris, France

MASEF (Mathematics of Insurance, Economics and Finance), Finance specialty.

- Stochastic Calculus, Levy Processes with Jumps
- Stochastic Differential Equations
- Numerical Methods (Monte Carlo)

2004—2007 **MSc in Mathematics & Engineering** École Polytechnique, Palaiseau, France

Pure mathematics specialization.

- Algebra, Arithmetics, Numerical Methods
- Differential Topology, Relativity
- Physics, Biology

2001—2004 **Preparatory Classes** Lycée Masséna, Nice, France

French Preparatory Classes, mathematics specialty.

- Linear Algebra, Topology, Numerical Methods
- Mechanics, Electromagnetism, Thermodynamics

Professional Experience

Sep 17—Present **Postdoctoral Research Scholar** University of California, Irvine, CA, USA
Working on developing new tools and on improving global biogeochemistry models with **J. Keith Moore** and **François Primeau**.

Mar 17—Aug 17 **Casual Research Assistant** University of New South Wales, Sydney, Australia
Continuing PhD work with **Mark Holzer**.

Jun 16—Dec 16 **Mathematics Tutor** University of New South Wales, Sydney, Australia
Numerical Methods and Statistics, 2nd year.

May 11—Aug 12 **Proposal Engineer** Degrémont, Suez Environnement, Sydney, Australia
Managed tendering projects for Design, Construction, Maintenance and Operation contracts. Participated in business development, liaising with potential clients, advertising on company capabilities.

Jul 08—Jun 09 **Currency Trader Assistant** Société Générale Investment Banking, Paris, France
MASEF Internship, researched new detection and calculation techniques for high frequency data used in automated arbitrage. In particular, developed algorithms to evaluate unbiased stochastic moments in real-time.

Apr 07—Jul 07 **Mathematics Research Intern** École Polytechnique, Palaiseau, France
École Polytechnique Specialty (Mathematics) Internship at the Laurent Schwartz Mathematics Center under the direction of **Jean Lannes**. Calculated the Witt ring of quadratic forms defined on number fields, on the field of p-adic numbers, and on Dedekind rings such as the integers.

Sep 04—Feb 05 **IT Intern** Bioforce, Lyon, France
Bioforce provides training and careers advice in aid programmes and logistics. Developed an Access database to improve communication and management.

Other Skills

Scientific Programming

MATLAB / Julia	**Extensive use**
java / C++	**Competent**
Ruby / Python / Stan	**Little experience**

Languages

French	**First language**
English	**Fluent**
Italian	**Intermediate**
Japanese	**Novice**

References

François Primeau
Department of Earth System Science
University of California, Irvine
CA, 92697, USA
fprimeau@uci.edu

Mark Holzer
Department of Applied Mathematics
School of Mathematics and Statistics
University of New South Wales
NSW, 2035, Australia
mholzer@unsw.edu.au

Trevor McDougall
Department of Applied Mathematics
School of Mathematics and Statistics
University of New South Wales
NSW, 2035, Australia
trevor.mcdougall@unsw.edu.au

J. Keith Moore
Department of Earth System Science
University of California, Irvine
CA, 92697, USA
jkmoore@uci.edu

Patrick Rafter
Department of Earth System Science
University of California, Irvine
CA, 92697, USA
prafter@uci.edu

Katrin Meissner
Climate Change Research Centre
University of New South Wales
NSW, 2035, Australia
k.meissner@unsw.edu.au

Publications

[2] The number of past and future regenerations of iron in the ocean and its intrinsic fertilization efficiency
B. Pasquier, M. Holzer
Biogeosciences *15.23 (2018) pp. 7177–7203* DOI: 10.5194/bg-15-7177-2018.

[3] Inverse-model estimates of the ocean's coupled phosphorus, silicon, and iron cycles
Benoît Pasquier, Mark Holzer
Biogeosciences *14.18 (2017) pp. 4125–4159* DOI: 10.5194/bg-14-4125-2017.

[4] The age of iron and iron source attribution in the ocean
Mark Holzer, Marina Frants, Benoît Pasquier
Global Biogeochemical Cycles *30.10 (2016) pp. 1454–1474* DOI: 10.1002/2016GB005418.

[5] The plumbing of the global biological pump: Efficiency control through leaks, pathways, and time scales
Benoît Pasquier, Mark Holzer
Journal of Geophysical Research: Oceans *121.8 (2016) pp. 6367–6388* DOI: 10.1002/2016JC011821.

[0] The F-1 method
Benoît Pasquier, François Primeau
SIAM Journal on Scientific Computing *(in preparation)* .

Conference Presentations

[1] Inverse-model estimates of the ocean's coupled phosphorus, silicon, and iron cycles.
Benoît Pasquier, Mark Holzer
Ocean Sciences Meeting, 2018, Portland, Oregon, USA.

[2] Response of the biological pump to perturbations in the iron supply: Global teleconnections diagnosed using an inverse model of the coupled phosphorus-silicon-iron nutrient cycles
Benoît Pasquier, Mark Holzer
AMOS National Conference, 2017, Canberra, Australia.

[3] Iron control on global productivity: an efficient inverse model of the ocean's coupled phosphate, silicon, and iron cycles
Benoît Pasquier, Mark Holzer
Ocean Sciences Meeting, 2016, New Orleans, Louisiana, USA.

[4] The plumbing of the global biological pump
Benoît Pasquier, Mark Holzer
AMOS National Conference, 2015, Brisbane, Australia.

Honors and Awards

2015 **Scolarship** — Cuomo Foundation, Monaco

2014 **Scolarship** — Frères Louis et Max Principale Foundation, Monaco

2014 - 2016 **Scolarship** — Monaco Government, Monaco
Higher studies scholarship

2013 **Scolarship** — Monaco Government, Monaco
H.S.H. The Prince Albert II Exceptional Scholarship

2013 - 2016 **Scolarship** — Monaco Scientific Centre, Monaco

2013 - 2016 **Tuition Fee Scholarship** — Graduate Research Shcool, UNSW, Sydney, Australia

2004 - 2008 **Scholarship** — Monaco Government, Monaco
Higher studies scholarship