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Cooperative Institute for Satellite Earth System Studies (CISESS)

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PUBLICATIONS

Snapshot of the Global Oceans in 2024

Cheng, Lijing, John Abraham, Kevin E. Trenberth, James Reagan, Huai-Min Zhang, Andrea Storto, Karina von Schuckmann, Yuying Pan, Yujing Zhu, Michael E. Mann, Jiang Zhu, Fan Wang, Fujiang Yu, Ricardo Locarnini, John Fasullo, Boyin Huang, Garrett Graham, Xungang Yin, Viktor Gouretski, Fei Zheng, Yuanlong Li, Bin Zhang, Liying Wan, Xingrong Chen, Dakui Wang, Licheng Feng, Xiangzhou Song, Yulong Liu, Franco Reseghetti, Simona Simoncelli, Gengxin Chen, Rongwang Zhang, **Alexey Mishonov**, Zhetao Tan, Wangxu Wei, Huifeng Yuan, Guancheng Li, Qiuping Ren, Lijuan Cao, Yayang Lu, Juan Du, Kewei Lyu, Albertus Sulaiman, Michael Mayer, Huizan Wang, Zhanhong Ma, Senliang Bao, Henqian Yan, Zenghong Liu, Chunxue Yang, Xu Liu, Zeke Hausfather, Tanguy Szekely, and Flora Gues, 2025: Record high temperatures in the ocean in 2024. Adv. Atmos. Sci., https://doi.org/10.1007/s00376-025-4541-3.

Summary: A sobering look at the state of ocean heating is at the center of a paper recently published in the journal *Advances in Atmospheric Sciences* by CISESS Scientist Alexey Mishonov and colleagues. Analyzing many observational and reanalysis datasets from major independent international data centers, the authors report on the global ocean state in 2024, focusing on the ocean heat content (OHC) in the top 2000-m layer of the ocean and the sea-surface temperature (SST). Both OHC and SST reached record-level highs in 2024 in response to increased greenhouse gas concentrations in the atmosphere. Of note, the global upper 2000-m OHC was the highest ever recorded by modern instruments, about 16 Zetta Joules higher than the value in 2023. The 2024 annual mean global SST was 0.05°C–0.07°C higher than in 2023 and a new record for the instrumentation era. Regions with record-high OHC included the Indian Ocean, the tropical Atlantic, the Mediterranean Sea, the North Atlantic, the North Pacific, and the Southern Ocean, leading to wide-ranging impacts, such as marine heatwaves, global mean sea-level rise, ocean deoxygenation, and extreme weather and ocean events. Modern climate models point toward a continued increasing trend in OHC unless net-zero emissions are reached.

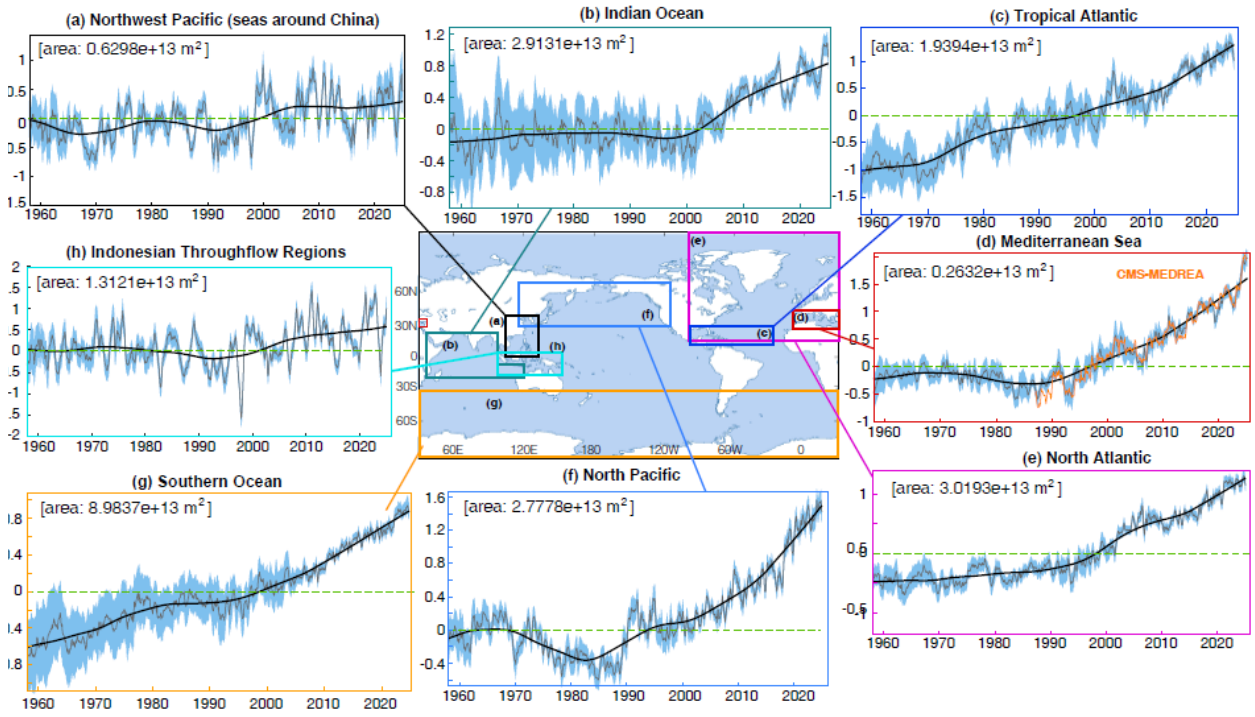

Figure. Regionally observed upper-2000-m change from 1958 through 2024 relative to a 1981–2010 baseline using Institute of Atmospheric Physics/Chinese Academy of Sciences data. Of the eight regions analyzed, six show record-high OHCs.

