Weekly Report – December 9, 2023

Cooperative Institute for Satellite Earth System Studies (CISESS)

NOAA/NESDIS/STAR

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Date of Submission: 8 December 2023

HIGHLIGHTS FOR NESDIS LEADERSHIP

People

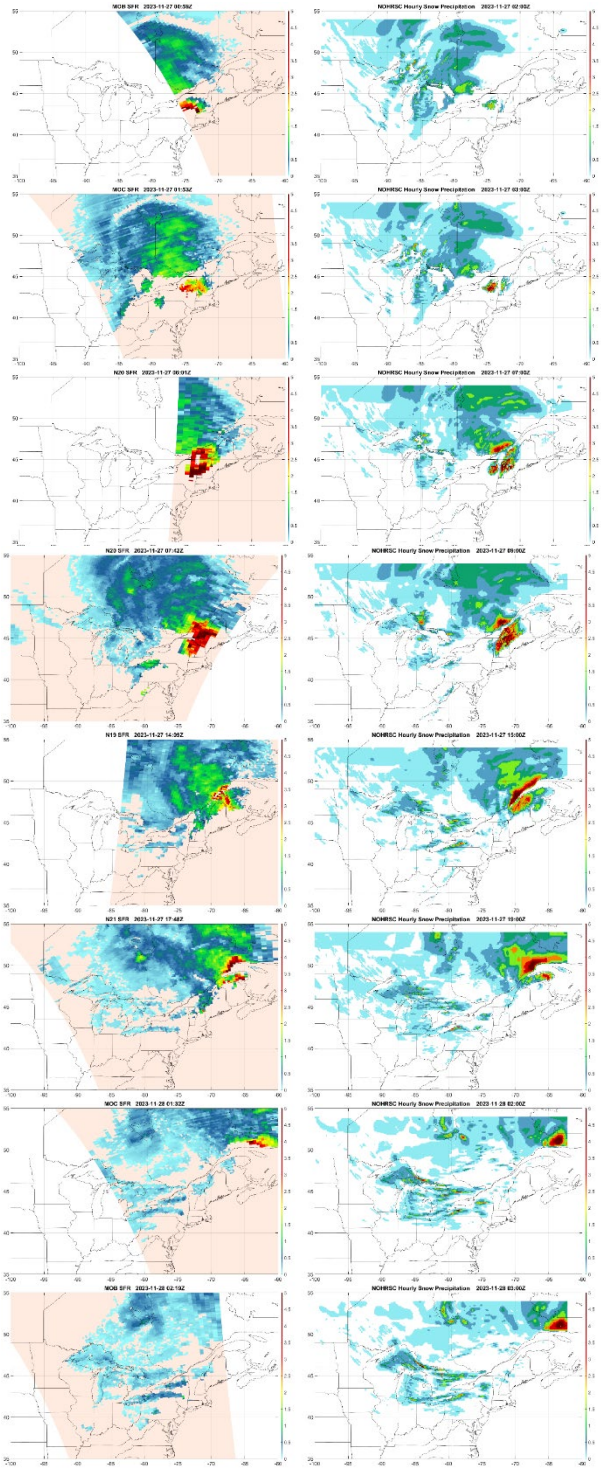
CISESS Scientist Nikelene McLean wins GEO Team Impact Award

Nikelene McLean is an ESSIC Faculty Assistant who works with CISESS Scientist Emily Smail, the Executive Director of Group on Earth Observations (GEO) Blue Planet, at the GEO Blue Planet Office. At the GEO Week Awards Gala held on November 8, McLean won a GEO Team Impact Award along with other members of the GEO Blue Planet Team.

Figure: GEO Blue Planet Team Impact Award Winners (left to right): Nikelene McLean (GEO Blue Planet US Office), Lillian Diarra (GEO Blue Planet EU Office), Richéda Speede (GEO Blue Planet Sargassum Information Hub), and Rahanna Juman (GEO Blue Planet Steering Committee). (Emily Smail, CISESS & STAR/SOCD, emily.smail@noaa.gov; Funding: Ocean Remote Sensing)

