# IcySea Sentinel-1 radar image

The Sentinel-1 layer grants you access to ESA's high resolution near-real time synthetic aperture radar (SAR) satellite images. With some experience, you can directly identify sea-ice structures such as individual ice floes or open cracks and ridges within a closed ice cover on the SAR images. For the Svalbard area Sentinel-1 images are provided approximately daily 1 to 8 hours after satellite recording. For high-resolution images, one image pixel is 30x30m; for low-resolution images, one image pixel is 300mx300m.

## How old are the Sentinel-1 images?

The age of the Sentinel-1 image is critical because sea-ice conditions change continuously. On average, Arctic sea-ice drifts 20 km per day.

Availability of Sentinel-1 images depends on the image acquisition plan by the European Space Agency (ESA) which varies from location to location. For instance, in Svalbard daily image updates can be expected. However, in the Kara Sea image updates can only be expected every 2-3 days or even less often for some individual tiles.

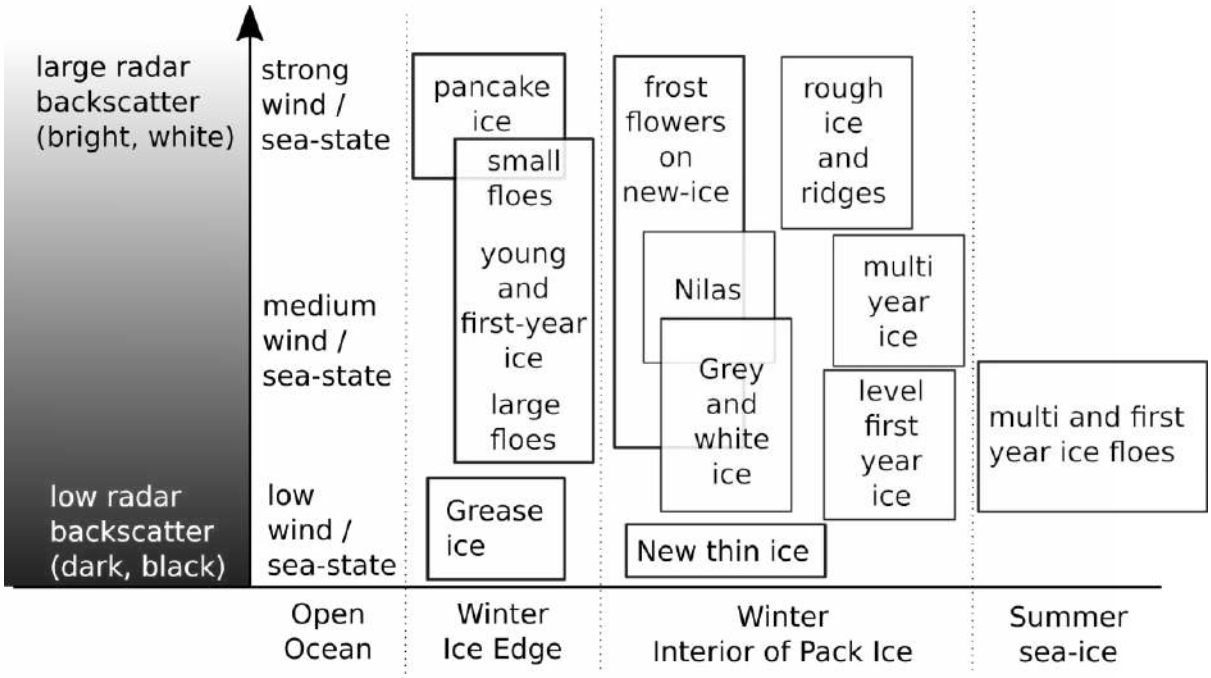
For your interpretation it is crucial to take into account the age of the image. By clicking on the small clock symbol in the Sentinel-1 layer button in the upper right corner of the IcySea base screen, you can see the age of every image tile in color. If you zoom in to the tile you also see the age displayed in hours. Tiles which consist of a merge from two or more satellite acquisitions display the age of the satellite image which covers the larger fraction of the tile.

