Weekly Report – December 1, 2023

Cooperative Institute for Satellite Earth System Studies (CISESS)

NOAA/NESDIS/STAR

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TRAVEL AND MEETING REPORTS

CISESS Scientist Participates in Great Barrier Reef Workshop: NOAA Coral Reef Watch (CRW) Scientist, Dr. Blake Spady (ReefSense & CISESS), attended GBR Pre-Summer Workshop about the upcoming summer season on the Great Barrier Reef (GBR) on November 23, 2023, in Townsville, Australia. Dr. Spady presented on the recent marine heatwaves in the Caribbean and eastern tropical Pacific. He described the unprecedented extent and severity of the events, as monitored by NOAA CRW's daily global 5km satellite coral bleaching heat stress monitoring products; and Four-Month Coral Bleaching Outlook. Currently, CRW's Outlook is not predicting a significant bleaching event for the GBR this summer. However, Dr. Spady did caution that the unprecedented timing and severity of this past summer's marine heatwave events in Florida and Caribbean, and their impacts, caught local coral reef managers by surprise, which could happen on the GBR as well, without appropriate planning and communication. The Great Barrier Reef Marine Park Authority (GBRMPA) uses NOAA CRW's satellite-based products as their primary source of information for their predictions, monitoring, and understanding of any marine heatwave events on the GBR. GBRMPA Chief Scientist David Wachenfeld did a press conference after the workshop, which can be seen on YouTube.

(POCs: Blake Spady, CISESS & ReefSense, blake.spady@noaa.gov, Funding: NOS)

This entry was also submitted as part of the SOCD report.

CISESS Scientists at the International Union of Geodesy & Geophysics General Assembly
CISESS PhD Student Reint Fischer gave a talk on "Decadal-scale trends and variability in Bering Sea ice extent, wind and wave conditions" at the XXVIII General Assembly of the International Union of Geodesy and Geophysics (IUGG) in Berlin this summer. His talk was co-authored by CISESS Scientists Sinead Farrell and Kyle Duncan. The Bering Sea has been losing days of sea ice coverage in winter, showing a 30% decline in March from 2012 to 2022. This has caused an increase in storminess: five of the last six years have set records for the most storms in the area. They found an increase in average significant wave height (SWH) to 2.7 m, double the

May-September average. Every winter, 20 days on average exhibit SWHs larger than 9 m. In September 2022, extratropical cyclone Merbok caused unprecedented wave conditions (SWH > 15 m) over the shelf that were uncharacteristic for the season, resulting in widespread coastal inundation and property damage. Their complete conference abstract is available at https://doi.org/10.57757/IUGG23-2661. *(Sinead Farrell, CISESS, sinead.farrell@noaa.gov, Funding: Ocean Remote Sensing & Jason)*

PUBLICATIONS

CISESS Scientists Contributed to AMS "State of the Climate in 2022"

(1) Precipitation Anomalies Primarily Driven by La Niña
Citation: Vose, R.E.; Robert Adler Lang, **Guojun Gu**, U. Schneider and X. Yin, 2023: Precipitation [in "State of the Climate in 2022"]. *Bull. Amer. Meteor. Soc.*, **104** (9), S57, https://doi.org/10.1175/BAMS-D-23-0090.1. (in *Global Climate*)
Summary: Areas that received the highest positive precipitation anomalies included Indonesia, the Philippines, Papua New Guinea and northern South America. Those with the lowest negative precipitation anomalies were North America, central South America and parts of southern and eastern Africa. The La Niña helped to generate the frequent flooding and mudslides in Malaysia, India, Pakistan and Brazil.

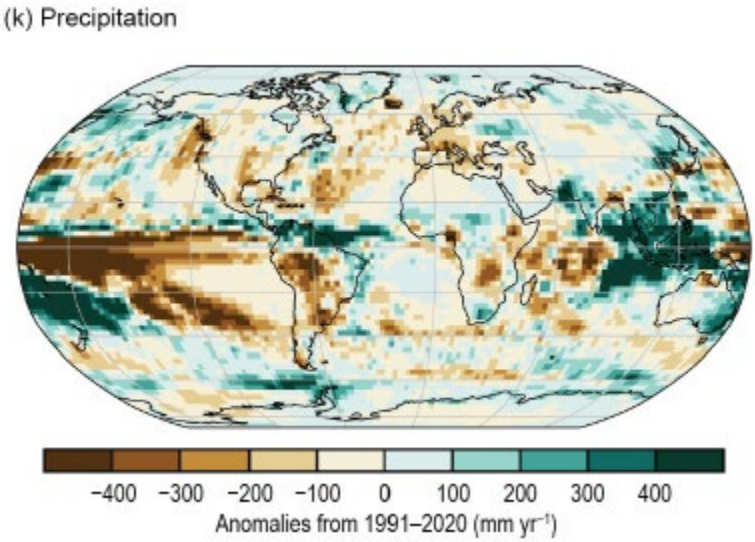

Figure: *Precipitation anomalies for 2022 using 1991-2020 climatology (mm yr^{-1}).*

(2) Ocean Heat Continues its Upward Trend

Citation: Johnson, G. C.; J. M. Lyman, C. Atkinson, Tim Boyer, L. Cheng, J. Gilson, M. Ishii, **Alexey Mishonov**, S. G. Purkey, James Reagan and K. Sato, 2023: Ocean Heat Content [in "State of the Climate in 2022"]. *Bull. Amer. Meteor. Soc*., **104** (9), S159–S162, https://doi.org/10.1175/BAMS-D-23-0090.1. (in *Global Ocean*)

Summary: Annual Upper (0 m–700 m) Ocean Heat Content Anomalies (OHCA) continue to show a strong upward trend despite the "triple dip" La Niña. Compared to the 1993-2022 OHCA, almost all the global oceans were warmer. OHCA was especially high in the western North Atlantic and subtropical South Atlantic in 2022. Southeast Greenland was anomalously cooler. The Bering Sea and Northwest Pacific warming trends increased. 55% of the ocean exhibited statistically significant warming trends (up from 49% in 2021). Only 2% had statistically significant cooling trends (down from 3% in 2021). Overlaid on the global ENSO signal is an overall warming trend, strongest near the surface but evident all the way down to 2000 dbars.

