**HIGHLIGHTS FOR NESDIS LEADERSHIP**

**Unique & Significant Reports**

**Extreme wave heights in the Bering Sea from remnants of Typhoon Merbok — CISESS Scientist**

Sinéad Farrell reports the results of her team’s satellite analysis of the flooding that devastated Coastal Alaska due to the remnants of Typhoon Merbok (Figure 1a) on 17 September 2022. Storm surge flooded communities along 1,000 miles (1,609 km) of Alaska’s west coast, damaging homes, submerging roads and triggering evacuations. Sentinel-6 Michael Freilich (S6MF), launched 21 November 2020, is today’s most advanced satellite radar altimeter tasked with measuring ocean height, waves, and winds. S6MF recorded 17 observations of significant wave height exceeding 14 m (46 feet) on 16-17 September 2022 (Figure 1b, dark red dots). Such sea state is defined as “phenomenal” by the World Meteorological Organization (WMO). During the 48-hour period, 5 % of all satellite radar altimeter observations in the Bering Sea exceeded 9 m (30 ft), defined as “very high” seas by the WMO (Figure 1c) and 19 % of observations exceeded 6 m (20 ft), WMO “high” seas. The largest individual observation of significant wave height was recorded by S6MF at 15.3 m (50.2 ft), equivalent in height to a five-story building. Although the Bering Sea is considered one of the most treacherous seas in the world, such very high and phenomenal sea states are unusual for the month of September. As part of a NOAA Jason/Sentinel-6 Program funded project for the NOAA/NASA Ocean Surface Topography Science Team (OSTST), Cooperative Institute for Satellite Earth System Studies (CISESS) scientists Sinead L. Farrell, Reint Fischer and Kyle Duncan are collaborating with John Kuhn and Eric Leuliette at the NOAA Laboratory for Satellite Altimetry on an investigation of long-term changes in the Bering Sea over the past two decades. They have found that the roughest seas are most commonly observed in the winter months between November and February. Their analysis of satellite radar altimeter observations of significant wave height in the Bering Sea shows median wave heights in the month of September typically span 1.5 to 2.4 m. Over a 20-year period between 2002 and 2021, only 5 % of observations show significant wave height > 4 m (Figure 1c, solid black curve). Conditions in September 2022 were quite different to this, when between 16-17 September, 5 % of all observations showed waves > 9 m tall (Figure 1c, gray bars).
Figure 1. (a) Remnants of Typhoon Merbok in the Bering Sea off Alaska, on 16 September 2022. (Image credit: NASA Aqua/MODIS Ture Color Corrected Reflectance NASA Worldview Earthdata, NASA Earth Observing System Data and Information System (EOSDIS), doi:10.5067/MODIS/MYD021KM.061). (b) Radar altimeter-derived significant wave height (m) in the Bering Sea, 16 – 17 September 2022 from the Radar Altimeter Database System. (c) Cumulative histograms of radar altimeter-derived significant wave height (m) in the Bering Sea, 16 – 17 September, 2022 (grey bars) and the 20-year climatology, September 2002 – 2021 (solid black line). (Sinéad Farrell, CISESS, sineadf@umd.edu, Funding: Jason/Sentinel 6 & Ocean Remote Sensing)
PUBLICATIONS

Top-of-the-Atmosphere Reflected Shortwave Radiative Fluxes from GOES-R:  
Pinker, Rachel T.; Yingtao Ma, Wen Chen, Istvan Laszlo, Hongqing Liu, Hye-Yun Kim, and Jaime Daniels, 2022: Top-of-the-atmosphere reflected shortwave radiative fluxes from GOES-R.  
STAR has been developing new algorithms for the GOES-R Advanced Baseline Imager (ABI) to derive surface and top-of-theatmosphere (TOA) shortwave (SW) radiative fluxes. This paper describes CISESS Scientist Rachel Pinker and her team’s evaluation of ABI instrument’s capabilities to derive such fluxes at the TOA. Comparisons were made with Clouds and the Earth’s Radiant Energy System (CERES) satellite and model simulations. Given the discrepancies found, the ultimate algorithm will have to address many variables including surface type classification, spectral reflectance information on each surface types, seasonal changes in surface types, and interference from clouds and aerosols.

![Comparison of TOA SW flux on 25 November 2017 at 17:57 Z for: (a) CERES; (b) ABI; (c) difference of ABI–CERES and (d) histogram of ABI–CERES differences. (Rachel Pinker, CISESS, pinker@umd.edu, Funding: GOES-R AWG)](image-url)
CISESS Scientists Contribute to New Books Release this Month
