

EGU 2020 SHARE GEOSCIENCE ONLINE

Winter atmospheric boundary layer observations over sea ice in the coastal zone of the Bothnian Bay (Baltic Sea)

Marta Wenta (University of Gdansk), David Brus (Finnish Meteorological Institute), Konstantinos Doulgeris (Finnish Meteorological Institute), Ville Vakkari (Finnish Meteorological Institute), Agnieszka Herman (University of Gdansk)

martawenta@gmail.com

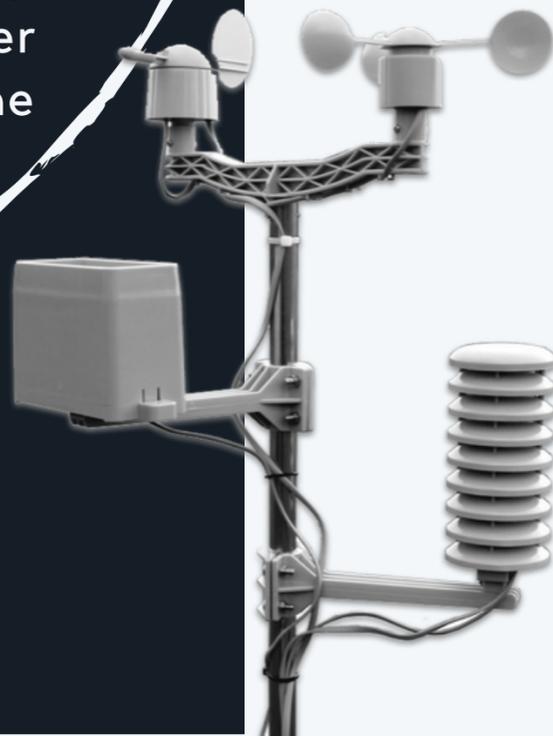
Part of the project:
"Observations and modeling of
sea ice interactions with the
atmospheric and oceanic
boundary layers" No.
2018/31/B/ST10/00195 (financed
by Polish National Research
Center)



The **HAOS** (Hailuoto Atmospheric Observations over Sea Ice) campaign took place off the westernmost point of the Hailuoto island, Baltic Sea between 27 February and 2 March 2020. The aim of our project was to obtain a broad range of observations of ABL properties over inhomogenous sea ice. Measurements of temperature, relative humidity and air pressure at different heights have been carried out with fixed wing UAV 1.5 km off the coast. The detailed structure of the surface below was photographed by a multirotor drone; the images were later used to create orthomosaic maps. Total number of 27 fixed wing UAV and 4 multirotor flights were carried out. Additionally, throughout the time of the campaign a weather station and Halo Doppler Lidar operated on the pier of Hailuoto Marjaniemi.



2-3 days before the HAOS campaign the new sea ice emerged off the western shore of Hailuoto. Due to the combined influence of sea currents and atmosphere, this newly formed ice moved slowly along the boundary of landfast ice, which was located close to our launching point. Thanks to extremely precise orthomosaic maps we can study how, what appeared from the shore as stable sea ice cover, moved and changed throughout the 5 days. Meanwhile, the fixed wing UAV observations gave us information about ABL response to those variations. Apart from data, HAOS contributes to the studies on UAVs capabilities in the ABL and surface observations over sea ice in areas inaccessible by foot and conditions similar to the ones found in the Arctic.



