Weekly Report

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

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Products and Applications

Awards and Recognition

2022 AMS Banner I. Miller Award: John Knaff, Charles Sampson (NRLMRY), and Kate Musgrave will receive the 2022 Banner Miller Award from the American Meteorological Society.

> *The Banner I. Miller Award is given for an outstanding contribution to the science of hurricane and tropical weather forecasting published in a journal with international circulation during the 48 months prior to the deadline for nominations. The award is selected every other year (typically in a year between biennial Conferences on Hurricanes and Tropical Meteorology) and is presented to the authors of the publication.* - AMS

The citation will read "For groundbreaking work in developing a new application to significantly improve the prediction of rapid intensification of tropical cyclones in the Western North Pacific." Award winners will receive the award at the upcoming 35th AMS Conference on Hurricanes and Tropical Meteorology. (POC: John Knaff, STAR, Kate Musgrave, CIRA, John.Knaff@noaa.gov, Kate.Musgrave@colostate.edu) Funding: PRDA

NESDIS Reimagined Highlight: C. Slocum was highlighted in the 9 September 2021 edition of NESDIS Reimagined as part of the "Reimagined Shines Spotlight on PEER Colleague." The Professional Early-career Engagement Roundtable (PEER) is a NESDIS-based cohort that focuses on recruitment, retention, culture, and learning, & education activities for early career professionals.
(POC: C. Slocum, Christopher.Slocum@noaa.gov; Funding: PRDA)

Reimagined Shines Spotlight on PEER Colleague

Chris Slocum

Briefly describe your role at NESDIS
I am a **Physical Scientist in STAR**'s Regional And Mesoscale Meteorology Branch that is co-located with the Cooperative Institute for Research in the Atmosphere in Fort Collins. Through my role, I work to improve operational **tropical cyclone forecast guidance** with geostationary and low-Earth orbiting data. These products support the missions of the National Hurricane Center, Central Pacific Hurricane Center and DOD Joint Typhoon Warning Center. Specifically, I am using **artificial intelligence/machine learning** to extract additional physical information from the satellite data. I apply that

Figure: NESDIS Reimagined newsletter PEER highlight featuring Chris Slocum.

Publications

Media and Outreach

Workshops, Conferences, and Meetings

NSIDC Cryosphere Seminar: On 15 September 2021, C. Seaman presented a seminar titled, “VIIRS Imagery and the Cryosphere” as part of the CIRES/NSIDC Cryosphere Seminar series. This seminar series is hosted by the University of Colorado Cooperative Institute for Research in Environmental Science (CIRES) and the National Snow and Ice Data Center (NSIDC) on a monthly basis. C. Seaman presented a variety of cryosphere-related applications of VIIRS imagery, including: the value of the Day/Night Band and the 1.24 µm channel (M-8); the new VIIRS Snowmelt RGB and the Snow/Cloud-Layers products; and the utility of Polar SLIDER (https://rammb-slider.cira.colostate.edu/?sat=jpss) for monitoring the polar regions. This remote talk was recorded and will be posted to the CIRES YouTube channel following some minor edits. (POC: Curtis Seaman, CIRA, curtis.seaman@colostate.edu) Funding: JPSS

Satellite Book Club Seminar: On 16 September 2021, B. Line presented “Satellite Imagery Applications During Burn Scar Flash Flood Events” for the Satellite Book Club (SBC) Seminar Series. The SBC convenes weekly to provide an opportunity for scientists throughout the NOAA satellite domain to share a topic of interest, followed by an open discussion. There were a total of 111 attendees. T. Schmit served as Facilitator for the discussion that followed, which included great participation from the audience. An archive of SBC seminars can be found here. (POC: B. Line, CoRP/RAMMB, T. Schmit, CoRP/ASPB, bill.line@noaa.gov, tim.j.schmit@noaa.gov) Funding: PDRA

NOAA 3rd AI Workshop - Planning Team: C. Slocum chaired the nineteen member Logistic Organizing Committee for the 3rd NOAA AI Workshop on Leveraging AI in Environmental Sciences that was held from 13 to 17 September 2021. The workshop organization effort was led by the newly authorized NOAA Center for AI after two successful workshops led by STAR. The theme for this year's workshop is "Transforming Weather, Climate Services, and Blue Economy with Artificial Intelligence." The workshop included 200+ presentations from all mission areas of NOAA and including participation from across the Earth and space sciences enterprise. 1300+ individuals registered to attend the workshop with eight plenary sessions with speakers including NOAA Administrator Dr. Rick Spinrad, OSTP Assistant Director of Artificial Intelligence Dr. Lynne Parker, and others from government, private sector, and academia, 22 oral presentation sessions, 7 poster sessions, and a week long pre-workshop hackathon. The full agenda is available at https://2021noaaaiworkshop.sched.com/. (POC: C. Slocum, Christopher.Slocum@noaa.gov; Funding: PRDA)

Figure: Banner for the workshop that was held virtually but with Boulder flair (planned in-person location). The full agenda can be found at https://2021noaaaiworkshop.sched.com/.

