Rui Cheng

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EDUCATION

California Institute of Technology, Pasadena, CA
Ph.D., M.S. Environmental Science and Engineering, Electrical Engineering (minor) — Aug 2022
Advisor: Christian Frankenberg

Lehigh University, Bethlehem, PA
M.S. Earth and Environmental Sciences — May 2017

Sun Yat-sen University, Guangzhou, China
B.S. Honor, Atmospheric Science — Jun 2015

RESEARCH INTERESTS

Land-atmosphere coupling, terrestrial ecosystem remote sensing and modeling, climate dynamics, extreme climate events

SKILLS

Remote Sensing	Hyperspectral Reflectance; Solar-Induced chlorophyll Fluorescence (SIF); Microwave; SAR; LiDAR; Thermal;
GIS	ENVI, QGIS, ArcGIS, Google Earth Engine
Field Skills	Eddy Covariance Instruments; Scanning Spectrometer; ASD FieldSpec; PhenoCam
Modeling	Canopy Radiative Transfer Modeling; Earth System Models (CliMA, CESM)
Machine Learning	Computer Vision; CNNs; Cloud Computing & Parallel (AWS, SuperCloud@MIT)
Programming	Python, Julia, Matlab, Fortran, BASH, HTML, GIT, HDF5, NetCDF, Xarray

PROFESSIONAL EXPERIENCE

Sep 2022 - present — **Postdoc Associate**, *Massachusetts Institute of Technology*

with Profs. David Des Marais, Dara Entekhabi, Charles Harvey, and Saurabh Amin

- Writing grant proposals (DOE, NASA, MIT internal grants)
- Evaluating the impact of disturbances on carbon cycling in tropical forests
- Upscaling the understanding of the carbon cycle from local to global scale
- Linking disturbances, climate change, and social impact

Jul 2017 – Aug 2022 — **Graduate Research Assistant,** *California Institute of Technology*

with Profs. Christian Frankenberg and Tapio Schneider

- Physiologically connected vegetation photosynthesis with hyperspectral reflectance and Solar-Induced chlorophyll Fluorescence (SIF) [4, 5, 7]
- Corrected the application of SIF in complex terrain [2]
- Quantitatively evaluated clouds and the atmosphere in temporally upscaled SIF [2]
- Advanced the applicability of SIF and reflectance in the Arctic [1]
- Predicted the interannual variability of California precipitation six months in advance using large-scale climate dynamics, such as PDO and ENSO [3]

Sep 2015 – Jun 2017 **Graduate Research Assistant,** *Lehigh University*

with Prof. Benjamin Felzer

- Detected droughts and floods globally using reanalysis data
- Compared the meteorological droughts and floods to regional crop yields and ethnographic records [8]

Jul 2014 – Oct 2014 **Research Intern,** *Locison Ltd, Foshan, China*

- Processed Wi-Fi signals from indoor shopping malls
- Detected extreme events from Wi-Fi signals [9]

PUBLICATIONS

[1] Cheng, R., Magney, T.S., Orcutt, E.L., Pierrat, Z., Köhler, P., Bowling, D.R., Bret-Harte, M.S., Euskirchen, E.S., Jung, M., Kobayashi, H., Rocha, A.V., Sonnentag, O., Stutz, J., Walther, S., Zona, D., Frankenberg, C. **Evaluating photosynthetic activity across Arctic-Boreal land cover types using solar-induced fluorescence** (2022). *Environmental Research Letters*. https://doi.org/10.1088/1748-9326/ac9dae

[2] Cheng, R., Köhler, P., & Frankenberg, C. **Impacts of topography and radiation on temporal upscaling of instantaneous solar-induced chlorophyll fluorescence** (2022). *Agricultural and Forest Meteorology.* https://doi.org/10.1016/j.agrformet.2022.109197

[3] Cheng, R., Novak, L., & Schneider, T., **Predicting the interannual variability of California's total annual precipitation** (2020). *Geophysical Research Letters*, 48, e2020GL091465. https://doi.org/10.1029/2020GL091465