OUR GOAL

**TO STUDY THE ATMOSPHERIC
BOUNDARY LAYER RESPONSE TO SEA
ICE SURFACE INHOMOGENEITIES.**

**TO ANALYZE DIURNAL CHANGES IN ABL
PROPERTIES.**

**TO PROVIDE DATA FOR MODEL RESULTS
VALIDATION.**

Haiuloto
Atmospheric
Observations over
Sea ice

H A O S

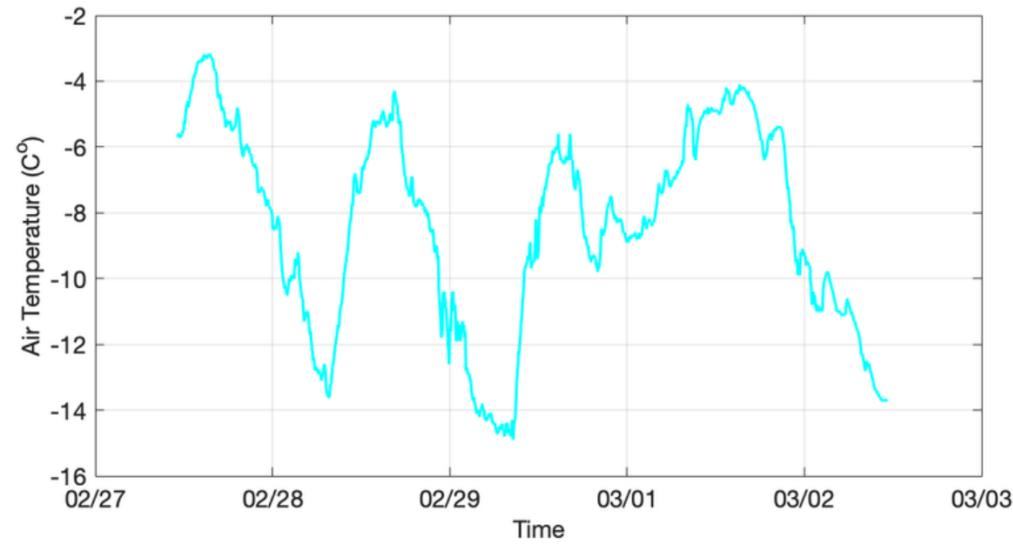
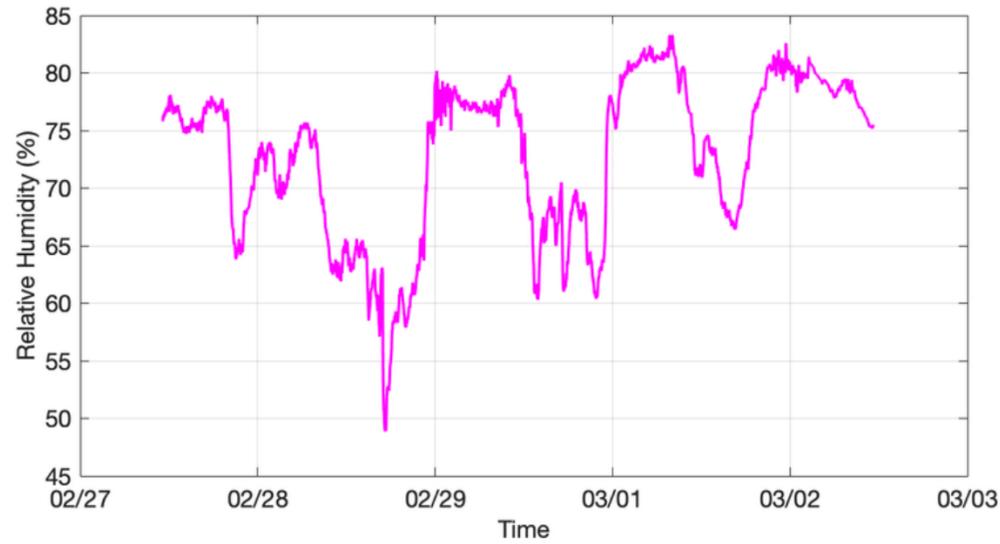
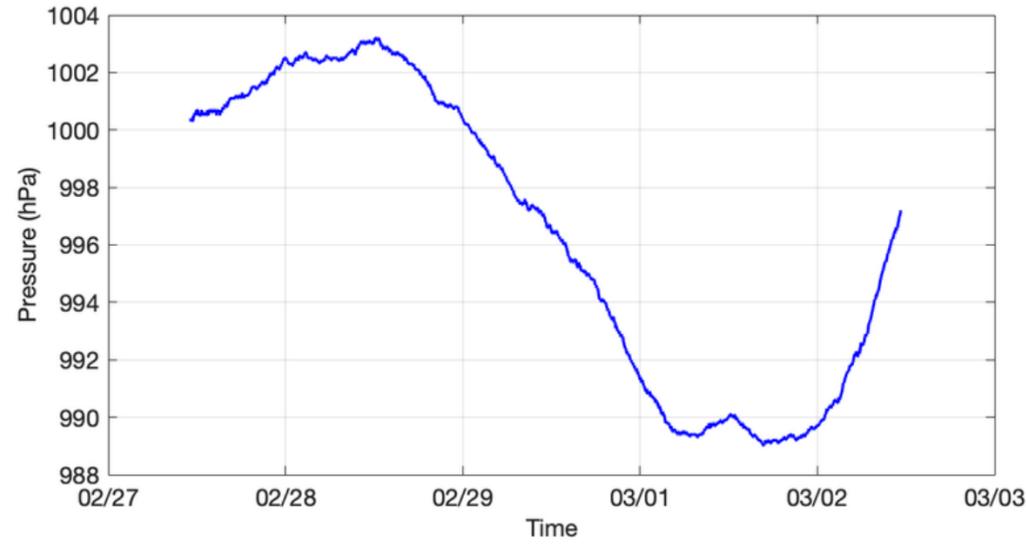
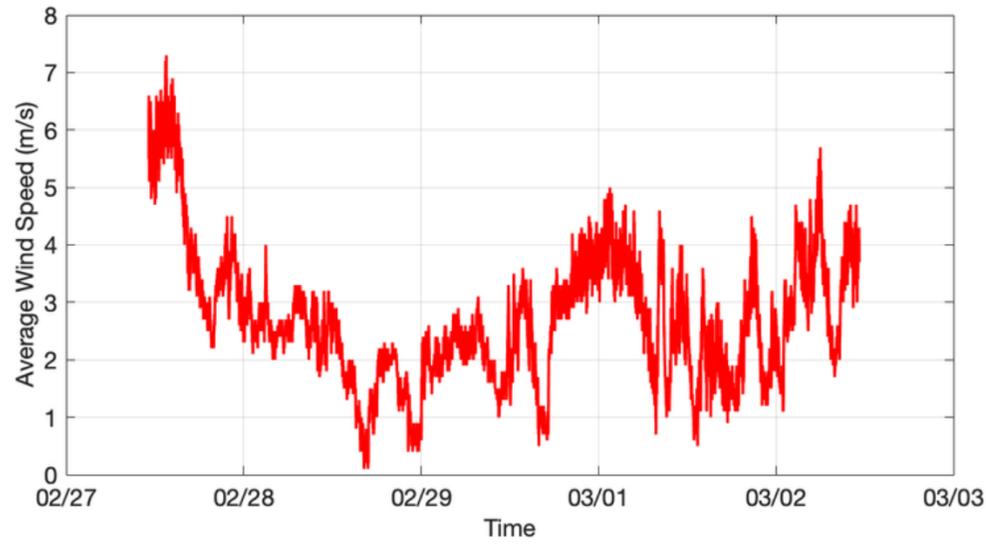
27 February - 2 March 2020





