

# Dr. SARA C. SANCHEZ

Assistant Professor  
Department of Atmospheric and Oceanic Sciences  
University of Colorado, Boulder, 311 UCB, Boulder, CO 80309  
*sara.sanchez@colorado.edu*

## RESEARCH INTERESTS

Climate variability, paleoclimate, global change, tropical climate dynamics, biogeochemistry

## EDUCATION

- 2018      **Ph.D. - Oceanography**, specialization Climate Science  
Scripps Institution of Oceanography, University of California San Diego  
*Dissertation:* "Pacific Decadal Variability: insights from coral records, Earth System Models, and novel geochemical tracers"  
*Doctoral Committee:* Christopher Charles (advisor, SIO), Jose Carriquiry (University de Autonoma de Baja California), James Leichter (SIO), Art Miller (SIO), Margaret Schoeninger (UCSD), Shang-Ping Xie (SIO)
- 2015      **M.S. - Oceanography**  
Scripps Institution of Oceanography, University of California San Diego
- 2011      **B.S. - Environmental Science**, Mathematics minor  
University of Arizona, Tucson, AZ

## RESEARCH/PROFESSIONAL APPOINTMENTS

- 8/22-present      **Assistant Professor at University of Colorado**  
Department of Atmospheric and Ocean Sciences
- 10/20-8/22      **Chancellor's Postdoctoral Fellow**  
Department of Atmospheric and Ocean Sciences  
University of Colorado  
*Mentored by Dr. Kristopher Karnauskas*
- 10/18-10/20      **JISAO/CICOES Postdoctoral Fellow**  
hosted by the Department of Atmospheric Sciences  
University of Washington  
*Mentored by Dr. Gregory Hakim and Dr. Casey Saenger*
- 6/11-8/18      **Graduate student researcher** in Climate Sciences Curricular group  
Scripps Institution of Oceanography  
University of California San Diego  
*Advised by Dr. Christopher Charles*
- 8/09-5/10 &  
1/11-5/11      **Undergraduate Research Assistant**  
University of Arizona  
*Mentored by Dr. Julia Cole*
- 6/10-8/10      **Summer Student Fellow**  
Woods Hole Oceanographic Institution  
*Mentored by Dr. Delia Oppo and Dr. Bill Curry*
- 6/09-8/09      **Summer Student Scholar**  
National Science Foundation  
*Mentored by Dr. Lina Patino and Lisa Rom*

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### GRANTS AWARDED

- 2020            **University of Colorado Chancellor's Postdoctoral Fellowship**  
Title: Evaluating the mechanisms and impacts of persistent, extreme El Niño events  
PI: **Sara Sanchez**  
Amount: ~\$135,000.00
- 2018            **Joint Institute for the Study of the Atmosphere and Ocean Postdoctoral Fellowship**  
Title: Can coral  $\delta^{18}\text{O}$  archives help constrain variations in global P-E through data assimilation?  
PI: **Sara Sanchez**  
Amount: ~\$130,000.00
- 2013            **SIO NSF IGERT Program Mini-grant**  
Title: Strengthening observations of environmental change in the Pacific basin  
PI: **Sara Sanchez**  
Amount: ~\$9,000.00

### GRANTS PENDING

- 2022            **National Science Foundation**  
Paleo Perspectives on Present and Projected Climate (P4Climate)  
Title: Emergence of an Anthropogenic Salinity Signal in the IndoPacific  
PI: **Sara Sanchez**  
Requested Amount: \$442,344 to CU
- 2022            **National Science Foundation**  
Paleo Perspectives on Present and Projected Climate (P4Climate)  
Title: Collaborative Research: Characterizing Northern Hemisphere atmospheric variability from Central American wind gap-induced upwelling  
PI: Patrick Rafter (UC Irvine)  
Co-PI: **Sara Sanchez**  
Requested Amount: \$490,996 to CU

