

Dr Zhiyu Liu | *Professor of Physical Oceanography | Xiamen University*

CONTACT
INFORMATION

C3-416 Xiping Bldg
Xiang'an Campus
Xiamen University
Xiamen, 361102 China

Tel: +86-(0)592-2880106
Fax: +86-(0)592-2880107
E-mail: zyliu@xmu.edu.cn
Webpage: <https://mel2.xmu.edu.cn/liu>

RESEARCH
INTERESTS

The Dynamical Oceanography Group (DyOG) of Xiamen University, of which I am the head, seeks to advance dynamical interpretation and prediction of multi-scale oceanic processes and phenomena as revealed by observations and numerical simulations. The researches conducted by DyOG are mostly process-oriented and grounded in fundamental geophysical fluid dynamics. Ocean dynamics at scales around and below the deformation radius (i.e., the oceanic small to meso-scales) is a particular focus of DyOG. Topics with ongoing research efforts include: ocean turbulence & mixing, geophysical instabilities, ocean scale interactions & energy transfers, internal gravity waves, upper ocean dynamics, wave-turbulence/eddy decomposition/interactions, water mass transformation & overturning circulation.

PROFESSIONAL
PREPARATION

Ocean University of China, Qingdao, China
College of Physical and Environmental Oceanography
Department of Oceanography
Physical Oceanography Laboratory

Ph.D., Physical Oceanography, June 2009

- Dissertation Title: Turbulence and Mixing in Tidally Energetic Shelf Seas
- Supervisor: Prof. Hao Wei (now Professor of Tianjin University)

Bangor University, Menai Bridge, UK
College of Natural Sciences
School of Ocean Sciences

Visiting Study (with Prof. Stephen Thorpe FRS), Oct 2007 – April 2009

Arizona State University, Tempe, USA
Center for Environmental Fluid Dynamics

Visiting Study (with Dr Iossif Lozovatsky), Feb 2006 – May 2006

Ocean University of China, Qingdao, China
College of Physical and Environmental Oceanography
Department of Oceanography

B.Sc., Physical Oceanography, June 2004

ACADEMIC
EXPERIENCE

Xiamen University, Xiamen, China
College of Ocean and Earth Sciences
State Key Laboratory of Marine Environmental Science
Department of Physical Oceanography

Professor

Aug 2015 –

Associate Professor

Aug 2010 – July 2015

Assistant Professor

Aug 2009 – July 2010

University of New South Wales, Sydney, Australia
School of Mathematics and Statistics

Vist. Snr. Res. Fellow (with Trevor McDougall FRS)

Sep 2017 – Feb 2018

Université Pierre et Marie Curie, Paris, France
LOCEAN-IPSL

Visiting Scientist (with Marina Lévy)

Dec 2013 – Nov 2014

The Hong Kong University of Science and Technology, Hong Kong, China
Division of Environment & Department of Mathematics

Visiting Professor

Aug 2013 – Sep 2013

PUBLICATIONS

[68] Cao A., Liu Q., Zhang J., Shiller A.M., Cai Y., Zhang R., Gilbert M., Guo X., and **Liu Z.** (2024), Dissolved rare earth elements in the North Pacific Subtropical Gyre: Lithogenic sources and water mass mixing control, *Geochimica et Cosmochimica Acta*, 372, 42–61.

[67] Yuan Z., Browning T.J., Du C., Shen H., Wang L., Ma Y., Jiang Z.-P., **Liu Z.**, Zhou K., Kao S.-J., and Dai M. (2023), Enhanced phosphate consumption stimulated by nitrogen fixation within a cyclonic eddy in the Northwest Pacific, *Journal of Geophysical Research: Oceans*, 128(11), e2023JC019947.

[66] Xiao X., Zhou C., Yang Q., Jing Z., **Liu Z.**, Yuan D., Xu Z., Zhao W., and Tian J. (2023), Diapycnal upwelling over the Kyushu-Palau Ridge in the North Pacific Ocean, *Geophysical Research Letters*, 50(18), e2023GL104369.

[65] Liu G., Chen Z., Lu H., **Liu Z.**, He Q., He Y., Xu J., Gong Y., and Cai S. (2023), Energy transfer between mesoscale eddies and near-inertial waves from surface drifter observations, *Geophysical Research Letters*, 50(16), e2023GL104729.

[64] Liu L., Chen M., Wan X.S., Du C., **Liu Z.**, Hu Z., Jiang Z.-P., Zhou K., Lin H., Zakem E.J., Qin W., Dai M., and Zhang Y. (2023), Reduced nitrite accumulation at the primary nitrite maximum in the cyclonic eddies in the western North Pacific subtropical gyre, *Science Advances*, 9(33), eade2078.

