

# François W. Primeau

## Curriculum Vitae (revised September 2009)

### **Personal**

Present Position: Associate Professor (effective July 1, 2008)

Office Address: Earth System Science Department  
3216 Croul Hall,  
University of California, Irvine  
Irvine, CA 92697-3100

Office Telephone: (949) 824-9435

Citizenship: Canada,  
United States Permanent Resident

### **Education**

B.Math, 1990 Applied Math with Physics Electives, University of Waterloo, Waterloo  
Ontario, Canada

M.Sc., 1992 Mathematics, University of Alberta, Edmonton Alberta, Canada

Ph.D., 1998 Physical Oceanography, Massachusetts Institute of Technology/Woods  
Hole Oceanographic Institution

### **Appointments**

2008- Associate Professor, Earth System Science, University of California,  
Irvine, Irvine, CA

2008- Vice Chair for Graduate Studies, Earth System Science, University of  
California, Irvine

2008 Visiting Professor, Research Center for Environmental Change,  
Academia Sinica, Taipei, Taiwan

2001-2008 Assistant Professor, Earth System Science, University of California,  
Irvine, Irvine, CA

2007 Visiting Professor, Physics Department Universite catholique de Louvain,  
Belgium, Aug 25-Sep 22

1999-2001 Post-doctoral Scholar, University of Victoria / Canadian Climate Centre  
for Modelling and Analysis, Victoria, British Columbia

1998-1999 Post-doctoral Researcher, Scripps Institution of Oceanography, La Jolla,  
CA

1992-1998 Research Assistant, Massachusetts Institute of Technology, Cambridge,  
MA

1991-1992 Teaching Assistant, Department of Mathematics, University of Alberta,  
Edmonton, Alberta

### **Scientific Interests**

Physical Oceanography, Large-scale Dynamics, Climate, Global-scale Tracer  
Oceanography and Biogeochemical Cycles

## **Professional Activities**

Member of the Organizing Committee for the “16th Conference on Atmosphere and Ocean Fluid Dynamics“, 25-29 June 2007, Santa Fe, New Mexico

Session chair – Model developments for large- and small-scale processes in the ocean, EGU General Assembly, 15-20 April 2007, Vienna

American Meteorological Society Atmosphere and Ocean Fluid Dynamics Committee Member, June 2003-2006

Co-organizer of the CLIVAR sponsored international workshop “Multidecadal to Centennial Global Climate Variability“, 15-17 November 2006, Honolulu, Hawaii

Panelist – National Science Foundation Physical Oceanography Research Program

Panelist – National Science Foundation Chemical Oceanography Research Programs

Panelist - University of California Coastal Environmental Quality Initiative research grants

Reviewer - Journal of Physical Oceanography, Journal of Climate, Journal of Atmospheric Science, Dynamics of Atmospheres and Oceans, Climate Dynamics, Journal of Geophysical Research (Oceans), Nonlinear Processes in Geophysics, Journal of Marine Research, Deep Sea Research Part 1, Global Biogeochemical Cycles, Environmental Fluid Mechanics, National Science Foundation Physical Oceanography, Mathematical Geosciences and Atmospheric Sciences proposals, EOS Transactions American Geophysical Union

## **Professional Society Memberships**

American Geophysical Union

American Meteorological Society

## **Teaching**

Physical Oceanography (graduate and undergraduate)

Oceanography (undergraduate)

Data Analysis for Climate Sciences (undergraduate)

Geosciences Data Analysis and Modeling (graduate)

Atmospheric and Ocean Dynamics (graduate)

Topics in Climate (graduate)

Topics in Biogeochemistry (graduate)

## **Graduate, Undergraduate and Postgraduate Advising**

### **Current Student:**

Tim DeVries, Ph.D.

Pei Yuan Hsieh, Ph.D.

Ann Bardin, Ph.D.

### **Previous Students:**

Eun Young Kwon, Ph.D.