NOAA 3rd AI Workshop - CIRA/RAMMB Talks:

CIRA and RAMMB researchers and CSU collaborators presented 17 oral talks during the 3rd NOAA AI Workshop, including:

K. Haynes presented a talk titled "Using Machine Learning to Simulate 89-GHz Imagery from Geostationary Satellites". The talk discussed the ability of random forests and neural networks to predict microwave imagery from the GOES ABI, using tropical cyclone data from the TC PRIMED dataset. Co-authors: C. Slocum, J. Knaff, K. Musgrave, and I. Ebert-Uphoff. (POC: K. Haynes, Katherine.Haynes@colostate.edu; Funding: NOAA GOES-R)

J. Haynes presented a talk titled "Low Cloud Detection in Multilayer Scenes from GOES ABI using Machine Learning Methods". The talk discussed how machine learning is being used to improve low cloud detection from the GOES ABI, with an eye toward operational implementation in cooperation with our Aviation Weather Center partners. Co-authors: Y. Noh, S. Miller, K. Haynes, I. Ebert-Uphoff, and A. Heidinger. (POC: J. Haynes, John.Haynes@colostate.edu; Funding: NOAA GOES-R Program Office)

C. Slocum presented a talk titled "Beyond Dvorak: creating feature-based labels in geostationary imagery for tropical cyclones." The talk featured SALT (Satellite Analyst Labeling Toolkit) that provides better application specific tools for labeling NOAA satellite data in an AI-ready and analysis-ready manner. The talk used tropical cyclones for the application. (POC: C. Slocum, Christopher.Slocum@noaa.gov; Funding: PDRA)

K. Hilburn presented a talk titled “Improving GREMLIN: A Case Study in AI Application Development”. The talk discussed recent improvements to the GREMLIN model, including use of multi-task learning and uncertainty estimates for each pixel. The talk highlighted the value of GLM lightning area for improving GREMLIN estimates of synthetic radar reflectivity and convective and stratiform fraction. Co-authors: Y. Lee and I. Ebert-Uphoff. (POC: K. Hilburn, Kyle.Hilburn@noaa.gov; Funding: GOES-R).

I. Ebert-Uphoff presented a highlight talk entitled “Guide to Custom Loss Functions for Neural Networks in Environmental Science”. The talk highlighted community resources developed by CIRA to better customize neural networks to the special requirements of environmental science applications. Co-authors: R. Lagerquist, K. Hilburn, Y. Lee, K. Haynes, J. Stock, C. Kumler, J. Stewart. (POC: I. Ebert-Uphoff, iebert@colostate.edu; Funding: NSF, NOAA GOES-R, NOAA RDHPCS).

Y. Lee presented a talk titled “Exploring ways to effectively use temporal satellite images in detecting convection from GOES-16”. Results using convolutional 3D layers highly improved results from using convolutional 2D layers, and future work includes using optical flow developed by Jason Apke during preprocessing of the input data. Co-authors: K. Hilburn and I. Ebert-Uphoff. (POC: Y. Lee, Yoonjin.Lee@colostate.edu; Funding: GOES-R).

J. Stock presented a talk titled “Using Machine Learning to Improve Vertical Profiles of Temperature and Moisture for Severe Weather Forecasting”. Co-authors: J. Dandy, I. Ebert-Uphoff, J. Dostalek, L. Grasso. (POC: J. Dostalek, Jack.Dostalek@colostate.edu, L. Grasso, Lewis.Grasso@colostate.edu, I. Ebert-Uphoff, iebert@colostate.edu; Funding: NOAA)

L. Ver Hoef presented a talk titled “An Introduction to Topological Data Analysis for Remote Sensing”. Co-authors: Y. Lee, K. Hilburn, H. Adams, E. King, I. Ebert-Uphoff. (POC: I. Ebert-Uphoff, iebert@colostate.edu; Funding: CIRA, NSF)

A. Mamalakis presented a talk titled “Explainable Artificial Intelligence for Environmental Sciences: A benchmark to assess and compare neural network attribution methods”. Co-authors: I. Ebert-Uphoff, E. Barnes. (POC: I. Ebert-Uphoff, iebert@colostate.edu; Funding: NSF)

R. Lagerquist presented a talk titled “U-net++ for emulation and acceleration of a radiative-transfer model”. Co-authors: D. Turner, I. Ebert-Uphoff, J. Stewart, V. Hagerty (POC: R. Lagerquist, Ryan.Lagerquist@colostate.edu; Funding: CIRA)

R. Lagerquist presented a poster titled “U-nets for nowcasting the timing and location of thunderstorms based on satellite data”. Co-authors: Jebb Stewart, Imme Ebert-Uphoff, Christina Kumler. (POC: R. Lagerquist, Ryan.Lagerquist@colostate.edu; Funding: CIRA)

