Wenrui Jiang

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Research Interest

I use a combination of Lagrangian particle and budget analysis to study the evolution of tracer (heat, salinity, nutrient...) anomalies in the ocean. I am also interested in submesoscale dynamics. I am currently working on a project about the interaction between submesoscale filaments and inertial gravity waves with large-eddy simulation.

Education

Johns Hopkins University *Sept 2021 – present*
Ph.D. in Physical Oceanography (expected, 2025)
M.S. in Earth and Planetary Sciences (expected, 2025)
M.S.E. in Mechanical Engineering (2024)

Fudan University *Sept 2017 - June 2021*
B.S. in Atmospheric Science (2021)
Minor in Data Science (2021)

UCLA *Sept 2019 - Dec 2019*
Exchange student at Department of Atmospheric and Oceanic Sciences

Current Projects

Interaction Between Inertial-Gravity Waves and Submesoscale Filaments in the Upper Ocean
Collaborators: *Thomas W.N. Haine, Peter P. Sullivan, Charles Meneveau*

- We use NCAR-LES to simulate the evolution of upper ocean submesoscale filaments.
- At its mature phase, a compact inertial-gravity-wave train is introduced by perturbing the initial condition.
- We will examine the y-averaged TKE equations to understand the dissipation and downward transfer of energy.
- Lagrangian particles will be used to understand the transfer and convertion of pseudomomentum.

Generation and propagation of eastern subpolar North Atlantic salinity anomalies (In Prep)
Collaborators: *Thomas W.N. Haine*

- We traced the water masses backward in time to find the origin of the water that affects the Eastern Subpolar North Atlantic and the Arctic using the reanalysis product ECCO v4r4. Important pathways are identified and their variability are analyzed.
- A fresh and a salty event are analyzed in detail from the Lagrangian budget perspective. The results reconcile different explanations of the events by giving a more quantitative description. The importance of changes in stratification and thus the effect of vertical diffusion is highlighted.
- A large budget analysis equivalent of 100 billion particle years of Lagrangian Simulation is conducted, providing a holistic understanding of how the salinity anomalies in Eastern Subpolar are determined by upstream regions and terms in the salinity anomaly equation.

Air-sea Interaction Sustained the 2014-2015 Intense Marine Heat Wave in the North Pacific
Collaborators: *Gael Forget, Yuanyuan Song, Thomas W.N. Haine*

- We use passive tracer and Lagrangian budget to understand the three dimensional propagation of the marine heat wave.
- The marine heat wave is a result from three heating events. Anomalous circulation at the Californian Current Upwelling zone and the temperature front along North Pacific Current are responsible for continued heating. During winter time, the marine heat wave also experienced a lack of heat loss.
- A persistent low pressure system in the atmosphere seems to be responsible for the heating observed. The detail of this coupling is under examination.

Publications

[1] **Jiang, Wenrui** and Thomas W N Haine. Tracer budgets on lagrangian trajectories. *ESS Open Archive*, January 2025.

[2] Thomas W N Haine, Stephen M Griffies, Geoffrey Gebbie, and **Jiang, Wenrui**. A review of green's function methods for tracer timescales and pathways in ocean models. *ESS Open Archive*, August 2024.

[3] **Jiang, Wenrui**, Thomas W. N. Haine, and Mattia Almansi. Seaduck: A python package for eulerian and lagrangian interpolation on ocean datasets. *Journal of Open Source Software*, 8(92):5967, December 2023.

[4] Thomas W. N. Haine, Ali H. Siddiqui, and **Jiang, Wenrui**. Arctic freshwater impact on the atlantic meridional overturning circulation: status and prospects. *Phil. Trans. R. Soc. Lond. A*, 381(2262), October 2023.

[5] **Jiang, Wenrui**, Liguang Wu, and Qingyuan Liu. High-wind drag coefficient based on the tropical cyclone simulated with the wrf-les framework. *Frontiers in Earth Science*, 9, May 2021.

Conference Proceedings

[1] **Wenrui Jiang** and Thomas WN Haine. Lagrangian budget on the subpolar north atlantic salinity anomalies. In 2024 Ocean Sciences Meeting. AGU, 2024

Open source projects

Seaduck *seaduck*

- A tool for interpolation, Lagrangian particle simulation, and closing tracer budget on Lagrangian trajectories.
- Develop, test, and continuously maintain.
- Documentation: macekuailv.github.io/seaduck/

Poseidon viewer *poseidon-viewer*

- A visualization tool for the LLC4320 ocean dataset.
- Write the backend interpolator and the documentation.
- Documentation: sciserver.github.io/poseidon-viewer

Teaching Experience

Spring 2023	TA and guest lecturer, 'Oceans and Atmospheres', Johns Hopkins University
Fall 2022	TA, 'Introduction to Global Environmental Change', Johns Hopkins University

Awards

2020	The 2nd Conditional Nonlinear Optimum Perturbation (CNOP) method summer school: Outstanding Student
2020	Interdisciplinary Contest in Modeling: Meritorious Winner
2018	First-class Scholarship (2nd out of 80)
2017	Freshman Scholarship (Top 5%)

Leadership and Volunteering

Sept. 2023 - June 2024	Website Manager for Chinese-American Oceanic and Atmosphic Association
Feb. 2023 - July 2023	Host of "Ocean Seminar" among Oceanographers in Maryland
Feb. 2023 - present	Host of "A&O Seminar/Meeting" at JHU
March 2021 - May 2021	Volunteer Teacher, Qingpu, China
Jan. 2019 - Aug. 2019	President of Fudan Astronomy Club