

Weekly Report

RAMMB / CIRA
Cooperative Research Program Division (CoRP)
STAR/NESDIS
National Oceanic and Atmospheric Administration (NOAA)

Submitted by: Austin Boone
Prepared by: RAMMB/CIRA contributors
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Products and Applications

SLIDER Hardware Upgrades: The CIRA IT team updated SLIDER's hardware. This update resulted in a big boost of image display capabilities in late February when both data processing and web hosting were moved from three aging servers in the ACRC building next to CIRA on CSU's Foothills Campus to four new servers in the Suzanne And Walter Scott, Jr. Bioengineering Building on main campus. The new machines are 2-3x faster than the previous hardware, and, combined with new storage, have an expanded archive of imagery available for users to browse (60-90 days depending on the satellite and sector selected, increased from about 10 days). The location of the servers in the Scott Building's data center also places the imagery one step closer to users—and with increased bandwidth—resulting in improved loading times. CIRA's IT team and researchers contributing imagery to SLIDER deserve a big "Thank You!" for their help in making the transition as smooth as possible. (POC: K. Micke, M. Niznik, N. Tourville, S. Finley CIRA, Kevin.Micke@colostate.edu, Mattie.Niznik@colostate.edu, Natalie.Tourville@colostate.edu, Steve.Finley@colostate.edu; Funding: GOES-R, JPSS)

Awards and Recognition

Publications (Citation: followed by a Summary:)

The following manuscript was posted as preprint on arXiv and submitted for publication to the new AMS journal *Artificial Intelligence for the Earth Systems (AIES)*:

Citation: Ryan Lagerquist, Imme Ebert-Uphoff, Can we integrate spatial verification methods into neural-network loss functions for atmospheric science?, arXiv preprint, available at <https://arxiv.org/abs/2203.11141>.

The manuscript discusses the integration of neighborhood filters and spectral filters (using Fourier or wavelet decomposition) into neural network training. It explores how to implement such filters and their effect on predictions for a real-world example, namely predicting the occurrence of convection in Taiwan based on Himawari-8 satellite imagery. The figure below shows a schematic for the neighborhood based loss function approach.

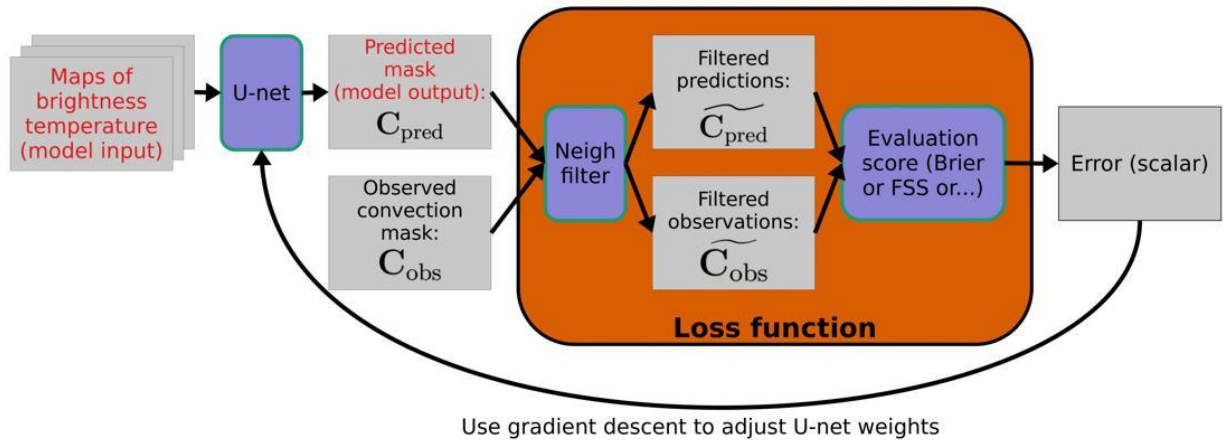


Figure 6: Implementation of neighbourhood filter inside a U-net. The neighbourhood filter is embedded inside the loss function, where it is applied to both the predictions and the observations.