### PEER REVIEWED PUBLICATIONS

10. Maher, Nicola, Robert C. Jnglin Wills, Pedro DiNezio, Jeremy Klavans, Sebastian Milinski, **Sara C. Sanchez**, Samantha Stevenson, Malte F. Stuecker, and Xian Wu. "The future of the El Niño-Southern Oscillation: Using large ensembles to illuminate time-varying responses and inter-model differences." In review at *Earth System Dynamics Discussions* (2022): 1-28.
9. Walter, Rachel M., Hussein R. Sayani, Thomas Felis, Kim M. Cobb, Nerilie J. Abram, Ariella K. Arzey, Alyssa R. Atwood, Logan D. Brenner<sup>7</sup>, Émilie P. Dassié, Kristine L. DeLong, Bethany Ellis, Matthew J. Fischer, Nathalie F. Goodkin, Jessica A. Hargreaves, K. Halimeda Kilbourne, Hedwig Krawczyk, Nicholas P. McKay, Sujata A. Murty, Riovie D. Ramos, Emma V. Reed, Dhruvajyoti Samanta, **Sara C. Sanchez**, Jens Zinke, and the PAGES CoralHydro2k Project Members. "The CoralHydro2k Database: a global, actively curated compilation of coral  $\delta^{18}\text{O}$  and Sr/Ca proxy records of tropical ocean hydrology and temperature for the Common Era." In review at *Earth System Science Data Discussions* (2022): 1-56.
8. **Sanchez, Sara C.**, and Kristopher B. Karnauskas. "Diversity in the persistence of El Niño events over the last millennium." *Geophysical Research Letters*: e2021GL093698.
7. Gerald A. Meehl, Jadwiga H. Richter, Haiyan Teng, Antonietta Capotondi, Kim Cobb, Francisco Doblas-Reyes, Markus G. Donat, Matthew H. England, John C. Fyfe, Weiqing Han, Hyemi Kim, Ben P. Kirtman, Yochanan Kushnir, Nicole S. Lovenduski, Michael E. Mann, William J. Merryfield, Veronica Nieves, Kathy Pegion, **Sara Sanchez**, Adam Scaife, Doug Smith, Aneesh C. Subramanian, Lantao Sun, Diane Thompson, Caroline Ummenhofer, Shang-Ping Xie. "Initialized Earth System prediction from subseasonal to decadal timescales." *Nature Reviews Earth & Environment* 2, no. 5 (2021): 340-357.
6. Parsons, Luke A., Daniel E. Amrhein, **Sara C. Sanchez**, Robert Tardif, M. Kathleen Brennan, and Gregory J. Hakim. "Do multi-model ensembles improve reconstruction skill in paleoclimate data assimilation?." *Earth and Space Science* 8, no. 4 (2021):e2020EA001467.
5. **S.C. Sanchez**, G.J. Hakim, C.P. Saenger. Climate model teleconnection patterns govern the tropical Pacific response to early 19th century volcanism in coral-based data assimilation reconstructions. *Journal of Climate* 34, no. 5 (2021): 1863-1880.

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4. **S.C. Sanchez**, N. Westphal, G.H. Haug, H. Cheng, R.L. Edwards, T. Schneider, K.M. Cobb, and C. D. Charles. "A Continuous Record of Central Tropical Pacific Climate Since the Mid-nineteenth Century Reconstructed From Fanning and Palmyra Island Corals: A Case Study in Coral Data Reanalysis." *Paleoceanography and Paleoclimatology* 35, no. 8 (2020): e2020PA003848.
3. **Sanchez, Sara C.**, Dillon J. Amaya, Arthur J. Miller, Shang-Ping Xie, and Christopher D. Charles. "The Pacific Meridional Mode over the last millennium." *Climate Dynamics* (2019):1-14.
2. Rafter, P. A., **Sanchez, S. C.**, Ferguson, J., Carriquiry, J. D., Druffel, E. R., Villaescusa, J. A., & Southon, J. R. (2017). Eastern tropical North Pacific coral radiocarbon reveals North Pacific Gyre Oscillation (NPGO) variability. *Quaternary Science Reviews*, 160, 108-115.
1. **Sanchez, S. C.**, Charles, C. D., Carriquiry, J. D., & Villaescusa, J. A. (2016). Two centuries of coherent decadal climate variability across the Pacific North American region. *Geophysical Research Letters*, 43(17), 9208-9216.

