Weekly Report – January 09, 2026

Cooperative Institute for Satellite Earth System Studies (CISESS)

NOAA/NESDIS/STAR

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PUBLICATIONS

Climate-driven Changes in Marine Ecosystems and Biogeochemical Cycles

Citation: Larkin, Alyse A., Melissa L. Brock, **Adam J. Fagan**, Allison R. Moreno, **Skylar D. Gerace**, Lauren E. Lees, Stacy A. Suarez, Emiley A. Eloe-Fadrosh, and **Adam C. Martiny**, 2025: Climate-driven succession in marine microbiome biodiversity and biogeochemical function. *Nat. Commun.,* **16**, 3926, https://doi.org/10.1038/s41467-025-59382-1.

Summary: CISESS Consortium Scientist Adam Martiny (UC Irvine), the task leader of *Bio-GO-SHIP: A global analysis of large-scale changes to ocean plankton systems*, and graduate students Adam Fagan (UCI) and Skylar Gerace (UCI) co-authored a study published in *Nature Communications*. Using an 11-year metagenomic time series from the Southern California Bight, the researchers found that climate variability drives predictable microbial succession across time scales. Both seasonal cycles and El Niño-Southern Oscillation events (see Figure) structure marine microbial communities in consistent ways. Cold, nutrient-rich conditions favor large-genome, copiotrophic microbes, while warm, nutrient-poor conditions favor oligotrophic taxa. In addition, shifts in dominant taxa lead to systematic changes in genomic functional potential. Warm, stratified conditions are associated with increased nitrogen (N) and phosphorus (P) stress genes, while cold, nutrient-replete periods show higher frequencies of iron acquisition genes and organic carbon (C) degradation enzymes. Another key finding was that warming favors high C:nutrient ratios and reduced carbon processing. Under warm (El Niño-like) conditions, the ecosystem shifts toward lower biomass, reduced C degradation potential, and elevated particulate C:N:P ratios. In contrast, cooler (La Niña-like) periods support higher biomass, more active carbon processing, and lower C:nutrient ratios. These patterns suggest that continued ocean warming is likely to push coastal ecosystems toward states with weaker carbon cycling and stronger macronutrient stress, with broad implications for marine biogeochemistry. *(Summarized by Kate Cooney, kscooney@umd.edu, Task I)*

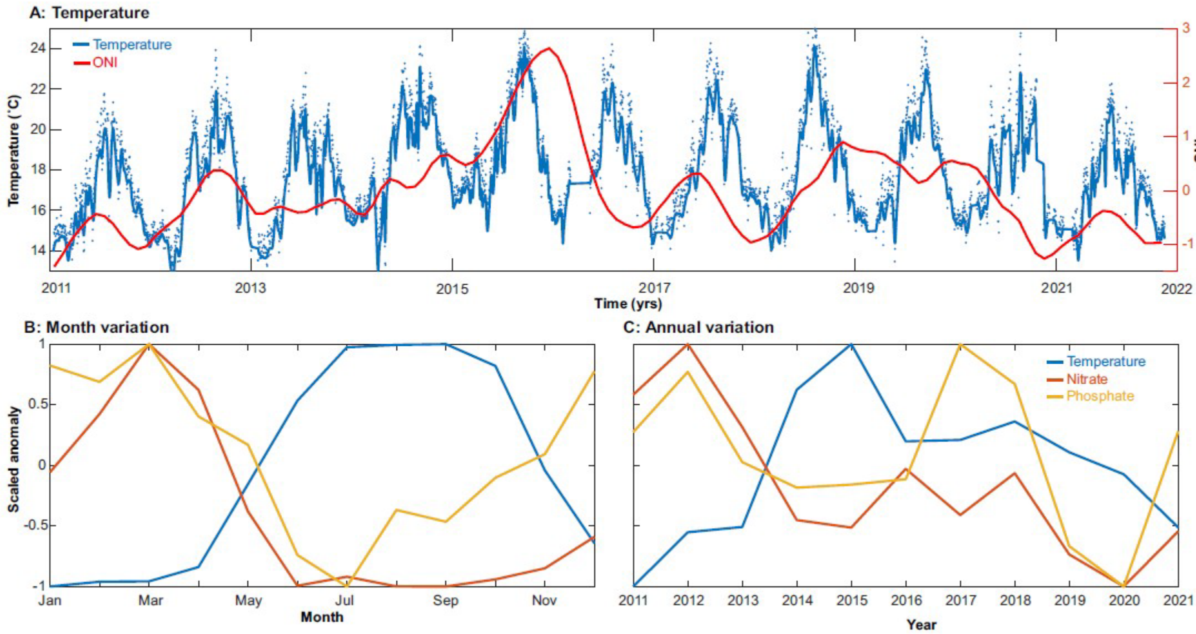

Figure: Seasonal oscillations in temperature and nutrients observed in the Southern California Bight from 2011-2021. (A) Temperature (°C) measured at the Southern California Coastal Observing Systems automated shore-station and the Ocean Nino Index (ONI). (B) Monthly anomaly in temperature, nitrate, and phosphate. (C) 2011 to 2021 annual anomalies in temperature, nitrate, and phosphate. Anomalies were found by fitting linear models with 12 monthly and yearly levels and scaled from −1 to 1 for presentation.

