

# Operational Sea-Surface Temperature data retrieved from satellites

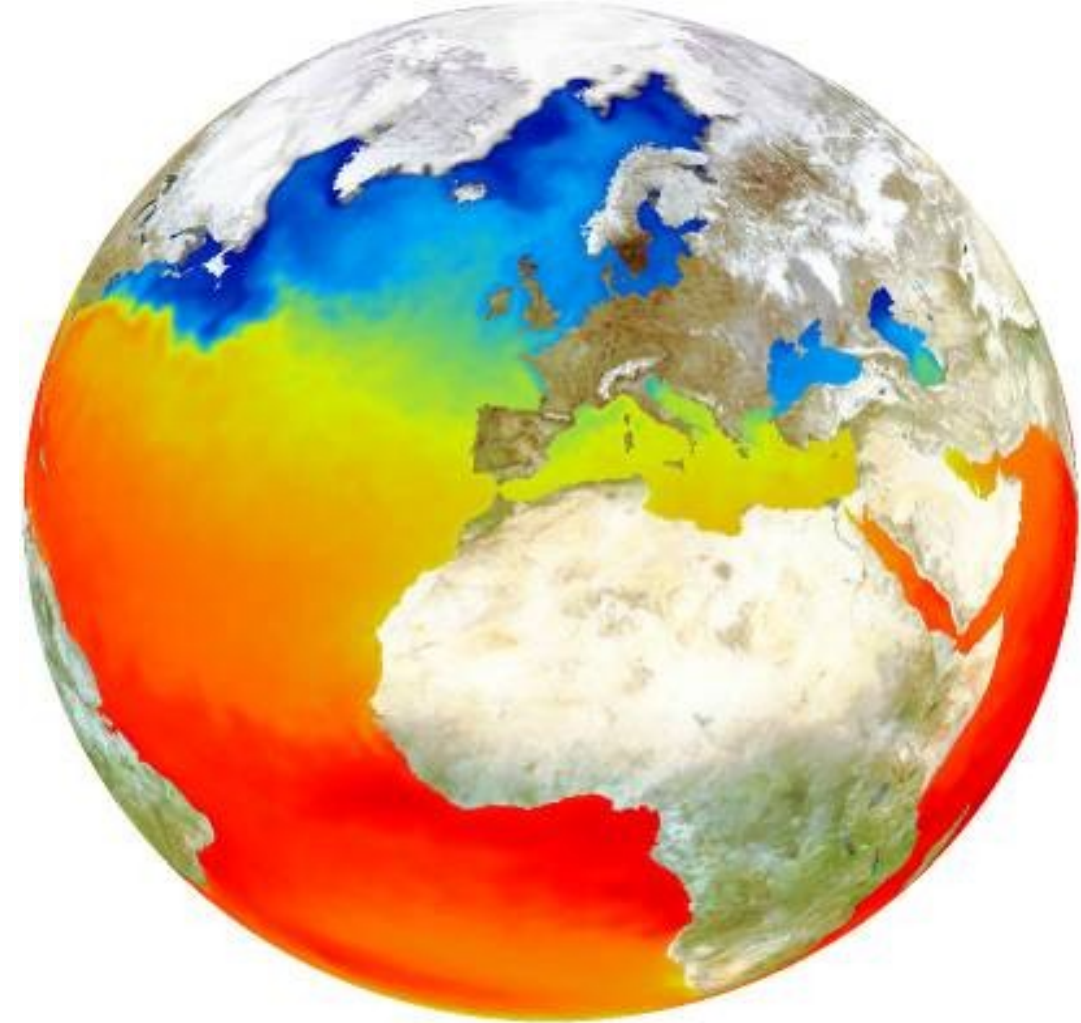


**Ioanna Karagali**, Jacob L. Høyer, Chiara Bearzotti, Erika Hayashi, Anne O'Carroll\*,  
GHRSSST Science Team

Danish Meteorological Institute / Group for  
High Resolution Sea-Surface Temperature

\*EUMETSAT

*ika@dmi.dk*



# Sea Surface Temperature (SST) from satellites

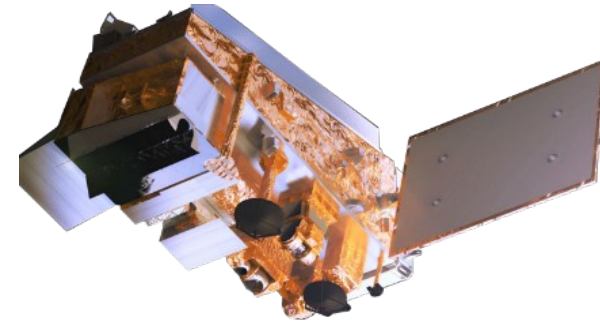
As global and regional temperatures continue to increase, Sea Surface Temperature from satellite remote sensing continues to be