[63] Robertson R., Zhao C., Wang W., Xu Z., and **Liu Z.** (2023), A case study off the Tiwi Islands and the Coburg Peninsula: Baroclinic on one side and barotropic on the other, *Progress in Oceanography*, 216, 103057.

[62] Hu Z.*, Lin H.[†], **Liu Z.**[†], Cao Z., Zhang F., Jiang Z., Zhang Y., Zhou K., and Dai M. (2023), Observations of a filamentous intrusion and vigorous submesoscale turbulence within a cyclonic mesoscale eddy, *Journal of Physical Oceanography*, 53(6), 1615–1627. (**advised student*, [†]*corresponding author*)

[61] Bai X., Lamb K.G., **Liu Z.**[†], and Hu J.[†] (2023), Intermittent generation of internal solitary-like waves on the northern shelf of the South China Sea, *Geophysical Research Letters*, 50(6), e2022GL102502.

[60] Wang C.*, **Liu Z.**[†], and Lin H. (2023), On dynamical decomposition of multiscale oceanic motions, *Journal of Advances in Modeling Earth Systems*, 15(3), e2022MS003556.

[59] Wang C.*, **Liu Z.**[†], and Lin H. (2023), A simple approach for disentangling vortical and wavy motions of oceanic flows, *Journal of Physical Oceanography*, 53(5), 1237–1249.

[58] Yuan Z., Browning T.J., Zhang R., Wang C., Du C., Wang Y., Chen Y., **Liu Z.**, Liu X., Shi D., and Dai M. (2023), Potential drivers and consequences of regional phosphate depletion in the western subtropical North Pacific, *Limnology and Oceanography Letters*, 8(3), 509–518.

[57] Xie X., Wang Y., **Liu Z.**, Liu X., Chen D., and Zhang D. (2023), Observation of near-inertial waves in the bottom boundary layer of an abyssal seamount, *Journal of Physical Oceanography*, 53(2), 635–645.

