

The background of the slide is a scenic landscape photograph. It shows a wide, calm lake or fjord in the middle ground, surrounded by rolling hills and mountains. The foreground is dominated by a dense forest of evergreen trees. The sky is a mix of blue and light orange, suggesting a sunrise or sunset. The overall tone is natural and serene.

**New and complementary information on water management derived  
from new satellite based systems**

Frano Cetinic  
EDInsights AS

## SNOW MEASUREMENTS



## WATER SYSTEM MEASUREMENTS





# SnowInfo

**Quick and secure login**

**Easily switch between internal or external information layers**

**Easily switch between different catchments. The statistics table is automatically updated**

**Compare this years daily SCF data with statistics from previous years**

**Use slider to explore the dynamics in the data**

**Snow Cover DEMO**

**Layers**

**Snow Cover Fraction**

**Snow Cover Fraction**  
Hallingdal  
April 30th 2016 SCF: 74.8%

Yearly graphs  
2006, 2016

SCF (%)

2001-2015 Average  
2016  
2006

Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

61,299, 5,339, 8 30 km 10 mi

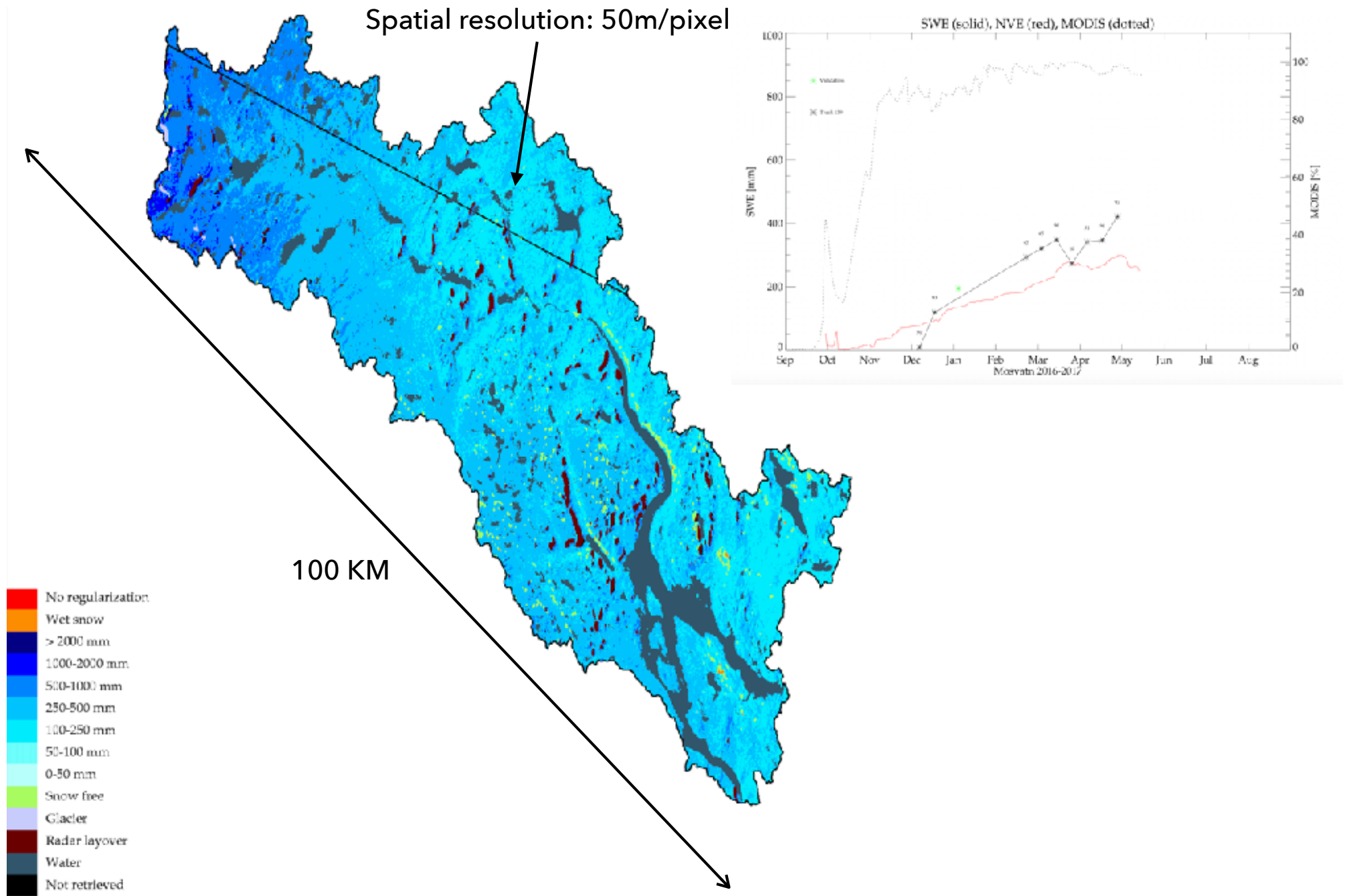
# WaterInfo

**CHANGES IN SURFACE WATERS**

Water level (m)

DOY

●●●●● S1 vannstand, 2015  
 ▲▲▲▲▲ S1 vannstand, 2016  
 ——— NVE vannstand, 2015  
 - - - - - NVE vannstand, 2016





## DEVELOPMENT OF THE WATERINFO SERVICE

- ▶ **Goal:** Develop and demonstrate a service that provides continuous data on **water surface area** for lakes/ reservoirs
  - ▶ Automatic production
  - ▶ Time-series of information
  - ▶ Scalable system
    - ▶ >100 lakes
- ▶ Project length 2017-2019
- ▶ Supported by European Space Agency & Norwegian Space Centre



