Products and Applications

Accelerating the Exploitation of Satellite Observations to Improve Flood and Inundation Monitoring and Forecasts: CISESS Scientist Qingyuan Zhang and colleagues have developed a framework to compare Visible/Infrared Imager Radiometer Suite (VIIRS) Flood Inundation Maps (FIM) with Sentinel-1 synthetic aperture radar (SAR) FIM. VIIRS daily FIM products provide water extent information with cloud-free observations. SAR FIM maps provide water extent information with day-and-night, all-weather observing capabilities. However, current existing SAR FIM products have limited spatial and temporal coverages. Integrating VIIRS FIM products and current SAR FIM products has the potential to enhance the capability to improve FIM products. One question before the integration is – are VIIRS FIM products and SAR FIM products comparable under cloud-free condition? Figure 1 shows two comparison examples in March during 2019 Midwestern Great Flood. These two examples both show that both VIIRS and SAR FIM products capture the major water bodies including flooded areas. So, integrating these two types of FIM products will be helpful and valuable, especially when VIIRS can’t provide water extent information and SAR FIM products are available.
Figure 1. Two comparison examples of VIIRS FIM products and Sentinel-1 SAR FIM products in March during Midwestern Great Flood in 2019 (SAR FIM products are available at https://rapid-nrt-flood-maps.s3.amazonaws.com/).

(POC: Qingyuan Zhang, qyzhang@umd.edu, Funding: JSTAR and NOAA grant A20OAR4600288)

Publications

Faster Warming in the Gulf Stream: CISESS Scientist Alexey Mishonov (NCEI) has a new article in press and published online July 27 in the journal Limnology and Oceanography. This article documents a study that aims to better understand regional long-term climate trends caused by the Gulf Stream decadal variability. The oceanographic conditions in the Gulf of Maine, Scotian Shelf, Slope Sea, and surroundings are determined by interplay of two major circulation systems—the Gulf Stream and Labrador Current. The in situ data analysis confirms a continuous slow warming within all three areas over the last five decades. This warming has accelerated in the last ten years coinciding with a strengthened northward incursion of warm water in the summer months. Such strong northward migration of warm water was not seen in the four preceding decades, making the current rapid warming different. They argue that the recent decadal-scale warming is unique and may signal that the shift of the thermal regime in this
region may be at least partially caused by a changed pattern of the Gulf Stream extension zone’s long-term variability.

Figure: Annual temperature differences (ocean climate shift; see text) between the averages: 1995-2017, and 1965-1984; — south of the Laurentian Channel outflow, the Scotia Shelf and Slope Water area, and in the Gulf of Maine.


*(POC: Alexey Mishonov, alexey.mishonov@noaa.gov, Funding: NCEI)*

**Removing Bias in Upper AtmosphereDatasets:** CISESS Scientists Xin Jing, Xi Shao, Tung-Chang Liu and Bin Zhang (STAR/SOCD) have a new article in the July 2021 issue of *Atmosphere*. This article describes the validation of the consistency of the GCOS Reference Upper Air Network (GRUAN) RS92 and RS41 datasets, versions EDT.1 and GDP.2, in the upper troposphere and lower stratosphere (200–20 hPa). Vaisala RS92 was the operational radiosonde used by GRUAN, which was transitioned to Vaisala RS41 after two years of using both radiosondes [Dirksen et al., 2020]. The validation data came from the dual launch campaigns at the GRUAN site and using the radio occultation (RO) product and the ERA5 reanalysis from ECMWF as standards for double difference comparison. Separate comparisons with the references were also performed in order to trace the origin of the bias between the two instruments. Then, the performance of the GRUAN raw temperature correction algorithm was evaluated, from the aspects of day–night, the solar zenith angle, and the pressure level, for GDP.2 version products. The results
show that RS92.EDT.1 has a warm bias of 0.355 K, compared to RS41.EDT.1, at 20 hPa, during
daytime. This bias was found to mainly originate from RS92.EDT.1, based on the separate
comparison with RO or ECMWF ERA5 data. RS92.GDP.2 is consistent with RS41.GDP.2, but a
separate comparison indicated that the two original GDP.2 products have a ~1 K warm bias at
20 hPa during daytime, compared with RO or ECMWF ERA5 data. The GRUAN correction
method can reduce the warm bias up to 0.5 K at 20 hPa during daytime. As a result, this GRUAN
correction method is efficient, and it is dependent on the solar zenith angle and pressure level.

**Figure.** Results of bias (GDP.2–RO/ECMWF) for all-day (a), daytime (b), and night-time (c).
The blue and red squares indicate bias (RS92.GDP.2original–RO) and
bias \( (RS92.\ GDP.\ 2_{\text{original}} - ECMWF) \), respectively, and the blue and red ‘x’ indicate bias \( (RS92.\ GDP.\ 2_{\text{corrected}} - RO) \) and bias \( (RS92.\ GDP.\ 2_{\text{corrected}} - ECMWF) \), respectively. The blue and red triangles indicate bias \( (RS41.\ GDP.\ 2_{\text{original}} - RO) \) and bias \( (RS41.\ GDP.\ 2_{\text{original}} - ECMWF) \), respectively, and the blue and red crosses indicate bias \( (RS41.\ GDP.\ 2_{\text{corrected}} - RO) \) and bias \( (RS41.\ GDP.\ 2_{\text{corrected}} - ECMWF) \), respectively.

Jing, Xin; Xi Shao, Tung-Chang Liu, and Bin Zhang, 2021 Comparison of GRUAN RS92 and RS41 radiosonde temperature biases. *Atmosphere*, **12**, 857, [https://doi.org/10.3390/atmos12070857](https://doi.org/10.3390/atmos12070857).

*(POC: Xin Jing, xinjing@umd.edu, JSTAR & COSMIC-2)*