

## ICHIRO FUKUMORI

PERSONAL INFORMATION:

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RESEARCH INTERESTS:

Climate variability; Sea level change; General circulation of the ocean; State estimation; Data assimilation; Numerical modeling; Adjoint modeling; Satellite remote sensing

EDUCATION:

1989: Ph.D. (Physical Oceanography), Joint Program in Oceanography, Massachusetts Institute of Technology and Woods Hole Oceanographic Institution  
1983: B.S. (Geophysics), University of Tokyo, Japan

PROFESSIONAL EXPERIENCE:

2023-present: Senior Research Scientist, Jet Propulsion Laboratory, California Institute of Technology.  
2005-2015: Supervisor, Ocean Circulation Group, Jet Propulsion Laboratory, California Institute of Technology.  
2003-present: Principal Scientist, Jet Propulsion Laboratory, California Institute of Technology.  
1999-2005: Team Leader, Ocean Data Assimilation, Jet Propulsion Laboratory.  
1992-2003: Research Scientist, Jet Propulsion Laboratory, California Institute of Technology.  
1990-1992: Resident Research Associate, National Research Council, at Jet Propulsion Laboratory, California Institute of Technology.  
1989-1990: Postdoctoral Associate, Massachusetts Institute of Technology.  
1983-1989: Research Assistant, Massachusetts Institute of Technology.  
1983: Research Assistant, Woods Hole Oceanographic Institution.

PROFESSIONAL ACTIVITIES:

ECCO Summer School, May 2019  
NASA Oceans Melting Greenland Science Team, 2015-2021  
NASA Sea Level Change Team, 2014-2017  
Japan Marine Science Foundation Data Assimilation Summer School, August 2016  
NASA Ocean Surface Topography Science Team, 2013-2016  
Ecole de Physique des Houches, International Summer School, June 2012  
NASA GRACE and GRACE-FO Science Team, 2011-present  
NASA Ocean Salinity Science Team, 2009-2015  
U.S. CLIVAR Working Group on Decadal Prediction, 2009-2011  
GODAE Summer School, September 2004  
U.S. CLIVAR Pacific Implementation Panel, 2004  
U.S. Argo Science Panel 2001-2013  
WOCE Young Investigator Workshop, June 2000  
U.S. Global Ocean Data Assimilation Experiment Steering Team, 1999-2003  
Consortium for Estimating the Circulation and Climate of the Ocean (ECCO), 1998-present  
Japan Marine Science Foundation Data Assimilation Summer School, August 1998  
International Global Ocean Data Assimilation Experiment Steering Team, 1997-2003  
NASA Jason-1 Science Working Team, 1997-2008

### PROFESSIONAL AFFILIATIONS:

American Geophysical Union, American Meteorological Society, The Oceanography Society, Institute of Electrical and Electronics Engineers

### POSTDOCS ADVISED (current position):

William Llovel (Researcher, University of Brest/IFREMER/IRD/CNRS, France), Zhengqing Ye (unknown), Peng Yu (Researcher, ESSIC, University of Maryland), Joshua K. Willis (Scientist, JPL), Sophie Ricci (Researcher, CERFACS, France), Ou Wang (Technologist, JPL), Seungbum Kim (Signal Analysis Engineer, JPL), Mototaka Nakamura (retired, previously Scientist, JAMSTEC, Japan), Naoki Hirose (Professor, University of Kyushu, Japan).

