Weekly Report – March 4, 2022

Satellite Climate Studies Branch (SCSB)/CISESS

NOAA/NESDIS/STAR

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HIGHLIGHTS FOR NESDIS LEADERSHIP

Use-Inspired Science

Exploring Super Resolution Satellite Images with Artificial Intelligence: CISESS scientists Bin Zhang, Yan Bai and Xi Shao are using artificial intelligence (AI) to enhancing satellite images to include more detailed features to mimic higher resolution images. The Visible Infrared Imaging Suite (VIIRS) science team has experimented a couple of AI models and has had some success. The figure below shows sample output from Sentinel 2 with 60-meter resolution (left) to produce 10-meter resolution image (right) for the San Jose International Airport. This approach poses problems for radiometric fidelity, but could be useful to users.

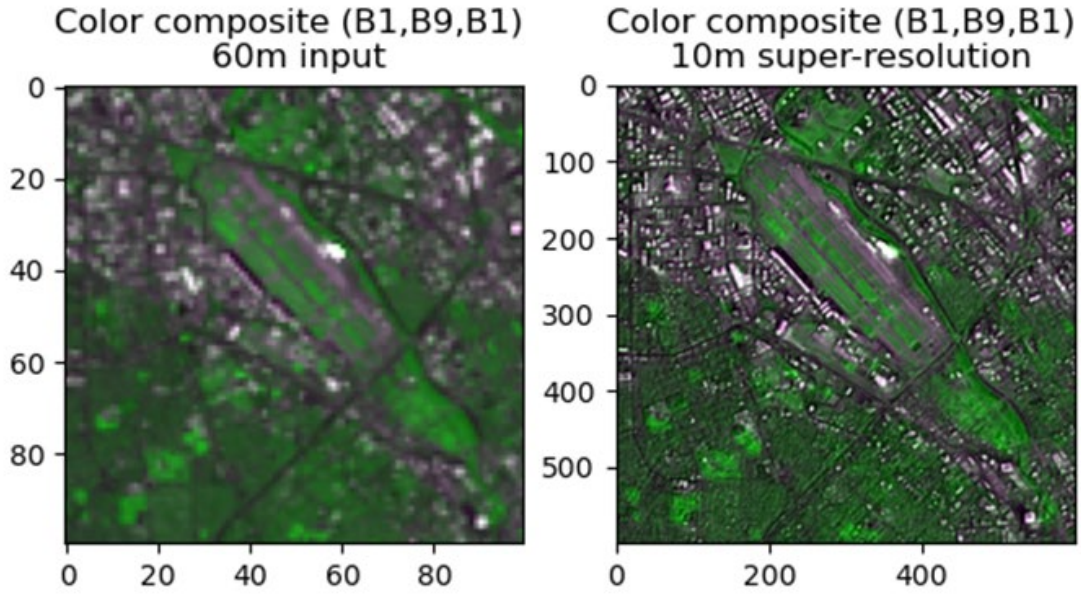


Figure: Sentinel 2 images over the San Jose International Airport with 60m resolution (left) enhanced to 10m resolution (right) with the AI model.

(Bin Zhang, bin.zhang@noaa.gov, Yan Bai, yan.bai@noaa.gov, and Xi Shao, xi.shao@noaa.gov, NESDIS/STAR/SMCD/SCDAB, JSTAR)

People

Kudos for CISESS Scientist Sarah O'Connor: Erica Towles, Program Manager of NOAA's National Coral Reef Monitoring Program (NCRMP), sent CISESS a letter of commendation for CISESS Scientist Sarah O'Connor. O'Connor has been serving as the subject-matter expert on a major two-year project to develop the first-ever GIS-based NCRMP data visualization tool. Knowles wrote:

> *She has been invaluable to me in terms of communicating potential challenges with respect to data formatting and beyond as wenavigate the data delivery process with the contractor. She consistently has provided me with timely and clear descriptions of issues so that I may efficiently address them with the NCRMP PIs and/or the contractor. She has been an integral part of the NOAA side of the project team, and I, quite frankly, do not think the project would be going as well as it is without her inputs.*

(Sarah O'Connor, NESDIS/NCEI/OGSSD/OSB CoRIS, sarah.oconnor@noaa.gov, NCEI)

FUTURE OUTLOOK

Summary Items

Date and Name of Meeting/Event/Significant Publications	*Details Below **
• 3/14 OAR Outstanding Paper Awards (NOAA Library), Gary Matlock	N