(Adam Martiny, CISESS, amartiny@uci.edu; Funding: GOMO)

The Role of SST Trends and Atlantic Warming in Shaping California's 2023/2024 Winter Precipitation

Citation: Zhang, Tao, and Arun Kumar, 2025: Challenges in understanding atmospheric responses to SSTs—an illustrative case of 2023/2024 winter. *Geophys. Res. Lett.*, **52**(11), e2025GL115361. https://doi.org/10.1029/2025GL115361.

Summary: Tao Zhang (no longer with CISESS) and co-author present a case study of atmospheric responses to sea surface temperature (SST) anomalies and their trends in different ocean basins, using as an example the winter of 2023/2024 in California. That particular El Niño winter season was unusual in that California's precipitation signal was noticeably weaker than that during several past El Niño events of similar strength, namely the events of 1982/1983, 1997/1998, and 2015/2016. The authors carried out model experiments, including sensitivity runs, using a large ensemble (100-member) of Atmospheric Model Intercomparison Project (AMIP)-style simulations. They report that the observed SST trend, characterized by warming in the western Pacific, Indian Ocean, and in particular, the Atlantic Ocean and cooling in the eastern Pacific, contributed to a reduction in California precipitation during the 2023/2024

winter, especially in southern California. Results presented in the paper suggest that cross-basin interactions and long-term warming can modify El Niño's impacts on weather, highlighting the need to account for these complexities to improve seasonal forecasts. The authors do note that their simulations were based on sensitivity experiments using a single modeling framework and encourage the development of systematic, community-driven initiatives to dig into the subtleties of variations in El Nino-Southern Oscillation teleconnections.

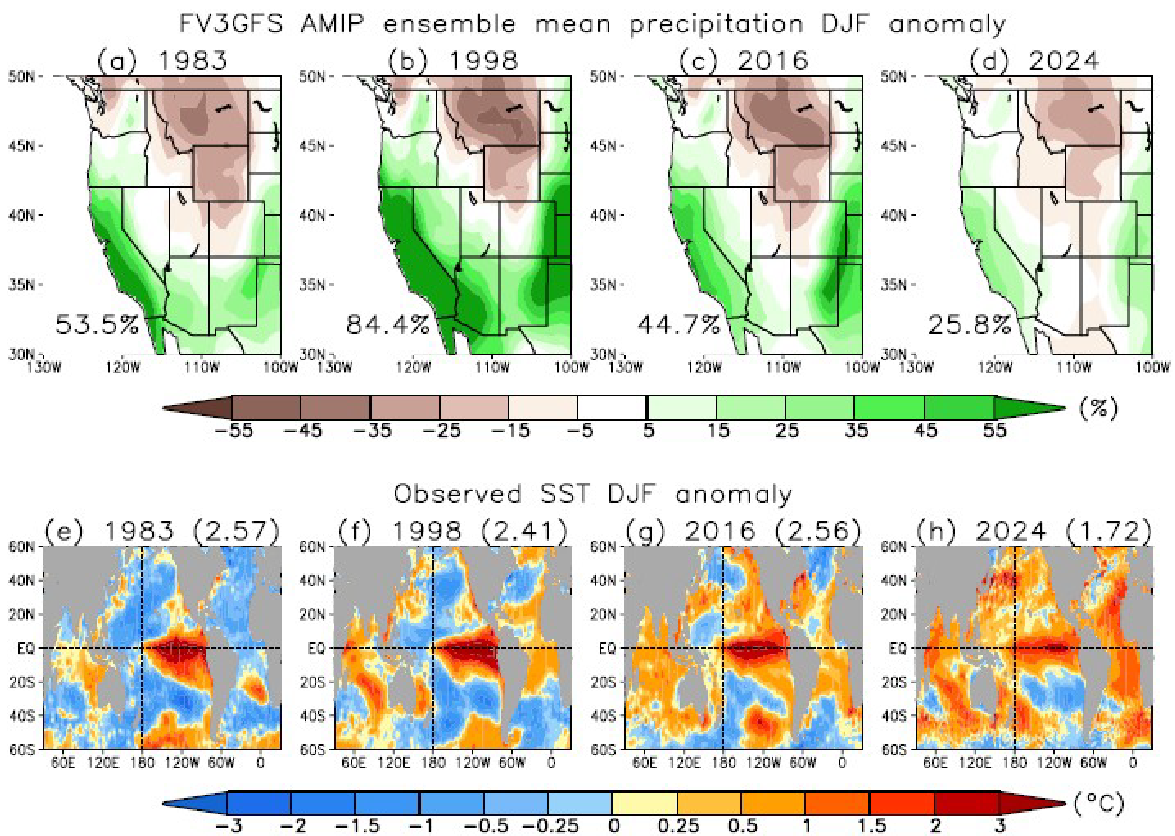

Figure: (Top) Simulated 100-member ensemble mean precipitation anomalies (percent departures) and (bottom) observed SST anomalies for (a, e) 1982/1983 December–February (DJF), (b, f) 1997/1998 DJF, (c, g) 2015/2016 DJF, and (d, h) 2023/2024 DJF. Plotted values in the top panels are percent departures for the California state. Values of the Nino-3.4 (i.e., the region 5°N - 5°S and 170° - 120°W) SST anomaly (°C) are listed in the titles of the bottom panels.

(Tao Zhang; Funding while at CISESS: CPC)

(Maureen Cribb, CISESS, mcribb@umd.edu, Funding: CISESS Task I)