**crucial for understanding, monitoring and modelling the climate**

The **Group for High Resolution Sea Surface Temperature (GHR SST)** coordinates on providing satellite-derived global Sea-Surface Temperature with good estimates of uncertainty to operational users, climate / ocean monitoring / prediction and the science community

## GHR SST Catalogue

<https://www.ghrsst.org/ghrsst-data-services/for-sst-data-producers/ghrsst-catalogue/#/search?from=1&to=30>

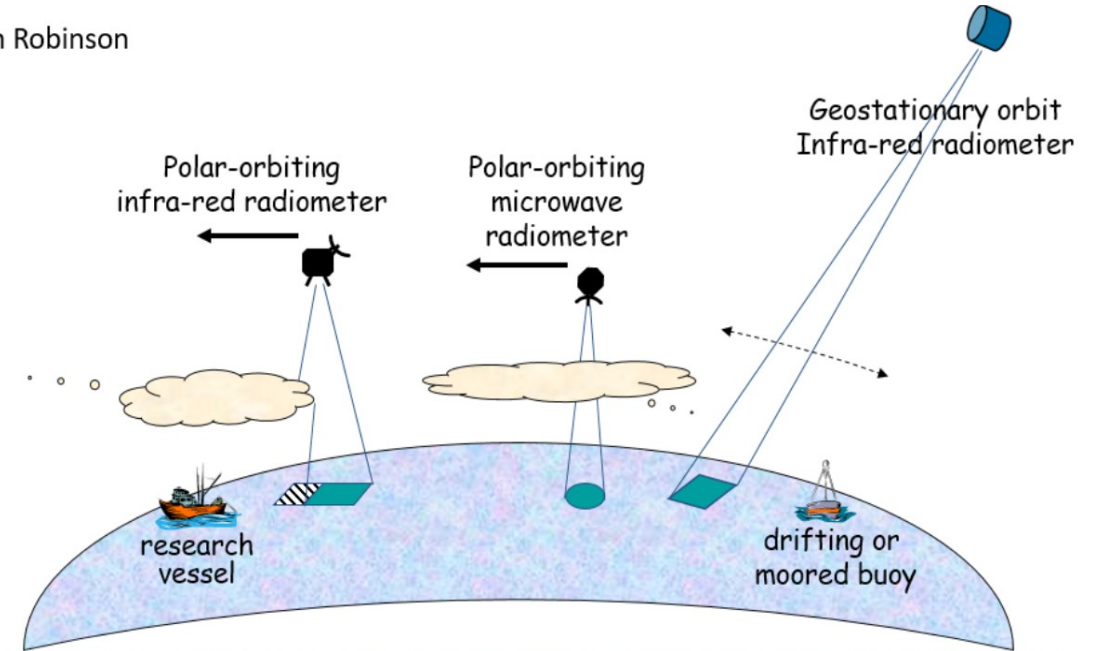
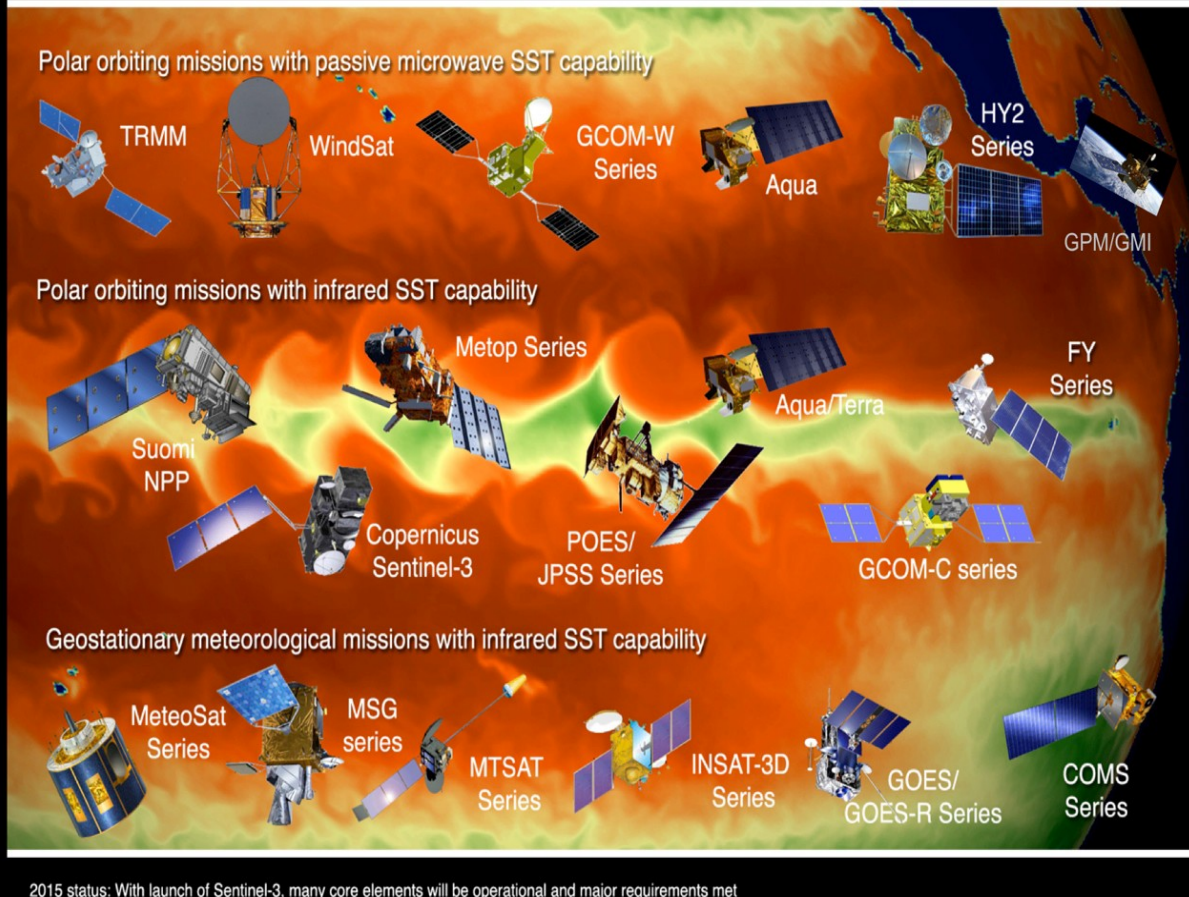


