MATTHEW R. ARCHER

Physical Oceanographer

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Research interests: submesoscale and mesoscale ocean variability; satellite altimetry; data assimilation; observing system simulation experiments; sea surface height mapping; boundary current systems; frontal dynamics; eddy-mean flow interaction; high frequency radar.

EDUCATION

2010 – 2016 **Ph.D. in Meteorology and Physical Oceanography**
University of Miami, Rosenstiel School of Marine & Atmospheric Sciences, USA
Advisor: Lynn K. Shay

2006 - 2009 **B.Sc. in Ocean Science** (1st Class Honors)
University of Plymouth, UK
Advisor: Daniel Conley

RESEARCH EXPERIENCE

2020 – *present* **Research Technologist,** Ocean Altimetry missions
Jet Propulsion Laboratory, Pasadena, CA, USA

Working on the Surface Water and Ocean Topography (SWOT) satellite mission, to solve mission-related scientific problems via data analysis, ocean modeling, and data assimilation.

2018 – 2020 **Postdoctoral Research Scientist**
Jet Propulsion Laboratory, Pasadena, CA, USA
Supervisor: Lee-Lueng Fu

I worked within a specialized team focusing on Cal/Val activities for the SWOT mission. My contributions include:

- Validation of a multi-scale data assimilation system (MSDA) using multi-platform observations (altimeters, radiometers, moorings, glider, HF radar)
- Analysis of observing system simulation experiments for the post-launch Cal/Val based on the MSDA
- Mapping along-track altimetry measurements in the California Current system to produce the highest-possible resolution sea surface height maps for the Cal/Val site

2016 – 2018 **Postdoctoral Research Fellow**
School of Mathematics and Statistics, University of New South Wales, Australia
Supervisors: Moninya Roughan and Shane Keating

- Research: East Australian Current structure and variability and its influence on shelf circulation, based on observations from moorings, HF radar, drifters, and satellite imagery

- Project Management: managed deployment of two new radar sites, from site permits, to installation, and data processing. Inter-organizational planning: use of Slack and conference calling to plan activities between 4 institutions over multiple time zones
- Fieldwork: Led the physical oceanography 'Blue Team', tracking eddies onboard the R/V Investigator during 19d cruise "The Whole Enchilada: From predation to production in Tasman Sea's ecosystems". Obtained 26 drifters from NOAA and Pacific Gyre and deployed in a targeted study to investigate cross-shelf transport driven by an eddy dipole

2010 – 2016 **Graduate Research Assistant**
Upper Ocean Dynamics Laboratory, RSMAS, University of Miami, USA
Supervisor: Lynn K. Shay

- Thesis: On the submesoscale and mesoscale variability of the Florida Current, based on observational analysis of HF radar, satellite imagery, ADCP, and CTD data
- Fieldwork: regular radar maintenance at three operational sites in South Florida
- Modeling: ran a 2-layer quasi-geostrophic model to study effects of varying the bottom slope on baroclinic instability (class project)

Apr - Aug 2014 **Project Manager | Chief Scientist**
WHARF Experiment (Wave Heights And Currents in the Florida Straits)
Principle Investigator: Lynn K. Shay

- Experiment planned around the Student Equipment Grant I was awarded by NortekUSA: the deployment of a subsurface mooring in the Straits of Florida to measure in-situ wave height and current velocity profiles. Played a key role in the experimental design and writing the proposal manuscript submitted to SECOORA end of 2013. Collaborated with mooring specialists to design a mooring for the 4-month deployment. Leadership role as Chief Scientist aboard two research cruises onboard the R/V Walton Smith in the Straits of Florida

Apr 2012 **Consultant (**Subcontract to UM)
US Pacific Command: Ship Tracking East of the Philippines Archipelago
Program Manager: Andy Wood | Principle Investigator: Pierre Flament

- Worked in a small consulting team to develop a real-time long-range ship tracking system in the South China Sea. Successfully identified dozens of ships, verified by our collaborator Lockheed Martin's aerial unmanned vehicles. Fieldwork: deployed 16 MHz HF radar system in remote Zambales region of Philippines

Jul - Sep 2009 **Research Intern**
Department of Oceanography, University of Hawaii at Manoa, USA
Supervisor: Pierre Flament

- Processed and analyzed HF radar current and wind data to quantify seasonal patterns in oceanic and atmospheric conditions off the coast of Panay, Philippines. Research cruise: 5 days aboard R/V Kilo Moana (*Hawai'i Ocean Time-series*)

