

JONGSOO SHIN

Research Associate III
Department of Physical Oceanography, Woods Hole Oceanographic Institution (WHOI),
Woods Hole, MA, 02543

EMAIL: jongsooshin5@gmail.com, jongsoo.shin@whoi.edu

RESEARCH INTERESTS

- Climate System Reversibility and Hysteresis
- Earth System Modeling and Development (e.g., MCOM in CESM2)
- Climate Change Projection and Extreme Events under Net-Zero/Negative Emission Scenarios

EDUCATION

- 2022 Ph.D., Yonsei University, Atmospheric Sciences
Thesis: "Irreversible surface temperature change via the delayed North Atlantic and Southern Ocean response to a carbon dioxide removal scenario" Advisor: Soon-II An
- 2017 M.Sc., Yonsei University, Atmospheric Sciences
Thesis: "Mechanisms of heat waves over the Korean peninsula, and their projection in the 21st century" Advisor: Soon-II An
- 2015 B.Sc., Yonsei University, Atmospheric Sciences

EMPLOYMENT HISTORY

2023. 10–2026. 06 Research Associate III, Physical Oceanography, **WHOI**, Woods Hole, MA, USA
Research: Developed and integrated the Multi-Column Ocean Model (MCOM) within the CESM2 framework.
2022. 09–2023. 09 Postdoctoral Scientist, Division of Environmental Science and Engineering, **POSTECH**, South Korea
Research: Investigated the Extreme precipitation under the Net-Zero/Negative emission scenarios.

AWARDS

- Endless Frontier Technical Staff Fellowship, Woods Hole Oceanographic Institution (2026)
- Postdoctoral Fellowship, National Research Foundation of Korea (2024–2025)
- Ph.D. Student Fellowship, National Research Foundation of Korea (2019–2021)
- Best Paper Award, BK21 PLUS at Yonsei University (2017)
- Best Poster Award, the Korean Society of Climate Change Research (2017)

REFEREED PUBLICATIONS

First Author Publications

1. **Shin, J.**, Park, S. W., Kug, J. S., An, S. I., ... & Kim, J. S. (2026). Negative CO₂ emissions for long-term mitigation of extremes in the land hydrological cycle. *Nature communications*.
2. Yang, Y. M., **Shin, J.**, Park, S. W., Park, J. H., An, S. I., Kug, J. S., ... & Im, N. (2024). Fast reduction of Atlantic SST threatens Europe-wide gross primary productivity under positive and negative CO₂ emissions. *npj Climate and Atmospheric Science*, 7(1), 117. Equal contribution first author.
3. **Shin, J.**, Olson, R., & An, S. I. (2019). Improved probabilistic twenty-first century projections of sea surface temperature over East Asian marginal seas by considering uncertainty owing to model error and internal variability. *Climate Dynamics*, 53(9), 6075-6087.
4. **Shin, J.**, Olson, R., & An, S. I. (2018). Projected heat wave characteristics over the Korean Peninsula during the twenty-first century. *Asia-Pacific Journal of Atmospheric Sciences*, 54(1), 53-61.

Co-Author Publications

2026

5. Yang, Y. M., **Shin, J.**, Park, J. H., An, S. I., Wang, B., & Khourdajie, A. (2026). Reduced mid-latitude

El Niño-related precipitation due to southern ocean warming under abrupt CO₂ change scenarios. *Climate Dynamics*, 64(1), 3.

6. Park, B. J., Min, S. K., An, S. I., Yeh, S. W., Son, S. W., Kug, J. S., Jun, S. Y., **Shin, J.**, Ryu, Y. H. Ryu & Park, I. H. (2026). Hemispheric contrast in summer season duration responses to CO₂ removal. *Communications Earth & Environment*.
7. Cheng, Y., Olson, R., **Shin, J.**, An, S. I., Chang, W. (2026) Long-Term Historical Slowdown in Atlantic Meridional Overturning Circulation. *Environmetrics*. 37(4), e70101.