Yina Liu, Undergraduate Senior Thesis

Andrea Steinberger, Undergraduate Senior Thesis

### **Postdoctoral Associate:**

Xingwen Li

### **Sea Going Experience**

R/V Knorr, WOCE South Indian Ocean Hydrographic Sections (I8S/I9S),  
1 December 1994 to 19 January 1995

### **Honors and Awards**

University of California, Irvine School of Physical Sciences Outstanding Contributions to Undergraduate Education 2002-2003

Named by Andrea Steinberger as the faculty member who had the most impact on them at UCI, 2003 Honors Convocation

Natural Science and Engineering Research Council (NSERC) graduate studies scholarship, Canada, 1992.

### **Funding History**

2009-2012, "Collaborative Research: The Role of Basin Modes in Pacing Pacific Decadal Variability", NSF OCE Physical Oceanography, PI, UCI part \$206,145.00, total \$587,556.00

2007-2010, "Collaborative Research: New Diagnostics of Water-Mass Ventilation Estimated from Tracer Data", NSF OCE Physical Oceanography, lead-PI, UCI part \$270,312.00, total \$684,229.00

2006-2009, "New Techniques for Simulating and Analyzing Biogeochemical Tracers in Seasonally Varying Global Ocean Models", NSF OCE Chemical Oceanography, lead PI \$398,008.00

2003, "Acquisition of an Earth System Modeling Facility for Coupled Climate Chemistry and Biogeochemistry Studies" NSF, Co-PI \$1,105,000.00

2003, "A new approach for estimating advective flow and eddy diffusivity using Lagrangian data" Physical Sciences committee on Research Grant, PI \$3,500.00

2002-2006, "A modeling study of the intrinsic low-frequency variability of the Gulf Stream and Kuroshio Extension systems", NSF OCE Physical Oceanography, sole-PI \$376,882.00

### **UCI Service**

Member of the Mathematics Diagnostics Testing Project (MDTP) Working Group 2008-present

Faculty advisor for undecided and undeclared students at the University of California Irvine, 2001-2003

Mentor for UC California Alliance for Minority Participation in science, engineering and mathematics 2005

Academic Senate School of Physical Sciences Representative Fall 2005-2006

Grader for Test of Oral English Proficiency (TOEP), Fall 2005-present

Selection Committee for Faculty Endowed Fellowships 2005

Selection Committee for ARCS fellowship nominations 2006

## **Community Outreach**

- "The Oceans and Global Warming" Fullerton College Futures Speaker, May 2007
- "The Science of Tsunamis" UCI Extension Osher Lifetime Education Fall 2005 Program, 14 October 2005
- "Understanding Ocean Transport", Presented to the UCI FOCUS (Faculty Outreach Collaborations Uniting Scientists, Students and Schools) program, Irvine, CA, 3 August 2005.
- "The Science of Tsunamis", UCI Mesa Court Faculty Involvement Program, 24 February 2005
- "How Tsunamis Work", UCI Coalition for Tsunami Relief Effort Forum organized by The American Red Cross at UCI, also served as panelist, 26 January 2005
- Panelist on COX Forum channel 3 for discussion about earthquakes and tsunamis with special attention to the potential risks for California's coastline, 13 January 2005