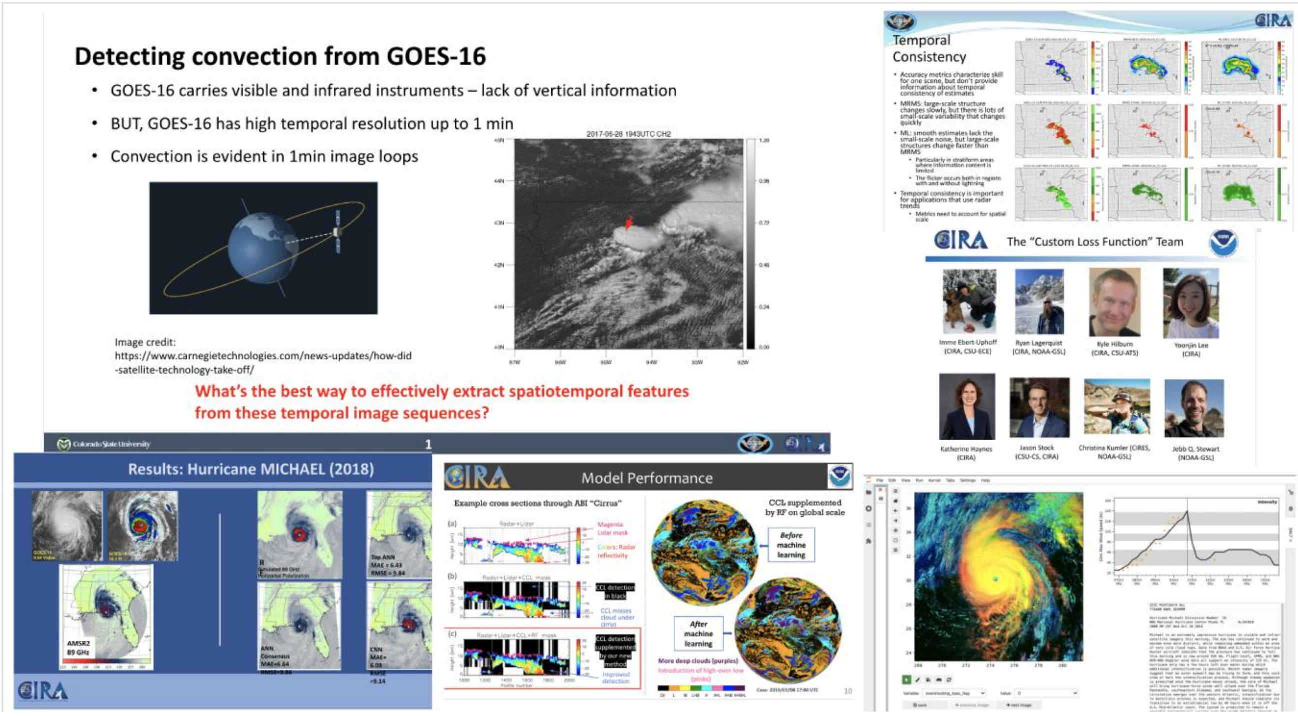

Figure: A selection of CIRA/RAMMB presentation slides from the 3rd NOAA AI Workshop presented by Yoonjin Lee, Kyle Hilburn, Imme Ebert-Upoff, Chris Slocum, John Haynes, and Kathy Haynes (clockwise from top left).

Training and Education

Refresher Training: Derivative Classification Annual 2021 Training: J. Knaff completed the derivative classification annual training for 2021 provided by Center for Development of Security Excellence (CDSE) Security Training, Education and Professionalization Portal (STEPP). (POC: John Knaff, STAR, John.Knaff@noaa.gov) Funding: PRDA

New JPSS Quick Guide! The *CMORPH-2 Precipitation Rates - Quick Guide* has been developed and published online for National Weather Service (NWS) users to view. The reference material highlights the product's algorithm makeup, resolutions, latency, applications, limitations and product example imagery in AWIPS. The production and review of the quick guide was a collaborative effort between CIRA, CIMSS, GINA, WFO - Juneau, AK, and the Climate Prediction Center (CPC). Click on the following link to access the guide via the VISIT webpage: https://rammb.cira.colostate.edu/training/visit/quick_guides/CMORPH2_Quick_Guide_v1.pdf. (POC: Jorel Torres, Bernie Connell, Erin Sanders, CIRA, Jorel.Torres@colostate.edu, Bernie.Connell@colostate.edu, Erin.Sanders@colostate.edu). Funding: JPSS.

Other

Manuscript review: J. Knaff reviewed a manuscript for the *Bulletin of the American Meteorological Society.* (POC: John Knaff, STAR, John.Knaff@noaa.gov) Funding: PRDA

LOIs submitted to FY2022 Weather Program Office Research Programs Announcement: Two LOIs were submitted to the weather testbeds/Joint Hurricane Testbed. Decisions on whether full proposals are encouraged will be made in mid October 2021. If encouraged, funding will be requested for federal travel and publication costs for J. Knaff and C. Slocum. (POC: John Knaff, Christopher Slocum, STAR, John.Knaff@noaa.gov, christopher.slocum@noaa.gov) Funding: PRDA