While neighborhood filters are easy to implement and their pros and cons are easy to understand, spectral filtering provides significant challenges, but turns out to provide some advantages, namely yielding better calibrated probabilities than standard methods, which warrant further exploration. The approach and results were also presented by Ryan Lagerquist at CIRA's bi-weekly ML core meeting on 3-23-2022. (POC: R. Lagerquist, I. Ebert-Uphoff, CIRA, Ryan.Lagerquist@colostate.edu, iebert@colostate.edu. Funding: CIRA, NSF)

Media and Outreach

Imagery of Southern Storms:

This week a powerful mid-latitude cyclone triggered several rounds of storms across the Southern US. GeoColor, Airmass RGB, and GLM imagery provided impressive views of the system. URLs of this imagery are below. (D. Smith, S. Miller, C. Seaman, R. Brummer, Y.J. Noh, CIRA, D. Lindsey, OSGS, Dakota.Smith@colostate.edu, Steven.Miller@colostate.edu, Curtis.Seaman@colostate.edu, Dan.Lindsey@noaa.gov, Renate.Brummer@colostate.edu, Yoo-Jeong.Noh@colostate.edu, Funding: GOES-R)

Animation of GeoColor+GLM lightning:

https://twitter.com/CIRA_CSU/status/1506387191085232128

Animation of Airmass RGB images:

https://twitter.com/CIRA_CSU/status/1506750826412318720

Multi-day animation of GeoColor + GLM:

https://rammb.cira.colostate.edu/ramsdisk/online/loop.asp?data_folder=loop_of_the_day/goes-16/20220323000000&number_of_images_to_display=500&loop_speed_ms=150

JPSS Social Media Posts during the past two weeks (via Twitter):

14 March 2022: ALPW observations of a low pressure system in the Gulf of Alaska, and moisture influx into the Pacific North West.

https://twitter.com/CIRA_CSU/status/1503480940961710081?s=20&t=tzRkYeGYXFvm_cGYErziVw

17 March 2022: A mid-latitude cyclone moving offshore, observed by the VIIRS Day Cloud Phase Distinction RGB.

https://twitter.com/CIRA_CSU/status/1504571710519005198?s=20&t=fLUqGtBX9DIMOH9bKqevWQ

18 March 2022: NCC observations of snow cover over Colorado and western Kansas.

https://twitter.com/CIRA_CSU/status/1504926902754107403?s=20&t=n00ySBrBz8WAV5GFKUiDfA

23 March 2022: VIIRS Snow-Cloud Layers product observations of sea ice in the Bering Sea.

https://twitter.com/CIRA_CSU/status/1506748145685909514?s=20&t=6Ds2AVHCzqukEUDH3MsqWw

(POC: J. Torres, CIRA, Jorel.Torres@colostate.edu, Funding: JPSS)

Workshops, Conferences, and Meetings

JPSS SCIENCE SEMINAR SERIES – Presenter Steve Miller: On 21 March 2022, Steve Miller (CIRA Director and CSU/Atmospheric Science Professor) was the presenter for the monthly JPSS Science Seminar Series. His talk was titled: **“In search of bioluminescent milky seas with the VIIRS Day/Night Band”**. This presentation summarized Miller’s recent publication in Nature/Scientific Reports. **Summary:** Steve Miller’s work demonstrates how studies of milky seas caused by bioluminescence is possible with the JPSS satellite’s Day/Night Band. Such studies allow for detailed understanding of when and where milky seas are likely to occur.

Presentation Abstract: “A new generation of low-light sensing satellites —the Day/Night Band (DNB)—has demonstrated the ability to detect a rare form of widespread marine bioluminescence called the Milky Sea—a phenomenon thought to be caused by luminous bacteria which impacts a "snowfield" effect to the nighttime waters.

Captured in the seafaring adventure novels Twenty Thousand Leagues under the Seas and Moby Dick, Milky Seas remain a modern-day science mystery in terms of their exact formation mechanisms, structure, composition, and reasons for occurring. This presentation shows first examples of Milky Seas detected by the Day/Night Band, a NOAA-operated satellite sensor on board the Joint Polar Satellite System constellation—and highlights a massive (100,000 square km) Milky Sea that occurred south of Java in 2019. These new observations and demonstrated capability pave the way toward new research and discovery surrounding a fascinating and fantastic mystery of the high seas, and maritime lore.”