## **Refereed Publications**

1. Primeau, F. W. and G. E. Swaters, 1994: The Effect of Alongshore Topographic Variation and Bottom Friction on Shelf Wave Interactions. *Journal of Physical Oceanography*, 24,1021-1039.
2. Primeau, F. W., 1998: Multiple Equilibria of a Double-Gyre Ocean Model with Super-Slip Boundary Conditions. *Journal of Physical Oceanography*, 28, 2130-2147.
3. Cessi, P. and F. W. Primeau, 2001: Dissipative selection of low-frequency modes in a reduced gravity basin. *Journal of Physical Oceanography*, 31, 127-137.
4. Primeau, F. and P. Cessi, 2001: Coupling between wind-driven currents and mid-latitude storm tracks. *Journal of Climate*, 14, 1243-1261.
5. Primeau, F., 2002: Multiple equilibria and low-frequency variability of wind-driven ocean currents. *Journal of Physical Oceanography*, 32, 2232-2256.
6. Primeau, F., 2002: Long Rossby wave basin-crossing time and the resonance of low-frequency basin modes. *Journal of Physical Oceanography*, 32, 2652-2665.
7. Hall, T. and F. W. Primeau, 2004: Separating the Natural and Anthropogenic Air-Sea Flux of CO<sub>2</sub>: The Indian Ocean, *Geophys. Res. Lett.*, 31, L23302, doi:10.1029/2004GL020589.
8. Primeau, F., 2005: Characterizing transport between the surface mixed layer and the ocean interior with a forward and adjoint global ocean transport model. *Journal of Physical Oceanography*, 35, No. 4, pp. 545-564. doi: 10.1175/JPO2699.1
9. Primeau, F. and M. Holzer 2006: The Ocean's Memory of the Atmosphere: Residence-Time and Ventilation-Rate Distributions of Water Masses. *Journal of Physical Oceanography*, 36, 1439-1456
10. Holzer, M., and F. W. Primeau 2006: The Diffusive Ocean Conveyor. *Geophys. Res. Lett.*, 33, L14618, doi:10.10292006GL026232.
11. Primeau, F. 2006: On the variability of the exponent in the powerlaw depth dependence of POC flux estimated from sediment traps. *Deep Sea Research Part I*, 53, 1335-1343 doi:10.1016/j.dsr.2006.06.003
12. Krakauer, N.Y., J. T. Randerson, F. W. Primeau, N. Gruber, and D. Menemenlis, 2006: Carbon isotope evidence for the latitudinal distribution and wind speed

- dependence of the air-sea gas transfer velocity. *Tellus* 58B, 390-417.
13. \*Kwon, E.Y. and F. Primeau 2006: Sensitivity and Optimization Study of a Biogeochemistry Ocean Model using an Implicit Solver and In-Situ Phosphate Data. *Global Biogeochemical Cycles*, 20, GB4009 doi:10.1029/2005GB00236114.
  14. Primeau, F. and D. Newman 2007: Bifurcation Structure of a Wind-Driven Shallow Water Model with Layer-Outcropping. *Ocean Modelling*, doi:10.1016/j.ocemod.2006.10.003
  15. Primeau, F. and D. Newman 2007: Elongation and Contraction of the Western Boundary Current Extension in a Shallow-Water Model: a Bifurcation Analysis. *In press, Journal of Physical Oceanography*.
  16. Holzer M., and F. Primeau 2008: The path-density distribution of oceanic surface-to-surface transport. *Journal of Geophysical Research, Oceans*. 113, C01018, doi:10.1029/2006JC003976.
  17. \*Kwon, E.Y. and F. Primeau 2008: Optimization and Sensitivity of a Global Biogeochemistry Ocean Model using Combined In-Situ, DIC, Alkalinity and Phosphate Data. *Journal of Geophysical Research Oceans, In press*.
  18. \*\*Li, X, and F. Primeau 2008: A Fast Newton-Krylov Solver for Seasonally Varying Global-Ocean Biogeochemistry Models. *Ocean Modelling*, 23, 13-20.
  19. Martiny, A.C., A.P.K. Tai, D. Veneziano, F. Primeau, and S.W. Chisholm, 2008: Taxonomic resolution, ecotypes and the biogeography of Prochlorococcus, *Environmental Microbiology*, doi10.1029/2007JC004520.
  20. Primeau, F. and E. Deleersnijder, 2009: On the time to tracer equilibrium in the global ocean. *Ocean Science*, 5, 13-28, [www.ocean-sci.net/5/13/2009](http://www.ocean-sci.net/5/13/2009)
  21. \*Kwon, E.Y., F. Primeau, and J. Sarmiento, 2009: The impact of remineralization depth on the air-sea carbon balance. *Nature Geoscience*, 2, 630-635, doi:10.1038/ngeo612
  22. \*DeVries, T. and F. Primeau, 2009: Atmospheric pCO<sub>2</sub> Sensitivity to the Solubility Pump: The Role of the Low-Latitude Ocean, *Global Biogeochemical Cycle, in press*.
  23. Holzer, M, F.W. Primeau, W.M. Smethie, and S. Khatiwala 2009: Where and how long ago was the western North Atlantic ventilated? Maximum-entropy inversions of bottle data from WOCE line A20. *Submitted to JGR-Oceans*.
  24. \*\*\*F. Primeau and S. Kibler "How much water forms in the Southern Ocean? A maximum entropy approach to water mass analysis". *In preparation*.