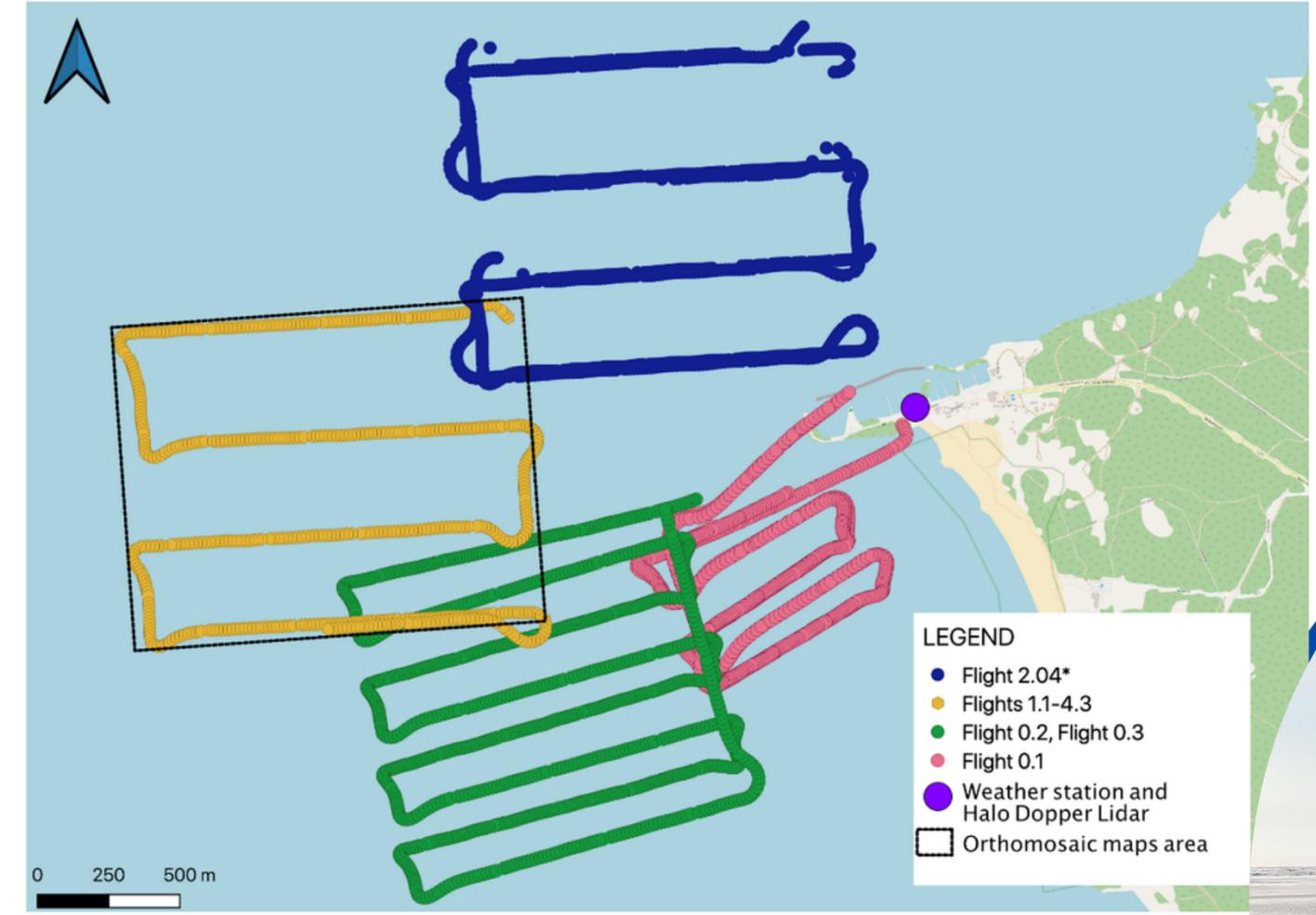
HAILUOTO

Automaitc Weather Station



weather conditions

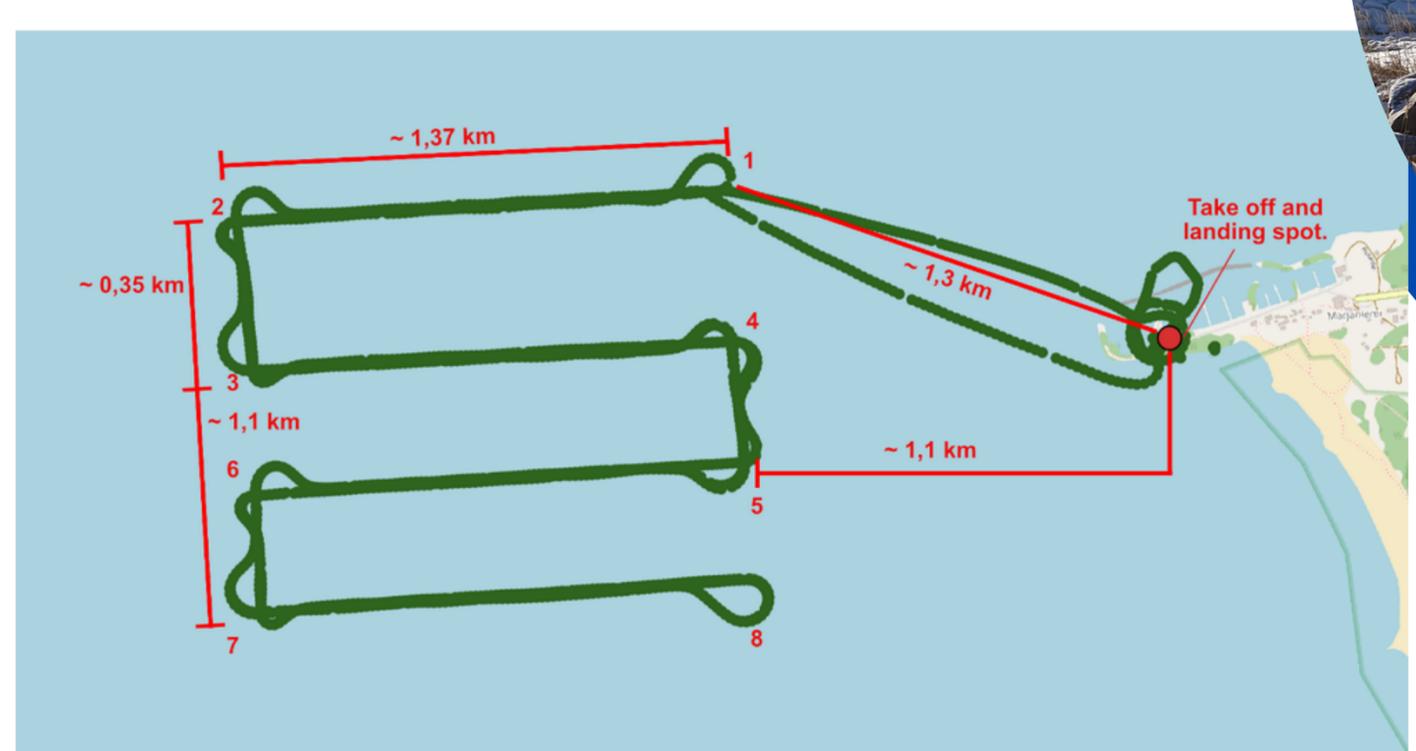
(a)