# SST satellite observing system constellation

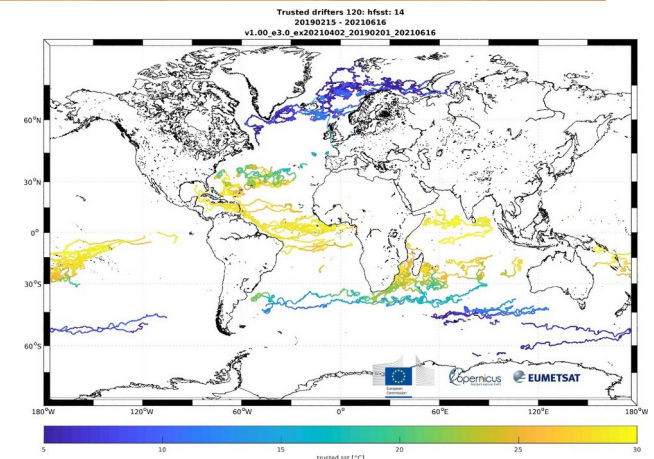
Ian Robinson

## CEOS Virtual Constellation for Sea Surface Temperature (SST-VC)

Providing best quality SST data for wide application through international collaboration, scientific innovation, and rigor



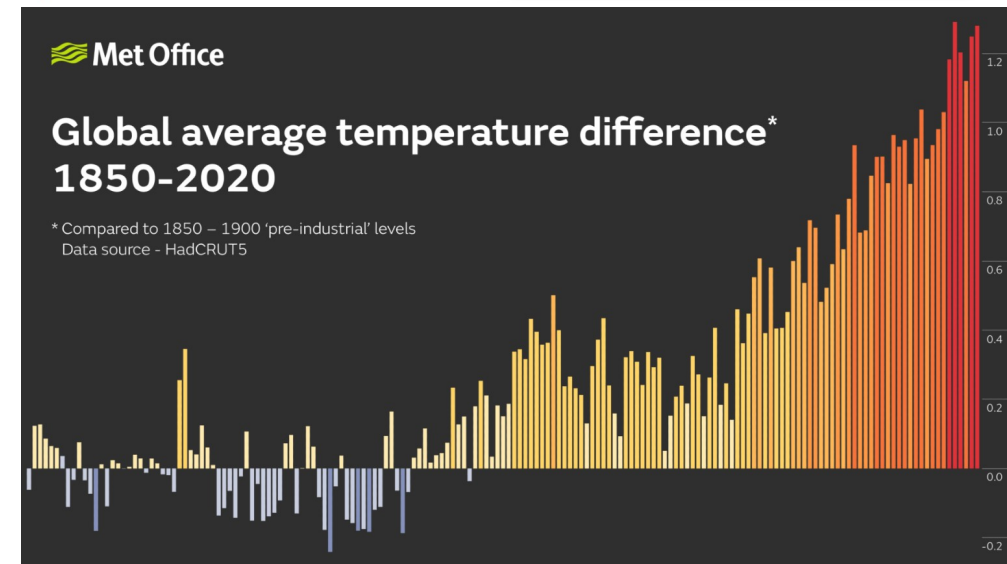
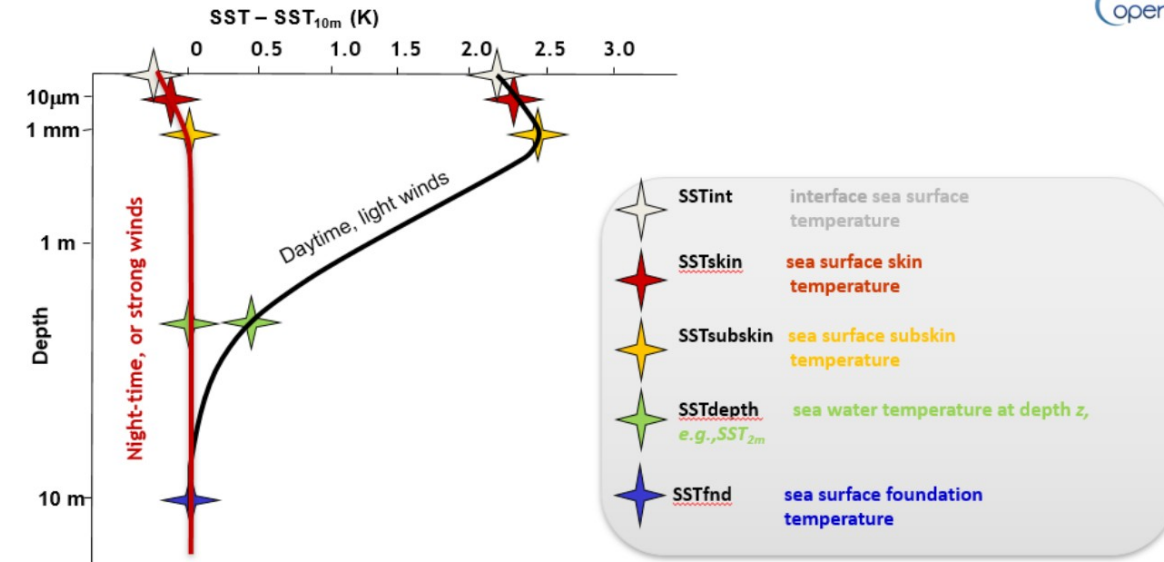
Fiducial Reference Measurements (FRM) also crucial for satellite validation and ensuring quality, consistency and traceability