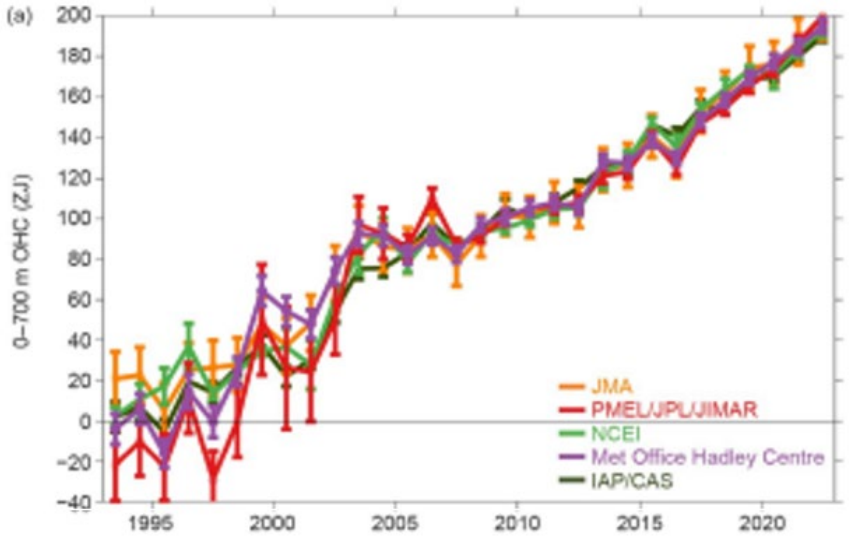

***Figure**: Annual average global integrals of in situ estimates of upper (0 m–700 m) ocean heat content anomaly. The different colors indicate the different sources of these estimates.*

(3) Stratospheric Ozone Lower in the Tropics and Southern Hemisphere

Citation: Weber, M.; W. Steinbrecht, C. Arosio, R. van der A, S. M. Frith, J. Anderson, L. M. Ciasto, M. Coldewey-Egbers, S. Davis, D. Degenstein, V. E. Fioletov, L. Froidevaux, D. Loyola, A. Rozanov, V. Sofieva, K. Tourpali, R. Wang, T. Warnock, and **Jeanette D. Wild**, 2023: Stratospheric Ozone [in "State of the Climate in 2022"]. *Bull. Amer. Meteor. Soc*., **104** (9), S94–S96, https://doi.org/10.1175/BAMS-D-23-0090.1. (in *Global Climate*)

Summary: While the Northern Hemisphere (polar and midlatitudes) continued to show recovery in stratospheric ozone loss, this was not the case for the Tropics or the Southern Hemisphere (SH). The increase in the Tropics can be explained by La Nina and the Quasi-Biennial Oscillation. The SH losses were due in part to these same forces, which weakened tropical upwelling and the Brewer-Dobson circulation. This caused less tropical ozone to be

transported to the polar regions. This, in turn, lowered polar stratospheric temperatures in the austral winter and spring, enhancing polar ozone losses. Another factor in the Antarctic ozone reductions may have been the Hunga Tonga volcanic eruption in January 2022, which injected large quantities of water and aerosols into the stratosphere. Aerosols transported to the polar stratosphere may have aided the ozone-destruction chemistry in the Antarctic. As a result, the SH is close to the all-time ozone low of the last 60 years.

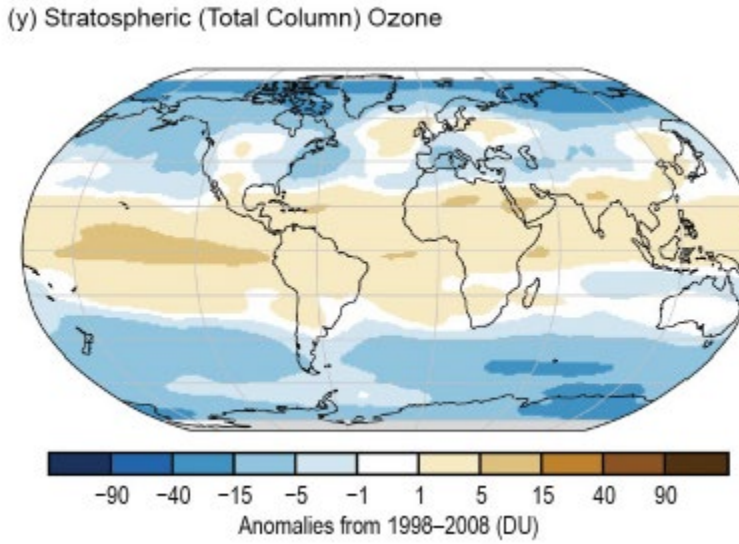

Figure: *Stratospheric ozone anomalies for 2022 using 1998-2008 climatology in Dobson Units (DU).*