

## Y. TONY SONG

### PRINCIPAL SCIENTIST

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### Education

Ph.D., Simon Fraser University, Canada (1990)

M.S., Chinese Academy of Sciences, Beijing (1984)

B.S., Zhengzhou University, Zhengzhou, China (1981)

### Research Interests

- Innovative remote sensing: Using satellite measurements (e.g., altimetry, gravimetry, ocean salinity) to study ocean circulation and sea level change.
- Tsunami source and early detection system: Using GPS and tele-seismic networks to study tsunami formation mechanism and to develop early warning system.
- Novel ocean modeling: Developing Ocean general circulation models (SCRUM & the non-Boussinesq ROMS) for coastal ocean and satellite data applications.

### Professional Experience

2018 ~ present	Principal Scientist, NASA Jet Propulsion Laboratory
2014 ~ present	Project Scientist, UCLA Joint Institute for Regional Earth System Science and Engineering (JIFRESSE)
1998 ~ 2018	Research Scientist, NASA Jet Propulsion Laboratory
1996 ~ 1997	Research Associate, Bedford Institute of Oceanography, Canada
1991 ~ 1996	Postdoc/Res. Assistant Professor, Rutgers University, NJ

### Services and Awards

- 2018 NASA **Exceptional Public Achievement Medal** for developing innovative technology
- 2016 The U.S. representative for APEC (Asia-Pacific Economic Corporation) for Earthquake Science
- 2017 JPL **Voyager Award** for an innovative technology using GPS
- 2015 **AGU Editor's Citation** for Excellence in Refereeing (*JGR-Oceans*)
- 2014 **Associate editor** for *Journal of Atmospheric and Oceanic Technology*
- 2011 NASA **Exceptional Scientific Achievement Medal** for pioneering work in tsunami research
- 2010 **The year in science**: #84 Yardstick for Killer Waves, selected by *Discover Magazine* as one of the top 100 amazing discoveries
- 2007 **Ed Stone Award** for outstanding research on *Detecting tsunami genesis and scales directly from coastal GPS stations*
- 2006 **Guest editor** for *JGR-Oceans*: "Dynamics and Circulation of the Yellow, East, and South China Sea"
- 1996 **Original Developer** of the S-Coordinate Rutgers University Model (SCRUM, United State Copyright ©1996-2096 #TXu 715-315)

## Featured Studies in the News

- 2008: <https://earthsky.org/earth/new-tsunami-warning-system-may-save-lives/>  
2010: <https://www.jpl.nasa.gov/news/news.php?feature=2633>  
2011: <https://www.jpl.nasa.gov/news/news.php?release=2011-374>  
2016: <http://www.nasa.gov/feature/jpl/dueling-climate-cycles-may-increase-sea-level-swings>  
2019: <https://eos.org/research-spotlights/ocean-warming-resumes-in-the-tropical-pacific>