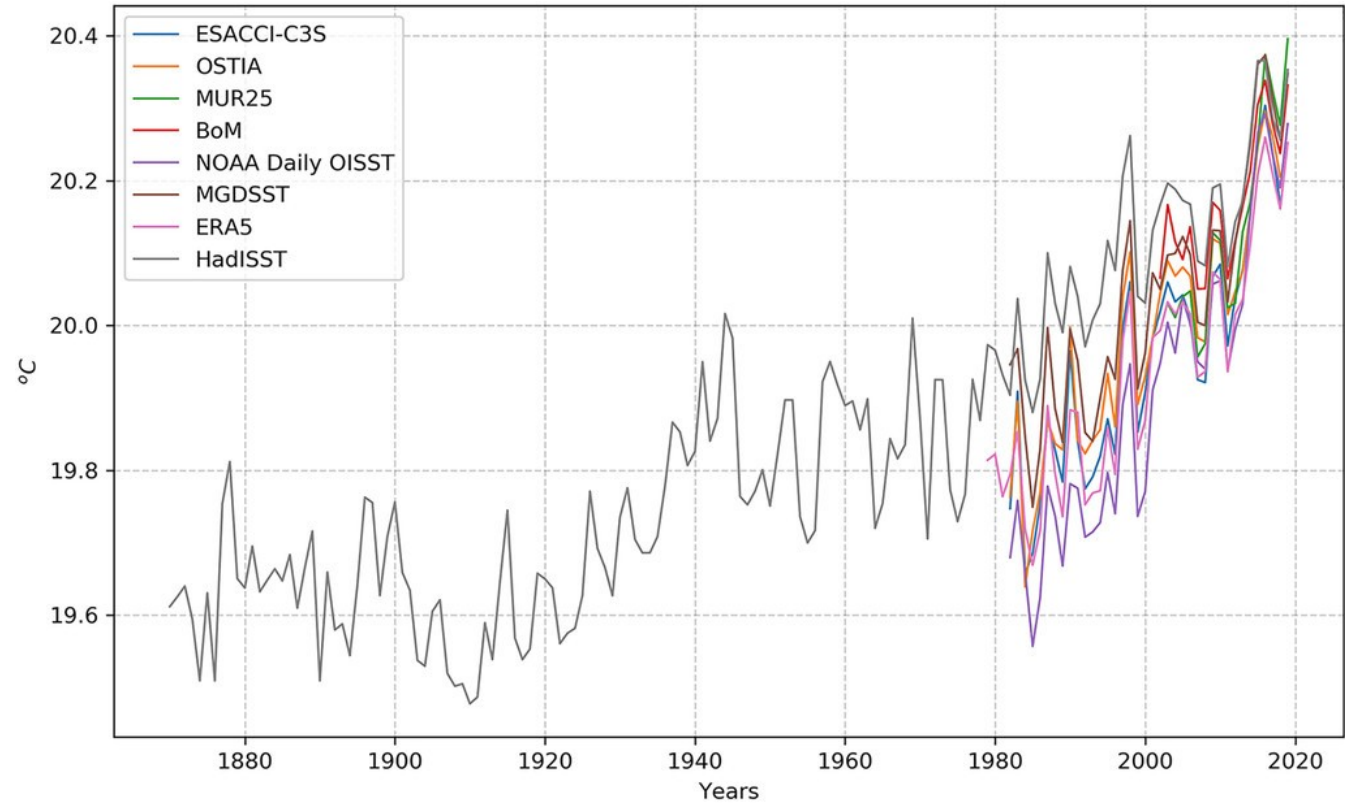