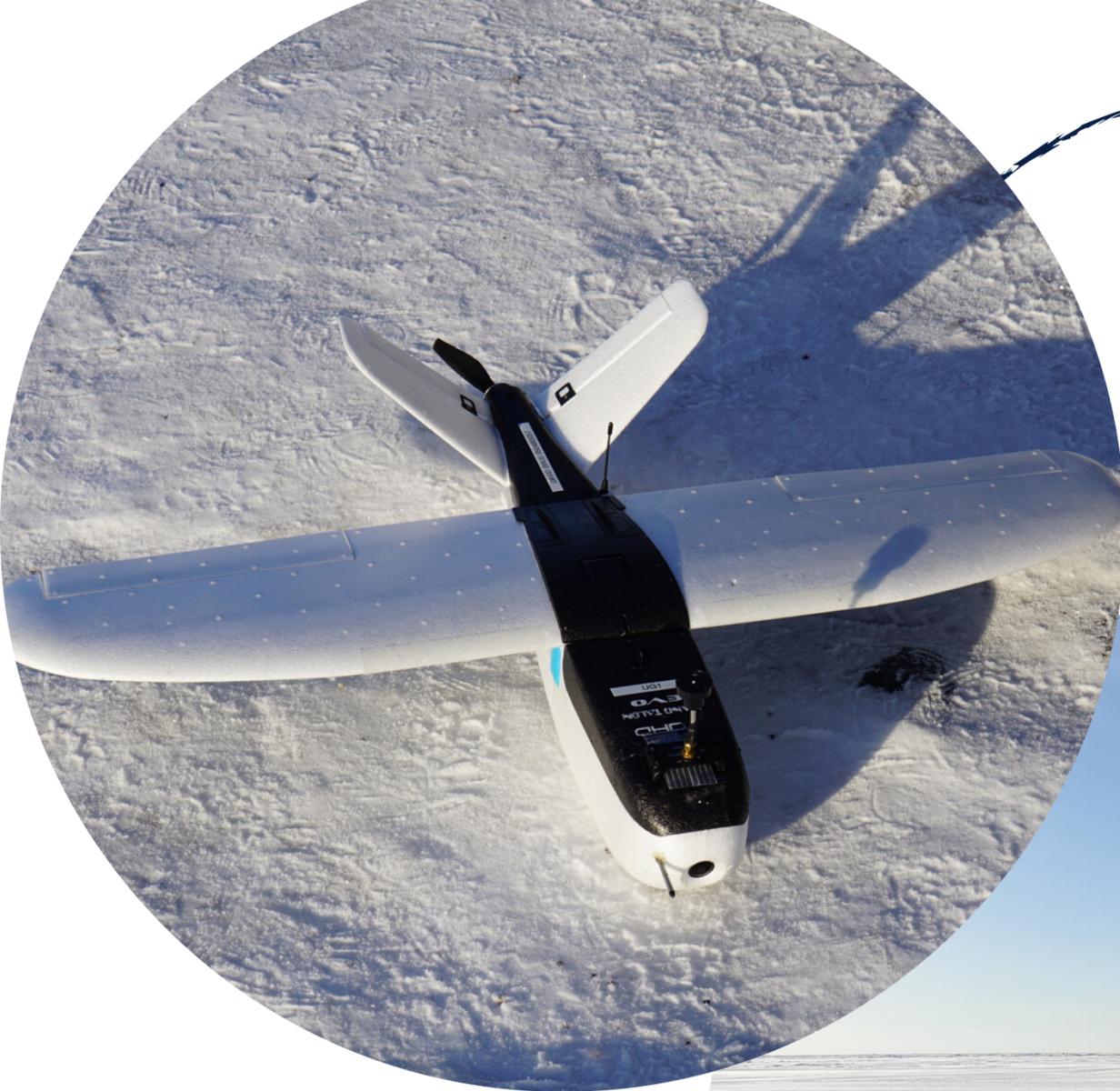


27 fixed winged UG1 flights
 4 orthomosaic maps
 4 days of ground measurements



(b)





UG1 UAV

air temperature
relative humidity
air pressure

AUTOMATIC WEATHER STATION

wind speed
wind direction
air temperature
relative humidity
air pressure
precipitation