- [56] Lin H., Xu S., **Liu Z.**[†], Hu J.[†], Zhang F., and Cao Z. (2023), Scale-dependent temperature-salinity compensation in frontal regions of the Taiwan Strait, *Journal of Geophysical Research: Oceans*, 128(2), e2022JC019134.
- [55] Yang W., Wei H., **Liu Z.**, and Zhao L. (2023), Widespread intensified pycnocline turbulence in the summer stratified Yellow Sea, *Journal of Geophysical Research: Oceans*, 128(1), e2022JC019023.
- [54] Shen D., Wang J., **Liu Z.**, and Wang F. (2023), Mixing in the upper western equatorial Pacific driven by westerly wind event, *Frontiers in Marine Science*, 9, 907699, doi:10.3389/fmars.2022.907699.
- [53] Lu H., Chen Z., Xu K., **Liu Z.**, Wang C., Xu J., Gong Y., and Cai S. (2022), Interannual variability of near-inertial energy in the South China Sea and western North Pacific, 49(24), *Geophysical Research Letters*, 49(24), e2022GL100984.
- [52] Chen Z., Liu G., **Liu Z.**, Chen S., Lu H., Xu J., Gong Y., Xie J., He Y., Chen J., He Y., and Cai S. (2022), Mutual enhancement of wind- and tide-induced near-inertial internal waves in Luzon Strait, *Journal of Physical Oceanography*, 52(12), 3259–3272.
- [51] Tu J., Fan D., **Liu Z.**, and Smyth W. (2022), Scaling the mixing efficiency of sediment-stratified turbulence, *Geophysical Research Letters*, 49(13), e2022GL099025.
- [50] Liu C., Feng L., Köhl A., **Liu Z.**, and Wang F. (2022), Wave, vortex and wave-vortex dipole (instability wave): three flavors of the intra-seasonal variability of the North Equatorial Undercurrent, *Geophysical Research Letters*, 49(11), e2021GL097239.
- [49] Wang C.* , **Liu Z.**[†], and Lin H.[†] (2022), Interpreting consequences of inadequate sampling of oceanic motions, *Limnology and Oceanography Letters*, 7(5), 385–391.
- [48] Cao Z.* , Hu Z.* , Bai X., and **Liu Z.** (2022), Tracking a rain-induced low-salinity pool in the South China Sea using satellite and quasi-Lagrangian field observations, *Remote Sensing*, 14(9), 2030.
- [47] Liu C., Huo D., **Liu Z.**, Wang X., Guan C., Qi J., and Wang F. (2022), Turbulent mixing in the barrier layer of the equatorial Pacific Ocean, *Geophysical Research Letters*, 49(5), e2021GL097690.
- [46] Yang W., Wei H., **Liu Z.**, and Li G. (2021), Intermittent intense thermocline shear associated with wind-forced near-inertial internal waves in a summer stratified temperate shelf sea, *Journal of Geophysical Research: Oceans*, 126(12), e2021JC017576.
- [45] Miao M., Zhang Z., Qiu B., **Liu Z.**, Zhang X., Zhou C., Guan S., Huang X., Zhao W., and Tian J. (2021), On contributions of multiscale dynamic processes to the steric height in the north-eastern South China Sea as revealed by moored observations, *Geophysical Research Letters*, 48(14), e2021GL093829.
- [44] Bai X.* , Lamb K.G., Hu J.[†], and **Liu Z.**[†] (2021), On tidal modulation of the evolution of internal solitary-like waves passing through a critical point, *Journal of Physical Oceanography*, 51(8), 2533–2552.
- [43] Du C.* , He R., **Liu Z.**, Huang T., Wang L., Yuan Z., Xu Y., Wang Z., and Dai M. (2021), Climatology of nutrient distributions in the South China Sea based on a large data set derived from a new algorithm, *Progress in Oceanography*, 195, 102586.
- [42] Qiu G., Xing X., Chai F., Yan X.-H., **Liu Z.**, and Wang H. (2021), Far-field impacts of a super typhoon on upper ocean phytoplankton dynamics, *Frontiers in Marine Science*, 8, 643608, doi:10.3389/fmars.2021.643608.
- [41] Peng S., Liao J., Wang X., **Liu Z.**[†], Liu Y., Zhu Y., Li B., Khokiattiwong S., and Yu W.[†] (2021), Energetics-based estimation of the diapycnal mixing induced by internal tides in the Andaman Sea, *Journal of Geophysical Research: Oceans*, 126(4), e2020JC016521.
- [40] Shen J., Jiao N., Dai M., Wang H., Qiu G., Chen J., Li H., Kao S.-J., Yang J.-Y., Cai P., Zhou K., Yang W., Zhu Y., **Liu Z.**, Chen M., Zuo Z., Gaye B., Wiesner M., and Zhang Y. (2020), Laterally transported particles from margins serve as a major carbon and energy source for dark

ocean ecosystems, *Geophysical Research Letters*, 47(18), e2020GL088971.

