

Sulian Thual

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SUMMARY

Background in research and academia focusing on climate dynamics, theory and applied mathematics. Expertise in tropical variability including El Niño Southern-Oscillation (ENSO), Madden-Julian Oscillation (MJO), geophysical fluid dynamics, numerical modeling, machine learning and data analysis.

EXPERIENCE

CLEMSON UNIVERSITY <i>Postdoctoral Researcher (full-time) • Machine Learning</i>	Clemson, USA 03/2025-present
MERCATOR OCEAN INTERNATIONAL <i>Oceanographer (full-time) • Validation of Global Reanalysis</i>	Toulouse, France 01/2023-08/2024
CECI-CERFACS, METEO-FRANCE <i>Postdoctoral Researcher (full-time) • ENSO theory</i>	Toulouse, France 10/2021-12/2022
FUDAN UNIVERSITY – INSTITUTE OF ATMOSPHERIC SCIENCES <i>Assistant Professor (full-time)</i>	Shanghai, China 09/2018-10/2019
NEW YORK UNIVERSITY - COURANT INSTITUTE OF MATHEMATICAL SCIENCES <i>Postdoctoral Research Associate (full-time) • MJO, ENSO modeling and theory</i>	New York, USA 01/2013-06/2018
UNIVERSITY TOULOUSE III <i>PhD (full-time) • Major Physical Oceanography, ENSO modeling and theory</i>	Toulouse, France 09/2009-10/2012
INSTITUT DE RECHERCHE POUR LE DEVELOPPEMENT (IRD) <i>Gap Year • regional modeling of the Humboldt current system</i>	Lima, Peru 2007-2008

EDUCATION

MIT – PROFESSIONAL EDUCATION <i>Applied Data Science Program • Machine learning theory and applications (6 projects + 1 capstone)</i>	Remote Aug-Nov 2021
UNIVERSITY TOULOUSE III <i>PhD • Major Physical Oceanography Dissertation title: Simple Models for the Modulation of El Niño-Southern Oscillation Mechanisms</i>	Toulouse, France 2009-2012
METEO-FRANCE <i>Master's degree of Sciences • Major Ocean-Atmosphere Dynamics</i>	Toulouse, France 2008-2009
ENSEEIH <i>Engineering Degree • Major Fluid Mechanics</i>	Toulouse, France 2005-2009

TEACHING

ENSEEIH <i>Co-Instructor, data sciences for climate, APP Climat (graduate level, 8h)</i>	Toulouse, France 02/2023-05/2023
FUDAN UNIVERSITY – INSTITUTE OF ATMOSPHERIC SCIENCES <i>Instructor, course semester on geophysical fluid dynamics (graduate level, 45h)</i>	Shanghai, China 01/2019-06/2019
NEW YORK UNIVERSITY - COURANT INSTITUTE OF MATHEMATICAL SCIENCES <i>Co-Instructor, course semester on ENSO dynamics (graduate level, 45h) Co-Mentor for Master Student (Manyuan Tao)</i>	New York, NY 09/2017-12/2017 09/2017-06/2018

SKILLS

ACADEMIC SERVICE: Scientific Reviewer for Nature Communications, Nature Climate Change, Journal of Climate, Geophysical Research Letter, Journal of Physical Oceanography, Nature Scientific Reports, JAMES
CODING: Python, Jupyter/Colab, Linux, Latex, Git (daily use) • Matlab, Fortran, IDL, Javascript (previous experience)
Python packages: matplotlib, numpy, xarray, scipy, sklearn, eofs, pandas, keras, tensorflow...

LANGUAGES: French (native), English (fluent), Spanish (fluent)
OTHERS: USA permanent resident (green card), drivers license

PROJECTS

- 1) Co-Investigator in a French NSF Research Project, Templex: Topological methods for Earth Dynamics (lead PI D. Sciamarella). Agence National de la Recherche (ANR, France), 2023, 508k euros (~\$550K).
- 2) International Collaborator in Chilean research program: Climate Action Planning (CLAP, Director B. Dewitte). CEAZA, funding ANID (2020 call for Strengthening scientific capacities of regional research center), coordination Ocean Decade Programme, 2020-2025.
- 3) Member of ENSO Conceptual Model Working Group (coordinator J. Vialard). US CLIVAR Pacific Region Panel, 2020-present.
- 4) Principal Investigator in a Chinese NSF Research Project, Dynamical interactions between the MJO and El Niño in the tropics: a theoretical framework. NSF China, 2019, 200K RMB (~\$30K). Grant renounced due to departure from China.