## Basic Interpretation Guidelines

One needs experience and practice to interpret SAR images. Sometimes it is extremely difficult even for an expert ice analyst to identify ice features on SAR images unambiguously. Here are some fundamental guidelines which always have their exceptions:

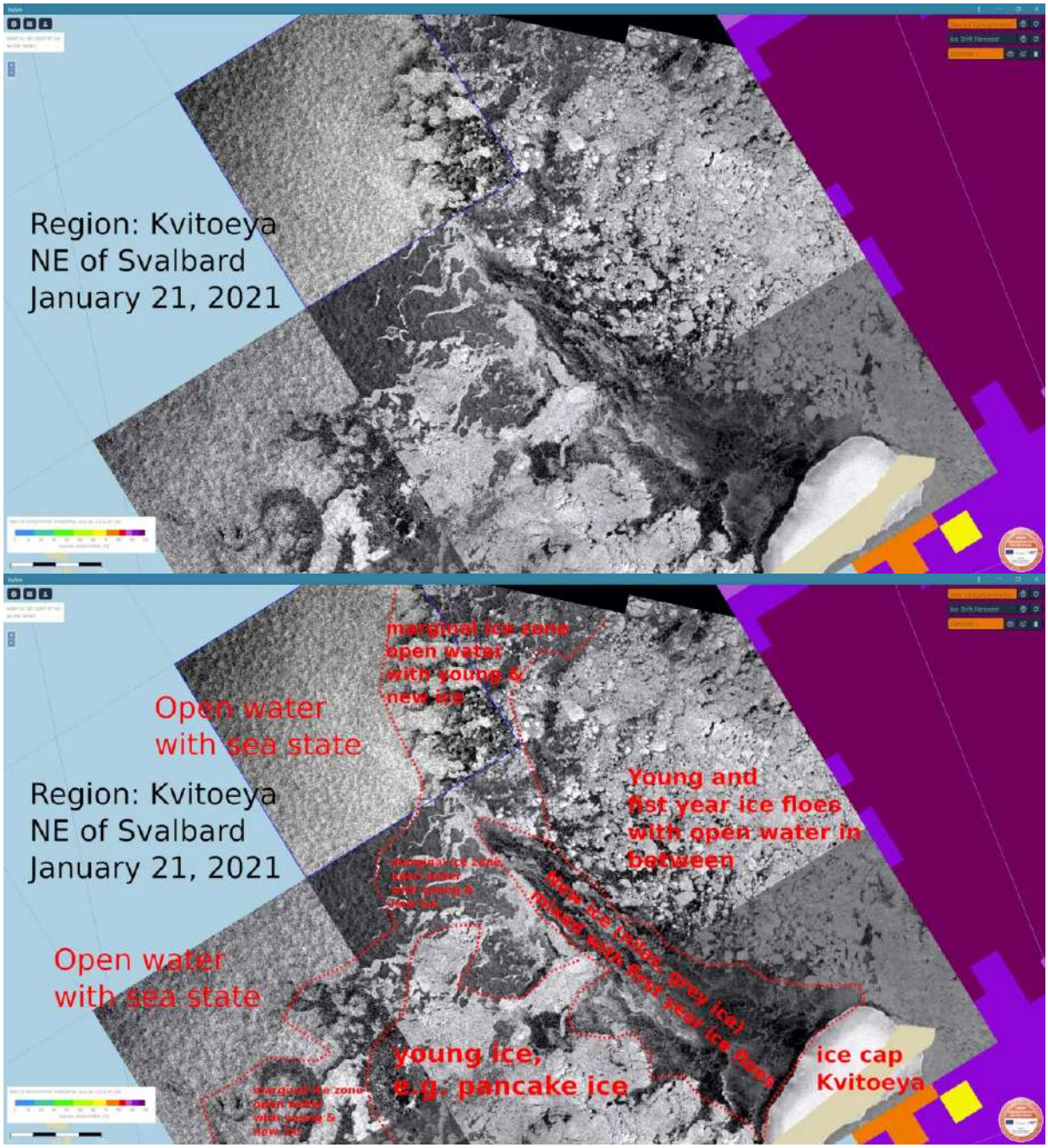
- Sentinel-1 penetrates clouds and is independent of daylight. Whatever you see on the Sentinel-1 layer: **IT IS NEVER CLOUDS** but always earth surface features (i.e. ocean, ice or land.).
- Rough surfaces appear brighter (white) than smooth surfaces (black).
- Ice features on SAR images are more distinct under winter conditions than in summer (when the ice is in the process of melting).
- Typical rough (bright, white) surfaces are: rough and windy open ocean, new ice with frost flowers, ice ridges and rubble fields, pancake ice.