# FREE AND OPEN DATA FROM THE SENTINEL SATELLITES

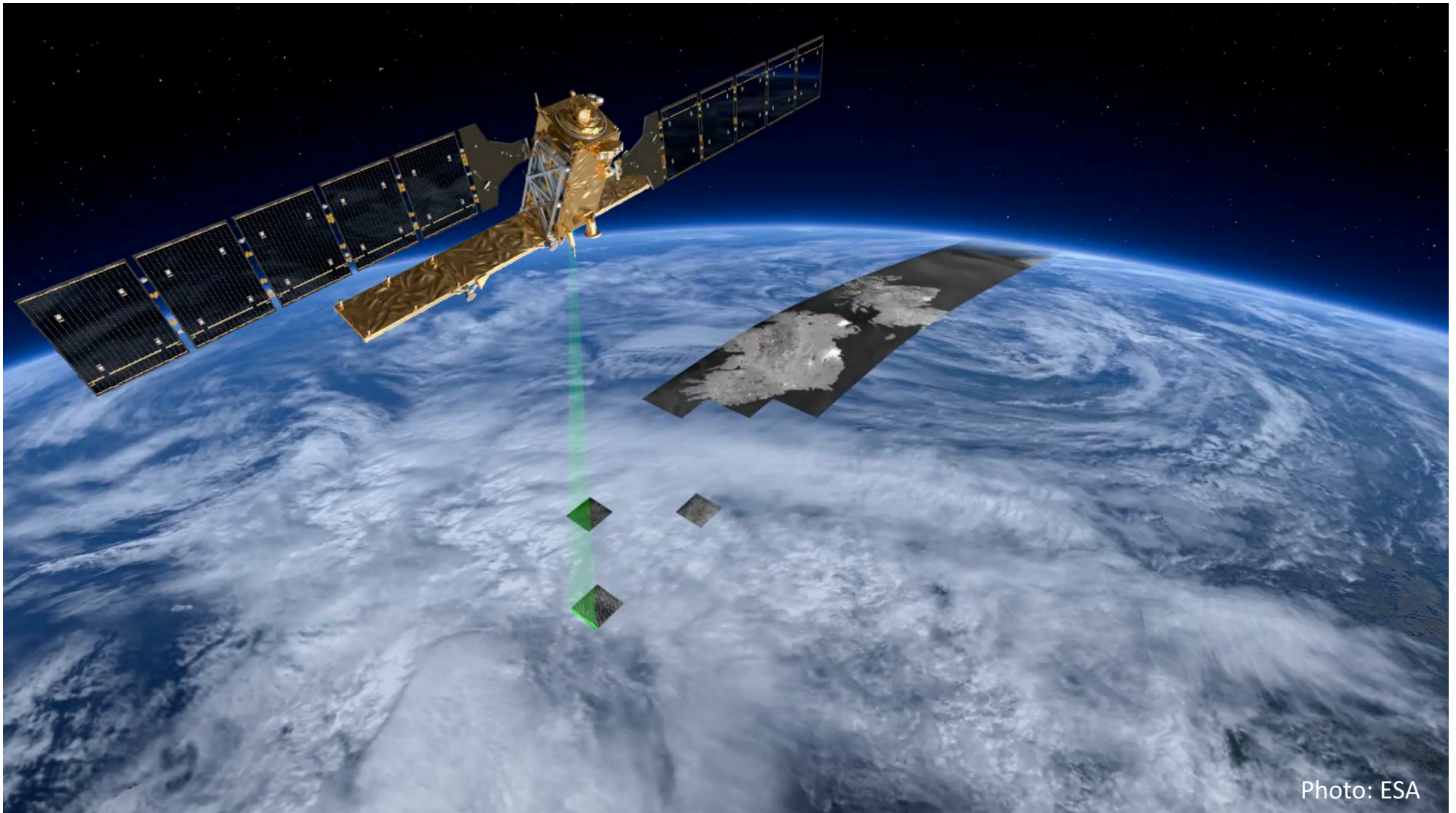


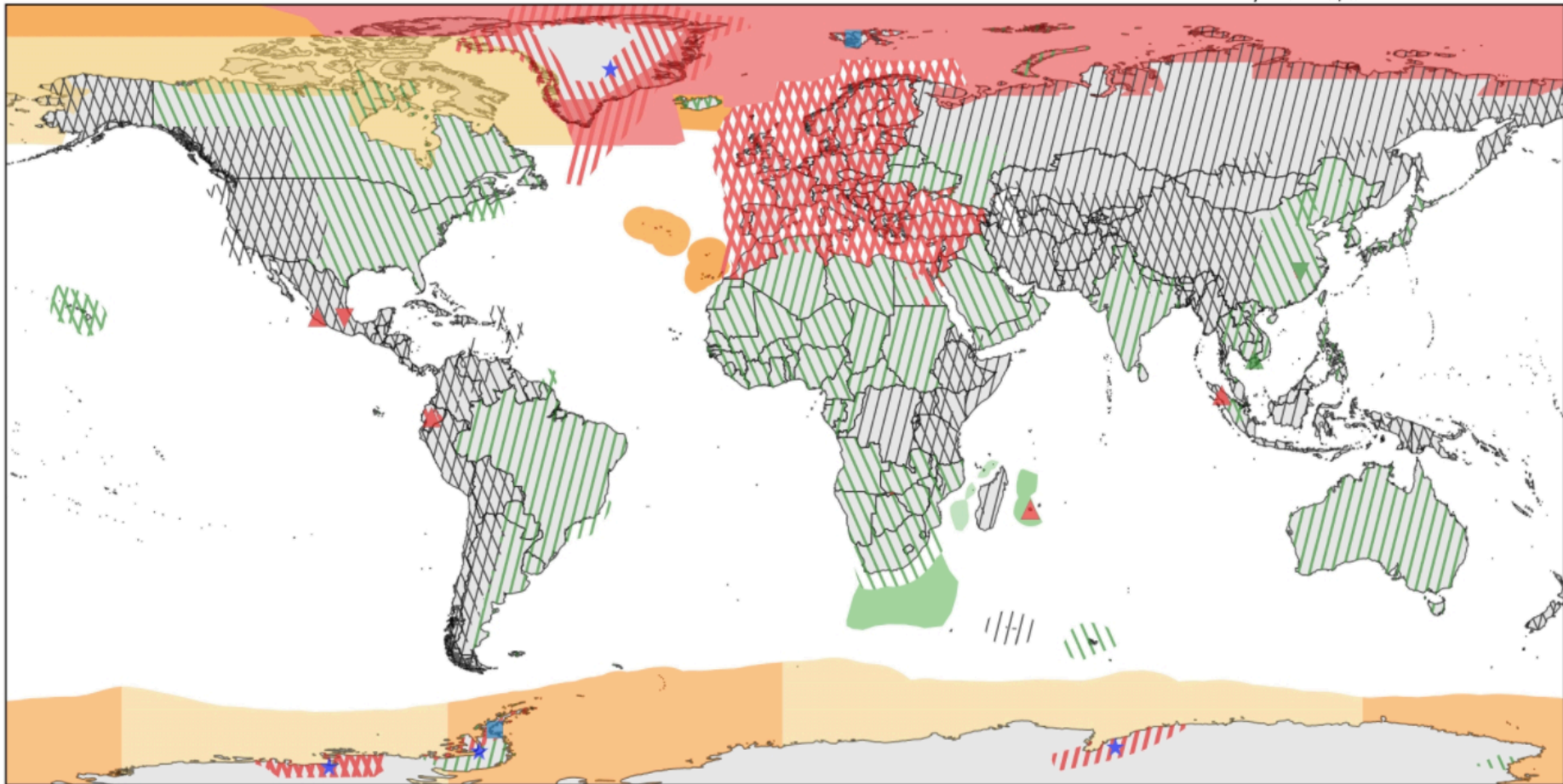
Photo: ESA



## Sentinel-1 Constellation Observation Scenario: Revisit & Coverage Frequency



validity start: 10/2016



