



# Reading satpics to find skateable ice

HLSK – May 25<sup>th</sup>, 2018 – Rob Mulders

With materials of (and many thanks to) Oskar Karlin and Jens Österlund



## Why now?

- European Union launched and funded Copernicus-program
- Six pairs of new earth-imaging satellites called **Sentinel**
- Three pairs (Sentinel 1 t/m 3) in orbit right now
- They are changing the Nordic skating world
- Why? Because.

# MODIS (the Americans)

## MODIS

**MOD**erate-resolution **I**maging **S**pectroradiometer on board NASA Terra and Aqua satellites.

Terra's orbit around the Earth is timed so that it passes from north to south across the equator in the morning, while Aqua passes south to north over the equator in the afternoon.

Together the instruments image the entire Earth every day.

# MODIS (the Americans)

## Source level

All “raw” images in different resolutions and colors

[NASA EarthData](#)

## Summary level

Nasa Worldview software combines images to cover the earth

[NASA WorldView](#)

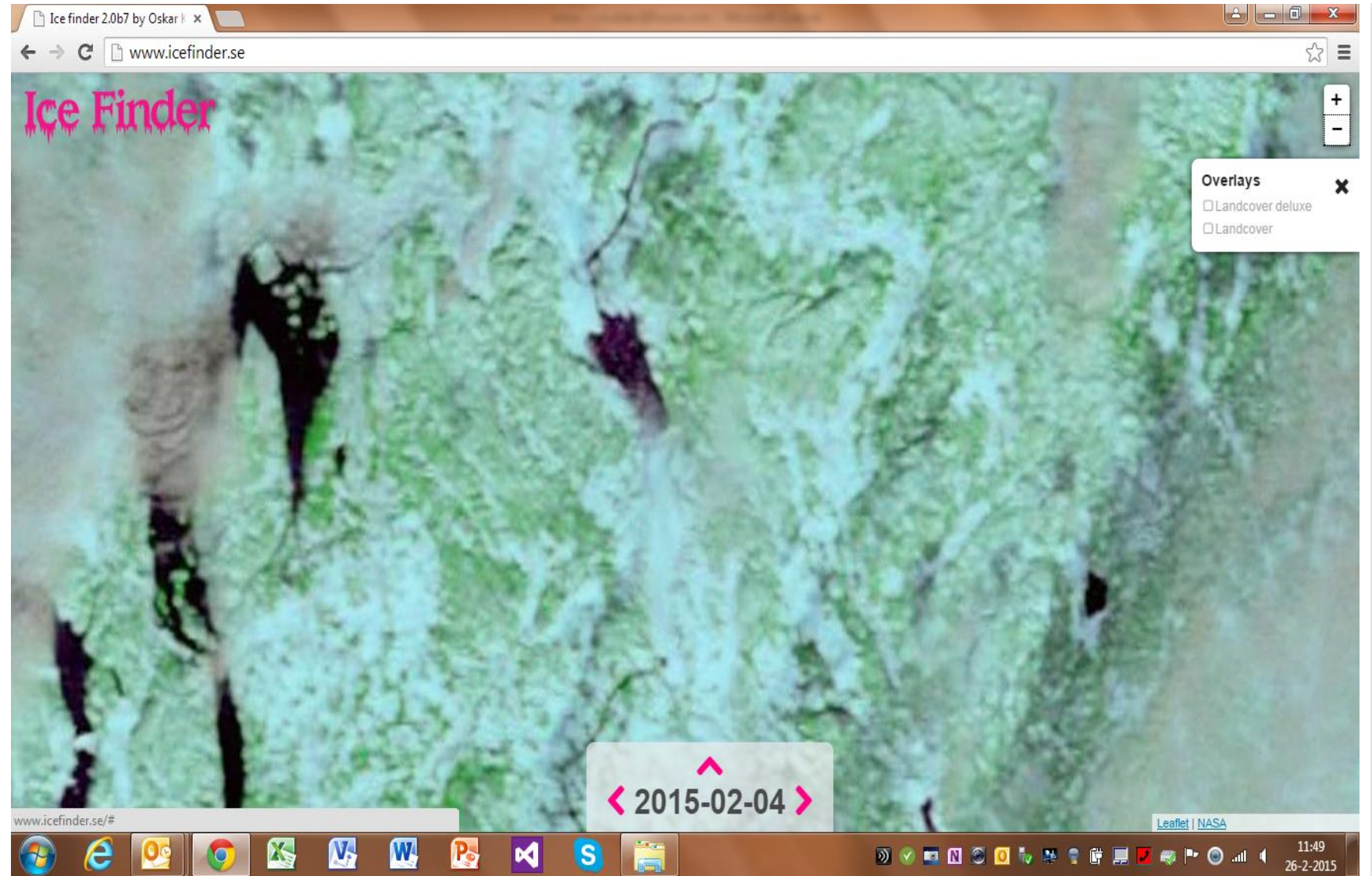
## Skating level

Oskar Karlin’s website Icefinder

Shows MODIS images for southern Sweden in a convenient way

[www.icefinder.se](#)

# MODIS (the Americans)



# SENTINEL (the Europeans)

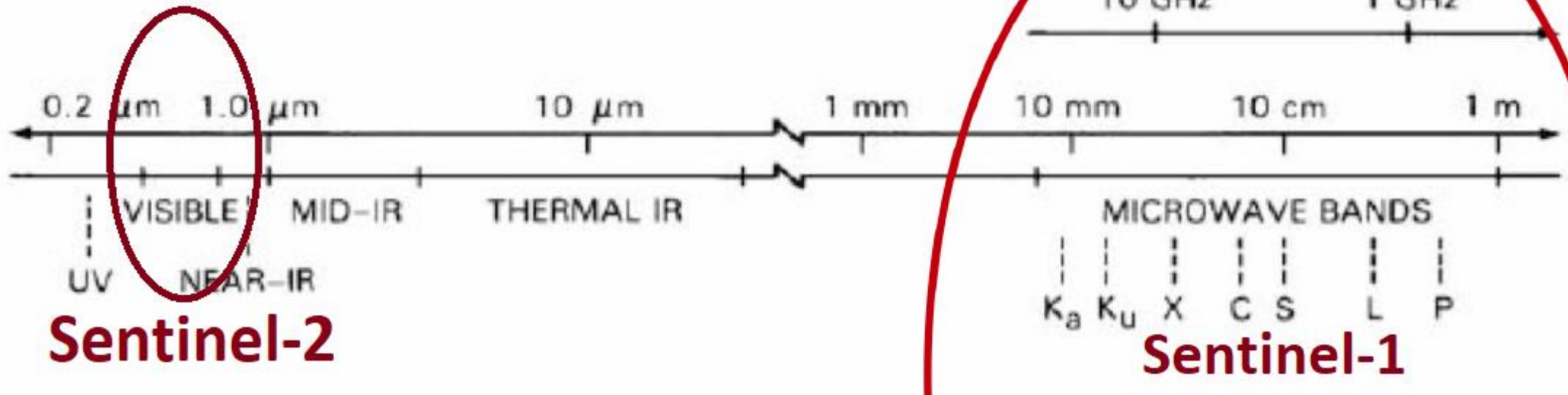
## **Sentinel-1**

An all-weather, day-and-night **radar** imaging mission for land and ocean services.

## **Sentinel-2**

A multispectral **high-resolution imaging** mission to provide imagery of soil and water cover, inland waterways and coastal areas.

