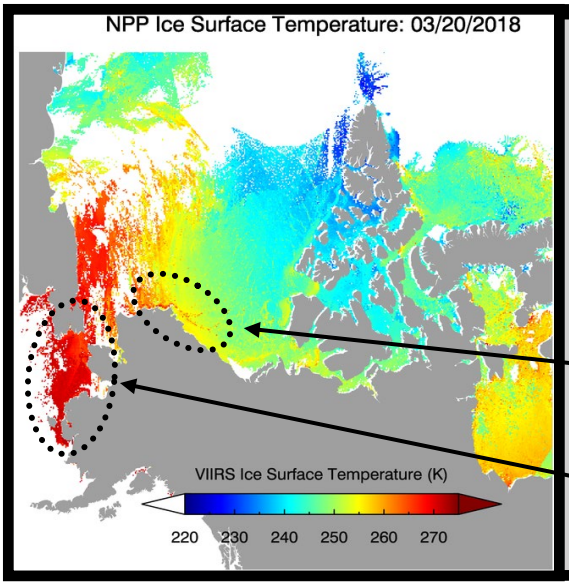
VIIRS Ice Surface Temperature

Quick Guide

Why is VIIRS Ice Surface Temperature Important?

Ice **s**urface **t**emperature (IST) is the radiating, or "skin" temperature at the ice surface. It includes the aggregate temperature of objects comprising the ice surface, such as snow and melt ponds. IST indicates the energy balance at the ice surface, which affects the energy exchange between the ice layer and atmosphere. The VIIRS Ice Surface Temperature algorithm works on clear (non-cloudy) pixels over frozen lakes or rivers as well as the ocean, but not over land ice.



VIIRS ice surface temperature over the Canadian Arctic on 23 March 2018

Sea ice leads showing warmer open water

First-year ice near melting point

Determination of Ice Surface Temperature:

Ice surface temperature is retrieved using brigthness temperatures at split window channels at 11 and 12 µm, which correspond to the M15 and M16 bands for VIIRS, and the satellite sensor scan angle. The algorithm is from the work of Key et al. (1997). The following equation is used:

$$T_S = a + bT11 + c(T11 - T12) + d\,[(T11 - T12)(sec\theta - 1)]$$

where T_S is the estimated surface skin temperature, $T11$ and $T12$ are the brightness temperatures at 11 and 12 µm, and θ is the sensor scan angle. The VIIRS coefficients a, b, c, and d are each derived separately for the Arctic and Antarctic.

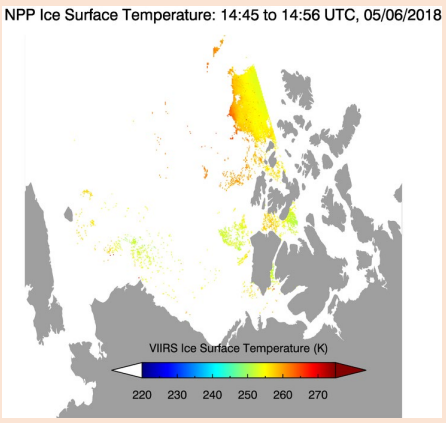
Impact on Operations

Primary Application: Satellite retrievals of IST have coverage that far surpasses former methods by ship, buoy, or ice camp observations. Unprecedented coverage allows for the improved understanding of ice surface melt and morphology.

Application: Long-term records of IST can be used to detect and understand the greenhouse effect and climate change in polar regions.

Limitations

Limitation: Algorithm depends on cloud-free retrievals. A low-quality cloud mask may result in incorrect surface temperature.



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Reference: Key, J., J. Collins, C. Fowler, and R. Stone, 1997, High-latitude surface temperature estimates from thermal satellite data. Remote Sensing Environ., 61, 302-309.