- Typical smooth (dark, black) features are: calm open ocean, new thin ice, grease ice, open cracks and leads, wet and flooded ice.
- The following graph inspired by the figure in Johannessen et al. (1997) summarizes qualitatively the radar backscatter strength of typical ice features.

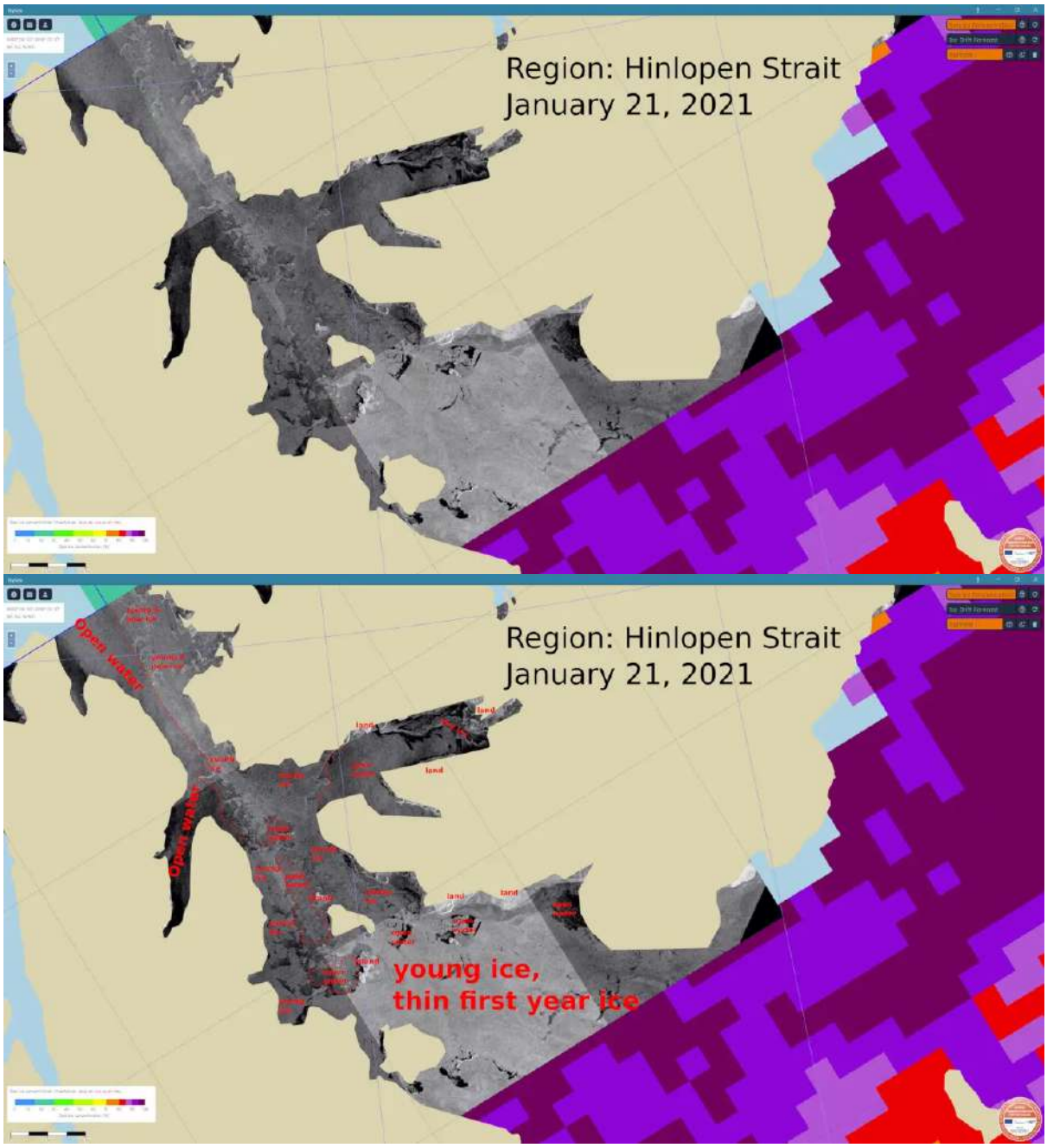



- Each tile has its own relative grayscale range normalized on the brightest feature in one tile. That also causes grayscale jumps at the edge to another tile.
- In ambiguous cases use additional layers such as sea-ice concentration, an ice chart or optical satellite images to support your interpretation.
- A good understanding of the appearance of sea-ice and the nature of SAR measurements is helpful.