# ELECTROMAGNETIC SPECTRUM



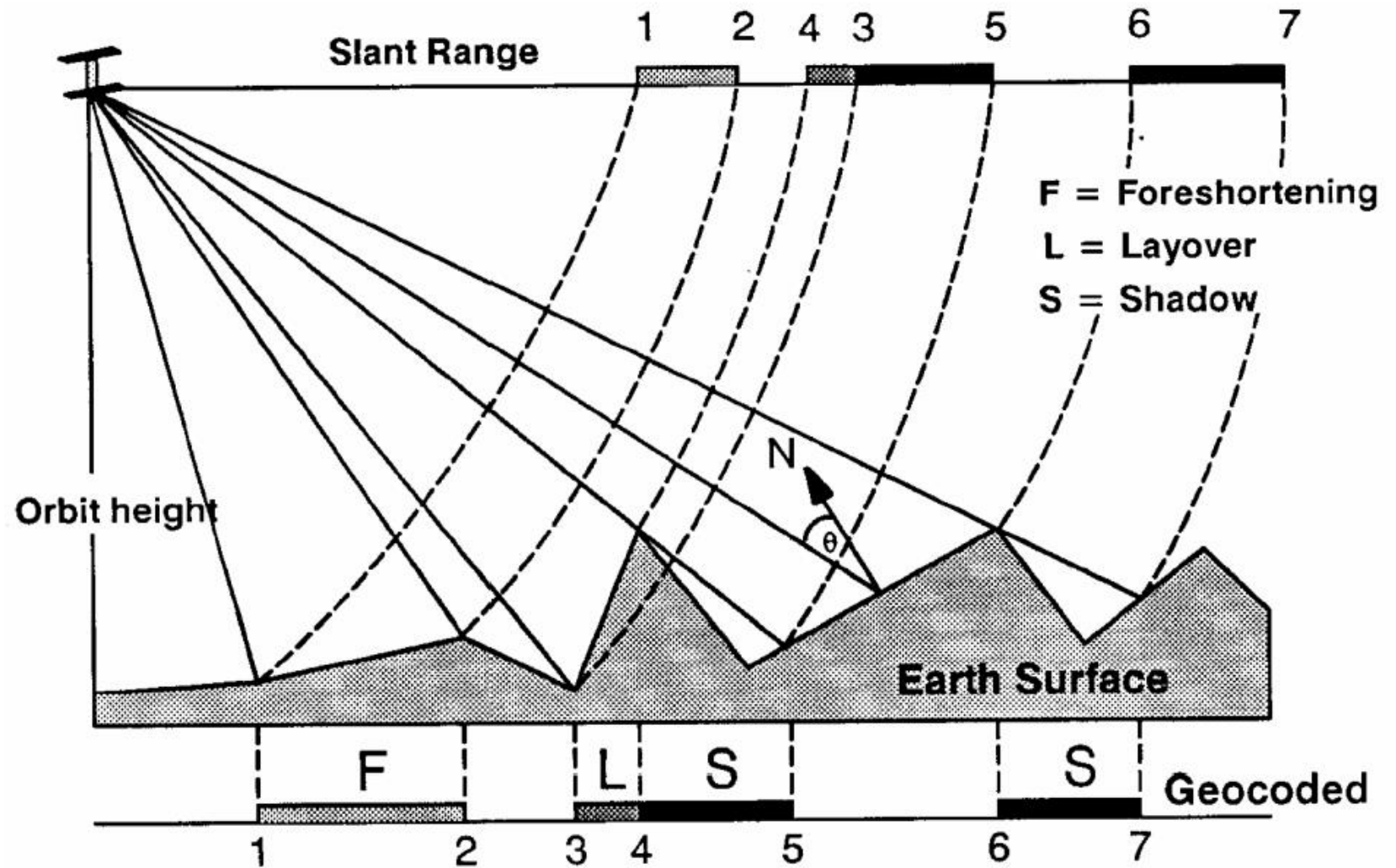
# Sentinel-2 makes “normal” pictures

## Sentinel-2

- Is taking “pictures” of earth in multiple “bands”
- Has a sun-synchronized orbit, to have the same reflected light and angles above every place on adjacent moments
- Therefore needs a motor and fuel aboard, will last 7 to 12 years
- Is not covering earth each day, but once every 2 to 4 days
- Clouds are disturbing the pictures
- Reading the images for skating is relatively easy
- Easiest tool to use is the [Sentinel Hub Playground](#)



Sentinel-1  
uses RADAR



# Sentinel-1 uses RADAR

## Sentinel-1

- Uses RADAR (Radio Detection And Ranging) to explore the surface of the earth
- Has a sun-synchronized orbit, to have the same position above every place on adjacent moments
- Therefore needs a motor and fuel aboard, will last 7 to 12 years
- Is not covering earth each day, but once every 2 to 4 days
- Clouds are NOT disturbing the pictures
- Reading the images for skating is difficult
- Easiest tool to use is the [Jens Österlund ISAR website](#)