**** N: New, U: Updated, P: In previous weekly report***

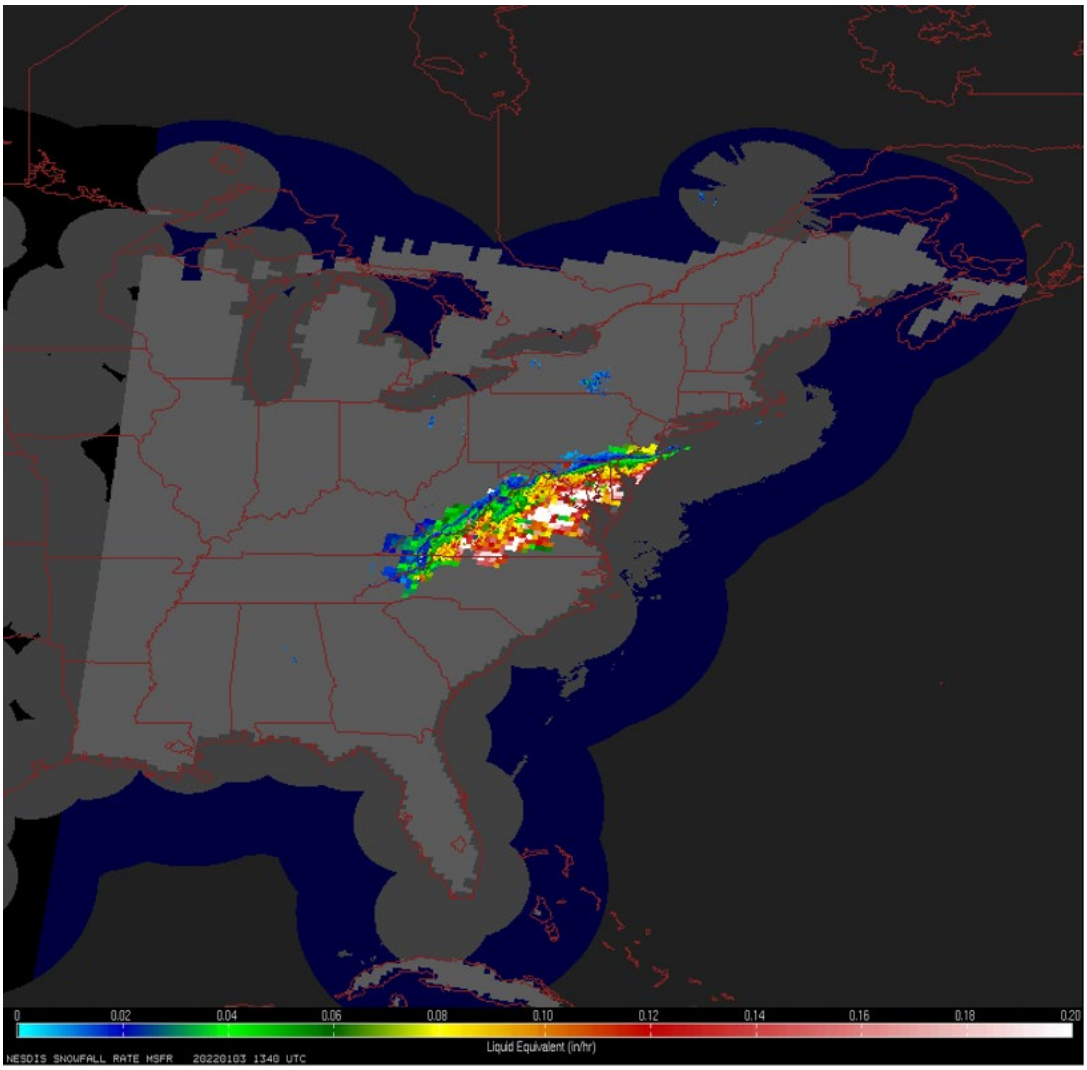
Detailed Article

Newly Submitted

OAR Outstanding Paper Awards: This event, on Monday, March 14 from 12:30 – 1:30, will honor the winners of the OAR Outstanding Paper Awards and offer a 10-minute lightning talk on each one. CISESS Scientist **Alex Koxyr** is a co-author of the winning article in the Ocean and Great Lakes category: "The Oceanic Sink for Anthropogenic CO_2 from 1994 to 2007."

TRAINING AND EDUCATION

Seminar for NSSL MRMS Group: H. Meng was invited to give a seminar to the Multi-Radar Multi-Sensor (MRMS) group at the NOAA National Severe Storms Laboratory (NSSL) on March 1. The MRMS products are widely used within and outside NOAA. The Snowfall Rate (SFR) team combines SFR with the MRMS instantaneous snowfall rate estimates to produce a radar-satellite merged mSFR product. The seminar was well received and a long discussion followed the seminar. The MRMS group requested SFR data for their study to incorporate satellite precipitation data in the hourly MRMS. They also provided information on an experimental precipitation type product which could be a validation source for SFR and snowfall detection algorithm. Below is an mSFR image from the January 3 nor'easter.



