

# Sea Ice Motion *from VIIRS+AMSR2* Quick Guide

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## What is VIIRS+AMSR2 Sea Ice Motion?

Sea ice motion from VIIRS+AMSR2 is a blended product using information from two polar-orbiting satellites to track sea ice motion during a 24-hour period. Two images from consecutive days are compared by cross correlation, and estimates of the speed and direction of ice features over the past 24 hours are derived.

## How does it work?

The ice motion algorithm works by tracking ice features in two consecutive images. This product is currently based on images 24 hours apart, though shorter time intervals are being evaluated. As the pattern of sea ice changes, the algorithm interprets the direction and distance between features in the two images as motion, and a motion vector is assigned to the location.

Higher-resolution imagery allows for more precise detection of sea ice motion, and can better assess motion over shorter time periods than imagery with lower resolution. The VIIRS M15 band (infrared window), at 750 m resolution, and the AMSR2 89.0 GHz band, at 5x3 km, are used. Since the algorithm attempts to create a motion vector for each ice pixel, plotting raw output produces vectors that are too crowded. Results are spatially averaged in order to create a smaller file size and interpretable result.

In order for the algorithm to only track sea ice motion, clouds in both the starting and ending images must be screened out in optical imagery (VIIRS). Clouds are generally transparent in passive microwave (AMSR2). The annual mean cloud coverage in the Arctic is around 70%, meaning that the majority of any image may be cloud covered. This reduces the number and coherence of sea ice motion vectors the algorithm can produce with VIIRS. Therefore, a blended VIIRS-AMSR2 ice motion product benefits from the all-sky capability of AMSR2 and the high-resolution that VIIRS provides in clear-sky areas.

## Data latency of VIIRS+AMSR2 Sea Ice Motion?

Currently, the VIIRS+AMSR2 Sea Ice Motion product is being produced with a latency of approximately 24 hours. This means that sea ice motion from 48 hours ago to 24 hours ago has finished processing and is available by 21:30 GMT.

## Examples of the VIIRS+AMSR2 Sea Ice Motion

Examples of Arctic sea ice motion maps and a regional Alaskan map are shown in Figure 1.

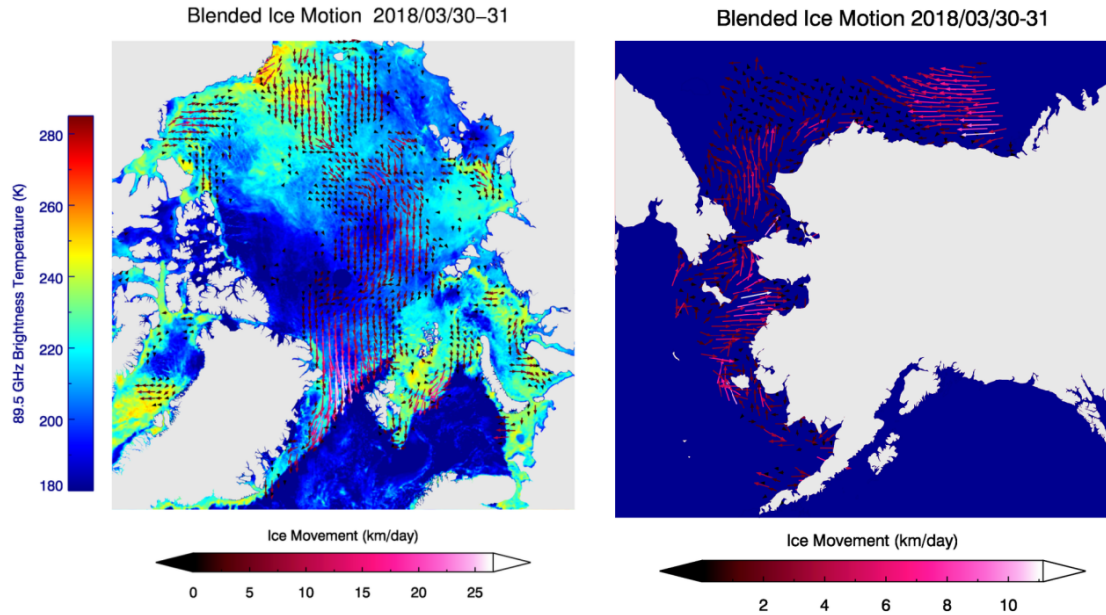


Fig. 1. Arctic (left) and Alaskan (right) blended sea ice motion from VIIRS+AMSR2. Faster motion is represented by a longer, brighter vector. Arctic sea ice motion is overlaid onto AMSR2 brightness temperatures.

## Product Benefits and Limitations

The advantages of this product are that it clearly illustrates the medium- to large-scale motion of ice over a 24-hour period. The limitations are: (1) AMSR2 is ambiguous when liquid water (melt ponds and melting ice) is present, so AMSR2 ice motion is of the highest quality during the winter, spring, and autumn (October–May in the Arctic). (2) The VIIRS M15 band cannot provide realistic motion vectors over a large area due to consistent cloud cover in the Arctic. (3) The vector motion results in output that is too spatially dense to interpret manually, so spatial averaging must be employed to achieve a readable result (such as the examples above). (4) Data latency and processing time introduce delays to the near-real-time generation of the product.

## Supplemental Information and Links

The Blended VIIRS+AMSR2 Sea Ice Motion is an experimental research product and does not yet have an algorithm theoretical basis document (ATBD). More examples of blended VIIRS+AMSR2 sea ice motion can be found at <http://stratus.ssec.wisc.edu/gcom/rtpproducts/>.

## Contact information

For questions about the product or this guide, please contact Aaron Letterly ([letterly@wisc.edu](mailto:letterly@wisc.edu)), Cooperative Institute for Meteorological Satellite Studies (CIMSS), University of Wisconsin–Madison.

# VIIRS+AMSR2 Sea Ice Motion Data Description

## VIIRS+AMSR2 ASCII Output Table

Text output in ASCII format gives the grid position, starting and ending latitude and longitude, direction, and length of the blended sea ice motion vectors VIIRS and AMSR2. ASCII output is written in a 12-column format as explained below. Each file has two lines of header text that are **NOT** in the same format as the rest of the output file.

<b>Column 1</b> Starting x-position of the gridded input of the motion vector	<b>Column 2</b> Starting y-position of the gridded input of the motion vector	<b>Column 3</b> x-velocity (u) of the vector in centimeters per second	<b>Column 4</b> y-velocity (v) of the vector in centimeters per second	<b>Column 5</b> Latitude of the starting point of the motion vector	<b>Column 6</b> Longitude of the starting point of the motion vector
<b>Column 7</b> Latitude of the end point of the motion vector	<b>Column 8</b> Longitude of the end point of the motion vector	<b>Column 9</b> x-displacement of the motion in kilometers	<b>Column 10</b> y-displacement of the motion in kilometers	<b>Column 11</b> Total distance of the motion between start/endpoint	<b>Column 12</b> Direction from which the motion is coming (in degrees)