PUBLICATIONS

BOOK CHAPTERS

- 1) Guilyardi, E., Capotondi, A., Lengaigne, M., Thual, S., Wittenberg, A., 2020: "ENSO modeling: History, Progress and Challenges". El Niño Southern Oscillation in a Changing Climate. AGU monograph.
- 2) Majda, A.J., Stechmann, S.N., Chen, S., Ogrosky, R., Thual, S., 2019: Stochastic Skeleton Model for the MJO. Tropical Intraseasonal Variability and the Stochastic Skeleton Method. Springer Briefs in Mathematics of Planet Earth.
- 3) Majda, A.J., Stechmann, S.N., Chen, S., Ogrosky, R., Thual, S., 2019: Refined Vertical Structure in the Stochastic Skeleton Model for the MJO. Tropical Intraseasonal Variability and the Stochastic Skeleton Method. Springer Briefs in Mathematics of Planet Earth.
- 4) Chen, N., Thual, S., and Stuecker, M. F., 2019: El Niño and the Southern Oscillation: Theory. Reference Module in Earth Systems and Environmental Sciences. Elsevier.
- 5) Chen, N., Thual, S., and Hu, S., 2019: El Niño and the Southern Oscillation: Observation. Reference Module in Earth Systems and Environmental Sciences. Elsevier.

JOURNAL ARTICLES

- 1) Vialard, J. and coauthors, 2024: The El Niño Southern Oscillation (ENSO) recharge oscillator conceptual model: achievements and future prospects, *Rev. Geophys.*, in press
- 2) von Schuckmann, K., and coauthors, 2024. The state of the global ocean. *State of the Planet*, 4, pp.1-30.
- 3) Thual, S. and Dewitte, B., 2023: ENSO complexity controlled by zonal shifts in the Walker circulation, *Nature Geosciences*, doi: s41561-023-01154-x
- 4) Thual, S., A. J. Majda, and N. Chen, 2019: Statistical occurrence and mechanisms of the 2014–2016 delayed super El Niño captured by a simple dynamical model, *Clim. Dyn.*, DOI 10.1007/s00382-018-4265-5
- 5) Thual, S., and Mosquera, K., 2018: Estudio teórico sobre la relación entre El Niño y la Oscilación Madden-Julian. *Boletín Técnico "Generación de información y monitoreo del Fenómeno El Niño" del IGP*, 5 (10), 5-9. (Spanish)
- 6) Thual, S., Majda, A.J. and Chen, N., 2018: A Tropical Stochastic Skeleton Model for the MJO, El Niño and Dynamic Walker Circulation: A Simplified GCM. *J. Climate*, DOI 10.1175/JCLI-D-18-0263.1
- 7) Morel, Y., Thual, S., Delcroix, T. and Hall, N., 2018: A theoretical model to analyze the Central to Eastern Pacific El Niño continuum, *Ocean Modelling*, DOI 10.1016/j.ocemod.2018.07.006
- 8) Chen, N., A. J. Majda, and S. Thual, 2017: Observations and Mechanisms of a Simple Stochastic Dynamical Model Capturing El Niño Diversity, *J. Climate*, 31, 449–471, DOI 10.1175/JCLI-D-16-0880.1
- 9) Thual, S., A. J. Majda, and N. Chen, 2017: Seasonal Synchronization of a Simple Stochastic Dynamical Model Capturing El Niño Diversity, *J. Climate*, DOI 10.1175/JCLI-D-17-0174.1
- 10) Thual, S., A. J. Majda, N. Chen and S. N. Stechmann, 2016: Simple Stochastic Model for El Niño with Westerly Wind Bursts, *Proc. Nat. Acad. Sci.*, 113, 37, 10245–10250, DOI 10.1073/pnas.1612002113.
- 11) Stachnik, J. P., D. E. Waliser, A. J. Majda, S. N. Stechmann, and S. Thual, 2015: Evaluating MJO initiation and decay in the skeleton model using an RMM-like index. *J. Geophys. Res. Atmos.*, 120, 486–508, DOI 10.1002/2015JD023916.
- 12) Thual, S., and A. J. Majda, 2015: A suite of skeleton models for the MJO with refined vertical structure, *Mathematics of Climate and Weather Forecasting*, 1, 70–95, DOI 10.1515/mcwf-2015-0004.
- 13) Thual, S., and A. J. Majda, 2015: A skeleton model for the MJO with refined vertical structure, *Clim. Dyn.*, 46, 2773–2786, DOI 10.1007/s00382-015-2731-x.
- 14) Thual, S., N. Ayoub, and B. Dewitte, 2015: Impact of Sea Level Assimilation on ENSO Initialization and Prediction: the Role of the Sea Level Zonal Tilt and Zonal Mean, *Mon. Weather Rev.*, 143, 1895–1906, DOI 10.1175/MWR-D-13-00352.1
- 15) Thual, S., A. J. Majda, and S. N. Stechmann, 2014: Asymmetric intraseasonal events in the stochastic skeleton MJO model with seasonal cycle, *Clim. Dyn.*, DOI 10.1007/s00382-014-2256-8.
- 16) Thual, S., A. J. Majda, and S. N. Stechmann, 2014: A Stochastic Skeleton Model for the MJO, *J. Atmos. Sci.*, 71, 697–715, DOI 10.1175/JAS-D-13-0186.1.
- 17) Thual, S., B. Dewitte, N. Ayoub, and O. Thual, 2013: An Asymptotic Expansion for the Recharge-Discharge Model of ENSO, *J. Phys. Oceanogr.*, 43, 1407–1416, DOI 10.1175/JPO-D-12-0161.1.
- 18) Thual, S., B. Dewitte, S.-I. An, S. Illig, and N. Ayoub, 2013: Influence of Recent Stratification Changes on ENSO stability in a Conceptual Model of the Equatorial Pacific, *J. Climate*, 26, 4790–4802, DOI 10.1175/JCLI-D-12-00363.1.
- 19) Thual, S., O. Thual, and B. Dewitte, 2012: Absolute or Convective instability in the equatorial Pacific and implications for ENSO, *Q.J.R. Meteorol. Soc.*, 139, 600–606, DOI:10.1002/qj.1988.