## MAGAZINE/ TRADE PUBLICATIONS

DeLong, Kristine L., Alyssa Atwood, Andrea Moore, and **Sara Sanchez**, Clues from the sea paint a picture of Earth's water cycle, *EOS*, 103, doi.org/10.1029/2022EO220231. Reviewed by science advisors.

## HONORS, AWARDS, FELLOWSHIPS

2022	ATOC Service Award
2018	SIO Department Graduate Student Excellence Research/Travel Award
2014	Krinsk Research Advancement Initiative
2014	Wyer Family Endowed Fellowship
2013	National Science Foundation GRFP Honorable Mention
2013	Ford Fellowship Honorable Mention
2012-14	Minorities Striving and Pursuing Higher Degrees of Success Mentee
2012	National Science Foundation GRFP Honorable Mention
2011-13	San Diego Fellowship
2011-13	National Science Foundation IGERT Fellowship Program Participant
2010	Woods Hole Oceanographic Institution Summer Student Fellow
2009	National Science Foundation Summer Student Scholar
2007-11	University of Arizona National Scholars Merit Scholarship

## INVITED SEMINARS & CONFERENCE PRESENTATIONS

- S. C. Sanchez**. Tropical Pacific Variability from paleo-data assimilation of coral  $\delta^{18}\text{O}$ . Workshop at University of Arizona, October 2022.
- S. C. Sanchez**. Consistency checks with paleo data assimilation: Example with volcanic eruptions. Invited speaker for school on Paleo Data Assimilation Workshop at Northern Arizona University, August 2022.
- S. C. Sanchez**. Trends and variability of tropical Pacific hydroclimate reconstructed with coral paleo-data assimilation. Invited speaker at University of Colorado Boulder HydroSymposium, April 2022.
- S. C. Sanchez**. Trends and variability of tropical Pacific hydroclimate reconstructed with coral paleo-data assimilation. Invited speaker at University of Illinois Climate Group, April 2022.
- S. C. Sanchez**. Paleo Tropical Pacific Decadal Variability. Invited speaker at CLIVAR Tropical Pacific Decadal Variability Working Group Meeting, February 2022.
- S. C. Sanchez**. Trends and variability of tropical Pacific hydroclimate reconstructed with coral paleo-data assimilation. Invited speaker at American Geophysical Union Fall Meeting, December 2021.
- S. C. Sanchez**. Paleoclimate Data Assimilation with the Last Millennium Reanalysis Framework. Invited honorarium speaker at Rice University, November 2021.

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**S. C. Sanchez.** Coral-based data assimilation for hydroclimate reconstructions. Invited speaker at Georgia Institute of Technology Earth and Atmospheric Science Seminar Series, April 2021.

**S. C. Sanchez.** Coral-based data assimilation. Invited speaker for Brown University Climate Bunch Seminar Series in the Earth, Environmental and Planetary Sciences Department, March, 2021.

**S. C. Sanchez.** Coral-based data assimilation to reconstruct the response of the tropical Pacific to early 19<sup>th</sup> century volcanism. Invited speaker at American Geophysical Union Fall Meeting, December 2020.

**S. C. Sanchez.** Coral-based data assimilation to reconstruct the response of the tropical Pacific to early 19<sup>th</sup> century volcanism. Invited speaker at Woods Hole Oceanographic Institution Paleoclimate and Climate Science Seminar Series, October 2020.