\* Coauthor is a graduate student advisee.

\*\* Coauthor is a postdoctoral advisee.

\*\*\* Coauthor is an undergraduate student advisee.

### **Other Publications**

5. Author of PowerPoint lecture outlines for McGraw Hill's college level introductory Oceanography Text Book, 2004
4. Primeau, F., 2003: Tracking water movement to and from the ocean surface. *Bulletin of the American Meteorological Society*, 84 no. 7, 897-898.
3. Primeau, F., 2003: Characterizing transport timescales between the surface mixed layer and the deep ocean using an OGCM and its adjoint. *American Meteorological Society*

*Atmosphere and Ocean Fluid Dynamics Meeting Extended Abstract*, June 2003 San Antonio Texas.

2. Primeau, F. W., 1998: Multiple Equilibria and Low-Frequency Variability of Wind-Driven Ocean Models. *MIT/WHOI Ph.D. Thesis* 157 PP
1. Primeau, F., 2002: Book Review of “A Guided Tour of Mathematical Methods for the Physical Sciences by Roel Sneider”. *EOS*, 83, no. 29, P317.

### **Conferences and Invited Presentations**

54. Primeau, F, Y. Elizabeth and K. Moore, “Controls on the remineralization profiles of sinking organic matter.” Chapman Conference on the Biological Carbon Pump in the Oceans, Brockenhurst, Hamshire, England, September, 2009
53. “Low-frequency long-wave Rossby basin modes.”, Université catholique de Louvain, August, 2009. (*invited*)
52. “Atmospheric pCO<sub>2</sub> sensitivity to the solubility pump: the role of the low-latitude ocean.” Université catholique de Louvain, August, 2009. (*invited*)
51. Primeau, F. and Scott Kibbler, “How much water forms in the Southern Ocean? A maximum entropy approach to global water mass analysis.” American Geophysical Union (AGU) Fall Meeting 2008, San Francisco (*invited*)
50. “Low Frequency Basin Modes”, National Taiwan University, Taipei, Taiwan, August, 2008 (*invited*)
49. “Sensitivity and Parameter Optimization of a Global Ocean Biogeochemistry Model using Dissolved Inorganic Carbon, Alkalinity and Phosphate Data.” Research Center For Environmental Changes, Academia Sinica, Taipei, Taiwan, August, 2008, (*invited*)
48. Eun Young Kwon and F. Primeau, “The present-day strength of carbonate pump and the impact of its change on global carbon cycling”, Ocean Sciences Meeting, Orlando, Florida, March 2008
47. Tim DeVries and F. Primeau, “A Quantitative Analysis of a Marine Radiocarbon Record”, Ocean Sciences Meeting, Orlando, Florida, March 2008.
46. “A Fast Newton-Krylov Solver for Global Ocean Biogeochemistry Models Suitable for Automatic Parameter Optimization Studies”, Ocean Sciences Meeting, Orlando, Florida, March 2008.
45. “A maximum entropy approach to the ocean water-mass analysis problem”, NASA Goddard Institute for Space Studies, New York, September 2007, (*invited*)
44. “A maximum entropy approach to extended water mass analysis”, UCL, Belgium, September 2007, (*invited*)
43. “Diagnosing surface-to-surface transport pathways and timescales in global circulation models”, UCL, Belgium, September 2007, (*invited*)
42. “Fully implicit global-ocean biogeochemistry models”, UCL, Belgium, September 2007, (*invited*)
41. “The dynamical systems approach to understanding the low-frequency variability of the wind-driven ocean circulation”, UCL, Belgium, September 2007, (*invited*)
40. “A Fast Newton-Krylov Solver for Global Ocean Biogeochemistry Models Suitable for Automatic Parameter Optimization Studies”, FUNDP, Département de Mathématique Namure, Belgium, September, 2007 (*invited*)