- [39] Lin H., **Liu Z.**[†], Hu J.[†], Menemenlis D., and Huang Y. (2020), Characterizing meso- to submesoscale features in the South China Sea, *Progress in Oceanography*, 188, 102420.
- [38] Liu C., Wang X., **Liu Z.**, Köhl A., Smyth W.D., and Wang F. (2020), On the formation of a subsurface weakly sheared laminar layer and an upper thermocline strongly sheared turbulent layer in the eastern equatorial Pacific: interplays of multiple-time-scale equatorial waves, *Journal of Physical Oceanography*, 50(10), 2907–2930.
- [37] Tu J., Fan D., Lian Q., **Liu Z.**, Liu W., Kaminski A., and Smyth W.D. (2020), Acoustic observations of Kelvin-Helmholtz billows on an estuarine lutocline, *Journal of Geophysical Research: Oceans*, 125(4), e2019JC015383.
- [36] Lian Q.* , Smyth W.D., and **Liu Z.**[†] (2020), Numerical computation of instabilities and internal waves from *in situ* measurements via the viscous Taylor-Goldstein problem, *Journal of Atmospheric and Oceanic Technology*, 37(5), 759–776.
- [35] Chen Z., Chen S., **Liu Z.**, Xu J., Xie J., He Y., and Cai S. (2019), Can tidal forcing alone generate a GM-like internal wave spectrum? *Geophysical Research Letters*, 46(24), 14,644–14,652.
- [34] Liu C., Fang L., Köhl A., **Liu Z.**, Smyth W.D., and Wang F. (2019), The subsurface mode tropical instability waves in the equatorial Pacific Ocean and their impacts on shear and mixing, *Geophysical Research Letters*, 46(21), 12,270–12,278.
- [33] Bai X.* , **Liu Z.**[†], Zheng Q., Hu J., Lamb K.G., and Cai S. (2019), Fission of shoaling internal waves on the northeastern shelf of the South China Sea, *Journal of Geophysical Research: Oceans*, 124(7), 4529–4545.
- [32] Makarim S.* , Sprintall J., **Liu Z.**, Yu W., Santoso A., Yan X.-H., and Susanto R.D. (2019), Previously unidentified Indonesian Throughflow pathways and freshening in the Indian Ocean during recent decades, *Scientific Reports*, 9, 7364, doi:10.1038/s41598-019-43841-z.
- [31] Zhang Z., **Liu Z.**, Richards K., Shang G., Zhao W., Tian J., Huang X., and Zhou C. (2019), Elevated diapycnal mixing by a sub-thermocline eddy in the western equatorial Pacific, *Geophysical Research Letters*, 46(5), 2628–2636.
- [30] Liu C., Wang X., Köhl A., Wang F., and **Liu Z.** (2019), The northeast-southwest oscillating equatorial mode of the tropical instability wave and its impact on equatorial mixing, *Geophysical Research Letters*, 46(1), 218–225.
- [29] Bian C., **Liu Z.**[†], Huang Y., Zhao L., and Jiang W. (2018), On estimating turbulent Reynolds stress in wavy aquatic environment, *Journal of Geophysical Research: Oceans*, 123(4), 3060–3071.
- [28] Du C.* , **Liu Z.**, Kao S.-J., and Dai M. (2017), Diapycnal fluxes of nutrients in an oligotrophic oceanic regime: The South China Sea, *Geophysical Research Letters*, 44(22), 11,510–11,518.
- [27] **Liu Z.**[†], Lian Q., Zhang F., Wang L., Li M., Bai X., Wang J., and Wang F. (2017), Weak thermocline mixing in the North Pacific low-latitude western boundary current system, *Geophysical Research Letters*, 44(20), 10,530–10,539.
- [26] Lozovatsky I., Fernando H.J.S., Planella-Morato J., **Liu Z.**, Lee J.-H., and Jinadasa S.U.P. (2017), Probability distribution of turbulent kinetic energy dissipation rate in ocean: Observations and approximations, *Journal of Geophysical Research: Oceans*, 122(10), 8293–8308.
- [25] Lin H., Hu J., **Liu Z.**, Belkin I.M., Sun Z., and Zhu J. (2017), A peculiar lens-shaped structure observed in the South China Sea, *Scientific Reports*, 7, 478, doi:10.1038/s41598-017-00593-y.
- [24] Wang X.* , **Liu Z.**, and Peng S. (2017), Impact of tidal mixing on water mass transformation and circulation in the South China Sea, *Journal of Physical Oceanography*, 47(2), 419–432.
- [23] Liu C., Köhl A., **Liu Z.**, Wang F., and Stammer D. (2016), Deep-reaching thermocline mixing in the equatorial Pacific cold tongue, *Nature Communications*, 7, 11576, doi:10.1038/ncomms11576.
- [22] **Liu Z.**[†] (2016), On instability and mixing on the UK Continental Shelf, *Journal of Marine*

Systems, 158, 72–83.