Flatwater

Small waves

Large waves



Smooth ice

Snow

Rough ice

Small floes

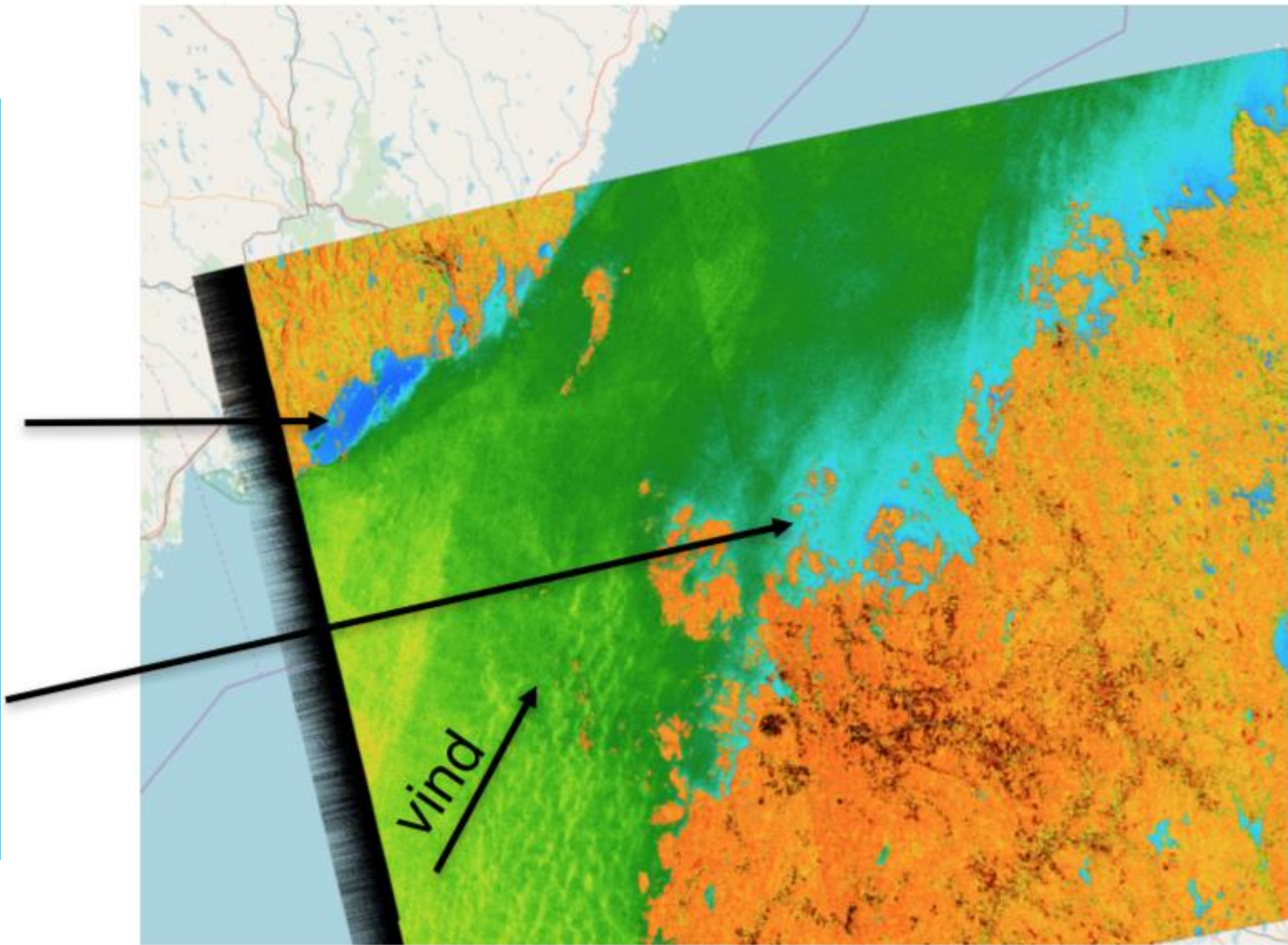
Large Floes

Forrest

Buildings

might be  
new ice

lee side of  
the wind



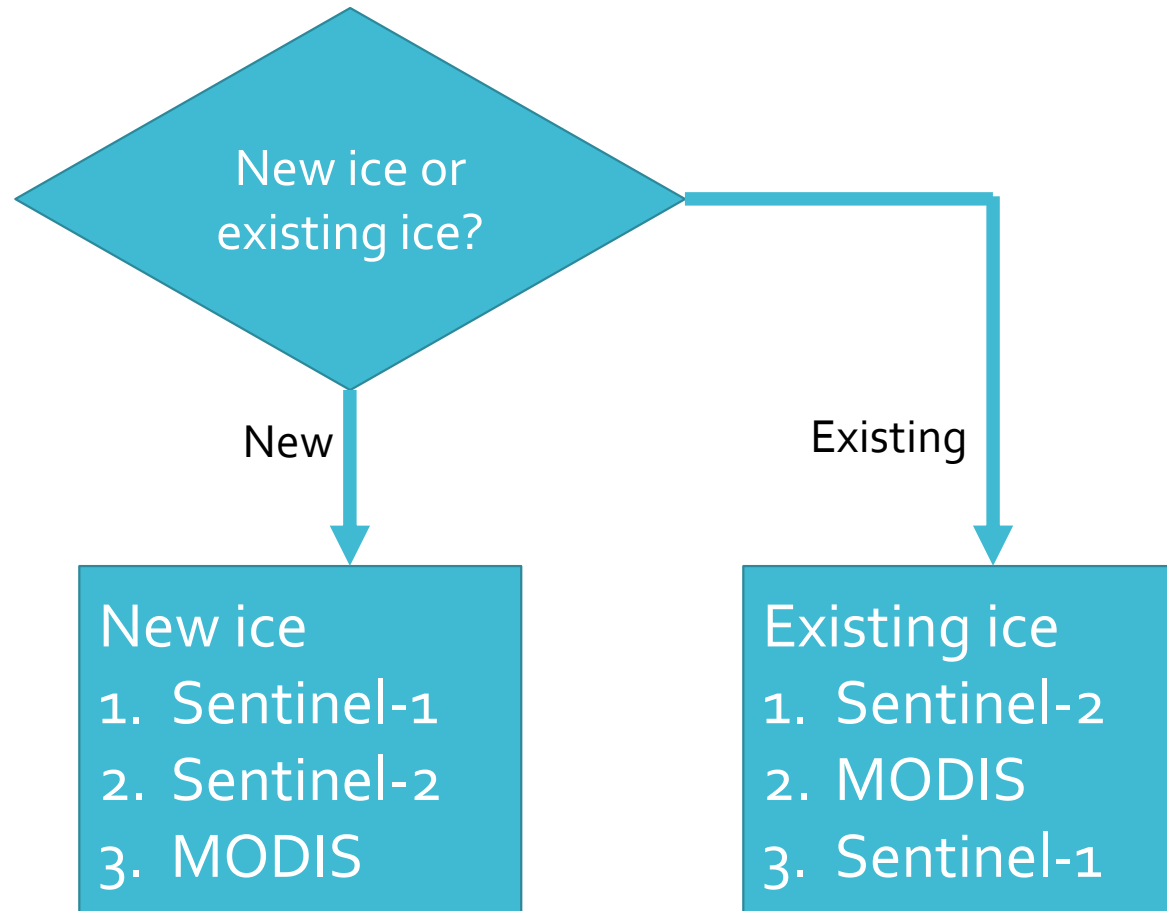
# Summary

Three kinds of satellite pictures:

1. MODIS viewed in Oskar Karlin's Ice Finder
2. Sentinel-2 viewed in Sentinel Hub Playground
3. Sentinel-1 viewed in Jens Österlund's ISAR

(New European tool coming up to search in all: [EO Browser](#))

Which order?