39. F. Primeau (Presenter) and D. Newman: "Bifurcation Structure of a Wind-Driven Shallow Water Model with Layer-Outcropping" 16<sup>th</sup> Conference on Atmospheric and Oceanic Fluid Dynamics, Santa Fe, 25-29 June 2007
38. "A maximum entropy approach to water mass analysis", Theoretical Physical Oceanography Seminar, Scripps Institution of Oceanography, UCSD, La Jolla, CA May 2007 (*invited*)
37. "A maximum entropy approach to water mass analysis", IMAU-Colloquium, Institute for Marine and Atmospheric Research Utrecht, Department of Physics and Astronomy, Universiteit Utrecht, April 2007, (*invited*)
36. "Elongation and contraction of the western boundary current extension in a shallow-water model: a bifurcation analysis", EGU General Assembly 2007, Vienna, April 2007, (*invited*)
35. F. Primeau (Presenter), Li, X. and and Kwon, E.Y.: "Fully implicit global ocean-biogeochemistry model", EGU General Assembly 2007, Vienna, April 2007
34. "Constraining ocean-biogeochemistry models using global in-situ tracer data", School of Earth Sciences, Stanford University, April 2007, (*invited*)
33. "The ocean water-mass analysis problem", School of Earth Sciences, Stanford University, April 2007 (*invited*)
32. Eun Young Kwon and Francois Primeau: "How Sensitive is the Ocean-Atmosphere Carbon Partitioning to Changes in Remineralization Rates of Biogenic Material in the Ocean?", American Geophysical Union (AGU) Fall Meeting December 2006, San Francisco, CA
31. Francois Primeau (Presenter) and Mark Holzer: "The path-density distribution of oceanic surface-to-surface transport", American Geophysical Union (AGU) Fall Meeting December 2006, San Francisco, CA
30. Scott Kibler and Francois Primeau: "A Maximum Entropy Approach to Water Mass Analysis", American Geophysical Union (AGU) Fall Meeting December 2006, San Francisco, CA
29. "A Maximum Entropy Approach to Water Mass Analysis", Bromery Lecture, Johns Hopkins University, October 2006 (*invited*)
28. "Multiple Equilibria and the Elongation-Contraction of the Kuroshio and Gulf Stream Extension Systems", PMEL Seminar Series, NOAA Western Regional Center, Seattle WA, January, 2006 (*invited*)
27. "The Ocean's Memory of the Atmosphere: Residence-Time Distributions and Water-Mass Ventilation", Physical Oceanography Lunch Time Seminar Series, School of Oceanography, University of Washington, Seattle WA January, 2006 (*invited*)
26. "The Ocean's Memory of the Atmosphere: Residence-Time Distributions and Water-Mass Ventilation", Physical Oceanography Research Department, Scripps Institution of Oceanography, UCSD, La Jolla, CA December 2004 (*invited*)
25. "Implicit Biogeochemistry Modeling", Community Climate System Model Biogeochemistry Working Group, National Center for Atmospheric Research, Boulder, CO, March 2006 (*invited*)
24. Francois Primeau (Presenter) and David Newman: "A Fully Implicit Formulation of a Layered Wind-Driven Ocean Model with Outcropping" American Geophysical Union (AGU) Fall Meeting December 2004, San Francisco, CA