### HONORS AND AWARDS:

NASA Exceptional Scientific Achievement Medal (2005, 2023)  
JPL Edward Stone Award for Outstanding Research Publication (2022)  
NASA Group Achievement Award, ECCO and PO.DAAC (2022)  
NASA Group Achievement Award, Oceans Melting Greenland Team (2017, 2019)  
NASA Exceptional Public Achievement Medal (2017)  
National Research Council Postdoctoral Fellowship (1990-1992)

### REFEREED PUBLICATIONS:

- 89) Wang, O., T. Lee, T. Frederikse, R. M. Ponte, I. Fenty, **I. Fukumori**, and B. D. Hamlington, 2024: What forcing mechanisms affect the interannual sea level co-variability between the Northeast and Southeast Coasts of the United States? *J. Geophys. Res. Ocean*, **129**, e2023JC019873. <https://doi.org/10.1029/2023JC019873>
- 88) Picuch, C. G., **I. Fukumori**, R. M. Ponte, M. Schindelegger, O. Wang, and M. Zhao, 2022: Low-Frequency Dynamic Ocean Response to Barometric-Pressure Loading. *J. Phys. Oceanogr.*, **52**, 2627–2641, <https://doi.org/10.1175/JPO-D-22-0090.1>.
- 87) Wang, O., and Coauthors, 2022: Local and remote forcing of interannual sea-level variability at Nantucket Island. *J. Geophys. Res. Ocean.*, **127**, e2021JC018275, <https://doi.org/10.1029/2021JC018275>.
- 86) Chandanpurkar, H. A., and Coauthors, 2022: Influence of Nonseasonal River Discharge on Sea Surface Salinity and Height. *J. Adv. Model. Earth Syst.*, **14**, e2021MS002715, <https://doi.org/10.1029/2021MS002715>.
- 85) **Fukumori, I.**, O. Wang, and I. Fenty, 2021: Causal Mechanisms of Sea-level and Freshwater Content Change in the Beaufort Sea. *J. Phys. Oceanogr.*, **51**, 3217-3234, <https://doi.org/10.1175/JPO-D-21-0069.1>.
- 84) Picuch, C. G., **I. Fukumori**, and R. M. Ponte, 2021: Intraseasonal Sea-Level Variability in the Persian Gulf, *J. Phys. Oceanogr.*, **51**, 1687-1704, <https://doi.org/10.1175/JPO-D-20-0296.1>.
- 83) Fournier, S., T. Lee, X. Wang, T. W. K. Armitage, O. Wang, **I. Fukumori**, and R. Kwok, 2020: Sea Surface Salinity as a Proxy for Arctic Ocean Freshwater Changes. *J. Geophys. Res. Ocean.*, **125**, e2020JC016110, <https://doi.org/10.1029/2020JC016110>.
- 82) Ponte, R. M., and Coauthors, 2019: Towards comprehensive observing and modeling systems for monitoring and predicting regional to coastal sea level. *Frontiers in Marine Science*, **6**, <https://doi.org/10.3389/fmars.2019.00437>.
- 81) Hughes, C. W., **I. Fukumori**, and Coauthors, 2019: Sea level and the role of coastal trapped waves in mediating the influence of the open ocean on the coast, *Surveys in Geophysics*, **40**, 1467-1492, <https://doi.org/10.1007/s10712-019-09535-x>.