2025

8. Li, Z. B., Liu, C., Azorin-Molina, C., An, S. I., Zhao, Y., Xu, Y., **J. Shin**, D. Chen & Shen, C. (2025). Asymmetric response of Northern Hemisphere near-surface wind speed to CO₂ removal. *Weather and Climate Dynamics*, 6(4), 1107-1117
9. Heo, E. S., An, S. I., & **Shin, J.** (2025). Asymmetric impact of the tropical Pacific on summertime Arctic sea ice trends under increasing and decreasing greenhouse gases. *Geophysical Research Letters*, 52(14), e2025GL116352.
10. Geng, X., Oh, J. H., Shin, Y., **Shin, J.**, Noh, K. M., Park, S. W., & Kug, J. S. (2025). Nonmonotonic Future Changes in the North Atlantic Warming Hole under a Fast CO₂ Emission Scenario. *Journal of Climate*, 38(21), 6011-6023.
11. Park, S. W., Mun, J. H., Lee, H., Steinert, N. J., An, S. I., **Shin, J.**, & Kug, J. S. (2025). Continued permafrost ecosystem carbon loss under net-zero and negative emissions. *Science Advances*, 11(7), eadn8819.

2024

12. Paik, S., Kim, D., An, S. I., Oh, H., **Shin, J.**, Goswami, B. B., ... & Mondal, S. K. (2024). Exploring causes of distinct regional and subseasonal Indian summer monsoon precipitation responses to CO₂ removal. *npj Climate and Atmospheric Science*, 7(1), 305.
13. Park, I. H., Yeh, S. W., Min, S. K., An, S. I., Xie, S. P., & **Shin, J.** (2024). Irreversible changes in the sea surface temperature threshold for tropical convection to CO₂ forcing. *Communications Earth & Environment*, 5(1), 659.
14. Kim, H. J., Kim, J. S., An, S. I., **Shin, J.**, Oh, J. H., & Kug, J. S. (2024). Pervasive fire danger continued under a negative emission scenario. *Nature Communications*, 15(1), 10010.
15. Im, N., Kim, D., An, S. I., Paik, S., Kim, S. K., **Shin, J.**, ... & Oh, H. (2024). Hysteresis of European summer precipitation under a symmetric CO₂ ramp-up and ramp-down pathway. *Environmental Research Letters*.
16. Hwang, J., Son, S. W., Garfinkel, C. I., Woollings, T., Yoon, H., An, S. I., ... & **Shin, J.** (2024). Asymmetric hysteresis response of mid-latitude storm tracks to CO₂ removal. *Nature Climate Change*, 14(5), 496-503.
17. Kim, G. I., Oh, J. H., Shin, N. Y., An, S. I., Yeh, S. W., **Shin, J.**, & Kug, J. S. (2024). Deep ocean warming-induced El Niño changes. *Nature communications*, 15(1), 6225.
18. Oh, J. H., Kug, J. S., An, S. I., Jin, F. F., McPhaden, M. J., & **Shin, J.** (2024). Emergent climate change patterns originating from deep ocean warming in climate mitigation scenarios. *Nature Climate Change*, 1-7.
19. Hwang, J., Son, S. W., An, S. I., Kug, J. S., Yeh, S. W., **Shin, J.** (2024) Basin-dependent response of Northern Hemisphere winter blocking frequency to CO₂ removal. *npj Climate and Atmospheric Science*, 7(1), 111. (Accepted in *Nature Climate Change*).

2023

20. Lee, Y. H., Yeh, S. W., Hong, J. S., **Shin, J.**, & An, S. I. (2023). Regime shift increase in East Asia's summer extreme hot day frequency across the late 1990s. *International Journal of Climatology*, 43(5), 2305-2317.
21. Mondal, S. K., An, S. I., Min, S. K., Kim, S. K., **Shin, J.**, Paik, S., ... & Liu, C. (2023). Hysteresis and irreversibility of global extreme precipitation to anthropogenic CO₂ emission. *Weather and Climate Extremes*, 100561.
22. Sung, M. K., An, S. I., **Shin, J.**, Park, J. H., Yang, Y. M., Kim, H. J., & Chang, M. (2023). Ocean fronts as decadal thermostats modulating continental warming hiatus. *Nature Communications*, 14(1), 7777.
23. Liu, C., An, S. I., Jin, F. F., **Shin, J.**, Kug, J. S., Zhang, W., ... & Kim, S. K. (2023). Hysteresis of the El Niño–Southern Oscillation to CO₂ forcing. *Science Advances*, 9(31), eadh8442.