23. Francois Primeau (Presenter) and David Newman: “Nonlinear dynamics of the elongation-contraction mode of the Gulf-Stream and Kuroshio extension systems”, 15<sup>th</sup> Conference on Atmospheric and Oceanic Fluid Dynamics, 13-17 June 2005, in Cambridge, MA
22. Francois Primeau (Presenter) and Mark Holzer: “The Ocean’s Memory of the Atmosphere: Residence-Time Distributions and Water-Mass Ventilation” 15<sup>th</sup> Conference on Atmospheric and Oceanic Fluid Dynamics, 13-17 June 2005, in Cambridge, MA
21. Alison Keir and Francois Primeau (Presenter): “On the variability of the exponent in the powerlaw depth dependence of POC flux estimated from sediment traps”, 13<sup>th</sup> Ocean Sciences Meeting 20-24 February 2006, in Honolulu, Hawaii (Poster)
20. Francois Primeau (Presenter) and Mark Holzer: Hawaii “The Ocean’s Memory of the Atmosphere: Residence-Time Distributions and Water-Mass Ventilation” 13<sup>th</sup> Ocean Sciences Meeting 20-24 February 2006, in Honolulu
19. Eun Young Kwon (Presenter) and Francois Primeau: “Sensitivity and Optimization Study Using an Implicit Biogeochemistry Ocean Model and In-Situ Phosphate, Alkalinity, and DIC Data”, 13<sup>th</sup> Ocean Sciences Meeting 20-24 February 2006, in Honolulu, Hawaii
18. Mark Holzer (Presenter) and Francois Primeau: “The Diffusive Ocean Conveyor”, 13<sup>th</sup> Ocean Sciences Meeting 20-24 February 2006, in Honolulu, Hawaii
17. Francois Primeau (Presenter) and Mark Holzer: “The Diffusive Ocean Conveyor”, European Geosciences Union General Assembly 2006, 02-07 April 2006, Vienna, Austria
16. Eun Young Kwon and Francois Primeau (Presenter): “Sensitivity and Optimization Study Using an Implicit Biogeochemistry Ocean Model and In-Situ Phosphate, Alkalinity, and DIC Data” European Geosciences Union General Assembly 2006, 02-07 April 2006, Vienna, Austria (Poster)
15. Joint Assembly of the International Union of Geodesy and Geophysics (IUGG) and International Association for the Physical Sciences of the Oceans (IAPSO) , 30-June 11-July, 2003 in Sapporo, Japan
14. 14<sup>th</sup> Conference on Atmospheric and Oceanic Fluid Dynamics, 9-13 June 2003, in San Antonio, Texas
13. American Geophysical Union (AGU) Fall Meeting 6-10 December, in San Francisco, California
12. Ocean Sciences Meeting 11-15 February, in Honolulu, Hawaii
11. Physical Oceanography Research Department, Scripps Institution of Oceanography, La Jolla, California, Fall 2001 (invited)
10. 13<sup>th</sup> Conference on Atmospheric and Oceanic Fluid Dynamics, 4-8 June, 2001 in Breckenridge, Colorado
9. WOCE Young Investigator Workshop, Boulder, Colorado, 2000 (invited)
8. Department of Earth Atmospheric and Planetary Sciences, MIT, Cambridge, Massachusetts, 2000 (*invited*)
7. 34<sup>th</sup> Congress of the Canadian Meteorological and Oceanic Society 29 May to 2 June, 2000, Victoria, British Columbia
6. Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Alberta, 1999 (*invited*)

5. 12<sup>th</sup> Conference on Atmospheric and Oceanic Fluid Dynamics 7-11 June 1999 in New York, New York
4. 33<sup>rd</sup> Congress of the Canadian Meteorological and Oceanic Society 31-May to 4-June, 1999 in Montreal, Quebec
3. Topics in Atmospheres and Oceans Seminar, University of Victoria, Victoria, British Columbia, 1998 (*invited*)
2. Centre for Climate and Global Change Research, McGill University, Montreal, Quebec, 1997 (*invited*)
1. Institute for Geophysics and Planetary Physics at Los Alamos National Laboratory, Los Alamos, New Mexico, 1997 (*invited*)