[4] Cheng, R., Magney, T.S., Dutta, D., Bowling, D.R., Logan, B.A., Burns, S.P., Blanken, P.D., Grossmann, K., Lopez, S., Richardson, A.D. and Stutz, J. **Decomposing reflectance spectra to track gross primary production in a subalpine evergreen forest** (2020). *Biogeosciences*, 17(18), pp.4523-4544. https://doi.org/10.5194/bg-17-4523-2020

[5] Magney, T.S., Bowling, D.R., Logan, B.A., Grossmann, K., Stutz, J., Blanken, P.D., Burns, S.P., Cheng, R., Garcia, M.A., Köhler, P. and Lopez, S., **Mechanistic evidence for tracking the seasonality of photosynthesis with solar-induced fluorescence** (2019). *Proceedings of the National Academy of Sciences*, 116(24), pp.11640-11645. https://doi.org/10.1073/pnas.1900278116

[6] Byrne, B., Liu, J., Yi, Y., Chatterjee, A., Basu, S., Cheng, R., Doughty, R., Chevallier, F., Bowman, K.W., Parazoo, N. C., Crisp, D., Li, X., Xiao, J., Sitch, S., Guenet, B., Deng, F., Johnson, M. S., Philip, S., Mcguire, P. C., and Miller, C. E. **Multi-year observations reveal a larger than expected autumn respiration signal across northeast Eurasia** (2022). *Biogeosciences*. https://doi.org/10.5194/bg-19-4779-2022

[7] Seyednasrollah, B., Bowling, D.R., Cheng, R., Logan, B.A., Magney, T.S., Frankenberg, C., Yang, J.C., Young, A.M., Hufkens, K., Arain, M.A. and Black, T.A. **Seasonal variation in the canopy color of temperate evergreen conifer forests** (2020). *New Phytologist*. https://doi.org/10.1111/nph.17046

[8] Felzer, B.S., Ember, C.R., Cheng, R. and Jiang, M. **The Relationships of Extreme Precipitation and Temperature Events with Ethnographic Reports of Droughts and Floods in Nonindustrial Societies** (2020). *Weather, Climate, and Society*, 12(1), pp.135-148. https://doi.org/10.1175/WCAS-D-19-0045.1

[9] Zhang, D., Qiu, G., Gao, Y., Fang, X., Cheng, R., Chang, A. and Chan, C.Y. **Crowdsourcing based radio map anomalous event detection system for calibration-on-demand** (2014). In *2014 International Conference on Indoor Positioning and Indoor Navigation (IPIN)* (pp. 220-229). IEEE.

SELECTED PRESENTATIONS

SIF-GPP relationship at high latitudes

Oct 2022 NASA OCO2/3 Science Team Meeting
Oct 2021 SpecNet Fall Community Meeting
Dec 2020 American Geophysical Union Fall Meeting
Jun 2020 NASA ABOVE Science Team Meeting

Temporally upscaling SIF: topography, atmosphere, and weather

Mar 2022 NASA OCO2/3 Science Team Meeting
Apr 2021 NASA JPL Carbon Club Seminar

Tracking photosynthetic seasonality using hyperspectral reflectance

Dec 2018 American Geophysical Union Fall Meeting
Nov 2018 Caltech Environmental Science and Engineering Seminar

Using climate indices to describe drought events in anthropological records

Jan 2017 American Meteorological Society Annual Conference
Dec 2016 Earth and Environmental Sciences Graduate Symposium, Lehigh University

TEACHING EXPERIENCE

2023 Spring **[TA] 1.1xx: Sensors and Networks,** *MIT,* Prof. Saurabh Amin
- Developing a new course and designing the syllabus

2023 Winter **[TA] TREX: Vegetation and Remote Sensing on the Island of Hawai'i,** *MIT*
Prof. David Des Marais
- Designing projects and mentoring independent studies

2022 Fall **[Instructor] GIS hands-on tutorials with drone and satellite images,** *MIT*
- Designed syllabus and taught lectures

2021 Spring **[TA] GE 157c: Remote Sensing for Environmental and Geological Applications,** *Caltech*
Prof. Bethany Elmann
- Designed syllabus and assignments, taught lectures, mentored independent studies, and led discussion sessions

2019 - 2022 **[Instructor] Data and Coding,** the Carpentries at *Caltech*
- Designed syllabus and aught lectures

