

### **ARKTALAS Science Workshop**

## Changes in the Arctic Ocean: Knowledge gaps and Impact of future satellite missions

Status of draft synthesis paper

UNIS, Longyearbyen, Spitsbergen Wednesday 27 April 2022





Sustainable development







#### Collect information from missions and products documentation

- > Geophysical parameters of interest
- > Existing missions & instruments
- > Future missions (ESA and Third Party Missions)

### Specific focus on

- > Arctic coverage
- > Temporal availability
- > Spatial and temporal resolution
- > Size of swath (if any)
- > Latency
- > Level of accuracy, sources of uncertainties



- Combine information with the needs and observation gaps identified within the project science studies
  - > Physical processes
    - Arctic Ocean circulation
    - Sea Ice evolution
    - Arctic Amplification
    - Arctic storms
    - Ocean tides in the Arctic
  - > Use of satellite products
    - Direct analysis of Arctic Ocean processes, synergy between products/missions
    - Comparisons with in situ observations
    - Model validation
    - Data assimilation
  - > Associated geophysical parameters
  - > Arctic coverage
  - > Temporal availability
  - > Spatial and temporal resolution
  - > Latency
  - > Level of accuracy, sources of uncertainties
- Identify filled/remaining gaps when considering future missions
- Produce synthesis paper



# **Collection of information**

#### Geophysical parameters of interest

- > Sea Ice parameters
  - Sea Ice Concentration
  - Sea Ice Thickness
  - Sea Ice Drift
  - Ice Type and Ice Edge (location, concentration, type, leads, polynyas, ridges, decay stage, iceberg)
  - Snow on Sea Ice
  - Sea Ice Albedo
  - Melt Ponds
  - Ice Surface Temperature
- > Ocean parameters
  - Sea Surface Temperature
  - Ocean Colour
  - Sea Surface Salinity
  - Sea Surface Height
  - Ocean Surface Currents
  - Ocean Surface Winds
  - Sea State (significant wave height, wave spectra)



# **Collection of information**

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# Synthesis of the information



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# Synthesis of the information



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- Identified current limitations
  - > Satellite products temporal and spatial resolutions
    - Observation resolution (lack of high-resolution acquisition modes) and availability (impact of clouds, daylight, etc)
    - Data processing: retracking in the presence of sea ice, gridding, temporal averaging, etc
    - Different generations of instruments, with increasing resolution, but limitations for climate long-term studies
    - Satellite data calibration and validation
  - > Geophysical parameters not currently measured
    - Snow depth over sea ice
    - Ocean Surface Total Currents
  - > Lack of in-situ data
    - Collocation in space and time with satellite observations
    - Location in regions of interest for studied processes (difficult to maintain instruments)
    - Long time series, at high frequency
  - > Models limitations
    - Complex interaction between processes (sea ice, waves, currents, tides...)
    - Not able to ingest observations at full resolution



#### • Future missions' answers to these limitations

- > Satellite products temporal and spatial resolutions
  - Observation resolution (lack of high-resolution acquisition modes) and availability (impact of clouds, daylight, etc)
  - Data processing: retracking in the presence of sea ice, gridding, temporal averaging, etc

→ Lessons learned from new missions to reprocess previous data (ex: Sentinel-6 LRM/SAR interleaved modes)

- Different generations of instruments, with increasing resolution, but limitations for climate long-term studies
- → Continuity of missions to build climate records: CHIME, CIMR, ROSE-L, HARMONY, etc...
- Satellite data calibration and validation
- $\rightarrow$  Cross-comparison with other missions

#### > Geophysical parameters not currently measured

- Snow depth over sea ice
- $\rightarrow$  CRISTAL
- Ocean Surface Total Currents
- $\rightarrow$  SEASTAR, SKIM