Jun - Aug 2008 **Research Intern**
Skidaway Institute of Oceanography, USA
Supervisor: Dana Savidge

- Applied HF radar to map wind direction over the South Atlantic Bight
- Research cruise: 4 days aboard R/V Savannah

REFEREED PUBLICATIONS

Archer, M., Li, Z., Wang, J. & Fu, L.-L. (submitted). Data assimilative modeling in support of SWOT calibration and validation: Performance during the pre-launch field campaign. In: *Journal of Geophysical Research: Oceans.*

Li, Z., **Archer**, M., Wang, J. & Fu, L.-L. (submitted). Formulation and demonstration of a multi-scale data assimilation system in support of the SWOT satellite mission. In: *Journal of Geophysical Research: Oceans.*

Wang, J., Fu, L.-L., Haines, B., …, **Archer**, M., … (submitted). On the development of SWOT in-situ Calibration/Validation for short wavelength ocean topography. In: *Journal of Atmospheric and Oceanic Technology.*

Archer, M., Li, Z., Wang, J. & Fu, L.-L. (in prep.). Ocean observing simulation experiments to evaluate the design performance of the SWOT post-launch Calibration/Validation field campaign. In: *Journal of Geophysical Research: Oceans.*

Archer, M., Li, Z., & Fu, L.-L. (2020). Increasing the space-time resolution of mapped sea surface height from altimetry. In: *Journal of Geophysical Research: Oceans*, 125, https://doi.org/10.1029/2019JC015878 [Data: https://doi.org/10.5281/zenodo.3858442]

Archer, M. R., A. Schaeffer, S. R. Keating, M. Roughan, R. Holmes, & L. Siegelman (2020). Observations of submesoscale instability and frontal subduction within the mesoscale eddy field of the Tasman Sea. In: *Journal of Physical Oceanography.* https://doi.org/10.1175/JPO-D-19-0131.1

Malan, N., M. R. **Archer**, M. Roughan, P. Cetina-Heredia, M. Hemming, C. Rocha, A. Schaeffer, I. Suthers, E. Quieroz (2020). Eddy-Driven Cross-Shelf Transport in the East Australian Current Separation Zone. In: *Journal of Geophysical Research: Oceans,* 125, https://doi.org/10.1029/2019JC015613.

Schaeffer, A., M. R. **Archer**, Q. Baumard, M. Roughan, & C. Kerry (2020). An assessment of the East Australian Current as a renewable energy resource. In: *Journal of Marine Systems,* 204, https://doi.org/10.1016/j.jmarsys.2019.103285.

Oke, P. R., M. Roughan, P. Cetina-Heredia, G. S. Pilo, K. R. Ridgway, T. Rykova, M. R. **Archer**, R. C. Coleman, C. G. Kerry, C. Rocha, A. Schaeffer, E. Vitarelli (2019). Revisiting the circulation of the East Australian Current: its path, separation and eddy field. In: *Progress in Oceanography,* 176, https://doi.org/10.1016/j.pocean.2019.102139.

Todd, R. E., F. Chavez, S. Clayton, S. Cravatte, M. Goes, M. Graco, X. Lin, J. Sprintall, N. Zilberman, M. R. **Archer**, et al. (2019). Global Perspectives on Observing Ocean Boundary Current Systems. In: *Frontiers in Marine Science.* doi: 10.3389/fmars.2019.00423.

Archer, M. R., S. R. Keating, M. Roughan, W. E. Johns, R. Lumkpin, F. Beron-Vera, & L. K. Shay (2018). The kinematic similarity of two western boundary currents revealed by sustained high-resolution observations. In: *Geophysical Research Letters*, 45 https://doi.org/10.1029/2018GL078429. [This work is featured in EOS *Editors Highlights*.]

Archer, M. R., Roughan, M., Keating, S. R., & Schaeffer, A. (2017). On the variability of the East Australian Current: Jet structure, meandering, and influence on shelf circulation. In: *Journal of Geophysical Research: Oceans,* 122, 8464–8481. https://doi.org/10.1002/2017JC013097.

Archer, M. R., Shay, L. K., & Johns, W. E. (2017). The surface velocity structure of the Florida Current in a jet coordinate frame. Journal of Geophysical Research: Oceans, 122, 9189–208, https://doi.org/10.1002/2017JC013286.

