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Long LI

Starting Research Positions

Research Interests

Stochastic Modeling, Uncertainty Quantification, Data Assimilation, Ensemble Forecasting, Numerical Methods, Scientific Computing, Geophysical Fluid Dynamics, Turbulence

Education

2017 – 2020 **PhD in Applied Mathematics**, *Université de Rennes I*, France

2015 – 2017 **Master in Applied Mathematics**, *Université Grenoble Alpes*, France

2012 – 2015 **Bachelor in Mathematics**, *Université Jean Monnet Saint Etienne*, France

Research Experience

2021 – 2025 **Starting Research Positions**, *Centre Inria de l'Université de Rennes*, France

- Projects Participation:
  - Research Associate in STUOD (European Research Council Project)
  - Postdoctoral Fellow in MEDIATION (French Priority Research Program)
- Scientific Contributions:
  - Stochastic parameterizations of subgrid-scale ocean processes, with data-driven design and validation in operational models
  - GPU-portable, auto-differentiable solvers and efficient time integration for stochastic geophysical fluid dynamics
  - Physically consistent stochastic modeling of air–sea coupling, wave–current interactions, and boundary layer turbulence

2017 – 2020 **Doctoral Researcher**, *Institut de recherche mathématique de Rennes*, France

- PhD Thesis: *Stochastic modeling and numerical simulation of ocean dynamics* [HAL], supervised by Etienne Mémin and Werner Bauer
  - Developed a hierarchy of stochastic large-scale ocean models
  - Investigated uncertainty quantification and ensemble forecasting

2017 **Research Intern**, *Laboratoire Jean Kuntzmann*, Grenoble, France

6 months

- MSc Thesis: *Global sensitivity analysis for a parametrized diffusion process*, supervised by Clémentine Prieur and Pierre Étoré
  - Developed a novel uncertainty quantification method for stochastic differential equations by integrating Feynman-Kac formulae with polynomial chaos expansion

2016 **Research Intern**, *Laboratoire Jean Kuntzmann*, Grenoble, France

3 months *Numerical methods for stochastic differential equations*, supervised by Clémentine Prieur

Supervision and Teaching

2021 – 2024

3 years **PhD Co-supervisor:** Francesco Tucciarone (Computer Science, University of Rennes I), *Stochastic parametrization of ocean models through high-resolution observations* [Thesis]. Publication of three book chapters and a journal article.

2024 **Master Intern Co-supervisor:** Antoine Guines (Mathematical Engineering, INSA
4 months Rouen), *Numerical study of a stochastic ocean model in the Mediterranean configuration*. A detailed comparison between deterministic and stochastic simulations.

2013 – 2015 **Tutor for undergraduate students:** *Exercise sessions in Analysis and Algebra*,
30 hours Faculty of Sciences and Techniques, Université Jean Monnet.

Peer Reviewing

Journals Journal of Advances in Modeling Earth Systems (JAMES), Geoscientific Model Development (GMD), Frontiers in Marine Science (Physical Oceanography)

Books Chapters in Mathematics of Planet Earth (MPE)

Languages

Chinese Native

English Fluent (C1)

French Fluent (C1)

Computer Skills

Programming Python, Fortran, C/C++, PyTorch, Julia, Matlab, R

HPC OpenMP, MPI, CUDA

Tools Vim, Jupyter Notebook, Markdown, LaTeX, ParaView, NetCDF, XIOS

Systems Linux, macOS, Git, SVN, Docker, OAR, SLURM, shell/batch scripting

Publications

Journal Articles

[doi] [pdf] [code] Li, L., Mémin, E., Chapron, B. (2025). A generalized stochastic formulation of the Ekman-Stokes model with statistical analyses. Journal of Physical Oceanography, 55, 1389–1407.

[doi] [pdf] [code] Tucciarone, F., Li, L., Mémin, E., Chandramouli, P. (2025). Derivation and numerical assessment of a stochastic large-scale hydrostatic primitive model. Journal of Advances in Modeling Earth Systems, 17, e2024MS004783.