**S.C. Sanchez.** Coral-based data assimilation to reconstruct the response of the tropical Pacific to early 19<sup>th</sup> century volcanism. Invited speaker at University of North Carolina Wilmington Department of Earth and Ocean Sciences Seminar Series, September 2020.

**S. C. Sanchez.** The Pacific Meridional Mode over the Common Era. Invited speaker at Georgia Institute of Technology Earth and Atmospheric Science Seminar Series, March 2017.

## TEACHING

Spring 2023	<i>Lecturer</i> for Climate Change Controversies and Policy Implications, 3 Unit course (CU Boulder ATOC 4800/5000, ENVS 5830)
Fall 2022	<i>Lecturer</i> for Our Changing Environment, 3 Unit course (CU Boulder ATOC 1060)
Summer 2021	<i>Lecturer</i> for Introduction to Oceanography, 3 Unit course (CU Boulder ATOC/GEOL 3070)
8/20	<i>Guest Lecturer</i> for Exploring the Atmospheric Sciences (UW-ATMS 220) on Paleoclimate variability
12/19	<i>Guest Lecturer</i> for Integrative Oceans (UW-Ocean210) on Pacific climate
5/19	<i>Guest Lecturer</i> for Climate and Climate Change (UW-ATMS 211) on ENSO
3/15 - 6/15	<i>Teaching Assistant</i> for Environmental Challenges (UCSD-MAE124/ ESYS103)
9/13 - 12/13	<i>Teaching Assistant</i> for Climate Change and Society (UCSD-SIO 25)

## SERVICE

Proposal Reviewer: National Science Foundation

Journal Reviewer: *Geophysical Research Letters, Journal of Climate, Coral Reefs, Climate Dynamics, Quaternary Science Research Letters, Journal of Geophysical Research: Oceans, Geochemistry, Geophysics, Geosystems, Paleoceanography and Paleoclimatology, Nature*

2020-present	ATOC JEDI Committee
2020-present	ATOC REU
2022-present	ATOC Fest Committee
2022-present	ATOC Distinguished Speaker Committee
2022-present	ATOC Earth Systems and Space Sciences Poster Conference Committee Chair
2021-present	Conference Session Convener: <i>2022 AGU Fall Meeting</i> “Advancing Paleoclimatology by combining data, models, and theory” <i>2022 Ocean Sciences Meeting</i> “Predictive Understanding of Pacific Decadal Variability and its Global Implications” <i>2021 AGU Fall Meeting</i> “Advancing Paleoclimatology by combining data, models, and theory”
2020 – present	PAGES CoralHydro2k Project to reconstruct tropical ocean hydroclimate and temperature from coral archives, <i>co-organizer</i> of the paleo-data assimilation group
2021- present	<i>Member</i> of the CLIVAR Tropical Pacific Decadal Variability working group
8/13-1/17	<i>SIO TG Committee</i> ; Scripps community building organization with weekly meetings. My

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specific role was to develop and maintain the membership-donation program.

9/12-9/13 *SIO Climate Science curricular group student representative*

## OUTREACH

- 01/21-present *Co-organizer of inaugural CU Boulder ATOC Research Experience for Undergraduates program Programming*
- 3/20-10/22 *Mentoring in Physical Oceanography Women to Increase Retention (MPOWIR) group member*
- 05/21-08/21 *Co-mentor for UCAR Significant Opportunities in Atmospheric Research and Science (SOARS) protégé Carlos Romero*
- 06/21-08/21 *CU Boulder ATOC REU presentation mentor, aided Ocean cohort in creating scientific poster and oral presentations*
- 6/20-8/20 *External mentor for Hispanic Association of Colleges and University (HACU)-National Science Foundation Summer Intern Alexandros Economou-Garcia*
- 3/14-10/16 *Scripps Peers; Graduate student mentor for first year Climate Science graduate students: Weijie Wang, Charlotte Beall, Tashiana Osborne.*
- 2012-20 *Memorable outreach events*
- \*Growing up in Science” lectures to the *JISAO Summer Internship Program (2018, 2020)*
  - \*Skype a Scientist Program
  - \*Innovations Academy: created a talk on Pacific Climate, El Nino and “The Blob” for elementary school students.
  - \*Avanzamos Conference at UCSD: conducted a physical oceanography demonstration for groups of Latina middle schoolers to increase interest in STEM careers
  - \*Advanced American Language Program at CSU Fullerton: created a presentation on the climate system for ESL groups.