24. Liu, C., An, S. I., Jin, F. F., Stuecker, M. F., Zhang, W., Kug, J. S., ..., **Shin, J.**, & Kim, S. K. (2023). ENSO skewness hysteresis and associated changes in strong El Niño under a CO₂ removal scenario. *npj Climate and Atmospheric Science*, 6(1), 117.

2022

25. Kim, S. K., **Shin, J.**, An, S. I., Kim, H. J., Im, N., Xie, S. P., ... & Yeh, S. W. (2022). Widespread irreversible changes in surface temperature and precipitation in response to CO₂ forcing. *Nature Climate Change*, 12(9), 834-840.
26. Kug, J. S., Oh, J. H., An, S. I., Yeh, S. W., Min, S. K., Son, S. W., ... & **Shin, J.** (2022). Hysteresis of the intertropical convergence zone to CO₂ forcing. *Nature Climate Change*, 12(1), 47-53.
27. Song, S. Y., Yeh, S. W., An, S. I., Kug, J. S., Min, S. K., Son, S. W., & **Shin, J.** (2022). Asymmetrical response of summer rainfall in East Asia to CO₂ forcing. *Science Bulletin*, 67(2), 213-222.
28. An, S. I., Park, H. J., Kim, S. K., **Shin, J.**, Yeh, S. W., & Kug, J. S. (2022). Intensity changes of Indian Ocean dipole mode in a carbon dioxide removal scenario. *npj Climate and Atmospheric Science*, 5(1), 1-8.
29. An, S. I., Park, S. E., **Shin, J.**, Yang, Y. M., Yeh, S. W., Son, S. W., & Kug, J. S. (2022). General circulation and global heat transport in a quadrupling CO₂ pulse experiment. *Scientific Reports*, 12(1), 1-11.
30. Oh, H., An, S. I., **Shin, J.**, Yeh, S. W., Min, S. K., Son, S. W., & Kug, J. S. (2022). Contrasting hysteresis behaviors of northern Hemisphere land monsoon precipitation to CO₂ pathways. *Earth's Future*, 10(6), e2021EF002623.
31. Oh, J. H., An, S. I., **Shin, J.**, & Kug, J. S. (2022). Centennial memory of the Arctic Ocean for future Arctic climate recovery in response to a carbon dioxide removal. *Earth's Future*, 10(8), e2022EF002804.
32. Jo, S. Y., Seong, M. G., Min, S. K., Kug, J. S., Yeh, S. W., An, S. I., ... & **Shin, J.** (2022). Hysteresis behaviors in East Asian Extreme Precipitation Frequency to CO₂ Pathway. *Geophysical Research Letters*, 49(18), e2022GL099814.
33. Pathirana, G., Oh, J. H., Cai, W., An, S. I., Min, S. K., Jo, S. Y., **Shin, J.**, Kug, J. S. (2022) Increase in convective extreme El Niño events in a CO₂ removal scenario. *Science Advances*, 9(25), eadh2412.
34. Kim, S., Choi, Y. J., Son, S. W., An, S. I., Kug, J. S., Yeh, S. W., **Shin, J.** (2022) Hemispherically asymmetric Hadley cell response to CO₂ removal. *Science advances*, 9(30), eadg1801
35. Paik, S., An, S. I., Min, S. K., King, A. D., **Shin, J.** (2022) Hysteretic behavior of global to regional monsoon area under CO₂ ramp-up and ramp-down. *Earth's Future*, 11(7), e2022EF003434

2021

36. An, S. I., **Shin, J.**, Yeh, S. W., Son, S. W., Kug, J. S., Min, S. K., & Kim, H. J. (2021). Global cooling hiatus driven by an AMOC overshoot in a carbon dioxide removal scenario. *Earth's Future*, 9(7), e2021EF002165.
37. Yeh, S. W., Song, S. Y., Allan, R. P., An, S. I., & **Shin, J.** (2021). Contrasting response of hydrological cycle over land and ocean to a changing CO₂ pathway. *npj Climate and Atmospheric Science*, 4(1), 1-8.