[doi] [pdf] [code] Clement, S., Blayo, E., Debreu, L., Brankart, J.-M., Brasseur, P., Li, L., Mémin, E. (2025). Link between stochastic grid perturbation and location uncertainty framework. Journal of Advances in Modeling Earth Systems, 17, e2024MS004528.

[doi] [pdf] [code] Thiry, L., Li, L., Mémin, E., Roullet, G. (2024). A unified formulation of quasi-geostrophic and shallow water equations via projection. Journal of Advances in Modeling Earth Systems, 16, e2024MS004510.

[doi] [pdf] [code] Thiry, L., Li, L., Roullet, G., Mémin, E. (2024). MQGeometry-1.0: a multi-layer quasi-geostrophic solver on non-rectangular geometries. Geoscientific Model Development, 17, 1749–1764.

[doi] [pdf] [code] Li, L., Deremble, B., Lahaye, N., Mémin, E. (2023). Stochastic data-driven parameterization of unresolved eddy effects in a baroclinic quasi-geostrophic model. Journal of Advances in Modeling Earth Systems, 15, e2022MS003297.

[doi] [pdf] [code] Brecht, R., Li, L., Bauer, W., Mémin, E. (2021). Rotating shallow water flow under location uncertainty with a structure-preserving discretization. Journal of Advances in Modeling Earth Systems, 13 (12), e2021MS002492.

[doi] [pdf] Bauer, W., Chandramouli, P., Chapron, B., Li, L., Mémin, E. (2020). Deciphering the role of small-scale inhomogeneity on geophysical flow structuration: a stochastic approach. Journal of Physical Oceanography 50, 983-1003.

[doi] [pdf] Bauer, W., Chandramouli, P., Li, L., Mémin, E. (2020). Stochastic representation of mesoscale eddy effects in coarse-resolution barotropic models. Ocean Modelling 151, 101646.

[doi] [pdf] [code] Resseguier, V., Li, L., Jouan, G., Derian, P., Mémin, E., Chapron, B. (2020). New trends in ensemble forecast strategy: uncertainty quantification for coarse-grid computational fluid dynamics. Archives of Computational Methods in Engineering, 1886-1784.

[doi] [pdf] Étoré, P., Prieur, C., Pham, D., Li, L. (2020). Global sensitivity analysis for models described by stochastic differential equations. Methodology and Computing in Applied Probability 22, 803-831.

Book Chapters

[pdf] [code] Li, L., Mémin, E., Chapron, B. (2025). A stochastic Ekman-Stokes model for coupled ocean-atmosphere-wave dynamics. Accepted by Stochastic Transport in Upper Ocean Dynamics IV.

[doi] [pdf] Tucciarone, F., Li, L., Mémin, E., Thiry, L. (2025). Transport noise defined from wavelet transform for model-based stochastic ocean models. Stochastic Transport in Upper Ocean Dynamics III, Mathematics of Planet Earth, vol 13. Springer, 287-303.

[doi] [pdf] [code] Mémin, E., Li, L., Lahaye, N., Tissot, G., and Chapron, B. (2024). Linear wave solutions of a stochastic shallow water model. Stochastic Transport in Upper Ocean Dynamics II, Mathematics of Planet Earth, vol 11. Springer, 223–245.

[doi] [pdf] Tucciarone, F., Mémin, E., Li, L. (2024). Data driven stochastic primitive equations with dynamic modes decomposition. Stochastic Transport in Upper Ocean Dynamics II, Mathematics of Planet Earth, vol 11. Springer, 321–336.

[doi] [pdf] Jamet, Q., Mémin, E., Dumas, F., Li, L., Garreau, P. (2024). Toward a stochastic parameterization for oceanic deep convection. Stochastic Transport in Upper Ocean Dynamics II, Mathematics of Planet Earth, vol 11. Springer, 143–157.