- 20) Dewitte, B., S.-W. Yeh, and S. Thual, 2012: Reinterpreting the thermocline feedback in the western-central equatorial Pacific and its relationship with the ENSO modulation, *Clim. Dynamics*, 41, 819-830, DOI 10.1007/s00382-012-1504-z.
- 21) Thual S., B. Dewitte, S.-I. An and N. Ayoub, 2011: Sensitivity of ENSO to stratification in a recharge-discharge conceptual model. *J. Climate*, 4, 4331-4348, DOI 10.1175/2011JCLI4148.1.
- 22) Dewitte, B., J. Choi, S.-I. An, and S. Thual, 2011: Vertical structure variability and equatorial waves during central Pacific and eastern Pacific El Niños in a coupled general circulation model, *Clim. Dynamics*, 38, 2275-2289, DOI 10.1007/s00382-011-1215-x.
- 23) Dewitte B., S. Thual, S.-W. Yeh, S.-I. An, B.-K. Moon and B. Giese, 2009: Low frequency variability of temperature in the vicinity of the equatorial thermocline in SODA: Role of equatorial wave dynamics and ENSO asymmetry. *J. Climate*, 22, 5783-5795, DOI 10.1175/2009JCLI2764.1.

PRESENTATIONS

CONFERENCES

- 1) The role of spatial shifting in El Niño/Southern Oscillation complexity. EGU Assembly, Vienna, Austria, Apr 23-28, 2023.
- 2) The role of spatial shifting in El Niño/Southern Oscillation complexity (Invited), 3rd summer school on theory, mechanisms and hierarchical modeling of climate dynamics: tropical oceans, ENSO and their teleconnections, ITCP hybrid meeting, Trieste, Italy, July 18-29, 2022.
- 3) A Dynamical Stochastic Skeleton Model for the MJO and ENSO (Invited), EGU Assembly, Vienna, Austria, Apr 7-12, 2019.
- 4) A Dynamical Stochastic Skeleton Model for the MJO and ENSO (Invited), Annual LASG Academic Conference, Beijing, China, Dec 4-5 2018.
- 5) A Stochastic Skeleton Model for the MJO and ENSO, IV International Conference on the El Niño-Southern Oscillation: ENSO in a warming climate, Guayaquil, Ecuador, Oct 16-18 2018.
- 6) A Simple Stochastic Model for El Niño with Westerly Wind Bursts. AGU Fall Meeting, San Francisco, Dec 12-16, 2016.
- 7) A Stochastic Skeleton Model for the MJO, AMS 31st Conference on Hurricanes and Tropical Meteorology, San Diego, Mar 30-Apr 4, 2014.
- 8) A Stochastic Skeleton Model for the MJO. AGU Fall Meeting, San Francisco, Dec 9-13, 2013.
- 9) Modulation of ENSO stability over the recent decades: the Role of Stratification. EGU Assembly, Vienna, Austria, Apr 22-27, 2012.
- 10) Sensitivity of ENSO to stratification in a conceptual model. AGU Meeting of the Americas, Foz do Iguacu, Brazil, Aug 8-12, 2010.