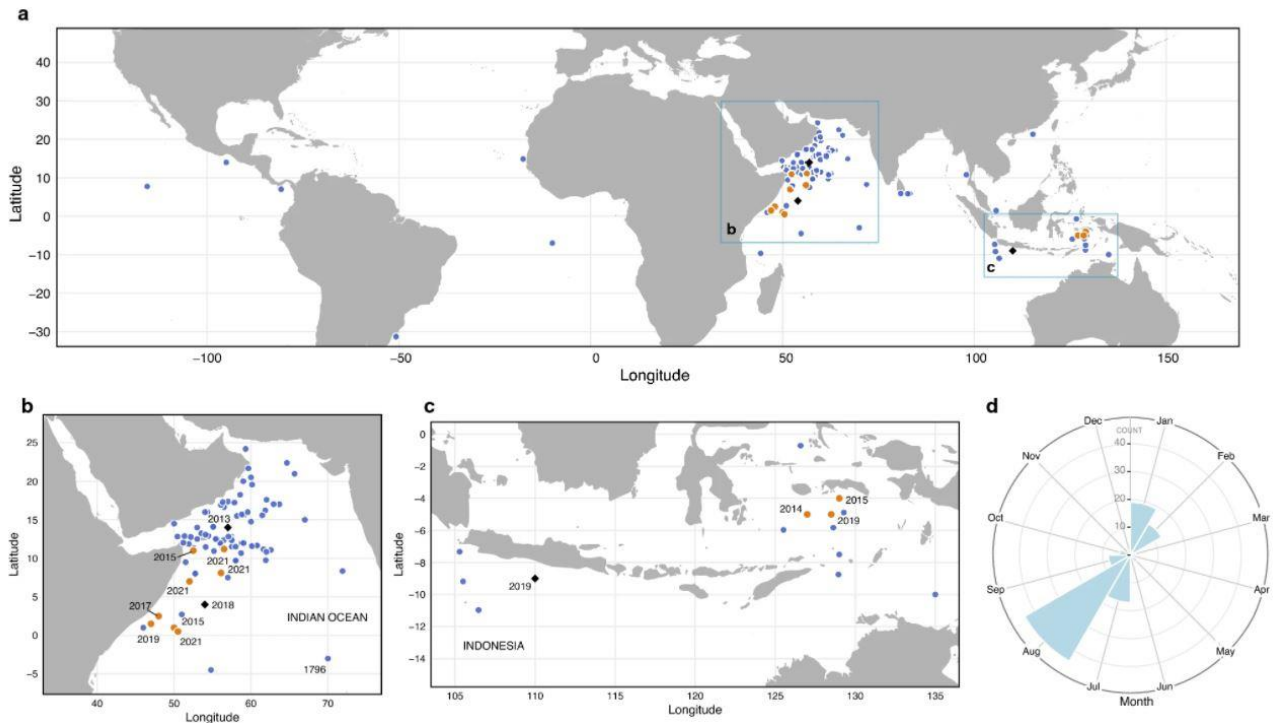


Figure from the Scientific Reports publication: Compilation of historical (1796–2010) ship reports and satellite detections of milky seas. Ship-report locations (blue) and the centroid locations of satellite-based DNB detections (black diamonds are cases highlighted in the main manuscript, and orange circles are cases presented in Supplementary Discussion) are shown for (a) global, (b) northwest Indian Ocean, and (c) Indonesia region. (d) Shows the temporal frequency of occurrence for all data.

Miller, S.D., Haddock, S.H.D., Straka, W.C., Seaman, C.J., Combs, C.L., Wang, M., Shi, W. and Nam, S.-H. Honing in on bioluminescent milky seas from space. *Sci Rep* **11**, 15443 (2021). <https://doi.org/10.1038/s41598-021-94823-z>

(POC: S. Miller, Steven.Miller@colostate.edu) Funding: JPSS

JTTI Review Meeting: G. Chirokova participated in the semi-annual JTTI review meeting and presented results for her JTTI project “Use of Ocean Stability Data and Machine Learning to Improve Tropical Cyclone Situational Awareness and NHC Statistical-Dynamical Intensity Guidance”. Significant progress was made with the development of the AWIPS2 real-time displays of the NCODA depth-averaged temperature (Tdy) and sea surface salinity (SSS). Tdy and SSS are two factors that will help determine the sea surface temperatures tropical cyclones experience near the center (under the eyewall) which result from wind-forced mechanical mixing as it translates across the ocean. Tdy and SSS are not currently used by the operational TC forecasters, and could help to improve tropical cyclones intensity forecasts. The part of the project related to the demonstration of NCODA ocean variables for situational awareness is now

estimated to be at NOAA readiness level 7. (G. Chirokova, D. Molenar, A. Libardoni, CIRA, J. Knaff, NESDIS/STAR, Galina.Chirokova@rams.colostate.edu, Debra.Molenar@colostate.edu, Alex.Libardoni@colostate.edu, John.Knaff@noaa.gov). Funding: JTTI, NOAA