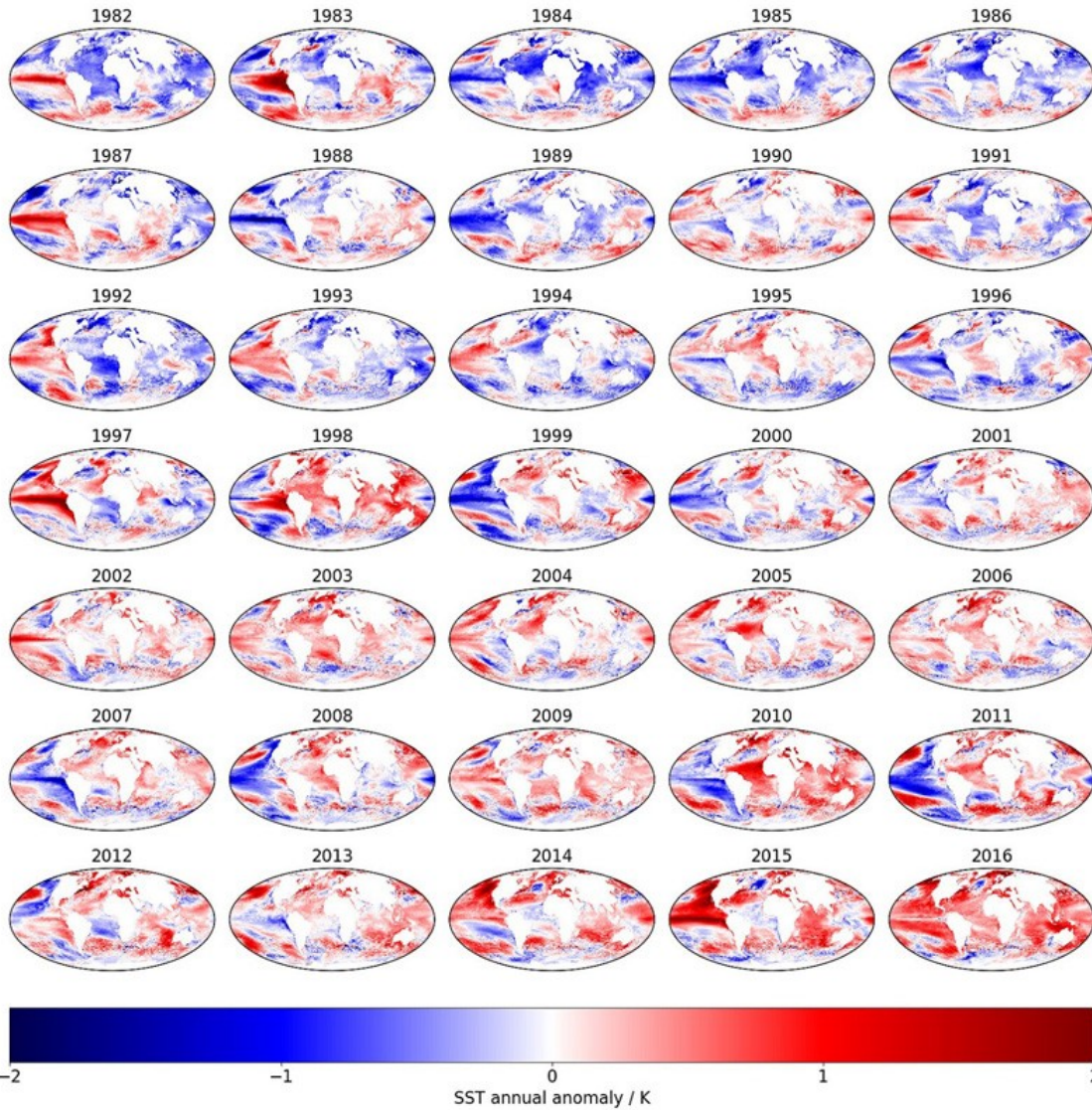
# Why is satellite SST important?