2019 Winter **[TA] ESE 103: Earth's Biogeochemical Cycles,** *Caltech,* Prof. Christian Frankenberg
- Led discussion sessions and lecture reviews

2018 Winter **[TA] ESE 131a: Physical Oceanography I,** *Caltech,* Prof. Jörn Callies
- Led discussion sessions and lecture reviews

2018 Fall **[TA] ESE 101: Earth's Atmosphere,** *Caltech,* Prof. Tapio Schneider
- Led discussion sessions and lecture reviews

2016 **Teacher Development Program,** *Lehigh University*

PROJECT FRAMEWORKS & ACADEMIC AFFILIATIONS

NASA	OCO2/3, Carbon Monitoring System, Arctic Boreal Vulnerability Experiment
NSF	Macrosystems Biology, Climate & Large-scale Dynamics, D-ISN-Illicit Supply Networks, Interdisciplinary Behavioral and Social Science
AmeriFlux	Flux course alumni 2017

MENTORING

Winter 2019	Lyn Li, A.B./B.S. Geophysics (Caltech'19)
2018-2019	Laura Hu, B.S. Computer Science & English (Caltech'21)

PROFESSIONAL SERVICE

Reviewing	Remote Sensing of Environment; Agricultural and Forest Meteorology; Biogeosciences; ISPRS Journal of Photogrammetry and Remote Sensing; Proceedings of the National Academy of Sciences (PNAS) Nexus; European Journal of Remote Sensing; Geocarto International; Science of the Total Environment; Remote Sensing; Forests
2022	Ameriflux Year of Remote Sensing Organizing Committee
2022	FLUXNET Co-op Education Committee Co-Lead
2022	NEON Advisory Groups - Remote Sensing Algorithm Group and Foliar Sampling Group
2022	Graduate Travel Fund Selection Committee for *American Geophysical Union Biogeosciences*
2021	Hilker Award Selection Committee for *American Geophysical Union Biogeosciences*
2021	Academic Search Committee for Department of Global Biology, Carnegie Science Institute
2019-2021	Resident Associate, *Caltech*
2017	Faculty Search Committee for Lehigh University

DEI & SCIENCE OUTREACH

2021	Science Outreach at 29 Palms, *American Geophysical Union Voices for Science* program
2021-present	Diversity, equity, and Inclusion Committee for *American Geophysical Union Biogeosciences*
2020-2022	Caltech Women in Geoscience Club
2017-2022	Caltech Women Mentor Women
2018	Mentor and Judge in SoCal Science Olympiad
2018	Science Outreach at the Washington STEAM Multilingual Academy, Pasadena, CA
2017-2018	Science Tutor for underrepresented students at Donegan Elementary School, Bethlehem, PA
2012-2014	Science Tutor for students with disabilities, Guangzhou, China

AWARDS

2018	Graduate Student Travel Grant, Ameriflux Annual Meeting
2017	Graduate Student Travel Grant, Caltech
2016	Graduate Student Travel Grant, Lehigh University
2015	University Distinctive Graduate, Sun Yat-sen University
2015	College Award for Outstanding Senior Thesis, Sun Yat-sen University
2012-2014	The First-Class Scholarships, Sun Yat-sen University

REFERENCES

Christian Frankenberg (Ph.D. Advisor)
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Professor of Environmental Science and Engineering
Jet Propulsion Laboratory Research Scientist
California Institute of Technology

Tapio Schneider (Ph.D. Committee Chair)
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Jet Propulsion Laboratory Senior Research Scientist
California Institute of Technology

Paul O. Wennberg (Ph. D. Committee)
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Professor of Atmospheric Chemistry and Environmental Science and Engineering
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David R. Bowling (Collaborator, PI)
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Professor of Biological Sciences and Atmospheric Sciences
University of Utah

John C. Lin (Collaborator, PI)
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Professor of Atmospheric Sciences
University of Utah

David Des Marais (Postdoc PI)
dldesmar@mit.edu
Cecil & Ida Green Career Development Professor
Assistant Professor of Civil and Environmental Engineering
Massachusetts Institute of Technology

Troy S. Magney (Collaborator, Mentor)
tmagney@ucdavis.edu
Assistant Professor of Plant Sciences
University of California, Davis