SEMINARS

- 1) ENSO complexity controlled by zonal shifts in the Walker circulation. Seminar at Mercator Ocean International, Toulouse, France, Jun 30 2023.
- 2) Rôle du déplacement des structures spatiales pour l'Oscillation Australe El Niño. Seminar at CNRM Météo-France (Jeudis du Climat), Toulouse, France, Oct 6 2022.
- 3) The role of spatial shifting in El Niño/Southern Oscillation complexity. ENSO conceptual models working group meeting (CLIVAR Pacific Region Panel), online, Sept 28, 2022.
- 4) On the role of Atmospheric Wind Bursts for El Niño onset and diversity, Department Seminar, Fudan University, May 21, 2019.
- 5) Identifying the ENSO harmonic oscillator in models and observations, Department Seminar, Fudan University, Mar 27, 2019.
- 6) A Stochastic Skeleton Model for the MJO and El-Niño Southern Oscillation, Workshop on Moist Processes in the Atmosphere, Oberwolfach, Germany, Feb 17-23 2019.
- 7) A Stochastic Skeleton Model for the ENSO and MJO, Applied Math Seminar, Dept of Mathematics, University of Wisconsin-Madison, Oct 5, 2018.
- 8) A Simple Dynamical Model for El Niño with Stochastic Wind Bursts, Seminar, Dept of Physical Oceanography, Woods Hole Oceanographic Institution, Massachusetts, Mar 27, 2018.
- 9) A Stochastic Skeleton Model for the MJO, Seminar at LEGOS-OMP, Toulouse, France, Jan 12, 2017.
- 10) A Stochastic Skeleton Model for the MJO. Seminar at LOCEAN, Paris, France, Jan 10, 2017.
- 11) A Stochastic Skeleton Model for the MJO. Seminar at CNRM Météo-France, Toulouse, France, Jan 3, 2017.
- 12) A Stochastic Skeleton Model for the MJO. CAOS Colloquium, New York University, Dec 7, 2016.
- 13) A Stochastic Skeleton Model for the MJO. MURI workshop, New York University, Oct 21, 2016.
- 14) A Stochastic Skeleton Model for the MJO (Invited). International Workshop on the Madden-Julian Oscillation, Chengdu, China, Aug 6-9, 2016.
- 15) A Skeleton Model for the MJO with Refined Vertical Structure. Workshop on Organization of Tropical Convection, Banff, Canada, Apr 26-May 1, 2015.
- 16) A Stochastic Skeleton Model for the MJO, Seminar at LEGOS-OMP, Toulouse, France, Dec 11, 2014.
- 17) A Stochastic Skeleton Model for the MJO. MURI workshop, New York University, Jan 20-24, 2014.
- 18) A Stochastic Skeleton Model for the MJO. Student Seminar, New York University, Nov 15, 2013.
- 19) Modulation of ENSO stability over the recent decades: the Role of Stratification. Seminar at Climate Theory Laboratory, Yonsei University, South Korea, Sept 15, 2012.
- 20) Sensitivity of ENSO to stratification. Seminar at Climate Theory Laboratory, Yonsei University, South Korea, May 21, 2011.

POSTERS

- 1) Quantifying Coastal Trapped Waves origins and impacts in a High-Resolution Global Reanalysis. Journées Scientifiques LEFE/GMMC 2023, Plouzané (France), May 31-June 02, 2023.
- 2) Seasonal Synchronization of a Simple Stochastic Dynamical Model Capturing El Niño Diversity. AGU Fall Meeting, New Orleans, December 11-15, 2017.
- 3) A Skeleton Model for the MJO with Refined Vertical Structure. AMS Annual Meeting, New Orleans, January 10-13, 2016.
- 4) A Stochastic Skeleton Model for the MJO. MURI workshop, New York University, Jan 30, 2016.

- 5) Asymmetric Intraseasonal Events in the Stochastic Skeleton Model with Seasonal Cycle. Workshop on Monsoons and ITCZs, Columbia University, September 15-18, 2015.
- 6) Asymmetric Intraseasonal Events in the Stochastic Skeleton Model with Seasonal Cycle. WWOSC, Montreal, Canada, August 16-21, 2015.
- 7) Correction of large scale modes by sea level data assimilation in an intermediate ENSO model. EGU Assembly, Vienna, Austria, April 22-27, 2012.

OUTREACH

- 1) Interview in online video: El Niño, le phénomène naturel qui réchauffe la planète. Brut, July 2023
- 2) Interview on national french radio, El Niño: le fond de l'air effraie. La Science CQFD, France Culture, June 2023.
- 3) Thual, S., and Mosquera, K., 2018: Estudio teórico sobre la relación entre El Niño y la Oscilación Madden-Julian. Boletín Técnico "Generación de información y monitoreo del Fenómeno El Niño" del Instituto Geofísico del Peru, 5 (10),5-9. (information bulletin in spanish)