3D ANEMOMETER

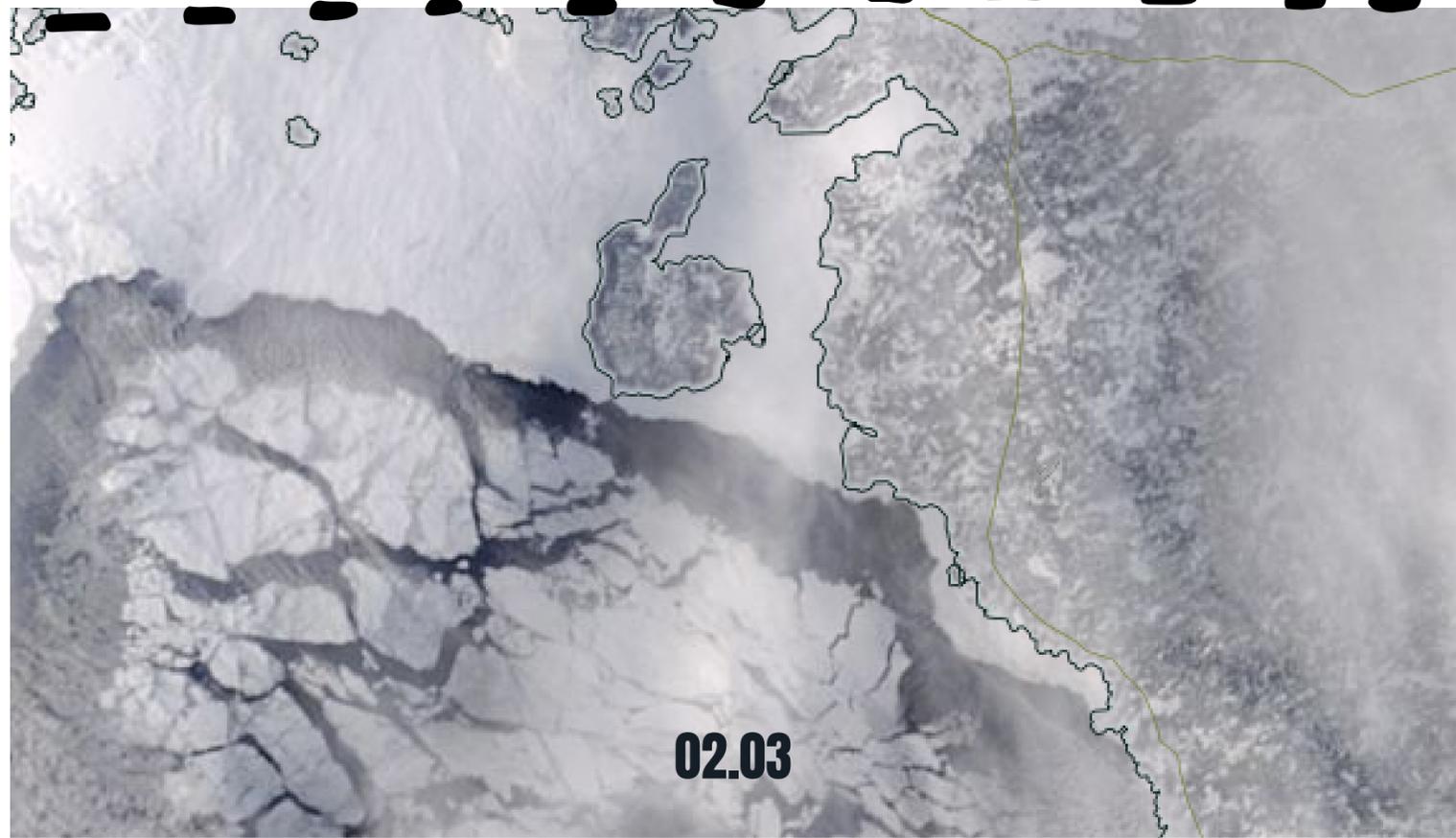
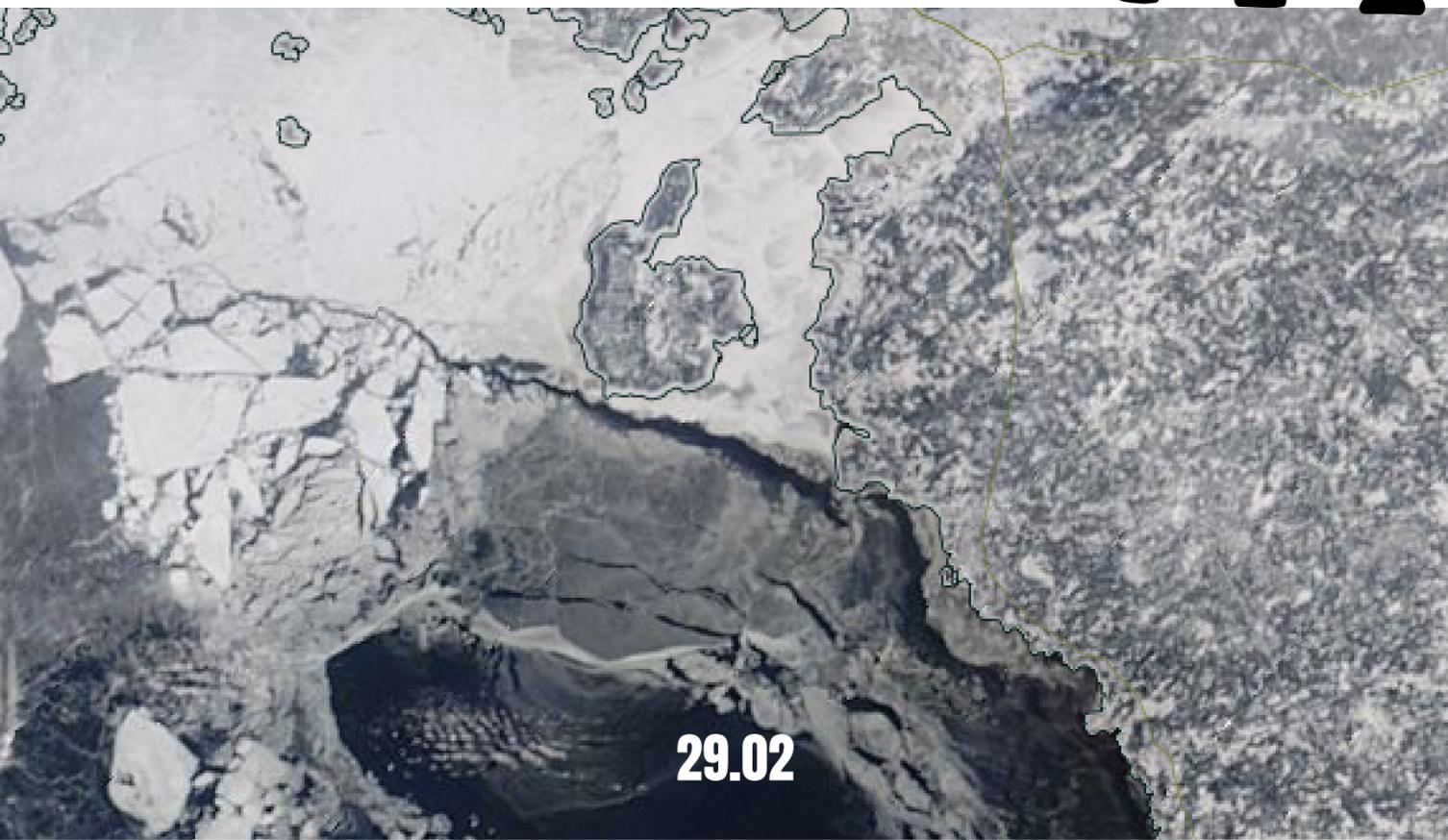