Archer, M. R., L. K. Shay, B. Jaimes, & J. Martinez-Pedraja, (2015). Observing frontal instabilities of the Florida Current using high frequency radar, In: Coastal Ocean Observing Systems, Liu, Y., H. Kerkering, R. H. Weisberg, eds. Elsevier. https://doi.org/10.1016/B978-0-12-802022-7.00011-0.

OTHER PUBLICATIONS + GRANTS

Archer, M. R. (2016). The Florida Current: Mean Jet Structure, Meandering, and Velocity Fluctuations Observed with HF Radar. *Open Access Dissertations*: https://scholarlyrepository.miami.edu/oa_dissertations/1648

Archer, M. R., Shay, L. K., & Martinez-Pedraja, J. (2015). Evaluation of WERA HF Radar Observations: Currents, Winds and Waves. In: Current, Waves and Turbulence Measurements (CWTM), 2015 IEEE/OES 11th (pp. 1-9). https://doi.org/10.1109/CWTM.2015.7098148

Shay, L. K., **M. R. Archer**, B. K. Haus & F. Zifteh (2013). Regional Coastal Ocean Observing System: Evaluating Significant Wave Heights from High Frequency Radars. Proposal to SECOORA for $60,000 [awarded]

Savidge, D., J. Amft, A. Gargett, **M. R. Archer**, D. Conley, G. Volgaris, L. Wyatt & K.-W. Gurgel (2011). Assessment of WERA Long-Range HF-radar Performance from the User's Perspective. CWTM IEEE/OES 10th (pp 31-38). https://doi.org/10.1109/CWTM.2011.5759520

Archer, M. R. (2008). WERA HF radar measurements of wind direction in the South Atlantic Bight, B.Sc Ocean Science Dissertation, Uni. Plymouth, 40 pages: https://pdfs.semanticscholar.org/05fa/46f232e385864006ee5dded44d0b911800ea.pdf

TEACHING + MENTORING

2021 **Mentor** to Emma Gurcan (Summer Undergraduate Research Fellowship – SURF)

- Undergraduate student at Caltech will be working this summer on a project related to SWOT

2018 **Advisor** to Quentin Baumard (intern at UNSW)

- Undergraduate student at Le Cnam Intechmer, Cherbourg, France
- Project title: "*Quantifying the hydrokinetic energy resource of the East Australian Current using in situ and remote measurements of the ocean current field*"
- I outlined the research project for Quentin based on his interests in ocean engineering and ocean renewable energy. He presented his work at the Australian Coastal and Oceans Modelling and Observations Workshop, and we published a paper in 2020.

2017-18 **Lecturer** "Topics in Australian Marine Science" at Sydney Institute of Marine Science

- 2 semesters of the Master's degree course. I taught the physical oceanography component (four 1-hour lectures each followed by a 2.5-hour data analysis lab)
- Lectures consisted of introductory physical oceanography topics and data analysis
- I updated the course and created new content, including new datasets to analyze. I wrote the final exam questions.

2012-13 **Teaching Assistant** "MSC 243 Weather Forecasting" at University of Miami

- 2 semesters of the Undergraduate degree course with Professor Sharan Majumdar
- Helped prepare homework, gave 2 lectures, graded all homework and exam questions, and answered student questions.

KEY SKILLS

Computing:

- *Operating Systems*: Windows, Linux, and Mac.
- *Coding*: Matlab (experienced), Python, Git, FORTRAN, GIS, PERL (familiar)
- *Supercomputing*: NASA Advanced Supercomputing facility
- *Website*: HTML, CSS

Fieldwork:

In addition to the open ocean research cruises and HF radar installations/maintenance listed under 'Research Experience': numerous day coastal excursions aboard University of Plymouth's R/V Catfish. Experience with side scan sonar, CTD and ADCP deployment. Ex-RYA certified: VHF radio, powerboat handling and sea survival. In my own time I have sailed five trips between Miami and the Bahamas, and once from Panama to Colombia.

Communication:

I am committed to improving my science communication in all forms – especially publications and oral presentations - and actively seek out opportunities to learn.

- *Writing*: Dallas Murphy Workshop, Nature Masterclass Scientific Writing, MetOcean Solutions Workshop, UNSW Climate Change Research Center Scientific Paper Writing Workshop
- *Oral*: Consortium for Ocean Science Exploration and Engagement (COSEEE) Presentation Bootcamp (standard and advanced)
- *Leadership:* JPL Multipliers Leadership 2-day workshop (2021)

SERVICE + ACTIVITIES

Topic editor: At the MDPI journal *Remote Sensing* since 2021.