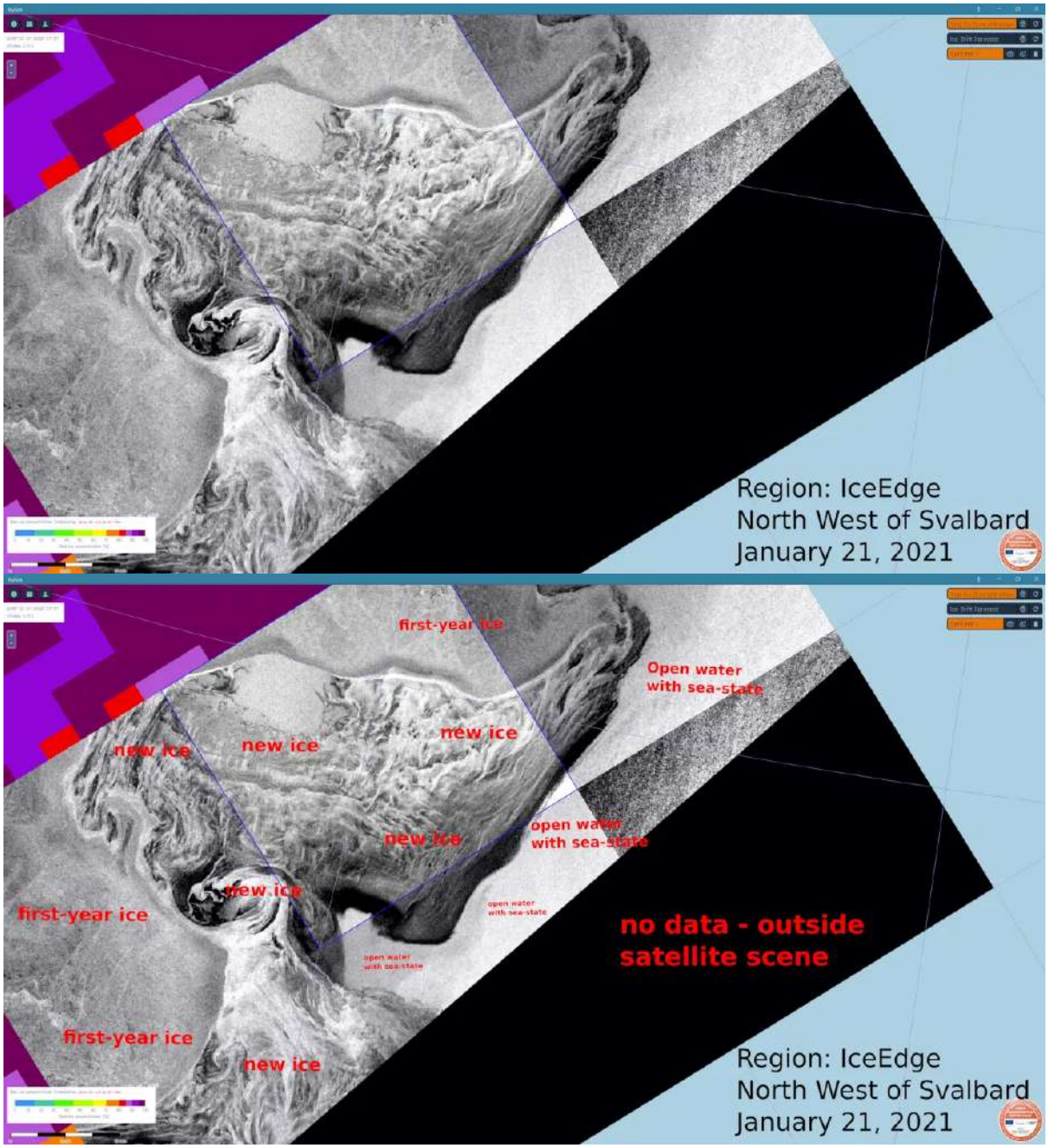
## Example 1: Winter Conditions, ice edge north-east of Svalbard