[doi] [pdf] [code] Li, L., Mémin, E., Tissot, G. (2023). Stochastic parameterization with dynamic mode decomposition. Stochastic Transport in Upper Ocean Dynamics, Mathematics of Planet Earth, vol 10. Springer, 179–193.

[doi] [pdf] [code] Thiry, L., Li, L., Mémin, E. (2023). Modified (hyper-)viscosity for coarse-resolution ocean models. In Stochastic Transport in Upper Ocean Dynamics, 273-285. Springer, Cham.

[doi] [pdf] Tucciarone, F., Mémin, E., Li, L. (2023). Primitive equations under location uncertainty: analytical description and model development. Stochastic Transport in Upper Ocean Dynamics, Mathematics of Planet Earth, vol 10. Springer, 287–300.

[doi] [pdf] Fiorini, C., Boulvard, P.-M., Li, L., Mémin, E. (2023). A Two-step numerical scheme in time for surface quasi-geostrophic equations under location uncertainty. Stochastic Transport in Upper Ocean Dynamics, Mathematics of Planet Earth, vol 10. Springer, 57–67.

Presentations

[slides] Li, L. (Mar. 2025). Stochastic modeling in geophysical fluid dynamics. Invited Seminar, ANGE Project-Team, INRIA, Paris, France.

[slides] Li, L. (Oct. 2024). A stochastic formulation of the Ekman-Stokes model. Atelier sur la représentation des fines échelles océaniques dans les simulations numériques, Ifremer, Plouzané, France.

[slides] Li, L. (Oct. 2024). Stochastic modeling in geophysical fluid dynamics. Invited Seminar, CALISTO Project-Team, Inria, Valbonne, France.

[slides] Li, L. (Sep. 2024). A generalized stochastic formulation of the Ekman-Stokes model with statistical analyses. 5th STUOD Annual Workshop, Inria, Rennes, France.

[slides] Li, L. (Sep. 2024). Stochastic modeling in geophysical fluid dynamics. Invited Seminar, Research Center for Mathematics and Interdisciplinary Sciences, Shandong University, Qingdao, China.

[slides] Li, L. (Sep. 2023). Uncertainty quantification of mesoscale air-sea interaction under transport noise. 4th STUOD Annual Workshop, Ifremer, Plouzané, France.

[slides] Li, L. (Nov. 2022). Stochastic transport in an idealized ocean-atmosphere coupled model. AIRSEA Team Seminar, Inria, Grenoble, France.

[slides] Li, L. (Sep. 2022). Stochastic transport in an idealized ocean-atmosphere coupled model. 3rd STUOD Annual Workshop, Imperial College London, London, UK.

[slides] Li, L. (May 2022). Stochastic transport in an idealized ocean-atmosphere coupled system. EGU General Assembly, Vienna, Austria.

[slides] Li, L. (Sep. 2021). Statistically data-driven modelling location uncertainty in mesoscale dynamics. 2nd STUOD Annual Workshop, Online.

[slides] Li, L. (Apr. 2021). Stochastic modeling of mesoscale eddies. EGU General Assembly, Online.

[slides] Li, L. (Sep. 2020). Stochastic modeling of the oceanic mesoscale eddies. 1st STUOD Annual Workshop, Online.

[slides] Li, L. (Sep. 2019). Stochastic modeling of mesoscale eddies in oceanic dynamics. Workshop on Frontiers of Uncertainty Quantification in Fluid Dynamics, Pisa, Italy.

[poster] Li, L. (Jul. 2019). Stochastic modeling of mesoscale eddies in barotropic wind-driven circulation. Workshop on Stochastic Parameterizations and Their Use in Data Assimilation, London, UK.

[slides] Li, L. (Apr. 2019). Oceanic dynamics under Location Uncertainty - Towards a consistent stochastic modeling. Workshop Conservation Principles, Data and Uncertainty in Atmosphere-Ocean Modeling, Potsdam, Germany.