PASS	REVISIT	FREQUENCY *	COVERAGE	FREQUENCY **	REFERENCE DATA SITES (6d repeat)
ASCENDING DESCENDING	6 days 12 days 24 days	6 days 12 days 24 days	1-2 days 3 days 6 days 12 days	Highly active volcanism Fast subsidence Short growth cycle, intensive agriculture Fast changing wetlands Fast moving outlet glaciers Permafrost & glaciers	

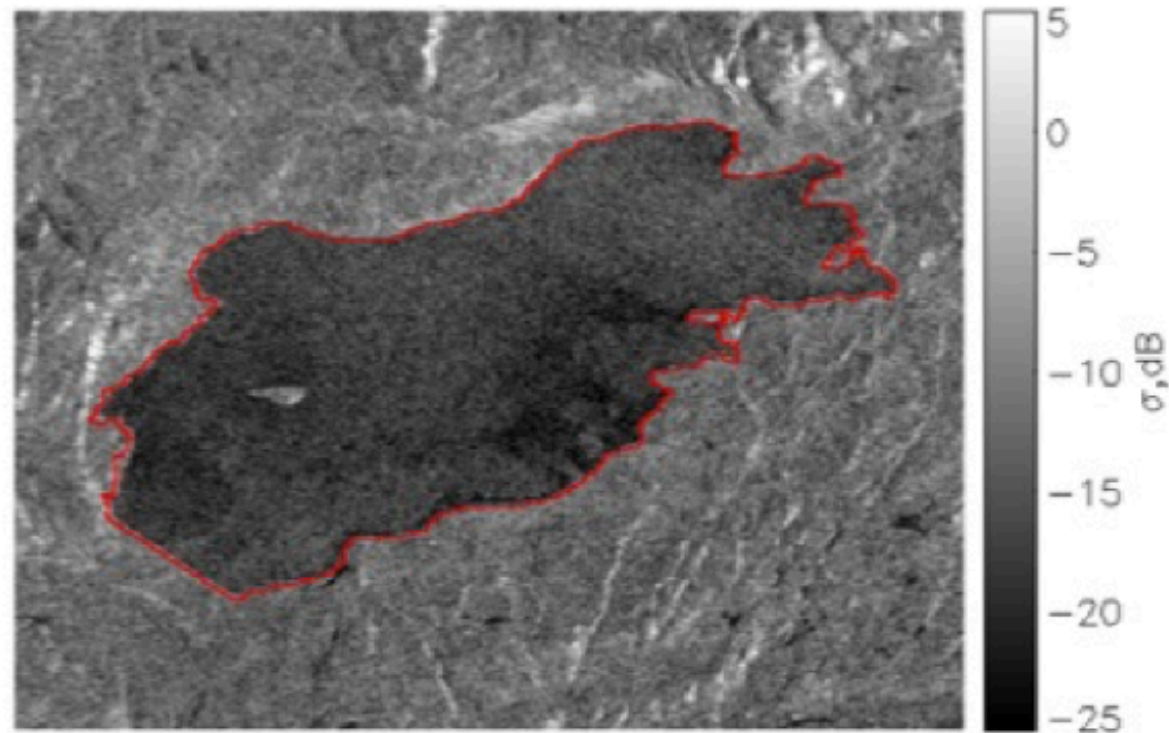
\* coverage ensured from same, repetitive relative orbits  
 \*\* coverage not considering repetitiveness of relative orbits