## Peer-Reviewed Publications

1. **Song, Y. T.**, P. S. Callahan, J. D. Desjonquieres, S. Fournier, and J. K. Willis (2024) A coupled atmosphere-ocean source mechanism was a predictor of the 2022 Tonga volcanic tsunami, *Communications Earth & Environment*, <https://doi.org/10.1038/s43247-024-01694-z>
2. Kang, S.-Y., J.-H. Moon, T. Kim, C. Jeon, and **Y. T. Song** (2024) Impact of river-discharged freshwater on surface ocean environments revealed by synergistic use of satellite measurements in the East China Sea. *Estuarine, Coastal and Shelf Science* **307**. <https://doi.org/10.1016/j.ecss.2024.108909>.
3. **Song, Y. T.**, K. Chen, and G. Prasetya (2023), Tsunami genesis of strike-slip earthquakes revealed in the 2018 Indonesian Palu event, *Pur Appl. Geophys.* <https://doi.org/10.1007/s00024-023-03295-x>.
4. Cha, Hyeonsoo, Jae-Hong Moon, T. Kim, and **Y. Tony Song** (2023) A process-based assessment of the sea-level rise in the northwestern Pacific marginal seas, *Communications Earth & Environment*. <https://www.nature.com/articles/s43247-023-00965-5>.
5. Lafarga, D., T. Bui, **Y. T. Song**, T. M. Smith, and S. S. P. Shen (2023), A Feasibility study of three-dimensional Empirical orthogonal functions from the NASA JPL ocean general circulation model: Computing, visualization and interpretation, *Tellus A*, doi:10.16993/tellusa.3223.
6. Bui, T., Lafara, D., T. M. Smith, **Y. T. Song**, and S. S. P. Shen (2023), Calculation, Visualization, and Interpretation of Three-Dimensional Atmosphere-Ocean Coupled Empirical Orthogonal Functions Using the Reanalyses Data, *Theoretical and Applied Climatology*, <https://doi.org/10.1007/s00704-023-04513-1>.
7. Jo, S., J.-H. Moon, T. Kim, **Y. T. Song** and H. Cha (2022) Interannual Modulation of Kuroshio in the East China Sea Over the Past Three Decades. *Front. Mar. Sci.* 9:909349. doi: 10.3389/fmars.2022.909349.
8. Cha, Hyeonsoo, Jae-Hong Moon, T. Kim, and **Y. Tony Song** (2021), Underlying drivers of decade-long fluctuation in the global mean sea-level rise, *Environ. Res. Lett.* 16 (2021) 124064. <https://doi.org/10.1088/1748-9326/ac3d58>.
9. Grzan, D. P, J. B. Rundle, J. M. Wilson, **Y. T. Song**, S. N. Ward, and Andrea Donnellan (2021). Tsunami Squares: Earthquake driven inundation mapping and validation by comparison to the Regional Ocean Modeling System. *Progress in Disaster Science* (2021), <http://dx.doi.org/10.1016/j.pdisas.2021.100191>.
10. Chen K., Liu Z., and **Y. T. Song** (2019). Automated GNSS and teleseismic earthquake inversion (AutoQuake Inversion) for tsunami early warning: retrospective and real-time results, *PAG*, <https://doi.org/10.1007/s00024-019-02252-x>.
11. Howe BM, Arbic BK, Aucan J, Barnes CR, Bayliff N, Becker N, Butler R, Doyle L, Elipot S, Johnson GC, Landerer F, Lentz S, Luther DS, Müller M, Mariano J, Panayotou K, Rowe C, Ota H, **Song YT**, Thomas M, Thomas PN, Thompson P,