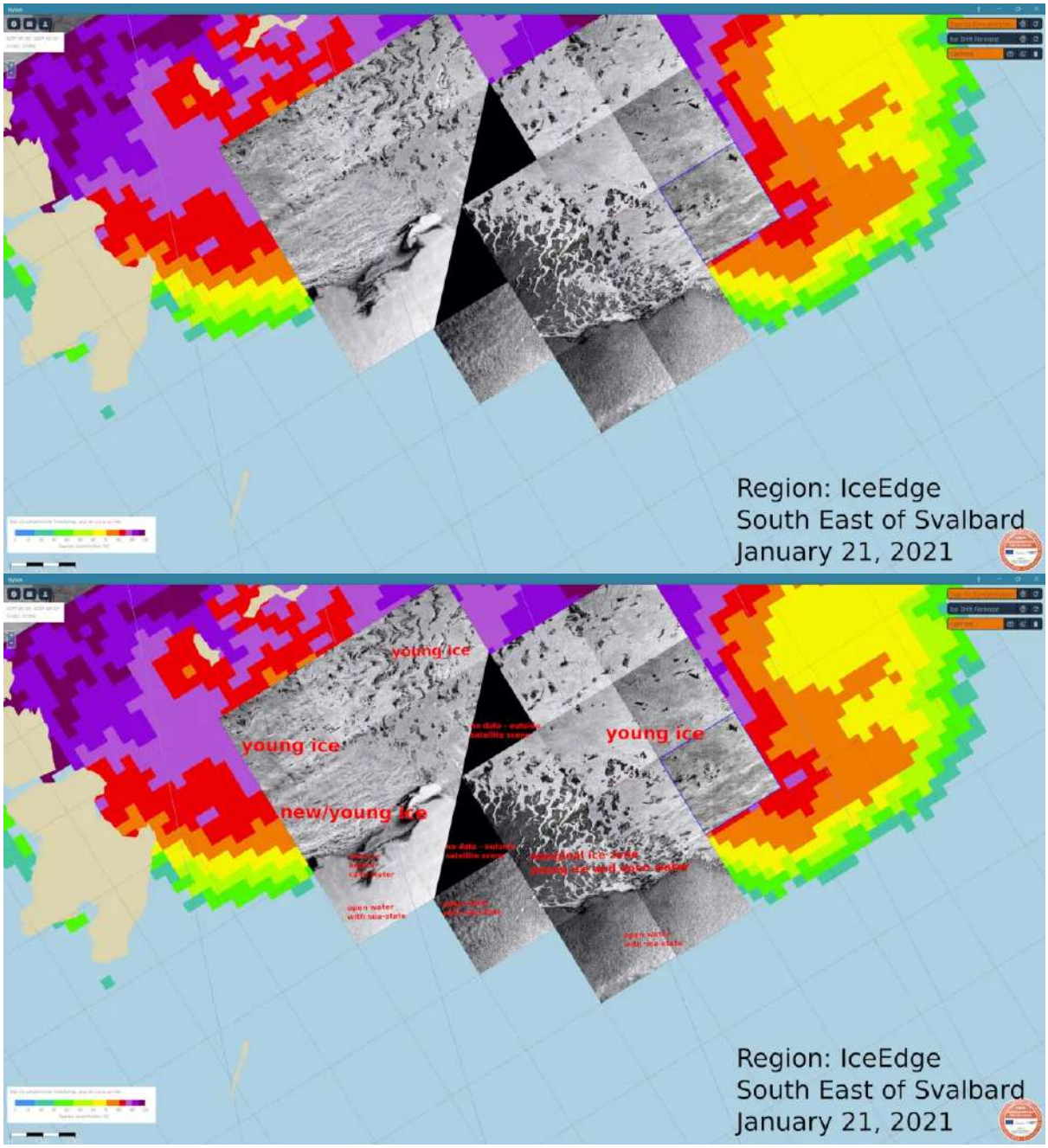
## Example 2: Winter Conditions, Hinlopen Strait



## Example 3: Winter Conditions, ice edge north-west of Svalbard



## Example 4: Winter Conditions, ice edge south-east of Svalbard



## Example 5: Winter Conditions, ice edge north-east of Svalbard