Reviewer: *Geophysical Research Letters, Journal of Geophysical Research: Oceans, Journal of Physical Oceanography, Remote Sensing, Journal of Marine Systems, Estuarine Coastal and Shelf Science, Oceanography magazine, Deep-Sea Research Part II, Continental Shelf Research.*

Session Chair: (1) Ocean Sciences 2020 in San Diego. Session Title: "*Boundary Currents and Shelf-Deep Ocean Exchange*". (2) Australian Meteorological and Oceanographic Society 2018 Annual Meeting in Sydney, Australia. Session Title: "*Ocean Variability on Timescales from Days to Decades*".

NASA Panel Reviewer: ROSES Future Investigators in NASA Earth and Space Science and Technology (Physical Oceanography), 2019-2021.

Board Member: Caltech Postdoc Association (2019-2020). As the division representative for JPL, I advocate for the postdoc community, conducting surveys, and organizing career/social events. I participated in the Caltech & Claremont Coaching Program in 2019-2020, in which I received 16 coaching sessions on career and leadership.

Outreach: Booth volunteering at: (1) Explore JPL day 2019, (2) CARTHE Tortuga outreach 2014-2016. School outreach: Science assembly talks at the UK elementary school Powers Hall Academy to 5 to 11-year-old school children, 2018.

Committees: Chair of the Student Travel Fund (2012-2016) fundraising and fund distribution to graduate students to travel for research activities. Member of the RSMAS Student Seminar Series (2013-2014), I organized and facilitated voting by faculty and students to determine the best annual student seminar and distribute prizes for exceptional presentations.

Technical Advisory Panel: National Ocean Sciences Bowl (2012-2013) – Physical Oceanography Question Reviewer in Washington DC. Competition judge in the 2013 Miami Ocean Sciences Bowl.

AWARDS + SCHOLARSHIPS

- *Australian Meteorological and Oceanographic Society Annual Meeting 2017 Research Award* – Scholarship for travel and registration to present
- *IEEE/OES CWTM 2015 Student Award* – Scholarship for travel and registration to present
- *Graduate Student Association Scholarship* – To attend the Dallas Murphy Writing Workshop
- *PICES 2013 Summer School Scholarship* – Ocean Observing Systems and Ecosystem Monitoring Summer School. Travel award to Hatfield Marine Science Center, Newport, OR
- *Nortek Student Equipment Award 2013* – Awarded an AWAC (Acoustic Wave and Current Profiler) for a 3-month deployment. Travel grant to present at an international conference
- *Harry D. Vernon Scholarship 2013* – For excellence in oceanographic research
- *2012 Ocean Sciences Meeting* (TOC/ AGU/ ASLO) – Outstanding Student Presentation Award
- *Weather (Wx) Challenge 2011/ 2012* - Graduate Student City Winner
- *Fugro & IMAREST Undergraduate Award 2009*– Best Student Dissertation

PROFESSIONAL MEMBERSHIPS

American Association for the Advancement of Science (*member since* 2015), American Geophysical Union **(***member since 2014*), Association for the Sciences of Limnology and Oceanography (*member since* 2016), The Oceanography Society (*member since 2011*), The Institute of Marine Engineering, Science & Technology (2009 s*tudent member*).

CONFERENCES + INVITED TALKS

Archer, M. R., Z. Li, J. Wang & L-L Fu, 2020. *An assessment of the data assimilation system developed for the SWOT satellite mission* @ Ocean Surface Topography Science Team Meeting **[virtual poster]**

Archer, M. R., 2020. *Toward Satellite Altimetry Measurements of Fine-Scale Ocean Variability* @ CASPO Seminar, Scripps Institute of Oceanography **[invited virtual talk]**

Archer, M. R., Z. Li, J. Wang & L-L Fu, 2020. *An assessment of the data assimilation system developed for the SWOT satellite mission* @ AGU Fall Meeting, USA **[virtual poster]**

Archer, M. R., Z. Li, & L-L Fu, 2019. *Increasing the resolution of mapped Sea Surface Height in the California Current system* @ Ocean Surface Topography Science Team Meeting, Chicago, USA **[poster]**

