Sep. 11, 2024

A Community Request on behalf of the CEOS Sea Surface Temperature (SST) and Coastal Observations, Applications, Services and Tools (COAST) Virtual Constellations supported by the GHRSST Science Team on the Proposed Coverage of Future Missions including the NASA Surface Biology Geology Mission for Coastal Ocean Observations

Members of the Committee of Earth Observation Satellites (CEOS) Sea Surface Temperature (SST) and Coastal Observations, Applications, Services and Tools (COAST) Virtual Constellations have noted the requirement of consistent ultra high resolution SST observations in the coastal zone where SST is a vital tracer of sub-mesoscale physical phenomena. Coastal hydrodynamic model validation and assimilation also require ultra high satellite-derived SST from several sources to be presented in a consistent manner with respect to spatial extent. Several science team members within the Group for High Resolution Sea Surface Temperature (GHRSST) Science Team also participate in related CEOS entities including the CEOS SST and the CEOS COAST Virtual Constellations (VCs). The GHRSST Project was established 25 years ago to promote state-of-the-art SST datasets built on community interoperability principles, product standardization (GHRSST Data Specification - GDS), and best practices for SST retrievals and data uncertainty.

An emerging focus and interest area of the CEOS VCs and GHRSST are the advent of ultra high resolution (<100 meter) SST retrievals from existing and future planned thermal infrared (IR) radiometer missions including NASA's ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) deployed in 2018, the joint CNES/ISRO Thermal infraRed Imaging Satellite for High-resolution Natural resource Assessment (TRISHNA) to be launched in 2026, and ESA's Land Surface Temperature Monitoring (LSTM) to be launched in 2028. Also of high interest are the ocean observing capabilities of the emerging NASA Surface Biology Geology (SBG) mission with the Thermal Infrared (TIR) instrument having a 60 meter spatial resolution and a 935 km swath. Recent documentation has the launch date of this part of the SBG mission in 2028.

These novel ultra high resolution IR measurements will certainly open a new era of SST observations and remotely sensed coastal oceanography as they are nearly an order of magnitude improvement over the typical "750-1100 meter" observations from traditional thermal IR sensors such as VIIRS, MODIS, SLSTR, AVHRR, METimage etc. JAXA's

Global Change Observation Mission - Climate (GCOM-C) launched in 2017 has IR observation with 250 meter resolution for coastal areas in a wide range (max 700 km from the coast) and bridges traditional thermal IR sensors and novel ultra high resolution IR measurements. From ECOSTRESS, results have shown large improvements in resolving coastal sub-mesoscale eddies and filaments, tidal signatures, and other phenomena not previously possible via thermal IR remote sensing. The ultra high resolution observations will also be critical for resolving the air-sea coupling in coastal regions where these eddies, filaments and fronts dominate.

The spatial resolution of observation is a key factor but also the size of the area is extremely important so that synoptic ocean observations can be made. All the ultra high resolution sensors have limitations on the quantity of ocean observations obtained as their designed focus has primarily been on land phenomena and telemetry bandwidth requirements preclude total global ocean coverage.

However, SBG-TIR stands in noteworthy contrast to the other three sensors in the reduced quantity of high resolution observations in very significant coastal areas (see Figure 1). In this typical example, SBG would miss the predominant coastal variability signatures of eddies and filaments off the west coast of North America, and its existing proposed global coverage map has similar “gaps” for many of the worlds dynamic upwelling and western boundary current regions.

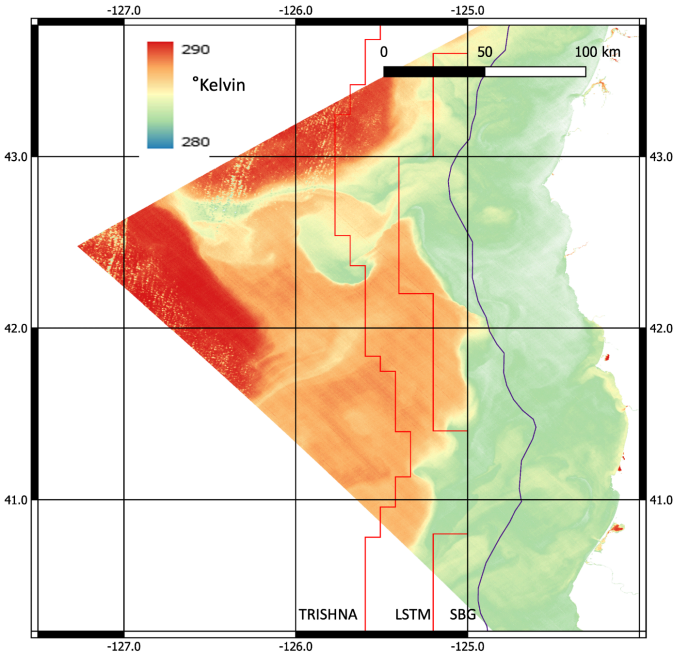

Figure 1. SST image from ECOSTRESS on 2021-09-01 with the proposed ocean observation boundaries from TRISHNA (orange line), LSTM (red line), and NASA’s SBG-TIR (purple line) overlaid. SBG would miss the thermal fronts, eddies and filaments observable from the other sensors.

We believe the SBG-TIR in its current specification will miss a rare opportunity to be complementary to the ultra high resolution SST observations of the TRISHNA and LSTM missions (minimum 100 km from coast). If the project adopts an improved coastal coverage similar to the other sensors, the SBG data will be significantly more valuable and usable, add a new time series dimension to coastal ocean SST observations, and increase the probability of breakthrough science and decision making.

We strongly encourage the CEOS members who plan future ultra high resolution TIR missions to provide the opportunity to obtain coastal SST in GHRSST format with enough coverage up to minimum 100 km from the coast, like LSTM and TRISHNA.

In particular, we recommend the SBG-TIR mission planners and project team improve the ocean coverage and make it more scientifically useful for the coastal ocean community and applications, and we are prepared to support this request with additional engagement and justification if needed.

We look forward to your response.

For your urgent consideration,

[Signatures]

CEOS SST-VC Co-Leads

CEOS COAST-VC Co-Leads

GHRSST Chair