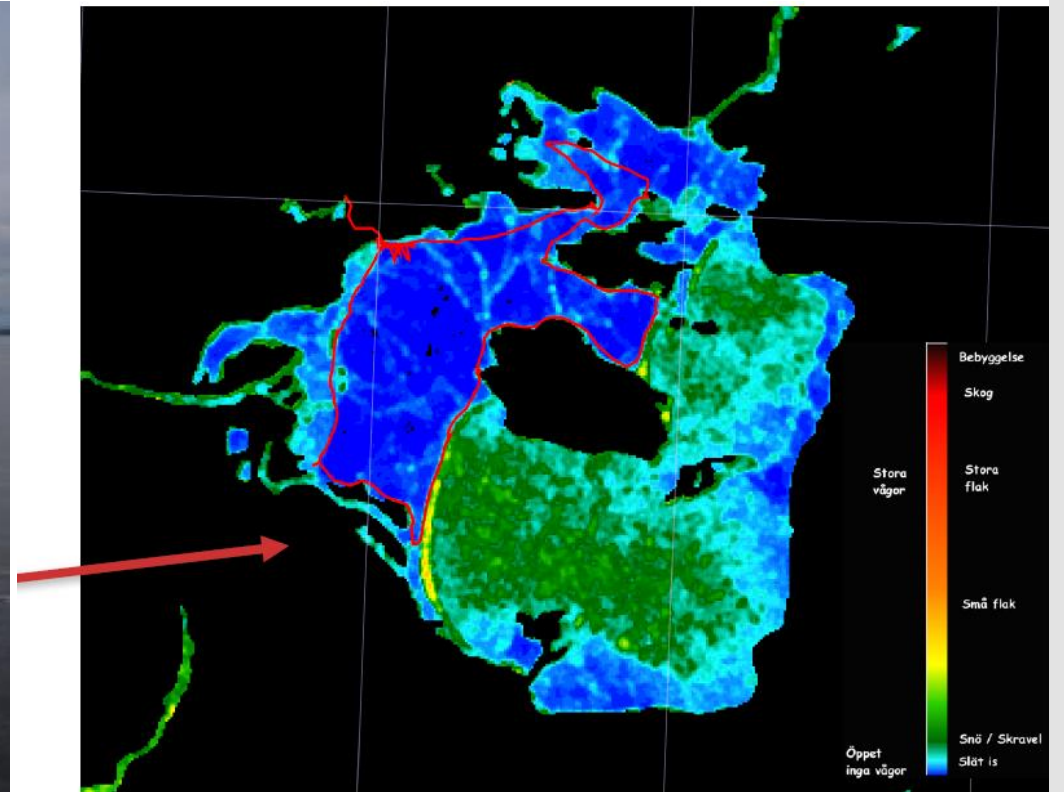
## Case Vannsjø

- Trip Anja, Rob, Hans, Derk at 15 - 18 december 2017
- We skated on Vestre Vansjø on Sunday the 17<sup>th</sup>
- Looking for existing ice for Monday (not cold enough for new)
- Sentinel-1 showed smooth surface on Østre Vansjø....
- ....but [MODIS](#) showed large part was open water instead of ice
- So we decided to go to Tunevatnet and Vestvatnet (FR69618)



# Case Ånnsjön

- SSSK in search for new ice in Jämtland beginning of Nov, 2016
- Sentinel-1 showed chance for new ice at Ånnsjön
- Turned out to be a good choice for November 5<sup>th</sup>, 2016!
- [Sentinel-2 image](#) of next day shows the open water in the south