Archer, M. R., Z. Li, & L-L Fu, 2019. *Increasing the resolution of mapped Sea Surface Height in the California Current system* @ SWOT Science Team Meeting, Bordeaux, France **[oral + poster]**

Archer, M. R., 2019. *Observations of submesoscale instability and frontal subduction within the mesoscale eddy field of the Tasman Sea* @ Caltech **[invited talk]**

Archer, M. R., 2019. *Submesoscale Instability in the East Australian Current System* @ Scripps Institute of Oceanography **[invited talk]**

Archer, M. R., 2018. *Observations of frontal subduction and instability across an eddy dipole jet* @ University of East Anglia **[invited talk]**

Archer, M. R., S.R. Keating, M. Roughan, R. Lumpkin, F. Beron-Vera, & L. K. Shay, 2018. *The similarity of two western boundary currents in a jet coordinate frame* @ AGU/ASLO Ocean Sciences Meeting, Portland, OR, USA **[oral]**

Archer, M. R., S.R. Keating, M. Roughan, R. Lumpkin, F. Beron-Vera, & L. K. Shay, 2018. *Inter-comparison of two analogous western boundary currents* @ Australian Meteorological and Oceanographic Society (AMOS) Meeting, Sydney, NSW, Australia **[oral]**

Archer, M. R., M. Roughan, S.R. Keating & A. Schaeffer, 2017. *The East Australian Current: Jet Variability and Influence of Shelf Circulation* @ Australian Meteorological and Oceanographic Society (AMOS) Meeting, Canberra, ACT, Australia **[oral]**

Archer, M. R., M. Roughan, S.R. Keating & A. Schaeffer, 2016. *Meandering of the East Australian Current at 30ºS* @ Australian Coastal and Oceans Modelling and Observations (ACOMO) Workshop, Canberra, ACT, Australia **[poster]**

Archer, M. R., L. K. Shay & W. E. Johns, 2015. *HF radar observations of the Florida Current in a Stream Coordinate System* @ Radiowave Oceanography Workshop (ROW), Woods Hole, MA, USA. **[oral]**

Archer, M. R., & L. K. Shay, 2015. *The Florida Current in Stream Coordinates: On the Effects of Meandering at 25°N to 26°N* @ Asia Oceania Geosciences Society (AOGS) Annual Meeting, Singapore **[oral]**

Archer, M. R., L. K. Shay, B. Jaimes & J. Martinez-Pedraja, 2015. *Coastal Ocean Observing in the Straits of Florida using HF Radar: An Overview of Recent Work* @ Southeast Coastal Ocean Observing Regional Association (SECOORA) Annual Meeting, Jacksonville, FL, USA **[poster]**

Archer, M. R., L. K. Shay, B. Jaimes & J. Martinez-Pedraja, 2015. *Evaluation of WERA HF Radar Observations: Currents, Winds and Waves* @ IEEE/OES 11th Current, Waves and Turbulence Measurement Workshop, St Petersburg, FL, USA **[oral]**

Archer, M. R., L. K. Shay, & J. Martinez-Pedraja, 2014. *Sensing oceanic cyclones and anticyclones across a western boundary current using WERA high frequency radars* AOGS Annual Meeting, Sapporo, Japan **[oral** presented by L.K. Shay**]**

Archer, M. R., L. K. Shay, B. Jaimes, & J. Martinez-Pedraja, 2014. *A near-inertial signal in a background current with strong horizontal shear: HF radar observations in the Straits of Florida* @ Radiowave Oceanography Workshop (ROW), Savannah, GA, USA **[oral]**

Archer, M. R., L. K. Shay, J. Martinez-Pedraja & A. B. Parks, 2012. *Application of High Frequency Radar and the Okubo-Weiss Parameter to Analyze Submesoscale Variability in the Florida Current* @ AGU/ASLO Ocean Sciences Meeting, Salt Lake City, UT, USA **[oral]**

Shay, L. K, J. Martinez-Pedraja, M. R. Archer, B. K. Haus, & A. B. Parks, 2012. *Submesoscale Surface Current Variability along the Florida Current* @ AGU/ASLO Ocean Sciences Meeting, Salt Lake City, UT, USA **[poster** presented by M. R. Archer**]**

Archer, M. R., & P. Flament, 2009. *HF radar measurements of wind direction in the Sulu Sea: Preliminary results* @ The Philippines Straits Dynamics Experiment (PhilEx) Meeting, Honolulu, HI, USA **[oral]**