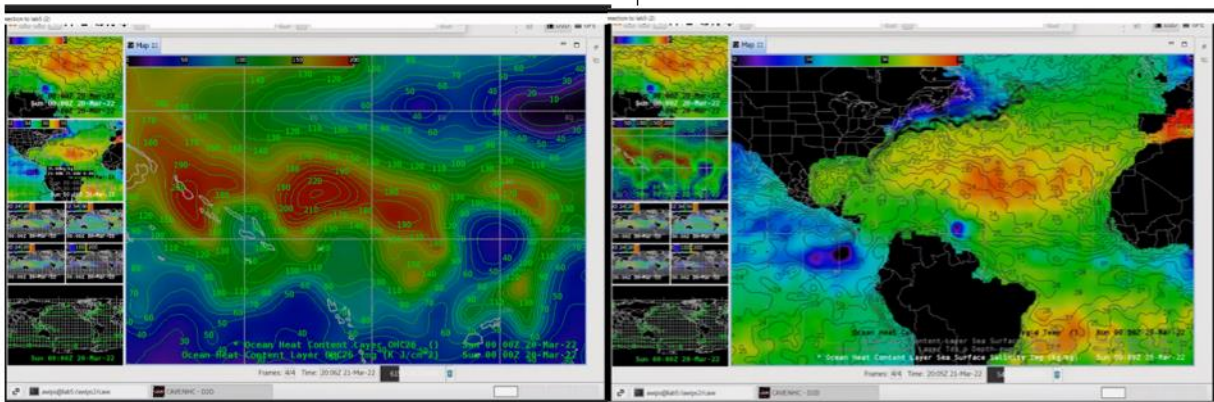


Figure. Examples of the NCODA AWIPS2 zoomed in displays for (left) Ocean Heat Content (OHC), and (right) depth-averaged temperature (T_{dy}) on top of sea surface salinity (SSS).

Training and Education

New Satellite Liaison Blog Posts: StAR scientist Bill Line published two blog posts, titled “[Mid-March 2022 Blowing Dust and Fires](#)” and “[Mid-March 2022 Severe Weather and 30-second Imagery](#)” These posts explore the use of satellite imagery, available in NWS AWIPS, during two recent active weather periods, including for tracking blowing dust, wildfires, and severe storms. See Figure below. (POC: B. Line, CoRP/RAMMB, bill.line@noaa.gov) Funding: PDRA