# QUANTIFYING SURFACE WATER EXTENT USING RADAR MEASUREMENTS

Satellite: Sentinel-1 a/b

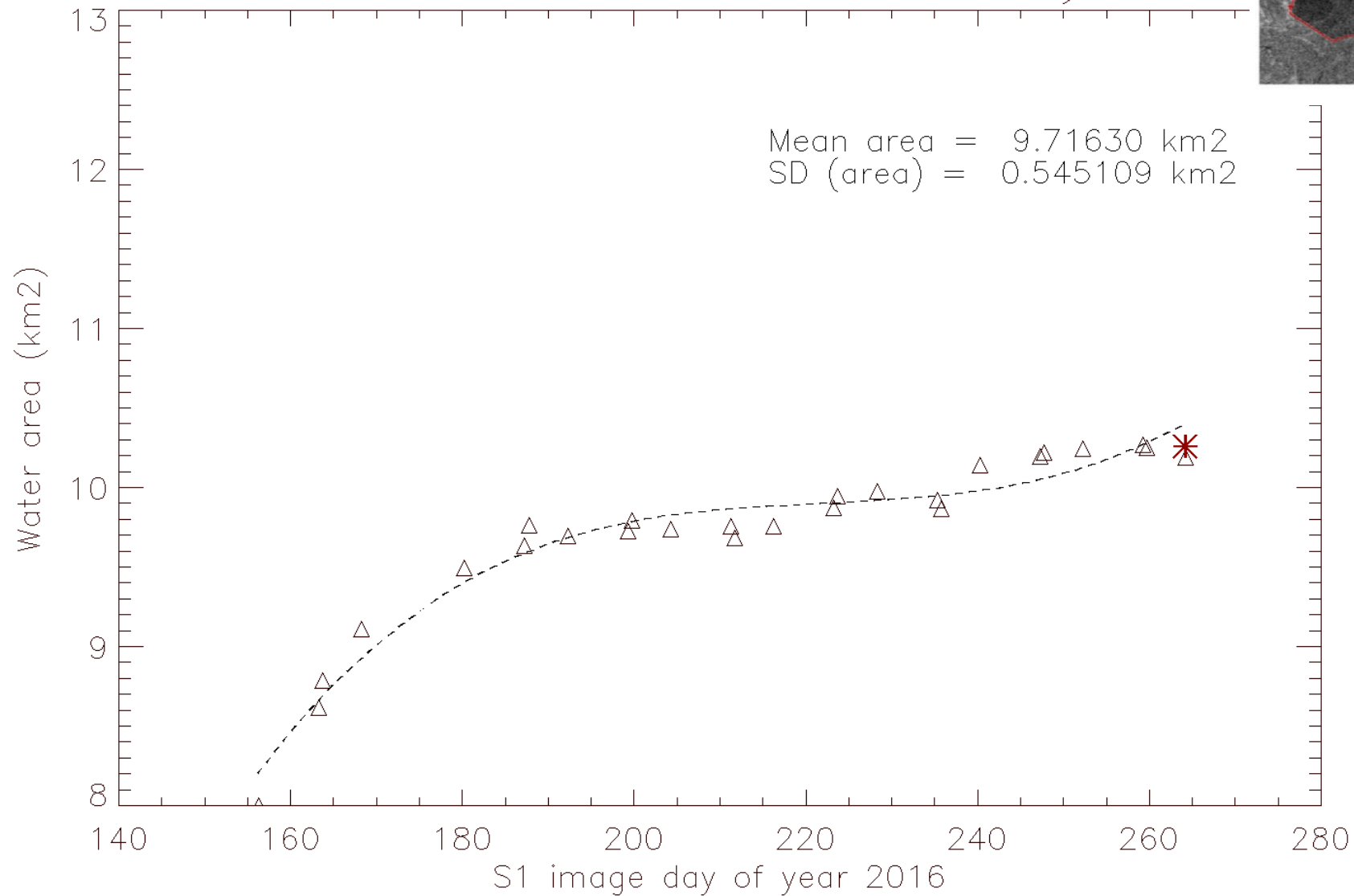
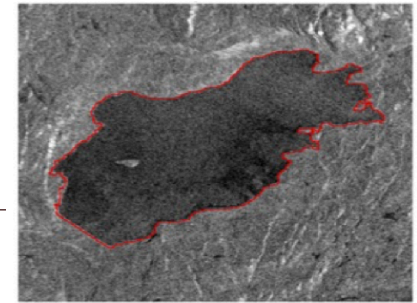
Pixel resolution: 5m x 20m