- Tilmann F, Weber T and Weinstein S (2019) SMART Cables for Observing the Global Ocean: Science and Implementation. *Front. Mar. Sci.*, <https://doi.org/10.3389/fmars.2019.00424>.
12. Benveniste J, Cazenave A, Vignudelli S, Fenoglio-Marc L, Shah R, Almar R, Andersen O, Birol F, Bonnefond P, Bouffard J, Calafat F, Cardellach E, Cipollini P, Le Cozannet G, Dufau C, Fernandes MJ, Frappart F, Garrison J, Gommenginger C, Han G, Høyer JL, Kourafalou V, Leuliette E, Li Z, Loisel H, Madsen KS, Marcos M, Melet A, Meyssignac B, Pascual A, Passaro M, Ribó S, Scharroo R, **Song YT**, Speich S, Wilkin J, Woodworth P and Wöppelmann G (2019) Requirements for a Coastal Hazards Observing System. *Front. Mar. Sci.*, <https://doi.org/10.3389/fmars.2019.00348>.
  13. Chen K., Smith J., Avouac J., Liu Z., **Song Y.T.**, Adriano G. (2019). Triggering of the Mw 7.2 Hawaii earthquake of May 4, 2018 by a dike intrusion. *Geophysical Research Letters*, doi: <https://doi.org/10.1029/2018GL081428>.
  14. Cha, S.-C., Moon, J.-H., & **Song, Y. T.** (2018), A recent shift toward an El Niño-like ocean state in the tropical Pacific and the resumption of ocean warming. *Geophysical Research Letters*, <https://doi.org/10.1029/2018GL080651> (highlighted by **EOS Research Spotlights, 4-2019**).
  15. Chen, K., F. Wanpeng, Z. Liu, **Y. T. Song** (2018), 2017 Mw 8.1 Tehuantepec earthquake: deep slip and rupture directivity enhance ground shaking but weaken tsunamis. *Seismological Research Letters*, <https://doi.org/10.1785/0220170277>.
  16. Chen, K., Z. Liu, C. Liang, **Y. T. Song** (2018), Towards the application of seismogeodesy in central Italy: a case study for the 24<sup>th</sup> August 2016 Mw 6.1 Italy earthquake modelling *Geophysical Journal International*, <https://doi.org/10.1093/gji/ggy089>
  17. **Song, Y. T.**, A. Mothat, S. Yim (2017), New insights on tsunami genesis and energy source, *J. Geophys. Res. Oceans*, 122, <http://dx.doi:10.1002/2016JC012556>.
  18. Shen, S. G. Behm, **Y. T. Song**, and T. Qu (2017), A dynamically consistent reconstruction of ocean temperature, *J. Atmos. Oceanic Tech.*, <https://doi.org/10.1175/JTECH-D-16-0133.1>.
  19. Fu, Y. **Y. T. Song**, and R. Gross (2017), Linking Oceanic Tsunamis and Geodetic Gravity Changes of Large Earthquakes, *Pur Appl. Geophys.*, <https://doi.org/10.1007/s00024-017-1510-5>.
  20. Titov, V., **Y. T. Song**, L. Tang, E. N. Bernard, Y. Bar-Sever, and Y. Wei (2016), Consistent estimates of tsunami energy show promise for improved early warning, *Pur Appl. Geophys.*, <http://doi.org/10.1007/s00024-016-1312-1>.
  21. Moon, J.-H. and **Y. T. Song** (2016), Decadal sea level variability in the East China Sea linked to the North Pacific Gyre Oscillation, *Cont. Shelf Res.*, <http://dx.doi.org/10.1016/j.csr.2016.05.003>.
  22. Moon, J.-H., Y. T. Song, and H. Lee (2015), PDO and ENSO modulations intensified decadal sea level variability in the tropical Pacific, *J. Geophys. Res. Oceans*, 120, <http://doi.org/10.1002/2015JC011139> (**Joint AGU-NASA press-release, March 2016**).
  23. **Song, Y. T.**, T. Lee, J.-H. Moon, T. Qu, and S. Yueh (2015), Modeling skin-layer salinity with an extended surface-salinity layer, *J. Geophys. Res. Oceans*, 120, <http://doi.org/10.1002/2014JC010346>.