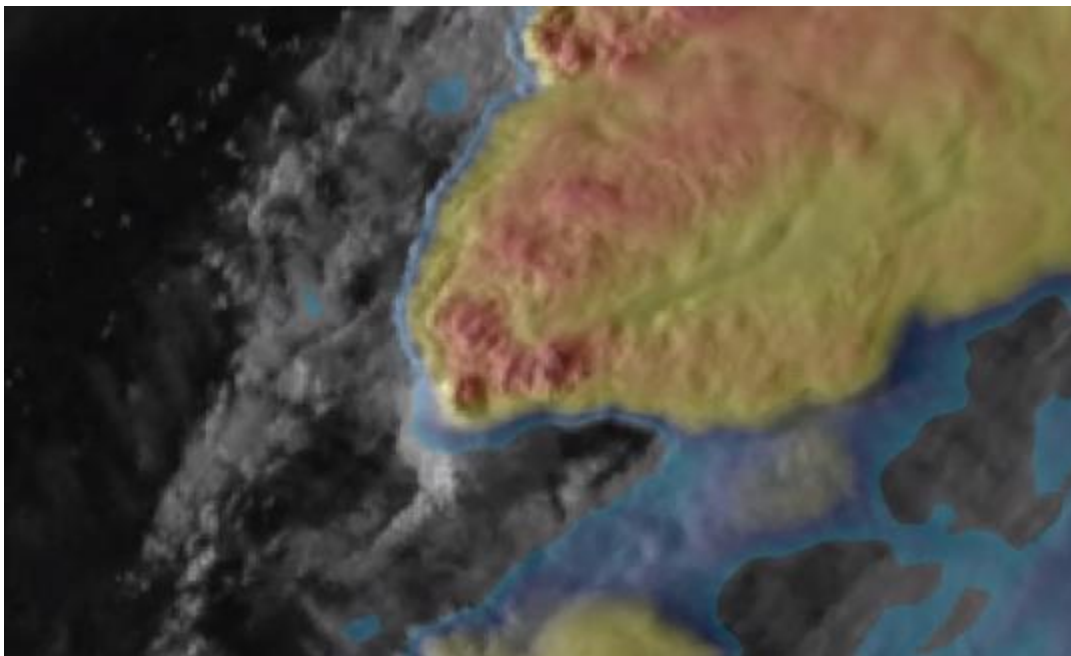


Figure: 21 March 2022 GOES-East 30-second VIS/IR Sandwich imagery over a central Texas thunderstorm captured rotation in the exposed updraft, along with other strong storm indicators.

Future Meetings and Events (dates, meeting/event, location, staff involved)

2022 CoRP Symposium Date Set: The Cooperative Research Program (CoRP) Science Symposium will take place over 25 July to - 27 July, 2022(2.5 days). This will be an in-person event hosted at the newly constructed CIRA Commons Conference Facility on the Foothills Campus of Colorado State University in Fort Collins, CO. The Symposium brings together members from the NOAA and academic community to discuss the latest developments in satellite remote sensing research and applications. It targets multidisciplinary research with a focus on early-career scientists and is part of a larger strategy to promote federal and academic partnerships/collaborations. This Symposium will focus on building stronger connections between NOAA's Cooperative Institutes (CIs) and Cooperative Science Center (CSC) faculty and students to promote a more diverse NOAA workforce in the future, with an emphasis on CI-affiliated students, postdocs, and junior scientists as conduits for collaboration.

A website has been created for this Symposium, where registration will open shortly:

https://www.cira.colostate.edu/conferences/corp_22/

(POC: S. Miller, CIRA, Steven.Miller@colostate.edu; and CIRA/RAMMB Ft. Collins staff, Funding: NOAA/CIRA)

ECMWF workshop on Machine Learning - NEXT WEEK:
Coming up next week: March 29-April 1, 2022. Go to <https://events.ecmwf.int/event/294/> to learn more. Registration is now closed but a [livestream](#) will be available. Focus is on four topics:

- 1) Machine learning for emulation of model components
- 2) Machine learning for forecasts from now-casting to seasonal
- 3) Machine learning for feature detection and user applications
- 4) Machine learning tools and high-performance computing.

To the best of our knowledge there are no CIRA talks scheduled, but CIRA folks may decide to attend. (POC: I. Ebert-Uphoff, CIRA, iebert@colostate.edu)

Virtual Summer School 2022 - Trustworthy Artificial Intelligence for Environmental Science (TAI4ES 2022):

Dates: **June 27 – July 1, 2022.** NCAR and the NSF AI institute (AI2ES) are organizing another summer school on how to make AI more *trustworthy* for environmental science applications. The summer school will have lectures in the morning and a Trust-a-thon in the afternoons. The Trust-a-thon is similar to a Hackathon, but participants will be given both data and ready-to-use AI models, and need to evaluate the trustworthiness of the models. I. Ebert-Uphoff (CIRA) is serving on the organizing committee for both lectures and the Trust-a-thon track. For more information,

see <https://www2.cisl.ucar.edu/events/tai4es-2022-summer-school> Registration is not yet open, but will be free. (POC: I. Ebert-Uphoff, CIRA, iebert@colostate.edu; Funding: NSF)

Other

CSU MURALS Judging: Mattie Niznik served as a judge at the [MURALS](#) (Multicultural Undergraduate Research Art and Leadership Symposium) event on March 25, 2022 at the CSU Lory Student Center Grand Ballrooms. MURALS is an undergraduate research symposium that intentionally reaches out to students of color in various disciplines to expose them to a variety of research opportunities. (POC: M. Niznik, Mattie.Niznik@colostate.edu)