Essential for climate monitoring, modelling and seasonal predictions:

- Improves seasonal predictions
- Influences atmospheric circulation
- Influences Weather forecasting boundary condition
- Influences density and circulation of oceans
- Impacts ocean bio-geochemistry and marine ecosystems



# Improving climate monitoring and prediction

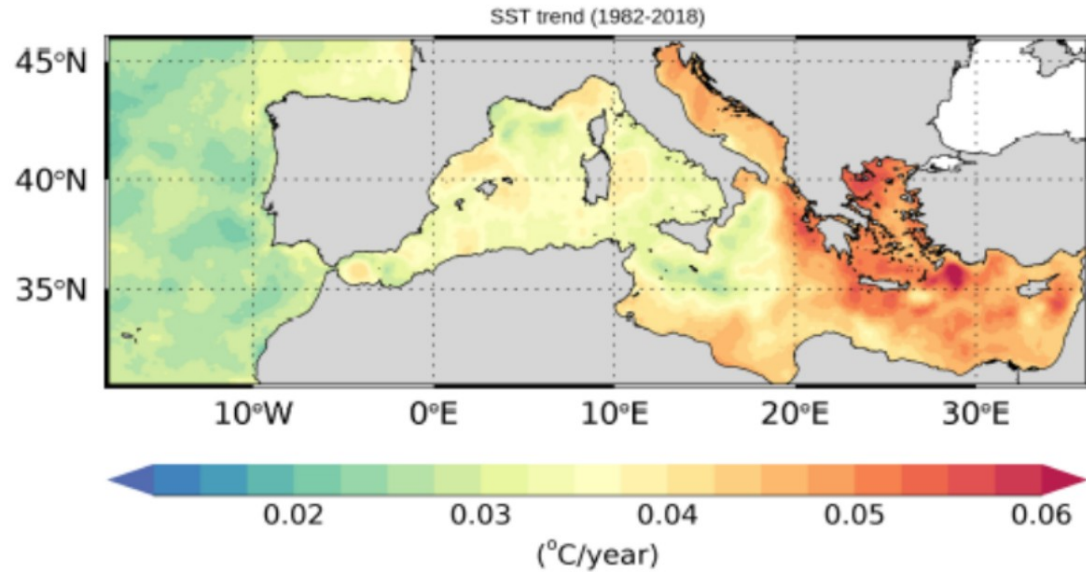


Yang et al. (2021), Sea Surface Temperature Intercomparison in the Framework of the Copernicus Climate Change Service (C3S), *Journal of Climate* 34 (13) <https://doi.org/10.1175/JCLI-D-20-0793.1>

Merchant et al. (2019), Satellite-based time-series of sea-surface temperature since 1981 for climate applications, *Scientific data* 6, 223 <https://www.nature.com/articles/s41597-019-0236-x>