- 80) Gregory, J. M., and Coauthors, 2019: Concepts and Terminology for Sea Level: Mean, Variability and Change, Both Local and Global, *Surveys in Geophysics*, **40**, 1251-1289, <https://doi.org/10.1007/s10712-019-09525-z>.
- 79) Khazendar, A., and Coauthors, 2019: Interruption of two decades of Jakobshavn Isbrae acceleration and thinning as regional ocean cools. *Nat Geosci*, **12**, 277-283, <https://doi.org/10.1038/s41561-019-0329-3>.
- 78) Heimbach, P., **I. Fukumori**, and Coauthors, 2019: Putting It All Together: Adding Value to the Global Ocean and Climate Observing Systems With Complete Self-Consistent Ocean State and Parameter Estimates. *Frontiers in Marine Science*, **6**, <https://doi.org/10.3389/fmars.2019.00055>.
- 77) Qu, T., **I. Fukumori**, and R. A. Fine, 2019: Spin-Up of the Southern Hemisphere Super Gyre. *J Geophys Res-Oceans*, **124**, 154-170, <https://doi.org/10.1029/2018jc014391>.
- 76) Quinn, K. J., R. M. Ponte, P. Heimbach, **I. Fukumori**, and J. M. Campin, 2019: Ocean angular momentum from a recent global state estimate, with assessment of uncertainties, *Geophysical Journal International*, **216**(1), 584-597, <https://doi.org/10.1093/gji/ggy452>.
- 75) Ferster, B. S., B. Subrahmanyam, **I. Fukumori**, and E. S. Nyadjro, 2018: Variability of Southern Ocean Transports, *J Phys Oceanogr*, **48**(11), 2667-2688, <https://doi.org/10.1175/jpo-d-18-0055.1>.
- 74) **Fukumori, I.**, P. Heimbach, R. M. Ponte, and C. Wunsch, 2018: A Dynamically Consistent, Multi-Variable Ocean Climatology, *B Am Meteorol Soc*, **99**(10), 2107-2128, <https://doi.org/10.1175/bams-d-17-0213.1>.
- 73) Piecuch, C. G., R. M. Ponte, C. M. Little, M. W. Buckley, and **I. Fukumori**, 2017: Mechanisms underlying recent decadal changes in subpolar North Atlantic Ocean heat content, *Journal of Geophysical Research: Oceans*, **122**(9), 7181-7197, <https://doi.org/10.1002/2017JC012845>.
- 72) Toyoda, T., et al. 2017: Interannual-decadal variability of wintertime mixed layer depths in the North Pacific detected by an ensemble of ocean syntheses, *Clim Dynam*, **49**(3), 891-907, <https://doi.org/10.1007/s00382-015-2762-3>.
- 71) Toyoda, T., et al. 2017: Intercomparison and validation of the mixed layer depth fields of global ocean syntheses, *Clim Dynam*, **49**(3), 753-773, <https://doi.org/10.1007/s00382-015-2637-7>.
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- 69) **Fukumori, I.**, 2017: Kamifusen no kagaku: Tsukuto fukuramu shikumi no kousatsu, *Kagaku*, **87** (4), 309-312. (in Japanese)
- 68) **Fukumori, I.**, 2017: Kamifusen, the self-inflating Japanese paper balloon, *Physics Today*, **70**(1), 78-79, <https://doi.org/10.1063/pt.3.3437>.
- 67) Fenty, I., et al. 2016: Oceans Melting Greenland: Early Results from NASA's Ocean-Ice Mission in Greenland, *Oceanography*, **29**(4), 72-83, <https://doi.org/10.5670/oceanog.2016.100>.
- 66) **Fukumori, I.**, O. Wang, W. Llovel, I. Fenty, and G. Forget, 2015: A near-uniform fluctuation of ocean bottom pressure and sea level across the deep ocean basins of the Arctic Ocean and the Nordic Seas, *Prog. Oceanogr.*, **134**, 152-172, <https://doi.org/10.1016/j.pocean.2015.01.013>.
- 65) Piecuch, C. G., **I. Fukumori**, R. M. Ponte, and O. Wang, 2015: Vertical structure of ocean pressure variations with application to satellite-gravimetric observations, *J. Atmos. Oceanic. Tech.*, **32**(3), 603-613, <https://doi.org/10.1175/JTECH-D-14-00156.1>.
- 64) **Fukumori, I.**, 2015: Combining models and data in large-scale oceanography: Examples from the Consortium for Estimating the Circulation and Climate of the Ocean (ECCO), in “Advanced Data Assimilation for Geosciences: Lecture Notes of the Les Houches School of Physics: Special Issue, June 2012”, E. Blayo, M. Bocquet, E. Cosme, and L. F.

