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Opportunity Title: Quantifying Arctic Ocean Tipping Points
Opportunity Reference Code: 0324-NPP-MAR26-JPL-EarthSci

Organization National Aeronautics and Space Administration (NASA)

Reference Code 0324-NPP-MAR26-JPL-EarthSci

How to Apply All applications must be submitted in Zintellect

Please visit the NASA Postdoctoral Program website for application instructions and requirements: How to Apply | NASA Postdoctoral Program (orau.org)

A complete application to the NASA Postdoctoral Program includes:

1. Research proposal
2. Three letters of recommendation
3. Official doctoral transcript documents

Application Deadline 4/2/2026 6:00:59 PM Eastern Time Zone

Description **About the NASA Postdoctoral Program**

The NASA Postdoctoral Program (NPP) offers unique research opportunities to highly-talented scientists to engage in ongoing NASA research projects at a NASA Center, NASA Headquarters, or at a NASA-affiliated research institute. These one- to three-year fellowships are competitive and are designed to advance NASA's missions in space science, Earth science, aeronautics, space operations, exploration systems, and astrobiology.

Description:

The rapid loss of perennial sea-ice is driving Arctic marine ecosystems past critical thresholds. We hypothesize that the 2016–17 Bering Sea marine heatwave initiated a tipping point cascade that disruptively altered Pacific Arctic (PA) marine ecosystems, causing new physical and ecological states to emerge. The PA is the most productive Arctic marine ecosystem and one of the most productive in the world, but recent changes threaten this productivity. The ecological consequences of these changes have been immediate and profound, ranging from the borealization of plankton communities to the collapse of critical salmon and snow crab fisheries.

Similarly, we hypothesize that the imminent collapse of the Nares Strait ice arches will initiate a tipping point cascade that destabilizes the Last Ice Area (LIA) and the North Water (NOW), the Arctic's most productive polynya. The LIA is home to the Arctic's oldest, thickest sea-ice and the final refuge for ice-obligated Arctic marine ecosystems, including culturally significant Arctic marine megafauna. The NOW is a globally unique open-water ecosystem, a winter refuge for High Arctic species, and highly vulnerable to change. Identifying early warning signals for LIA/NOW tipping points is urgently needed to inform mitigation, adaptation, and conservation management for communities and refugia like the Tuvaijuittuq Marine Protected Area.

To test our hypotheses, we are developing a 3-km resolution model for the Bering Sea-Chukchi Sea complex using the data-assimilative ECCO-Darwin ocean biogeochemistry state estimate to fully quantify and attribute abrupt physical-ecological changes occurring in the PA. Additionally, we are developing a model of the LIA/Nares Strait/NOW with 500–1000 meter horizontal grid spacing. Both models have solutions going back to ~1995. We will analyze multi-decadal time series of key PA habitat elements (e.g., Bering Sea cold pool) to quantify tipping point signatures. We will compare ECCO-Darwin's simulated Arctic ecosystem to in-situ plankton and fish surveys, oceanic solar-induced chlorophyll fluorescence (OceanSIF) derived from MODIS and TROPOMI, and new productivity and phytoplankton community composition (PCC) products enabled by PACE hyperspectral imagery to characterize Arctic marine ecological tipping point drivers and thresholds.

Our investigation will quantify the ecological consequences of tipping point cascades in Arctic marine ecosystems and guide management and mitigation strategies, e.g. for highly-productive fisheries and ice-obligated ecosystems that are essential to food security for local communities. Our results will mature key modeling and analysis tools for the upcoming FORTE and Arctic-COLORS field campaigns as well as the Fifth International Polar Year (IPY5, 2032–2033).

Bertin, C., Le Fouest, V., Carroll, D., Dutkiewicz, S., Menemenlis, D., Matsuoka, A., Manizza, M., & Miller, C. E. (2025). Terrestrial browning from colored dissolved organic matter (CDOM) changes the seasonal phenology of the coastal Arctic carbon cycle. *EGUsphere*. Advance online publication. https://doi.org/10.5194/egusphere-2025-973

Pan, B., et al., & Miller, C. E. (2025). Impact of glacial meltwater on phytoplankton ecology along the western Antarctic Peninsula. *Nature Communications Earth & Environment, 6,* 456. https://doi.org/10.1038/s43247-025-02435-6

Miller, C. E., et al. (2025). Airborne imaging spectroscopy surveys of Alaska and northwestern Canada 2017–2023. *Scientific Data, 12,* 692. https://doi.org/10.1038/s41597-025-04898-w

Bertin, C., Carroll, D., Menemenlis, D., Dutkiewicz, S., Zhang, H., Schwab, M., Savelli, R., Matsuoka, A., Manizza, M., Miller, C. E., Bowring, S., Guenet, B., & Le Fouest, V. (2025). Paving the way for improved representation of the carbon cycle in Arctic river plumes. *Permafrost and Periglacial Processes, 0*(1), 1–15. https://doi.org/10.1002/ppp.2271

Pecuchet, L., et al. (2025). Arctic and subarctic marine heatwaves and their ecological impacts. *Frontiers in Environmental Science, 13,* 1473890. https://doi.org/10.3389/fenvs.2025.1473890

Madani, N., et al., & Miller, C. E. (2024). A machine learning approach to produce a continuous solar-induced chlorophyll fluorescence dataset for understanding Arctic Ocean productivity. *Journal of Geophysical Research:*

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1, e2024JH000215. https://doi.org/10.1029/2024JH000215

Manizza, M., Menemenlis, D., Zhang, H., & Miller, C. E. (2023). Modeling the recent changes of phytoplankton bloom dynamics in the Arctic Ocean. *Journal of Geophysical Research: Oceans,*
128, e2022JC019152. https://doi.org/10.1029/2022JC019152

Bertin, C., Carroll, et al., Miller, C. E. (2023). Biogeochemical river runoff drives intense coastal Arctic Ocean CO2 outgassing. *Geophysical Research Letters,*
50, e2022GL102377. https://doi.org/10.1029/2022GL102377

Carroll, D., et al. (2022). Attribution of space-time variability in global-ocean dissolved inorganic carbon. *Global Biogeochemical Cycles,*
36, e2021GB007162. https://doi.org/10.1029/2021GB007162

Field of Science: Earth Science

Advisors:

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Applications with citizens from Designated Countries will not be accepted at this time, unless they are Legal Permanent Residents of the United States. A complete list of Designated Countries can be found at: https://www.nasa.gov/oiir/export-control.

Eligibility is currently open to:

- U.S. Citizens;
- U.S. Lawful Permanent Residents (LPR);
- Foreign Nationals eligible for an Exchange Visitor J-1 visa status; and,
- Applicants for LPR, asylees, or refugees in the U.S. at the time of application with 1) a valid EAD card and 2) I-485 or I-589 forms in pending status

Qualifications PhD in Earth Science, Arctic Systems, Remote Sensing, Oceanography, Physics, Chemistry, Earth System Modeling or equivalent

Experience with ECCO or other data assimilative ocean physical-biogeochemical models preferred. Expertise in analyzing Arctic satellite data for sea-ice, chlorophyll, and other relevant parameters strongly desired. Understanding of critical threshold/tipping point behavior in Earth System elements strongly desired.

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Point of Contact Mikeala

Eligibility Requirements

- **Degree:** Doctoral Degree.