- [21] Wang X.*, Peng S., **Liu Z.**, Huang R.X., Qian Y., and Li Y. (2016), Tidal mixing in the South China Sea: An estimate based on the internal tide energetics, *Journal of Physical Oceanography*, 46(1), 107–124.
- [20] Wu K., Dai M., Chen J., Meng F., Li X., **Liu Z.**, Du C., and Gan J. (2015), Dissolved organic carbon in the South China Sea and its exchange with the Western Pacific Ocean, *Deep Sea Research II*, 122, 41–51.
- [19] Lian Q.*, and **Liu Z.**[†] (2015), Turbulence and mixing in a freshwater-influenced tidal bay: Observations and numerical modeling, *Science China: Earth Sciences*, 58(11), 2049–2058.
- [18] Bai X.*, **Liu Z.**[†], Li X., and Hu J. (2014), Generation sites of internal solitary waves in the southern Taiwan Strait revealed by MODIS true-color image observations, *International Journal of Remote Sensing*, 35(11–12), 4086–4098.
- [17] Bai X.*, **Liu Z.**, Li X., Chen Z., Hu J., Sun Z., and Zhu J. (2013), Observations of high-frequency internal waves in the southern Taiwan Strait, *Journal of Coastal Research*, 29(6), 1413–1419.
- [16] Lozovatsky I.D., **Liu Z.**[†], Fernando H.J.S., Hu J., and Wei H. (2013), The TKE dissipation rate in the northern South China Sea, *Ocean Dynamics*, 63(11–12), 1189–1201.
- [15] Du C.*, **Liu Z.**, Dai M., Kao S.-J., Cao Z., Zhang Y., Huang T., Wang L., and Li Y. (2013), Impact of the Kuroshio intrusion on the nutrient inventory in the upper northern South China Sea: Insights from an isopycnal mixing model, *Biogeosciences*, 10(10), 6419–6432.
- [14] Dai M., Cao Z., Guo X., Zhai W., **Liu Z.**, Yin Z., Xu Y., Gan J., Hu J., and Du C. (2013), Why are some marginal seas sources of atmospheric CO₂? *Geophysical Research Letters*, 40(10), 2154–2158.
- [13] Zhu J.*, Hu J., and **Liu Z.**[†] (2013), On summer stratification and tidal mixing in the Taiwan Strait, *Frontiers of Earth Science*, 7(2), 141–150.
- [12] Liu X., Huang B., **Liu Z.**, Wang L., Wei H., Li C., and Huang Q. (2012), High-resolution phytoplankton diel variations in the summer stratified central Yellow Sea, *Journal of Oceanography*, 68(6), 913–927.
- [11] **Liu Z.**[†], and Lozovatsky I.D. (2012), Upper pycnocline turbulence in the northern South China Sea, *Chinese Science Bulletin*, 57(18), 2302–2306.
- [10] **Liu Z.**[†], Thorpe S.A., and Smyth W.D. (2012), Instability and hydraulics of turbulent stratified shear flows, *Journal of Fluid Mechanics*, 695, 235–256.
- [09] Lozovatsky I., **Liu Z.**[†], Fernando H.J.S., Armengol J., and Roget E. (2012), Shallow water tidal currents in close proximity to the seafloor and boundary-induced turbulence, *Ocean Dynamics*, 62(2), 177–191.
- [08] Lozovatsky I.D., Roget E., Planella J., Fernando H.J.S., and **Liu Z.** (2010), Intermittency of near-bottom turbulence in tidal flow on a shallow shelf, *Journal of Geophysical Research: Oceans*, 115(C5), C05006.
- [07] **Liu Z.**[†] (2010), Instability of baroclinic tidal flow in a stratified fjord, *Journal of Physical Oceanography*, 40(1), 139–154.
- [06] Thorpe S.A., and **Liu Z.** (2009), Marginal instability? *Journal of Physical Oceanography*, 39(9), 2373–2381.
- [05] **Liu Z.**[†], Wei H., Lozovatsky I.D., and Fernando H.J.S. (2009), Late summer stratification, internal waves, and turbulence in the Yellow Sea, *Journal of Marine Systems*, 77(4), 459–472.
- [04] Lozovatsky I.D., **Liu Z.**, Wei H., and Fernando H.J.S. (2008), Tides and mixing in the northwestern East China Sea Part II: Near-bottom turbulence, *Continental Shelf Research*, 28(2), 338–350.
- [03] Lozovatsky I.D., **Liu Z.**, Wei H., and Fernando H.J.S. (2008), Tides and mixing in the north-

western East China Sea Part I: Rotating and reversing flows, *Continental Shelf Research*, 28(2), 318–337.

[02] **Liu Z.**[†], and Wei H. (2007), Estimation to the turbulent kinetic energy dissipation rate and bottom shear stress in the tidal bottom boundary layer of the Yellow Sea, *Progress in Natural Science*, 17(3), 289–297.

[01] Wei H., He Y., Li Q., **Liu Z.**, and Wang H. (2007), Summer hypoxia adjacent to the Changjiang Estuary, *Journal of Marine Systems*, 67(3–4), 292–303.

AFFILIATIONS AND
SERVICE

Dean, College of Ocean and Earth Sciences, Xiamen University (2024–)

Associate Dean, College of Ocean and Earth Sciences, Xiamen University (2019–2024)

Associate Director, State Key Laboratory of Marine Environmental Science (2022–)

Acting Dean, Department of Physical Oceanography, Xiamen University (2013–2018)

Editor, *Ocean Dynamics* (2021–)

Editor, *Geoscience Letters* (2021–)

Editor, *Journal of Oceanography* (2017–)

Associate Editor, *Frontiers in Marine Science* (2018–)

Assistant Editor-in-Chief, *Acta Oceanologica Sinica* (2016–)

Member, AOGS Publication Committee (2017–)

Full Member, SCOR WG160: Analysing ocean turbulence observations to quantify mixing (ATOMIX) (2020–)

Guest Editor, *Ocean Dynamics* (2019–2020)

Secretary, AOGS Ocean Sciences Section (2012–2014)