- Cugliandolo Eds., Oxford University Press, Oxford, UK, 608pp,  
<https://doi.org/10.1093/acprof:oso/9780198723844.003.0023>.
- 63) Llovel, W., J. K. Willis, F. W. Landerer, and **I. Fukumori**, 2014: Deep-ocean contribution to sea level and energy budget not detectable over the past decade, *Nature Climate Change*, **4**(11), 1031-1035, <https://doi.org/10.1038/nclimate2387>.
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  - 61) Qu, T., S. Gao, and **I. Fukumori**, 2013: Formation of salinity maximum water and its contribution to the overturning circulation in the North Atlantic as revealed by a global GCM, *Journal of Geophysical Research: Oceans*, **118**(4), 1982-1994, <https://doi.org/10.1002/jgrc.20152>.
  - 60) **Fukumori, I.**, and O. Wang, 2013: Origins of heat and freshwater anomalies underlying regional decadal sea level trends, *Geophys. Res. Lett.*, **40** (3), 563-567, <https://doi.org/10.1002/grl.50164>.
  - 59) Llovel, W., **I. Fukumori**, and B. Meyssignac, 2013: Depth-dependent temperature change contributions to global mean thermosteric sea level rise from 1960 to 2010, *Global and Planetary Change*, **101**, 113-118, <https://doi.org/10.1016/j.gloplacha.2012.12.011>.
  - 58) Goddard, L., et al., 2013: A verification framework for interannual-to-decadal predictions experiments, *Clim Dynam*, **40**(1-2), 245-272, <https://doi.org/10.1007/S00382-012-1481-2>.
  - 57) Marcus, S. L., J. O. Dickey, **I. Fukumori**, and O. de Viron, 2012: Detection of the Earth rotation response to a rapid fluctuation of Southern Ocean circulation in November 2009, *Geophys. Res. Lett.*, **39**, <https://doi.org/10.1029/2011GL050671>.
  - 56) Song, T., **I. Fukumori**, C. K. Shum, and Y. Yi, 2012: Merging tsunamis of the 2011 Tohoku-Oki earthquake detected over the open ocean, *Geophys. Res. Lett.*, **39**, <https://doi.org/10.1029/2011GL050767>.
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  - 53) Solomon, A., et al., 2011: Distinguishing the roles of natural and anthropogenically forced decadal climate variability, Implications for Prediction, *Bull. Amer. Met. Soc.*, **92**, 141-156, <https://doi.org/10.1175/2010bams2962.1>.
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  - 51) Qu, T., S. Gao, **I. Fukumori**, R. A. Fine, and E. J. Lindstrom, 2010: The obduction of Equatorial 13°C Water in the Pacific identified by a simulated passive tracer, *J. Phys. Oceanogr.*, **40**, 2282-2297, <https://doi.org/10.1175/2010jpo4358.1>.
  - 50) Lee, T., W. R. Hobbs, J. K. Willis, D. Halkides, **I. Fukumori**, E. M. Armstrong, A. K. Hayashi, W. T. Liu, W. Patzert, and O. Wang, 2010: Record warming in the South Pacific and western Antarctica associated with the strong central-Pacific El Niño in 2009-10, 2010: *Geophys. Res. Lett.*, **37**, L19704, <https://doi.org/10.1029/2010GL044865>.
  - 49) Lee, T., T. Awaji, M. Balmaseda, N. Ferry, Y. Fujii, **I. Fukumori**, B. Giese, P. Heimbach, A. Kohl, S. Masina, E. Remy, A. Rosati, M. Schodlock, D. Stammer, and A. Weaver, 2010: Consistency and fidelity of Indonesian-throughflow total volume transport estimated by 14 ocean data assimilation products, *Dyn. Atmos. Oceans.*, **50** (2), 201-223, <https://doi.org/10.1016/J.Dynatmoce.2009.12.004>.
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- systems for GODAE, *Oceanography*, **22** (3), 96-109, <https://doi.org/10.5670/oceanog.2009.69>.