Unique & Significant Reports

NESDIS SFR Product Captures Intense Snowfall in Northeast and Great Lakes



On November 27 and 28, 2023, two systems occurred in the Great Lakes and the Northeast regions and brought strong snowstorms in these areas. One was a synoptic system that moved up the East Coast and produced intense snowfall from New York to Maine. Following this system, a strong lake effect snow developed in the Great Lakes region. The NOAA/NESDIS Snowfall Rate (SFR) product, retrieved from Passive Microwave (PMW) sensors aboard a suite of polar-orbiting satellites including SNPP, NOAA-20, NOAA-21, NOAA-19, Metop-B, and Metop-C, captured both events. In the figure (left), the images in the left column are a time series of the events captured by the satellite retrievals from early 27th to early 28th of November 2023. The right column shows the corresponding NOAA National Operational Hydrologic Remote Sensing Center (NOHRSC) hourly snow precipitation analyses. The comparison between the two products shows that the satellite retrievals agree well with NOHRSC snow analysis for the strong synoptic snowfall. The CISESS-developed SFR product was also able to capture the lake effect snowfall, e.g. the narrow bands of snowfall in and around Lake Erie and Lake Ontario. However, the intensity of the snowfall was underestimated. Further investigation using MRMS radar reflectivity showed that the most intensive lake effect snow was below 1.5 km above the surface. Since the satellites were only able to detect the snowfall signals from the upper part (i.e., higher than 2km) of the snowing cloud, this led SFR to underestimate the intensive snowfall. The SFR science team at STAR and CISESS is investigating additional environmental parameters to improve estimation for lake effect snow.

(POC: Y. Fan, CISESS, yfan1236@umd.edu, H. Meng, and J. Dong, Funding: PDRA, JPSS PGRR)

PUBLICATIONS

NOAA Coral Reef Watch Authors *Science* Paper on Climate Change Impacts to Coral Reefs
Citation: Hoegh-Guldberg, Ove; **William Skirving**, Sophie G. Dove, **Blake L. Spady**, Andrew Norrie, **Erick F. Geiger,** Gang Liu, **Jacqueline L. De La Cour** and Derek P. Manzello, 2023: Coral reefs in peril in a record-breaking year. *Science*, in press, https://doi.org/10.1126/science.adk4532.
Summary: The entire NOAA Coral Reef Watch (CRW) team, including four CISESS Scientists, has co-authored a report, led by University of Queensland (Australia) Professor Ove Hoegh-Guldberg and out in *Science* this week, that reveals alarming changes in the upper ocean's conditions, ecosystems and communities. The report found that these changes, which date back to the early 1980s when mass coral bleaching was first observed, strongly correlate with rising sea surface temperatures (SST) and climate cycles such as the El Niño Southern Oscillation (ENSO). In 2023, extreme marine heatwaves (MHWs) engulfed much of the eastern tropical Pacific (ETP) and wider Caribbean. Many Caribbean reefs experienced historically high heat stress that started much earlier (one-to-two months) and was sustained for much longer than normal. July 2023 was Earth's warmest July on record, and it was the fourth month in a row of record-high global SSTs. Anomalously high SSTs in the ETP and wider Caribbean have been more extensive this year than any other year in the satellite record. Individual coral reefs reached record levels of heat stress up to 12 weeks ahead of previously recorded peaks. Heat stress puts immense pressure on fragile yet vital tropical ecosystems such as coral reefs, mangrove forests, and seagrass meadows. In in the Florida Keys National Marine Sanctuary, the shallow coral patch reef, Newfound Harbor (a Mission: Iconic Reefs restoration site) accumulated heat stress of almost three times the previous record, with this occurring six weeks ahead of what was predicted. This trend occurred not only along Florida's Coral Reef, but also at many Caribbean reefs. **Historical data suggest the current MHWs in the ETP and wider Caribbean will likely be the precursor to a global mass coral bleaching and mortality event over the next 12 to 24 months as the El Niño continues.** Anthropogenic climate change is worsening the impacts that organisms and ecosystems experience during different phases of ENSO; and, increasingly, MHWs have been so extreme in certain locations that they have caused acute heat shock that rapidly kills corals before they even show signs of bleaching. The study is also a stark reminder that these trends will likely worsen unless greenhouse gas emissions decrease substantially. Coral-dominated ecosystems are likely to face substantial losses, leading to long-term damage to these and associated ecosystems, the people who rely on them, and coastal infrastructure across Earth's tropical regions. A NOAA press release about this *Science* paper can be viewed at https://www.noaa.gov/news-release/noaa-university-of-queensland-report-marine-heatwaves-severely-impacting-corals.

Figure: Mass coral bleaching of multiple coral species at Cheeca Rocks, Florida Keys in late July 2023. Credit: G. Kolodziej/NOAA, 24 July 2023.
(POC: Jacqueline De La Cour, CISESS & NESDIS/STAR/SOCD, jacqueline.shapo@noaa.gov, Funding: NOS).
This item was submitted in the SOCD Weekly Report.