24. Susanto, D. W, and **Y. T. Song** (2015), Indonesian throughflow proxy from satellite altimeters and gravimeters, *J. Geophys. Res. Oceans*, 119, <http://doi.org/10.1002/2014JC010382>.
25. Moon, J.-H., and **Y. T. Song** (2014), Seasonal salinity stratifications in the near-surface layer from Aquarius, Argo, and an ocean model: Focusing on the tropical Atlantic/Indian Oceans, *JGR-Oceans*, <http://doi.org/10.1002/2014JC009969>.
26. Yueh, S., W. Tang, A. Fore, A. Hayashi, **Y. T. Song**, and G. Lagerloef (2014), Aquarius geophysical model function and combined active passive algorithm for ocean surface salinity and wind retrieval, *J. Geophys. Res. Oceans*, <https://doi.org/10.1002/2014JC009939>.
27. Qu, T., **Y. T. Song**, and C. Maes (2014), Sea surface salinity and barrier layer variability in the equatorial Pacific as seen from Aquarius and Argo, *J. Geophys. Res. Oceans*, <http://doi.org/10.1002/2013JC009375>.
28. Xu, Z. and **Y. T. Song** (2013), Combining the all-source Green's functions and the GPS-derived source for fast tsunami prediction – illustrated by the March 2011 Japan tsunami, *J. Atmos. Oceanic Tech.*, <http://dx.doi.org/10.1175/JTECH-D-12-00201.1>.
29. Ford, M., J. M. Becker, M. A. Merrifield, **Y. T. Song** (2013), Marshall Islands fringing reef and atoll lagoon observations of the Tohoku tsunami, *Pur Appl. Geophys.*, doi:10.1007/s00024-013-0757-8.
30. Moon, J.-H., **Y. T. Song**, P. D. Bromirski, and A. J. Miller (2013), Multidecadal regional sea level shifts in the Pacific over 1958–2008, *J. Geophys. Res. Oceans*, 118, <http://doi.org/10.1002/2013JC009297>.
31. Moon, J.-H. and **Y. T. Song** (2013), Sea level and heat content changes in the western North Pacific. *J. Geophys. Res. Oceans*, <http://doi.org/10.1002/jgrc.20096>
32. **Song, Y. 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.*, <https://doi.org/10.1029/2011GL050767> (**Nature Highlights, March 8, 2012**).
33. Galvan, D. A., A. Komjathy, M. P. Hickey, P. Stephens, J. Snively, **Y. T. Song**, M. D. Butala, and A. J. Mannucci (2012), Ionospheric signatures of Tohoku-Oki tsunami of March 11, 2011: Model comparisons near the epicenter, *Radio Sci.*, 47, RS4003, <https://doi.org/10.1029/2012RS005023>.
34. **Song, Y. T.** and T. Qu (2011), Multiple satellite missions confirming the theory of seasonal oceanic variability in the northern Pacific, *Marine Geodesy*, <https://doi.org/10.1080/01490419.2011.590110>.
35. **Song, Y. T.** and F. Colberg (2011), Deep ocean warming assessed from altimeters, Gravity Recovery and Climate Experiment, in situ measurements, and a non-Boussinesq ocean general circulation model, *J. Geophys. Res.*, 116, C02020, <http://doi.org/10.1029/2010JC006601>.
36. **Song, Y. T.** and S.C. Han (2011), Satellite observations defying the long-held tsunami genesis theory, *D.L. Tang (ed.), Remote Sensing of the Changing Oceans*, <https://doi.org/10.1007/978-3-642-16541-2>, Springer-Verlag Berlin Heidelberg.
37. **Song, Y. T.**, R. Gross, X. Wang, and V. Zlotnicki (2010), A non-Boussinesq terrain-following OGCM for oceanographic and geodetic applications, *Advances in Geosciences*, 18 (Ocean Science 2008, Eds. Gan et al.), 63-86.
38. Fok, H.S., H.B. Iz, C.K. Shum, Y. Yi, O. Andersen, A. Braun, Y. Chao, G. Han, C.Y. Kuo, K. Matsumoto, and **Y. T. Song** (2010), Evaluation of ocean tide