# Applications of Sea Surface Temperature

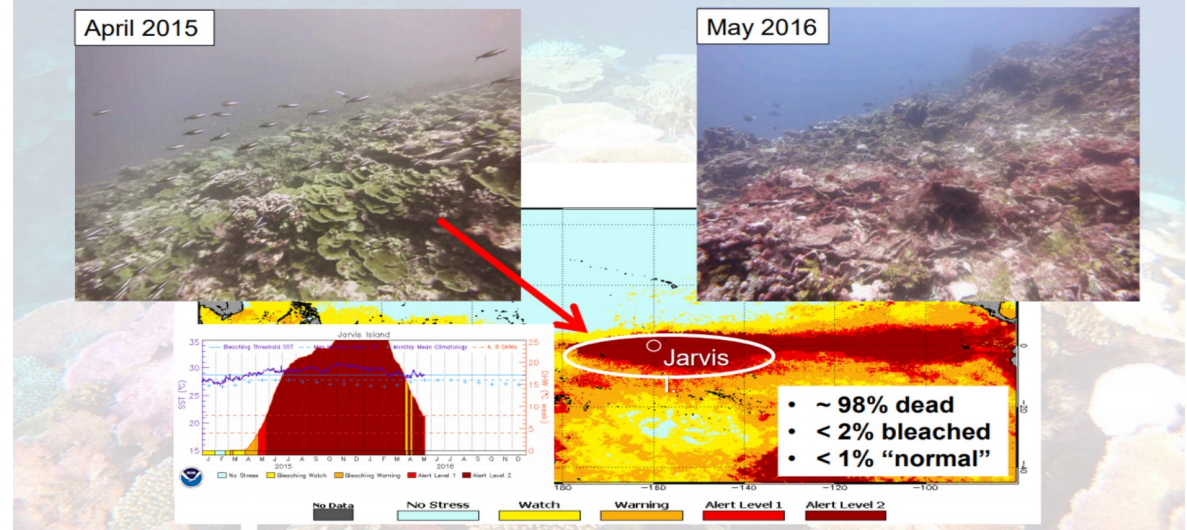
## Marine heat waves



Nearly continuous warming trend of  $0.041 \pm 0.006^\circ\text{C} / \text{year}$ .  
Warming of  $1.5^\circ\text{C}$  for 1982-2008 (Pisano et al. 2020)

## Coral heat stress SST user needs

### Heat Stress and Bleaching - Jarvis Island, Central Pacific



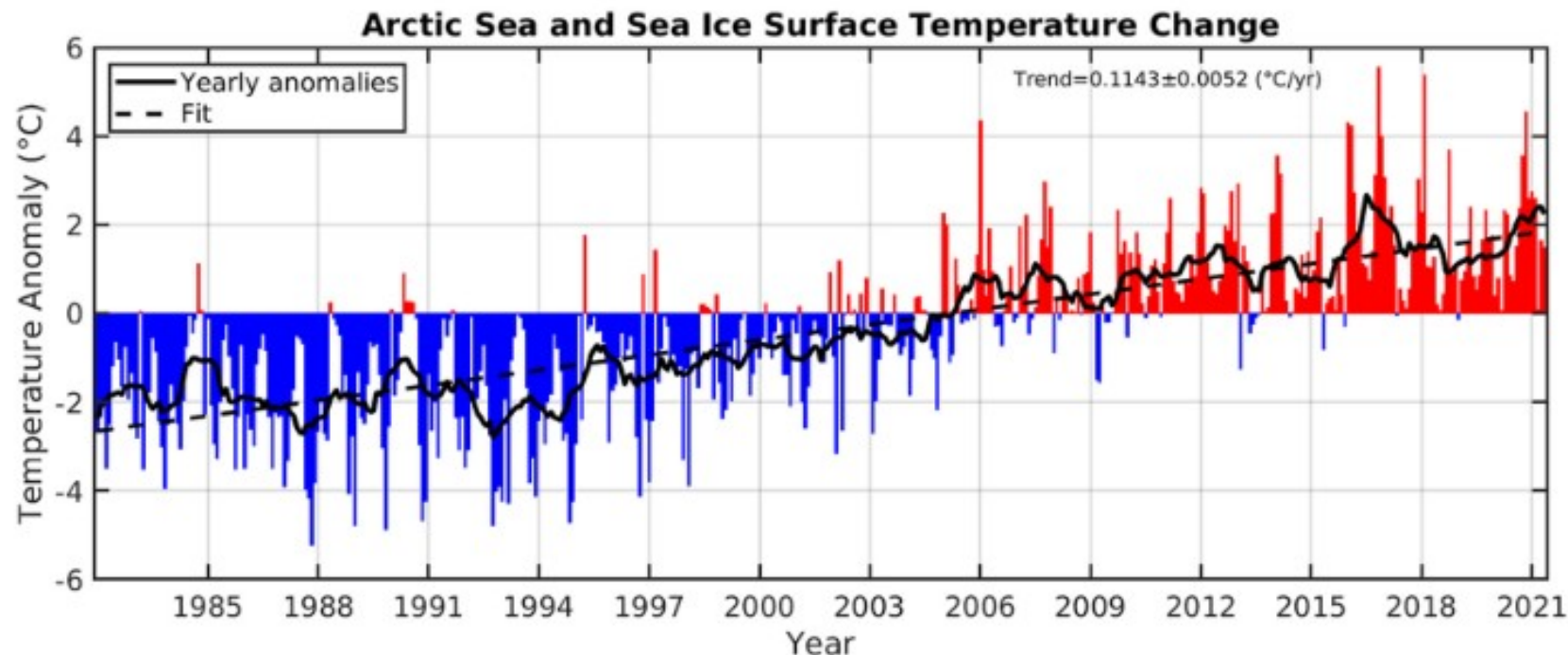
Skirving et al. (2020) *Coral heat stress user SST requirements* <https://doi.org/10.5281/zenodo.4700411>