## FIRST AUTHOR PRESENTATIONS

- S. C. Sanchez**, K. Karnauskas. Diversity in the persistence of El Niño events over the last millennium. Talk at the Ocean Sciences Meeting, February 2022.
- S. C. Sanchez**, K. Karnauskas. Diversity in the persistence of El Niño events over the last millennium. Talk at the American Geophysical Union Conference, December 2021.
- S. C. Sanchez**. Paleo Pacific Climate Variability. Department of Atmospheric and Oceanic Sciences Seminar series at the University of Colorado, Boulder, November 2021.
- S. C. Sanchez**, Alyssa Atwood, Matthew Fischer, Rachel M. Walter, Hussein Sayani, Thomas Felis, Nerilie Abram, Kim Cobb, Logan Brenner, Emilie Dassié, Kristine Delong, Bethany Ellis, Nathalie Goodkin, Jessica Hargreaves, Nicholas Hitt, Hali Kilbourne, Hedwig Krawczyk, Andrew Lorrey, Chris Maupin, Sujata Murty, Miriam Pfeiffer, Riovie Ramos, Emma Reed, Dhruvajyoti Samanta, Feng Zhu, Jens Zinke, Belen Martrat, Casey Saenger, Greg Hakim, Robert Tardif. Improving paleoclimate hydroclimate reconstructions with observations of  $\delta^{18}\text{O}_{\text{sw}}$ . Poster at Tropical Pacific Observing Network, May 2021
- S. C. Sanchez**. Reconstructing the ENSO response to the Mystery and Tambora eruptions with coral based data assimilation. Department of Atmospheric and Oceanic Sciences Seminar series at the University of Colorado, Boulder, February 2021.
- S. C. Sanchez**, G. Hakim, C. Saenger. Covariance patterns of CMIP5 simulations govern the tropical Pacific response to early 19<sup>th</sup> century volcanism in coral-based data assimilation reconstructions. Poster at the American Geophysical Union Conference, December 2019.
- S. C. Sanchez**, G. Hakim, C. Saenger. Covariance patterns of CMIP5 simulations govern the tropical Pacific response to early 19<sup>th</sup> century volcanism in coral-based data assimilation reconstructions. Poster at the International Conference of Paleooceanography Meeting, Sydney, Australia, September 2019.
- S. C. Sanchez**, G. Hakim, C. Saenger. Reconstructing tropical Pacific precipitation from coral based data assimilation. Talk at PAGES Coral Hydro2k workshop, Sydney, Australia, August, 2019.

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**S. C. Sanchez**, G. Hakim, C. Saenger. Using coral based data assimilation to reconstruct the response of the tropical Pacific to early 19<sup>th</sup> century volcanism. Talk at PAGES PaleoENSO workshop, Belitung, Indonesia, August, 2019.

**S. C. Sanchez**, D.A. Amaya, A.J. Miller, S.P. Xie, C.D. Charles. The Pacific Meridional Mode over the last millennium. Talk at the PAGES Climate Variability Across Scales workshop, Seattle, WA, January 2019.

**S. Sanchez**, C. Charles, J. Rae, J. Stewart, J. Smith. Constraining paleo carbonate chemistry: new insights from  $\delta^{11}\text{B}$  and B/Ca measurements in monitored corals from Palmyra Atoll. Poster Presentation at the Ocean Sciences Meeting, Portland, Oregon, February 2018.