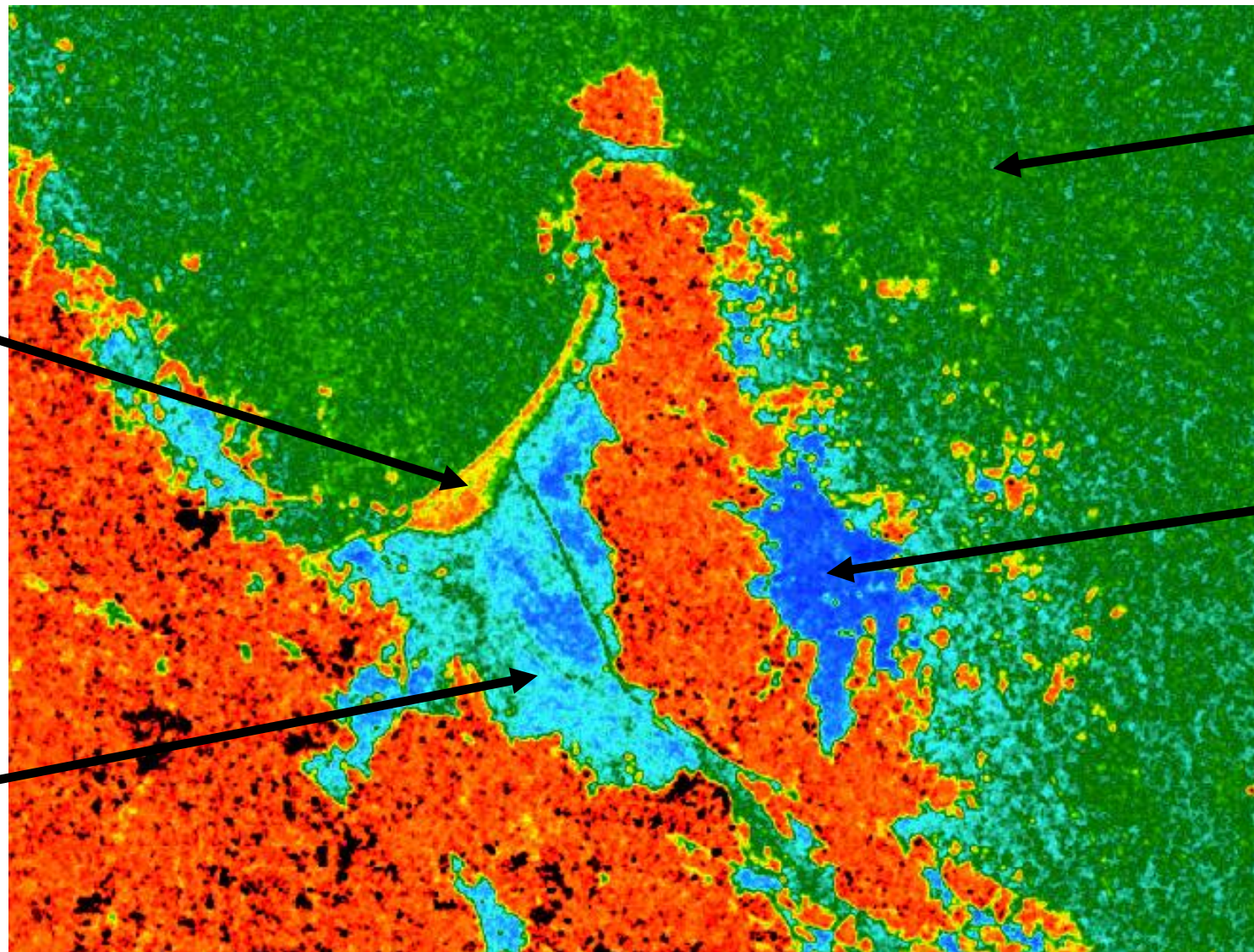




# Case Gräsö

ice blown together  
in northern wind

ice with  
snow



open  
water

new  
ice

# Questions

1. If you had wanted to do a daytour on Markermeer on March 2<sup>nd</sup>, 2018, which part would you have chosen?
2. Leontine and Rob skated Gullkronafjärden on March 29<sup>th</sup>, 2018. Do you think the same tour had been possible on April 11<sup>th</sup>, 2018?
3. Was there any ice on Torneträsk in Sweden on May, 23<sup>rd</sup>, 2018?
4. Is Müritz (normally spoken) sooner or later than Stettiner Haff?

# Answers

1. Markermeer on March 2<sup>nd</sup>? [Take a look](#)
2. Gullkrona still skateable on April 11<sup>th</sup>, 2018? [Take a look](#)
3. Ice on Torneträsk on May 23<sup>rd</sup>, 2018? Take a look [here](#) and [here](#)
4. Müritz sooner or later than Stettiner Haff? [Take a look](#)