UNDER REVISION AND MANUSCRIPT IN PREPARING

1. **Shin, J.**, An, S. I., Kug, J. S., Yeh, S. W., Son, S. W., Min, S. K., Yang, Y. M., & Park, J. H. Long-lasting Southern Ocean warming in a carbon dioxide removal scenario through warm water upwelling and sea ice-albedo feedback. (In preparation).
2. **Shin, J.**, Kwon, Y. O., Danabasoglu, G., Levy, M. N., Liang, Y. C., Lima, D. I., Liu, G., and Tseng, Y. H. Multi-Column Ocean Model (MCOM): A New 1-Dimensional Ocean Model in CESM2. *Journal of Advances in Modeling Earth System* (Submitted).
3. Paik, S. M., Kim, D. H., An, S. I., King, A., and **Shin, J.** Intensification of East Asian summer extreme precipitation under a net-zero anthropogenic CO₂ emission scenario. *Science Advances* (under review).
4. Liu, G., Kwon, Y. O., Buckley, M., Frankignoul, C., and **Shin, J.** Highly persistent subpolar Atlantic sea surface temperatures driven by re-emergence and 1-D ocean dynamics. *Science Advances* (Submitted).

SOFTWARE & CODE DEVELOPMENT

- **Shin, J.**, Kwon, Y. O., Danabasoglu, G., Levy, M. N., Liang, Y. C., Lima, D. I., Liu, G., and Tseng, Y. H. <https://github.com/mnlevy1981/CESM.git> cesm2.1.5_MCOM
- **Shin, J.**, Kwon, Y.-O., Enders, L., & Radhakrishnan, A. (2026). Western Boundary Current (WBC) Diagnostics. Zenodo. <https://doi.org/10.5281/zenodo.19265586>

RESEARCH GRANTS

- Center for Abrupt Climate, Ph. D. **Research Fellow** (Lead PI: Jong-Seong Kug, POSTECH), National Research Foundation of Korea, 2022–2023 (~\$200,000).
- Irreversible Climate Change Research Center, **Research Assistant** (Lead PI, Soon-Il An, Yonsei University), National Research Foundation of Korea, 2018–2023 (~\$6,650,000).
- Diagnosis of Irreversibility in the Climate System Using Climate Models with Biogeochemical Processes, **Research Assistant** (Lead PI, Soon-Il An, Yonsei University), Korea Institute of Science and Technology Information 2020 (Provision of supercomputing resources)
- Climate model experiment for the irreversibility of climate system, **Research Assistant** (Lead PI, Soon-Il An, Yonsei University), Korea Institute of Science and Technology Information, 2019 (Provision of supercomputing resources)

RELEVANT SKILLS

- Models: CESM (v1 & v2)
- Languages: NCL, Fortran, and Python

SERVICE: PROFESSIONAL

Scientific Community

- Member, *NOAA Model Diagnostics Task Force* (2024–2026)
- Member, *NCAR Climate Variability and Change Working Group (CVCWG)* (2024–2026)
- Committee member, *Korean Meteorological Society* (2024–present)

Societies

- Asia Oceania Geosciences Society (2021–present)
- Korean Society of Oceanography (2021–present)
- American Geophysical Union (2018–present)
- Korean Society of Climate Change Research (2016–present)
- Korean Meteorological Society (2015–present)

Journal Review

- *Journal of Climate* (2024)
- *Climate Dynamics* (2024)
- *Scientific Reports* (2025)
- *npj Climate and Atmospheric Science* (2026)

Guest Editor

- *Environments*, Special Issue (2026): Climate Responses and Extremes Under Net-Zero and Net-Negative Carbon Dioxide Emission Pathways.