**S. C. Sanchez**, C.D. Charles, D.A. Amaya, A.J. Miller. The Pacific Meridional Mode over the Common Era. Poster Presentation at the American Geophysical Union Fall Conference, San Francisco, California, December 2016.

**S. C. Sanchez**, C.D. Charles, J.D. Carriquiry. Two centuries of coherent Pacific-North American climate change at decadal timescales. Talk at the American Geophysical Union Fall Conference, San Francisco, California, December 2015.

**S. C. Sanchez**, C.D. Charles, J.D. Carriquiry. Two centuries of coherent Pacific-North American climate change at decadal timescales. Talk at the Graduate Student Climate Conference, Woods Hole, Massachusetts, November 2015.

**S. C. Sanchez**, C.D. Charles, J.D. Carriquiry, J. Villaescusa. Insight into the Pacific SST- North American hydroclimate connection from an Eastern Tropical North Pacific coral record. Talk in the Scripps Student Symposium, San Diego, California, September 2015.

**S. C. Sanchez**, C.D. Charles, J.D. Carriquiry, J. Villaescusa. Pacific decadal variability from a Clarion Island coral. Poster in International Conference of Paleoceanography, Sitges, Spain, September 2013.

**Sara Sanchez**, Lina Patino, Lisa Rom, and Susan Weiler. "An Analysis of NSF Geosciences 2009 Research Experience for Undergraduate Site Programs". Talk in the AGU Fall Conference, San Francisco, CA, December 2009.

## **FIELD CERTIFICATIONS, FIELDWORK**

9/16- 10/16	<i>Palmyra Atoll</i> : coral reef monitoring, site documentation, underwater drilling, and coral core collection.
7/13	<i>French Polynesia</i> (Mo'orea, Tubuai): underwater coral drilling and coral core collection.
2012	PADI Open Water Diving
2012	Scripps Institution of Oceanography Scientific Diving
2012	NAUI Rescue Scuba Diving
2012	NAUI Advanced Open Water Scuba Diving
2012	NAUI Nitrox Diving
2012-19	CPR/First Aid/O2 Course

## **WORKS IN PROGRESS**

Reconstructing tropical hydroclimate variability through coral based data assimilation.

Presented at AGU Fall Meeting, 2021. Collaborators: **Sara Sanchez**, Casey Saenger, Feng Zhu, Diane Thompson, Robert Tardif, Greg Hakim, Coral Hydro2k Team.

Observing the Isotopic Expression of Weak vs. Strong El Nino: A Palmyra Atoll Case Study. Preliminary work presented at AGU Fall Meeting 2020 and Coral Reef Symposium 2021. Collaborators: Stevenson, S., Merrifield, M., Cobb, K., Powell, B., Atwood, A., O'Connor, G., & **Sanchez, S.**

Coral skeleton  $\delta^{15}\text{N}$  records provide insights into the dynamic of the ETNP oxygen minimum zone. Preliminary work presented at International Coral Reef Symposium 2021 by collaborator. Collaborators: Nicholas Duprey, Alfredo Garcia, **Sara Sanchez**, Chris Charles, Jose Carriquiry, H.B. Vonhoff, Daniel Sigman, Gerald Haug.

Trends in Participation for Ocean Sciences Research Experiences for Undergraduates Programs. Preliminary work presented at Ocean Sciences 2020 by a collaborator. Collaborators: Elizabeth Lynch Rom, Tyler Pounds, Angela Ousley, Miranda Valdez, Shawndee Neilson, **Sara Sanchez**.

Constraining carbonate chemistry in a monitored coral reef system with  $\delta^{11}\text{B}$  and B/Ca measurements. Preliminary work presented at Ocean Sciences, 2018. Collaborators: **Sara Sanchez**, James Rae, Josh Stewart, Chris Charles, Jen Smith, Yui Takeshita.