- 47) Qu, T., S. Gao, **I. Fukumori**, R. A. Fine, and E. J. Lindstrom, 2009: Origin and pathway of Equatorial 13°C Water in the Pacific identified by a simulated passive tracer and its adjoint, *J. Phys. Oceanogr.*, **39**, 1836-1853, <https://doi.org/10.1175/2009jpo4045.1>.
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- 45) Kim, S.-B., and **I. Fukumori**, 2008: A near uniform basin-wide sea level fluctuation over the Japan/East Sea: A semi-enclosed sea with multiple straits, *J. Geophys. Res.*, **113**, C06031, <https://doi.org/10.1029/2007JC004409>.
- 44) Kuo, C.-Y., C. K. Shum, J.-Y. Guo, Y. Yi, A. Braun, **I. Fukumori**, K. Matsumoto, T. Sato, and K. Shibuya, 2008: Southern Ocean Mass Variation Studies Using GRACE and Satellite Altimetry, *Earth, Planets, and Space*, **60**, 477-485, <https://doi.org/10.1186/BF03352814>.
- 43) Qu, T., S. Gao, **I. Fukumori**, R. A. Fine, and E. J. Lindstrom, 2008: Subduction of South Pacific waters, *Geophys. Res. Lett.*, **35**, L02610, <https://doi.org/10.1029/2007GL032605>.
- 42) Fenoglio-Marc, L., J. Kusche, M. Becker, and **I. Fukumori**, 2007: Comment on “On the steric and mass-induced contributions to the annual sea level variations in the Mediterranean Sea” by David Garcia et al., *J. Geophys. Res.*, **112**, C1208, <https://doi.org/10.1029/2007JC004196>.
- 41) Kim, S.-B., T. Lee, and **I. Fukumori**, 2007: Mechanisms controlling the interannual variation of mixed layer temperature averaged over the NINO3 region, *J. Climate*, **20**, 3822-3843, <https://doi.org/10.1175/Jcli4206.1>.
- 40) Zlotnicki, V., J. Wahr, **I. Fukumori**, and Y. T. Song, 2007: Antarctic circumpolar current transport variability during 2003-05 from GRACE, *J. Phys. Oceanogr.*, **37** (2), 230-244, <https://doi.org/10.1175/Jpo3009.1>.
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- 37) Wu, X., M. B. Heflin, E. R. Ivins, and **I. Fukumori**, 2006: Seasonal and interannual global surface mass variations from multisatellite geodetic data, *J. Geophys. Res.*, **111**, B09401, <https://doi.org/10.1029/2005JB004100>.
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- 35) **Fukumori, I.**, 2006: What is data assimilation really solving, and how is the calculation actually done?, in “*Ocean Weather Forecasting: An Integrated View of Oceanography*”, E. P. Chassignet and J. Verron, Eds., Springer, 578pp, [https://doi.org/10.1007/1-4020-4028-8\\_11](https://doi.org/10.1007/1-4020-4028-8_11).
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- 29) Wang, O., **I. Fukumori**, T. Lee, and B. Cheng, 2004: On the cause of eastern equatorial Pacific Ocean T-S variations associated with El Niño, *Geophys. Res. Lett.*, **31**, L15309, <https://doi.org/10.1029/2004GL020188>.
- 28) Lee, T., **I. Fukumori**, and B. Tang, 2004: Temperature advection: Internal versus external processes, *J. Phys. Oceanogr.*, **34** (8), 1936-1944, [https://doi.org/10.1175/1520-0485\(2004\)034<1936:Taivep>2.0.Co;2](https://doi.org/10.1175/1520-0485(2004)034<1936:Taivep>2.0.Co;2).
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- 26) Wang, O., **I. Fukumori**, T. Lee, and G. Johnson, 2004: Eastern equatorial Pacific Ocean T-S variations with El Niño, *Geophysical Research Letters*, **31** (4), L04305, <https://doi.org/10.1029/2003GL019087>.
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