- models used for Jason-2 altimetry corrections, *Marine Geodesy*, 33, 285-303, doi:10.1080/01490419.2010.491027.
39. Qu, T. and **Y. T. Song** (2009), Mindoro Strait and Sibutu Passage transports estimated from satellite data, *Geophys. Res. Lett.*, <http://doi.org/10.1029/2009GL037314>.
  40. Qu, T., **Y. T. Song**, and T. Yamagata (2009), An Introduction to the South China Sea Throughflow: Its dynamics, variability, and application for climate, *Dynamics of Atmospheres and Oceans*, **47**, 3-14.
  41. **Song, Y. T.** and V. Zlotnicki (2008), The subpolar ocean-bottom-pressure oscillation and its links to ENSO, *Int. J. Remote Sensing*, Vol. **29** (21), 6091-6107.
  42. Zheng, Q., **Y. T. Song**, L. H. Lin, X. Hu, J. Meng, and D. Wang (2008), On generation source sites of internal waves in the Luzon Strait, *Acta Oceanologica Sinica*, **27** (3), 38-50.
  43. Xu, Q., Q. Zheng, H. Lin, Y. Liu, **Y. T. Song**, and Y. Yuan (2008), Dynamical analysis of mesoscale eddy-induced ocean internal waves using linear theories, *Acta Oceanologica Sinica*, **27** (3), 60-69.
  44. Zheng, Q., **Y. T. Song**, C.-R. Ho, and H. Lin (2008), Statistics of internal waves in the South China Sea, *Satellite Remote Sensing of South China Sea* (ed. A. K. Liu et al), Chapter **4**, 67-80.
  45. **Song, Y. T.**, L.-L. Fu, V. Zlotnicki, C. Ji, V. Hjorleifsdottir, C.K. Shum, and Y. Yi (2008): The role of horizontal impulses of the faulting continental slope in generating the 26 December 2004 Tsunami, *Ocean Modelling*, <https://doi.org/10.1016/j.ocemod.2007.10.007>.  
<https://www.sciencedirect.com/science/article/pii/S1463500307001321>
  46. **Song, Y. T.** (2007), Detecting tsunami genesis and scales directly from coastal GPS stations, *Geophys. Res. Lett.*, **34**, <https://doi.org/10.1029/2007GL031681>.
  47. Zheng, Q., H. Lin, J. Meng, X. Hu, and **Y. T. Song** (2007), Sub-mesoscale Ocean Vortex Trains in the Luzon Strait, *J. Geophys. Res.*, 112, C03021, doi:10.1029/2006JC003551.
  48. Zlotnicki, V., J. Wahr, I. Fukumori, and **Y. T. Song** (2006), The Antarctic Circumpolar Current: seasonal transport variability during 2002-2005, *J. Phys. Oceanogr.*, 37, doi:10.1175/JPO3009.1.
  49. **Song, Y. T.** (2006), Estimation of interbasin transport using ocean bottom pressure: Theory and model for Asian marginal seas, *J. Geophys. Res.*, 111, C11S19, doi:10.1029/2005JC003189.
  50. Zheng, Q., R. Dwi Susanto, Chung-Ru Ho, **Y. T. Song**, and Qing Xu (2006), Statistical and dynamical analyses of generation mechanisms of solitary internal waves in the northern South China Sea, *JGR-Oceans*, 112, C03021, doi:10.1029/2006JC003551.
  51. Zheng, Q., G. Fang, and **Y. T. Song** (2006), Introduction to special section: Dynamics and circulation of the Yellow, East, and South China Sea, *J. Geophys. Res.*, 111, C11S01, doi:10.1029/2005JC003261.
  52. **Song, Y. T.** and T. Y. Hou (2006), Parametric vertical coordinate formulation for multiscale, Boussinesq, and non-Boussinesq ocean modeling, *Ocean Modelling*. <http://dx.oj:10.1016/j.ocemod.2005.01.001>.
  53. **Song, Y. T.**, C. Ji, L.-L. Fu, V. Zlotnicki, C.K. Shum, Y. Yi, and V. Hjorleifsdottir (2005), The 26 December 2004 Tsunami Source Estimated from

