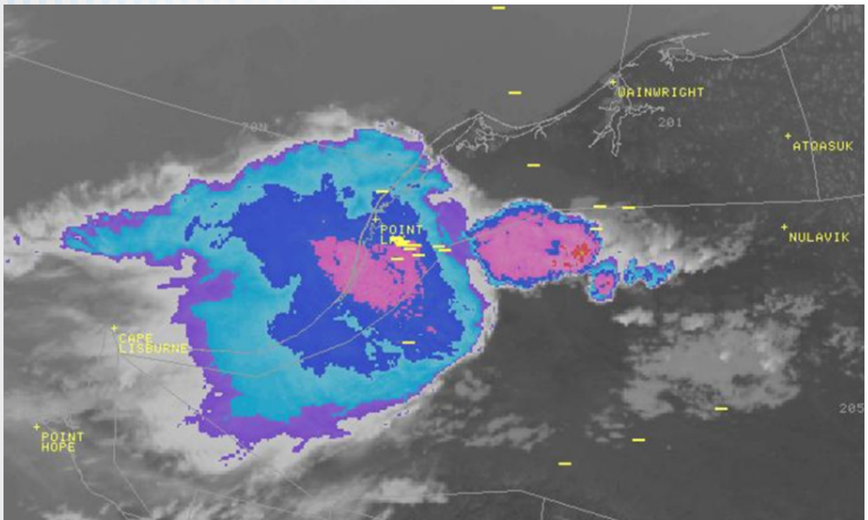
GINA

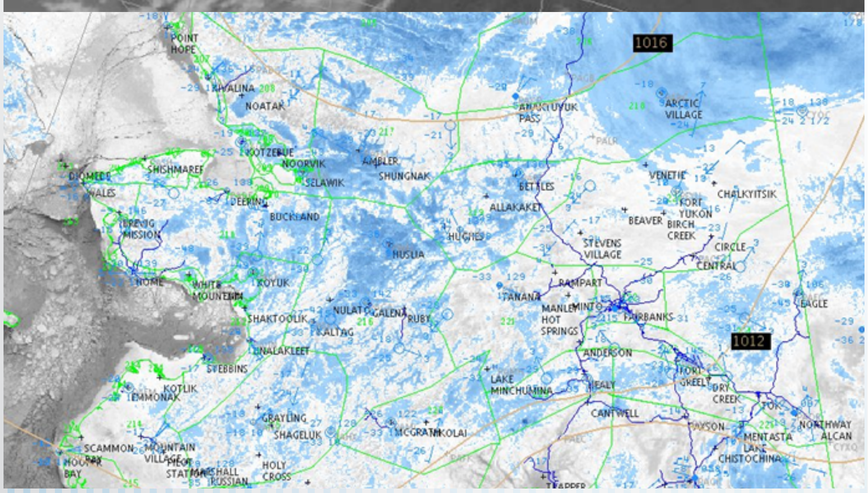
ALASKA DIRECT BROADCAST QUICK GUIDES
The 11 µm "Longwave IR" Band

OVERVIEW

The 11 µm band is the classic longwave infrared (IR) wavelength that has been used on several generations of polar orbiting and geostationary satellites. Longwave IR functions both day and night, without sensitivity to the presence or absence of sunshine as is the case down at the visible and even shortwave IR channels.

Longwave IR is commonly used to assess cloud top temperatures, and when this information is combined with a temperature profile of the ambient environment it may reveal the elevation of cloud tops. The 11 µm channel may also depict surface temperatures when skies are free of clouds; this capacity is particularly useful in Alaska during cold outbreaks in the winter. A weakness of the longwave IR is its inability to discriminate between two very different targets that happen to have similar temperatures. For example, using 11 µm imagery alone, it can be very difficult to differentiate between patches of low stratus and areas of clear skies over the ocean when the clouds and the sea surface are nearly the same temperature, which frequently occurs over the Bering Sea or Gulf of Alaska.





FROM BOOM TO BRRRRR

The top VIIRS 11.45 µm I5 image at left shows thunderstorms over northwest Alaska at 1936Z June 20, 2013. The color scale was chosen to highlight the temperatures of the convective cloud tops which were as cold as -60°C. Strikes from the lightning detection network are also overlaid in yellow.