Area (Sentinel-1) = 10.1869 km<sup>2</sup>





# TIME-SERIES OF INFORMATION OF WATER AREA

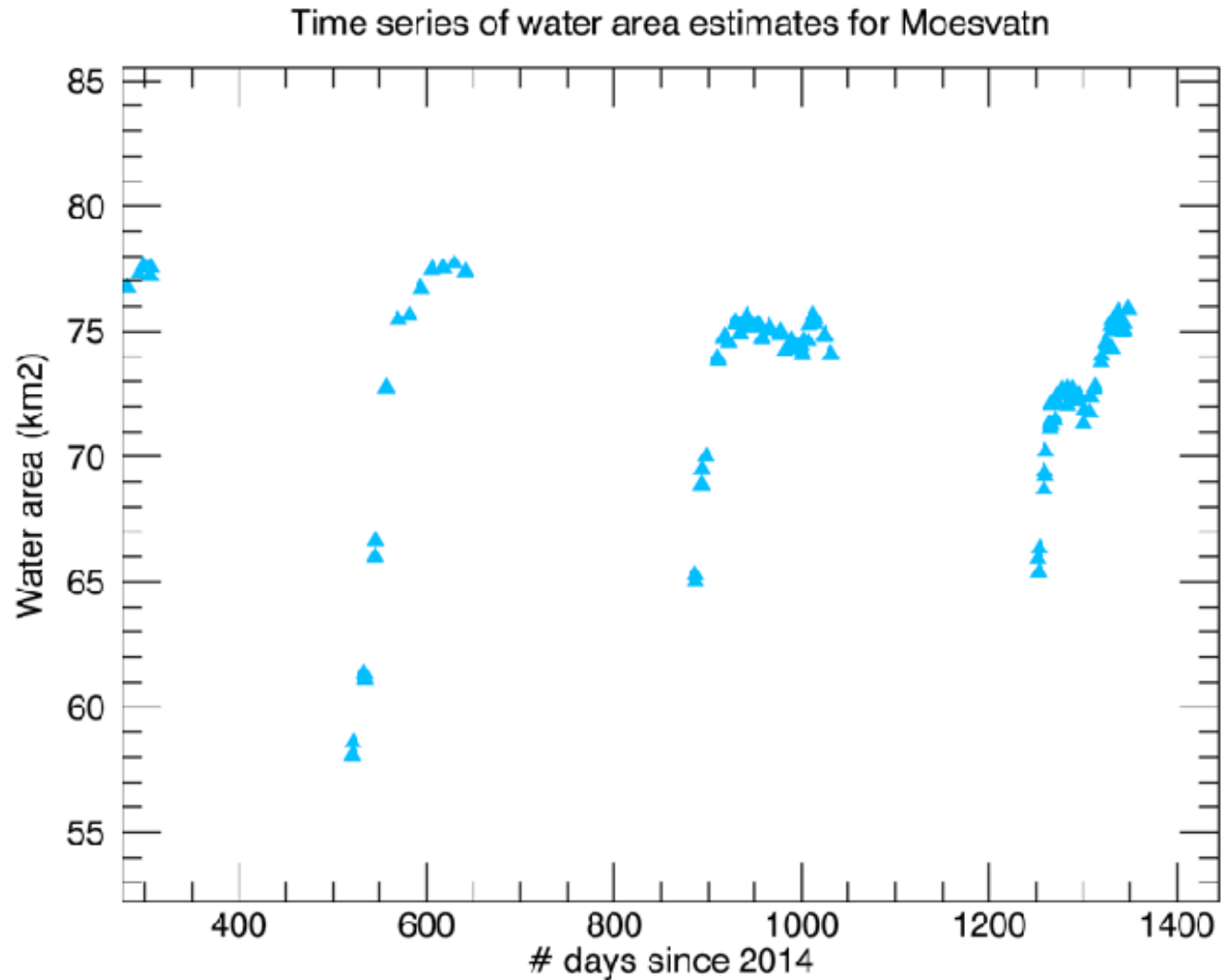


# WATER SURFACE AREA MØSVATN





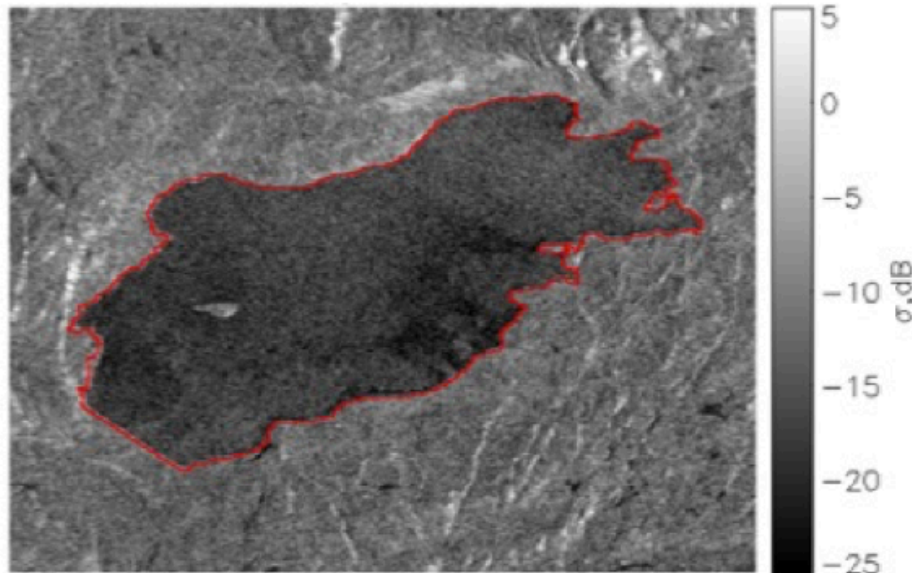
# WATER SURFACE AREA MØSVATN, JUNE–DECEMBER MONTHS



# SENTINEL MEASUREMENTS VS. HIGH-RESOLUTION

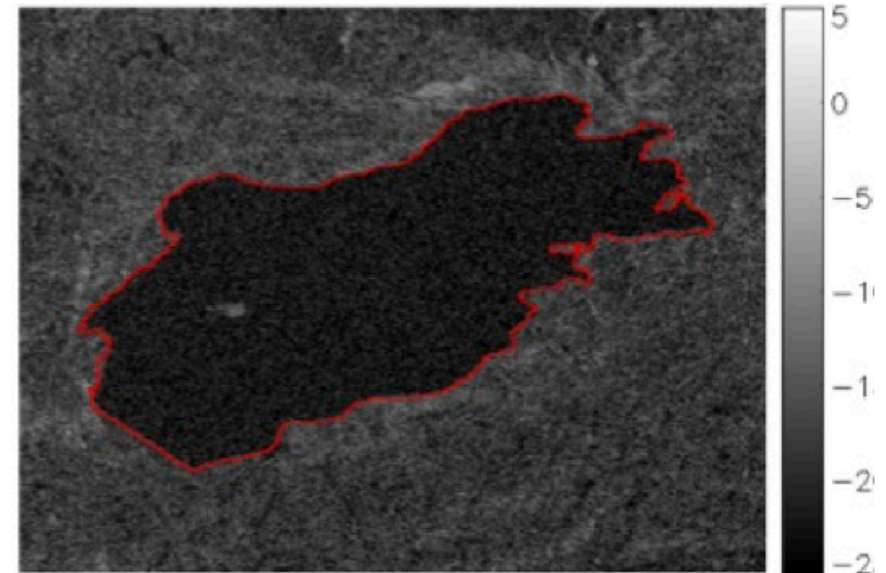
Satellite: Sentinel-1 a/b  
Pixel resolution: 5mx20m

Area (Sentinel-1) = 10.1869 km<sup>2</sup>



Satellite: Radarsat-2  
Pixel resolution: 3mx3m

Area (Radarsat-2) = 10.2595 km<sup>2</sup>



Difference = 0.06km<sup>2</sup>, or 0.7% av RS2-areal



## TECHNOLOGICAL CHALLENGES

- ▶ Data management and processing
- ▶ Ice on lakes
- ▶ Melting period
- ▶ Windy days/waves
- ▶ Low water levels
- ▶ Layover/shadowing

	Møsvatn 2014-2017
# geocoded	451
# classified	218
# rejected	65 (6)
# retained	147

## PRESENT EXPERIENCE

- ▶ Radar satellite measurements can be used to efficiently map/monitor changes in water surface areas
- ▶ Methodology constantly improving
- ▶ Global coverage
- ▶ Develop databases of information to;
  - ▶ Complement existing sources: “Innsjødatabasen” (NVE)
  - ▶ Strengthen understanding on environmental impact from hydropower operations







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Frano Cetinic

EDInsights AS

E-mail: [frano@edinsights.no](mailto:frano@edinsights.no)

Phone: (+47) 406 01 994