- Satellite Radar Altimetry and Seismic Waves, *Geophys. Res. Lett.*, **23**, doi:10.1029/2005GL023683.
54. Wang, P., **Y. T. Song**, Y. Chao, and H. Zhang (2005), Parallel computation of the Regional Ocean Model System (ROMS), *International Journal of High Performance Computing Applications*, Volume 19, No. 4, 375-385, UCRL-JRNL-211096.
  55. **Song, Y. T.** and V. Zlotnicki (2004), Ocean bottom pressure waves predicted in the tropical Pacific, *Geophys. Res. Lett.*, Vol. 31, No. 5, L05306, 10.1029/2003GL018980.
  56. Glenn, S. M., Arnone, R., Bergmann, T., Bissett, W. P., Crowley, M., Cullen, J., Gryzmski, J., Haidvogel, D., Kohut, J., Moline, M. A., Oliver, M., Orrico, C., Sherrell, R., **Song, Y. T.**, Weidemann, A., Chant, R., Schofield (2004), The Biogeochemical impact of summertime coastal upwelling in the Mid-Atlantic Bight. *J. Geophys. Res.*, **109** (C12S02), DOI:10.1029/2003JC002265.
  57. **Song, Y. T.** and Y. Chao (2004), The role of topography in coastal upwelling and cross-shore exchange: A theoretical study, *Ocean Modelling*, **6**(2), 151-176.
  58. **Song, Y. T.** and T. Tang (2002), Eddy-resolving simulations for the Asian marginal seas and Kuroshio using the nonlinear-terrain following coordinate system, *J. Korean Oceanogr.*, **37**(3), 167-177.
  59. **Song, Y. T.**, D. Haidvogel, and S. Glenn (2001), The effects of topographic variability on the formation of upwelling centers off New Jersey: A theoretical model, *J. Geophys. Res.* **106**, 9223-9240.
  60. **Song, Y. T.** and Y. Chao (2000), An embedded bottom boundary layer formulation for z-coordinate ocean models, *J. Atmos. Oceanic Tech.*, **17**, 546-560.
  61. **Song, Y. T.** and D. Wright (1998), A general pressure gradient formulation for ocean models. Part II: Energy, momentum, and bottom torque consistency, *Monthly Weather Review*, **126**, 3231-3247.
  62. **Song, Y. T.** (1998) A general pressure gradient formulation for ocean models. Part I: Scheme design and diagnostic analysis, *Month. Weather Rev.*, **126**, 3213-3230.
  63. Glenn, S., M. Crowley, D. Haidvogel, and **Y. T. Song** (1996), Underwater observatory captures coastal upwelling events off New Jersey, *EOS Trans. Amer. Geophys. Union*, **77**, 233, 236.
  64. Lardner, R. W. and **Y. Song**, 1995: Optimal estimation of eddy viscosity and friction coefficients for a quasi-three-dimensional numerical tidal model, *Atmosphere-Ocean*, **33**, 581-611.
  65. **Song, Y.** and T. Tang, 1994: On staggered Turkel-Zwas type schemes for the two-dimensional shallow water equations. *Month. Weather Rev.*, **122**, 223-234.
  66. **Song, Y.** and D. Haidvogel, 1994: A semi-implicit primitive equation ocean circulation model using a generalized topography-following coordinate system. *J. Comput. Phys.*, **115**, 228-244. (**Over 600 citations as of 2016**)
  67. **Song, Y.**, S. L. Das, and R. W. Lardner, 1994: Computation of density driven flows using the spectral method: Application to the Arabian Gulf. *Cont. Shelf Res.*, **14**, 1039-1052.
  68. **Song, Y.** and D. Haidvogel, 1993: Numerical simulations of California Current System under the joint effect of coastal geometry and surface forcing, in M.L.Spaulding et al. (eds). *Estuarine and Coastal Modeling*, **3**, 216-234.
  69. **Song, Y.** and T. Tang, 1993: Dispersion and group velocity in numerical schemes for three-dimensional hydrodynamic equations. *J. Comput. Phys.*, **105**, 72-82.

70. Lardner, R. W. and **Y. Song**, 1992: A comparison of spatial grids for numerical modeling of lows in near-coast seas, *Int. J. Numer. Methods. Fluids*, **14**, 109-124.
71. Lardner, R. W. and **Y. Song**, 1992: A hybrid spectral method for the three-dimensional numerical modeling of nonlinear flows in shallow seas, *J. Comput. Phys.*, **100**, 322-334.
72. Lardner, R. W. and **Y. Song**, 1991: An Algorithm for three-dimensional convection and diffusion with very different horizontal and vertical length scales, *Int. J. Numer. Methods Engineering.*, **32**, 1303-1319.
73. **Song, Y.** and M. Yang, 1986: Spectral approximation theory for multigroup neutron transport operators, *Acta Mathematica Scientia*, 6 (3), 339-352.
74. Zheng, S. and **Y. Song**, 1985: Characteristics of  $p > 1$ -order quasi-collectively compact operator and its applications, *Science bulletin*, **12**, 896-900.