The bottom VIIRS 11.45 µm I5 image is from a mostly clear morning over Interior Alaska at 1536Z March 14, 2015. The color scale highlights the surface temperatures, as low as -40°F. In cases like this, longwave IR can qualitatively "see" the wind at the surface. If wind happens to mix out a surface-based radiation inversion, the affected area will appear smoother and warmer at 11 µm than the colder more dendritic-looking calm areas.

Images courtesy of Melissa Kreller and Ed Townsend, WFO Fairbanks

ADDITIONAL REFERENCES

Quick guides to channels on the GOES-R Advanced Baseline Imager (ABI). ABI Band 14 is centered at 11.2 µm
http://www.goes-r.gov/education/ABI-bands-quick-info.html
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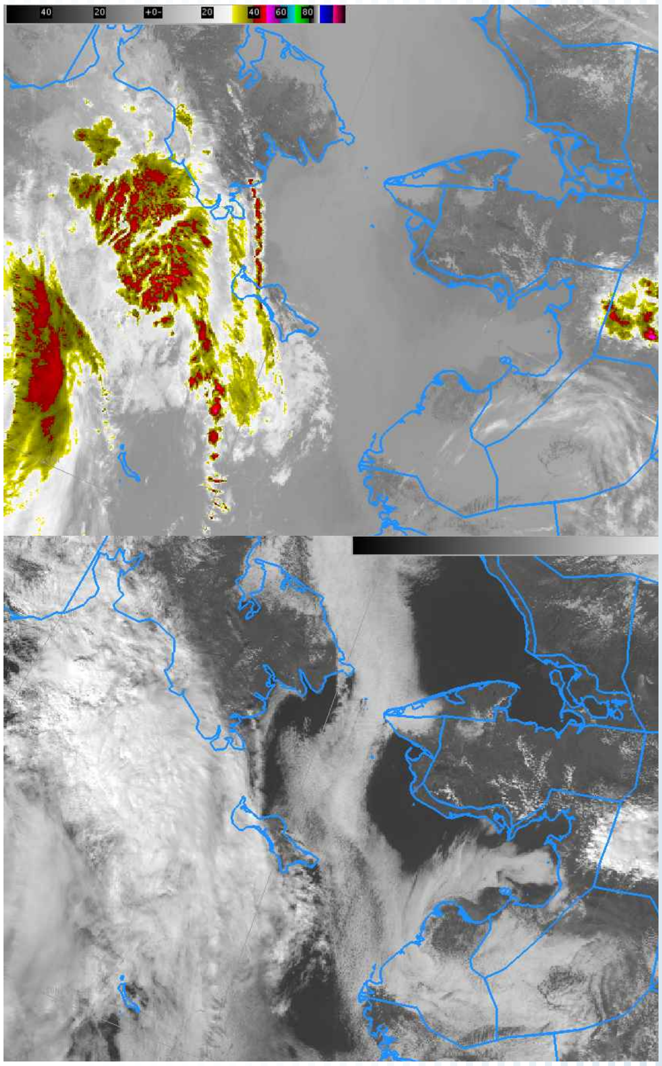
HAS ANYBODY SEEN MY STRATUS DECK?

A weakness of longwave IR imagery is its inability to depict any difference between targets having similar temperatures, even if those targets are as different from each other as clouds and ocean.

The top image at right is an 11.45 µm VIIRS I5 pass over the Bering Strait region at 0043Z July 29, 2015. There is a mix of low stratus clouds and clear ocean, but in this case, since the cloud tops and ocean surface have similar temperatures, the longwave IR imagery cannot depict any difference between the cloudy and clear areas. The longwave IR does do a good job of depicting the higher and colder clouds on the left-hand third of the image. The bottom image is from the same pass as above, but shows the 0.64 µm VIIRS I1 visible channel. Since it is daytime, the 0.64 µm wavelength easily highlights the difference in reflectance between the bright clouds and the dark ocean near the Bering Strait.

Longwave IR and visible imagery from the same pass can be overlaid and combined into a single image in AWIPS, or included as parts of a four-panel, with each channel contributing its strengths and helping more completely depict the state of the atmosphere.



11.45 µm VIIRS I5 over the Bering Straight at 0043Z July 29, 2015.

Satellite(s)	Instrument	Band Name	Wavelength	Resolution at NADIR
Suomi NPP	VIIRS	I5	11.45 µm	375 m
Terra and Aqua	MODIS	31	11.03 µm	1000 m
POES and METOP	AVHRR	4	11.8 µm	1100 m

Table showing the various satellites that carry instruments generating imagery at the approximate central wavelength of 11 m.

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