(Huan Meng, huan.meng@noaa.gov, Funding: PDRA)

PUBLICATIONS

Leveraging Machine Learning to Improve Sea Surface Temperature Retrievals
Citation:
Improvement of MiRS Sea Surface Temperature Retrievals Using a Machine Learning Approach
IEEE Journal on Selected Topics in Applied Earth Observations and Remote Sensing
Shuyan Liu (CIRA), **Christopher Grassotti, (CISESS)**, Quanhua Liu (STAR), **Yan Zhou (CISESS)**, and **Yong-Keun Lee (CISESS)**
A deep neural network was developed that successfully corrected errors in satellite retrievals of sea surface temperatures.
Summary:
The Microwave Integrated Retrieval System (MiRS) Science Team has published a paper in *IEEE Journal on Selected Topics in Applied Earth Observations and Remote Sensing* (JSTARS) titled "Improvement of MiRS sea surface temperature retrievals using a machine learning approach". In the study (Liu et al., 2022, doi: 10.1109/JSTARS.2022.3151002) which included CISESS co-authors Chris Grassotti, Yan Zhou, and Yong-Keun Lee, various approaches were tested to improve the sea surface temperature (SST) retrievals from NOAA-20/ATMS measurements. These included a deep neural network (DNN) that used MiRS operational retrievals along with ATMS measurements and other metadata such as location and satellite observation zenith angle (DNN-Retrieval), a DNN that used satellite data alone (DNN-TB), and a multilinear regression that used satellite data (MLReg-TB). In all cases tested, the DNN-Retrieval approach yielded the best performance relative to ECMWF analyses, both in terms of overall statistics, but also in terms of lack of spatial artifacts and reduced scan angle dependence. The figure below shows results from one of the testing days. The goal of the effort is not simply to improve the SST estimate, but to potentially incorporate the correction into the variational retrieval process itself within MiRS. For example, since the 1DVAR method simultaneously retrieves the atmospheric and surface state, optimizing the surface temperature specification may result in improved retrieval of the temperature and water vapor profiles.

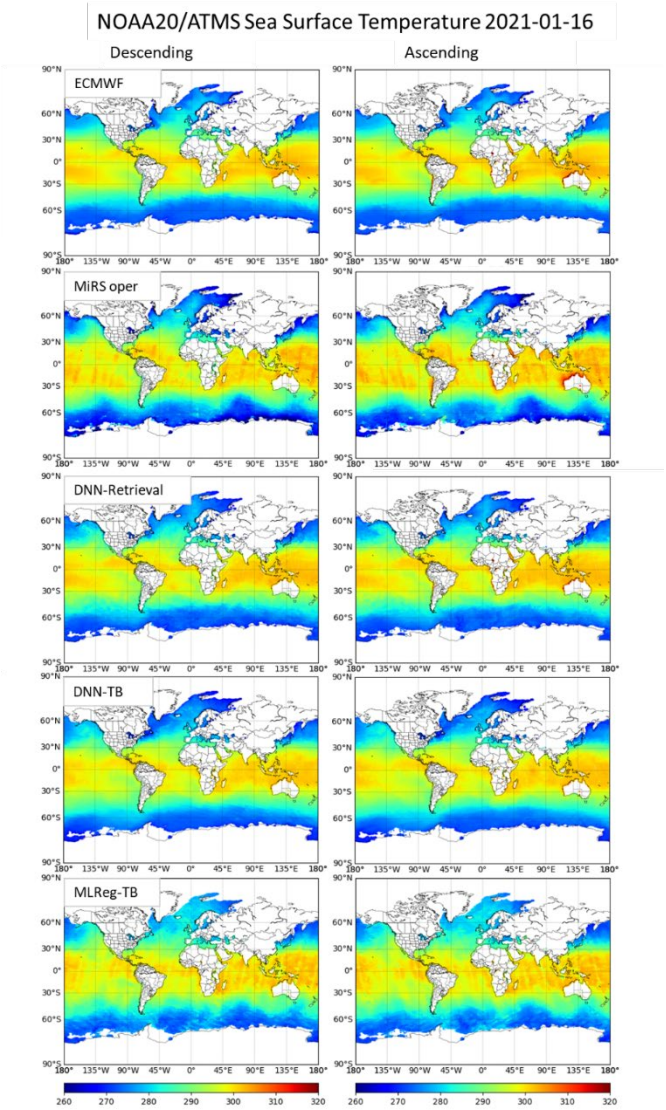


Figure: Global SST maps valid 2021-01-16 corresponding to: ECMWF analyses (top row), MiRS operational retrievals (second row), DNN-Retrieval (third row), DNN-TB (fourth row), MLReg-TB (bottom row) experiments for descending (left column) and ascending (right column), model training using 12 days in 2020.

The full article is availavble at https://dx.doi.org/10.1109/JSTARS.2022.3151002. (Christopher Grassotti, NESDIS/STAR/SMCD/SCDAB, christopher.grassotti@noaa.gov, Funding: JSTAR)