## Improving SST data quality in the Arctic

- SST and Ice-Surface Temperature products enable Arctic monitoring
- 4°C increase in Arctic Ocean (>60°N) surface temperature

**Challenges:** Lack of in situ data, accurate identification of sea-ice

**Need:** Improvement of Passive Microwave (PMW) data availability in Arctic



Nielsen-Englyst et al., **A combined sea and sea-ice surface temperature climate dataset of the Arctic, 1982-2021**, Remote Sensing of Environment, 284, 2023, <https://doi.org/10.1016/j.rse.2022.113331>.

# Challenges for improving Sea-Surface Temperature

## Improving coastal SST data quality

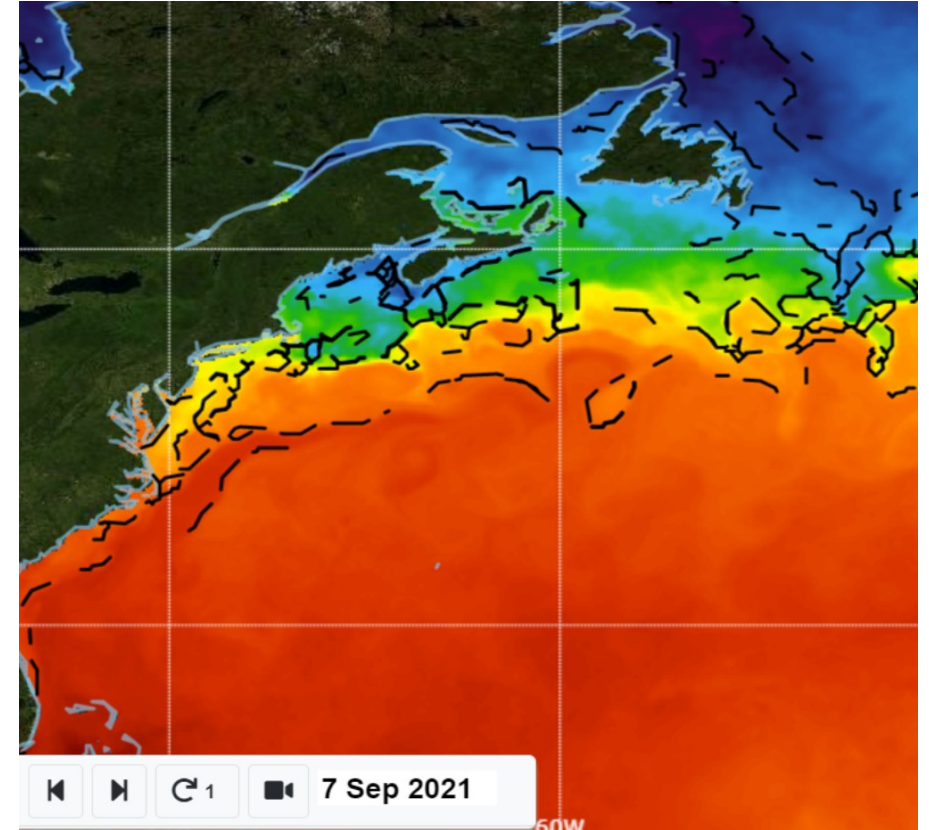
**Challenges:** greater variability in Water Vapour, temperature and aerosol, changes in surface emissivity and turbidity/cloud detection

**Need:** high spatial resolution satellite data from multiple sources.

## Improving SST feature resolution

**Challenge:** Reliance on high resolution infra-red data but limited by cloud cover

**Need:** Focus on new techniques e.g. in coastal, upwelling, polar and dynamic regions



<https://www.star.nesdis.noaa.gov/socd/ov/>



# Innovation and priorities for Sea Surface Temperature



## Priorities in next decade:

- Arctic and high-latitudes
- Coastal data quality
- SST feature resolution

## Observational needs of Sea Surface Temperature:

- Continuity and redundancy of the constellation of satellite observing system
- New generation of geostationary and polar-orbiting sensors has begun but innovation to translate these to higher resolution and better accuracy products is still needed
- Continued investment into Fiducial Reference Measurements (FRM) with known uncertainties for traceability and long-term assessment of stability of satellite SST



# Key take home messages

- Sea Surface Temperature is essential for operational meteorology, oceanography and seasonal predictions
- SST is crucial for climate monitoring, modelling and predictions
- Need continuity and redundancy of the constellation of satellite Sea Surface Temperature observing system
- Improvements related to identified user needs in products, algorithms and Fiducial Reference Measurements needed

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