(Alexey Mishonov, CISESS, alexey.mishonov@noaa.gov; Funding: NCEI)

Assessing Global Change Observation Mission-Climate Satellite Water Quality Products
Salem, Salem Ibrahim Salem, Mitsuhiro Toratani, Hiroto Higa, **SeungHyun Son**, Eko Siswanto, and Joji Ishizaka, 2025: Long-term evaluation of GCOM-C/SGLI reflectance and water quality products: variability among JAXA G-Portal and JASMES. *Remote Sens.*, **17**, 221, https://doi.org/10.3390/rs17020221.
Summary: The Japan Aerospace Exploration Agency's (JAXA's) Global Change Observation Mission-Climate satellite, with the Second-generation Global Imager (SGI) sensor onboard, has been collecting reflectance (R_{rs}) information since its launch in December 2017. R_{rs} is used to derive chlorophyll-a (Chla) and total suspended matter (TSM), indictors of water quality. JAXA provides these data via a couple of platforms, G-Portal and JASMES, each with different atmospheric correction methodologies and assumptions. Years on, a detailed assessment of the Chla and TSM products from these two platforms is needed. CISESS Scientist SeungHyun Son and colleagues from Japan and Egypt present such an assessment in their recent paper published in the journal *Remote Sensing*. Cruise measurements and NASA's Aerosol Robotic Network-Ocean Color (AERONET-OC) retrievals are used as validation datasets, and the period

evaluated is January 2018 to December 2023. Distinct differences between the two platforms are reported, highlighting the challenges of atmospheric correction observed in the ultraviolet and blue bands compared to longer wavelengths. The regional analysis focused on Japan and East Asia reveals that G-Portal data are stable and dependable over time, agreeing well with AERONET-OC observations. JASMES data are consistent over time but show more variability. Overall, both G-Portal and JASMES data can capture spatial and temporal variations in ocean color, noting that there is room for improvement in how the two platforms process SGI information.

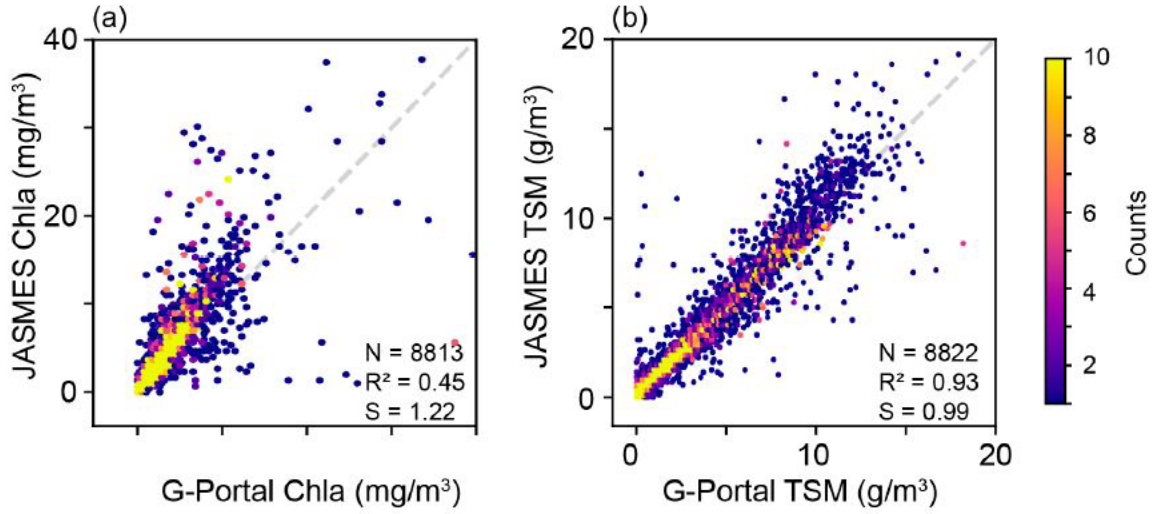

Figure. Density scatterplots comparing SGLI G-Portal and SGLI JASMES (a) Chla and (b) TSM over twenty-two sites in Japan and East Asia covering Case-1 (phytoplankton-dominated optical properties) and Case-2 (other types of waters with different optical characteristics) waters. N is the number of matched data points, R^2 is the coefficient of determination, and S is the slope of the best-fit line through the data from linear regression. The dashed grey line is the 1:1 line.

(SeungHyun Son, CISESS, shson@umd.edu; Funding: ORS)

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