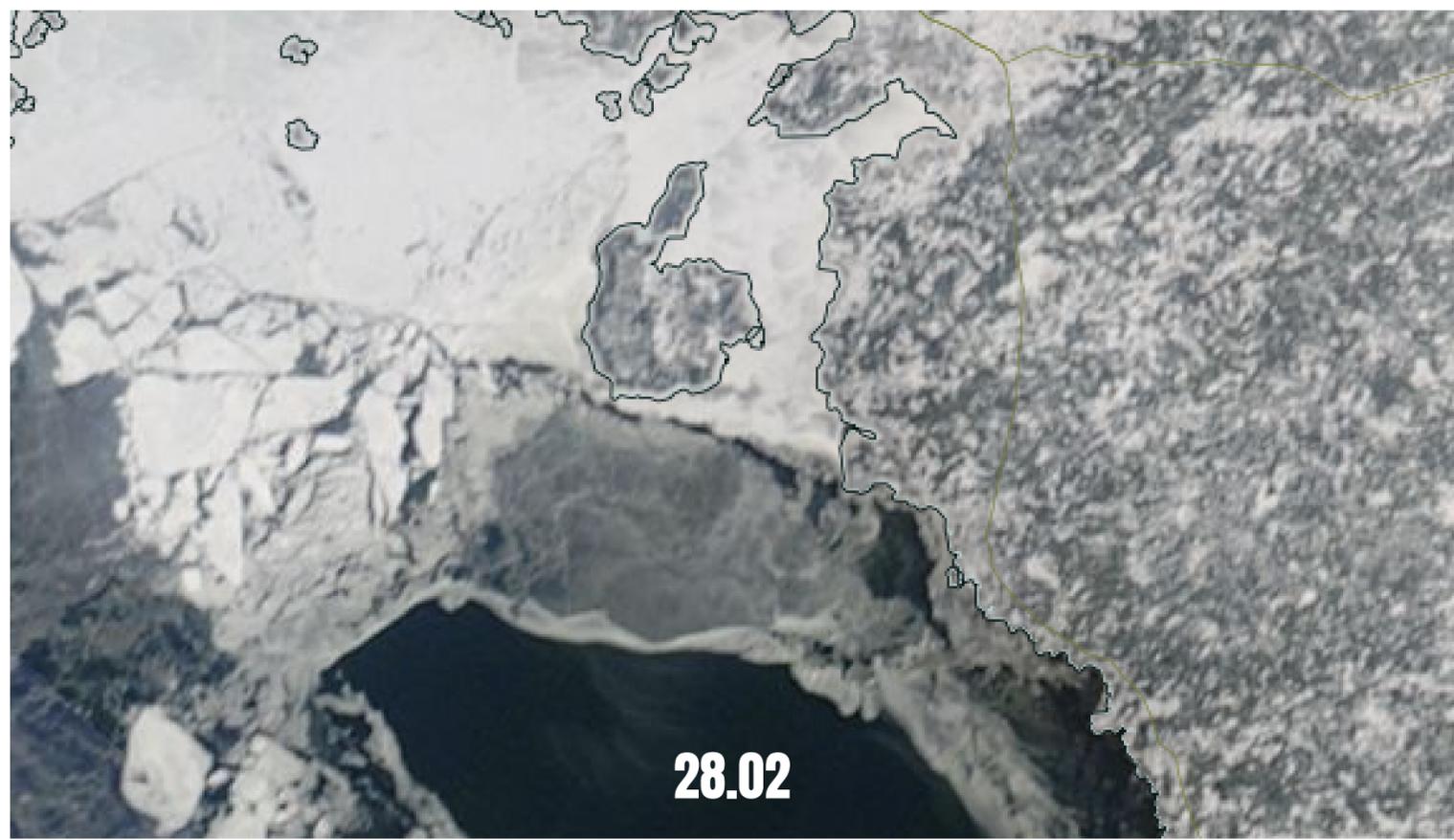
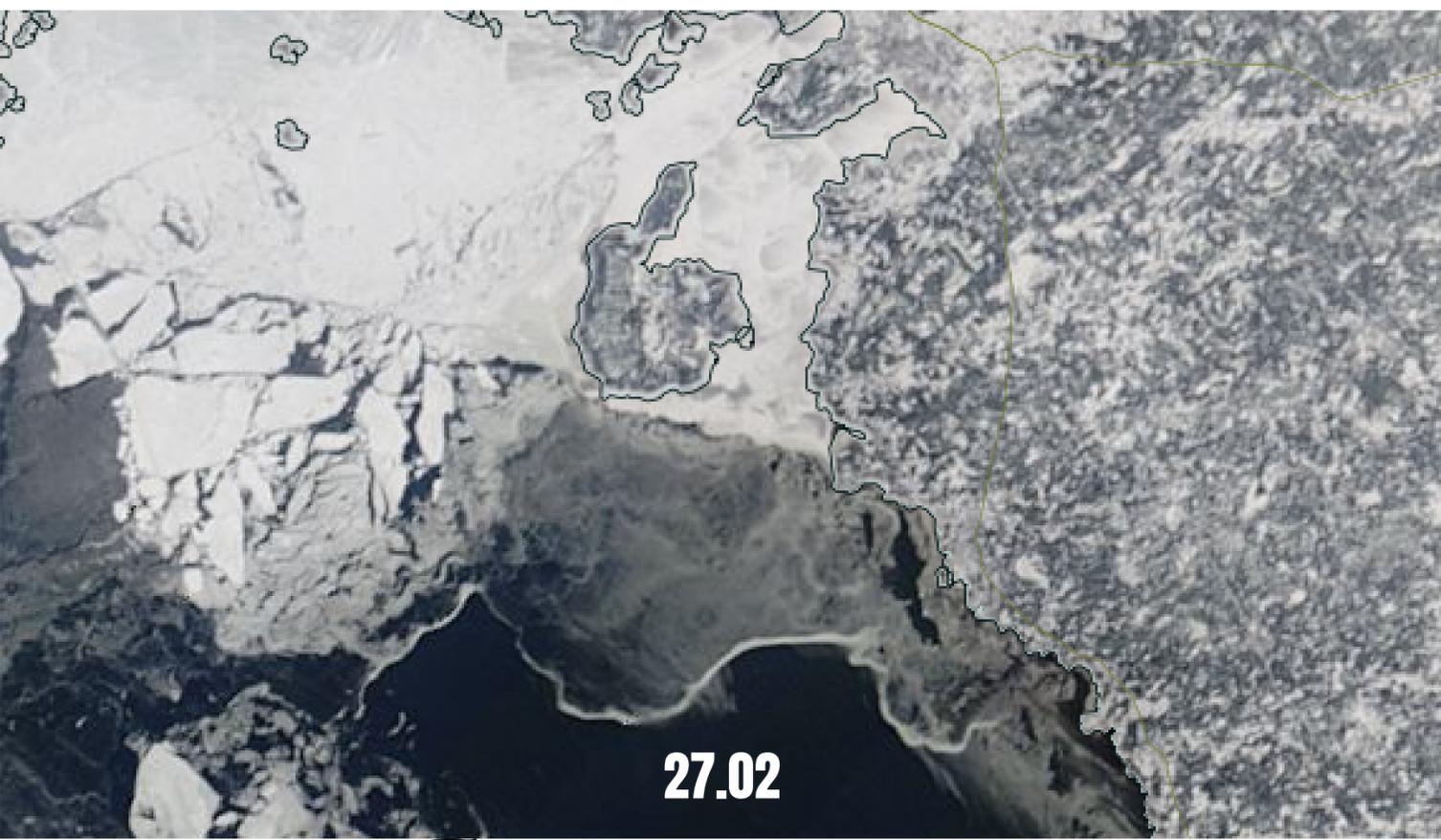
u, v, w wind components and acoustic temperature in 10hz resolution

HALO DOPPLER LIDAR

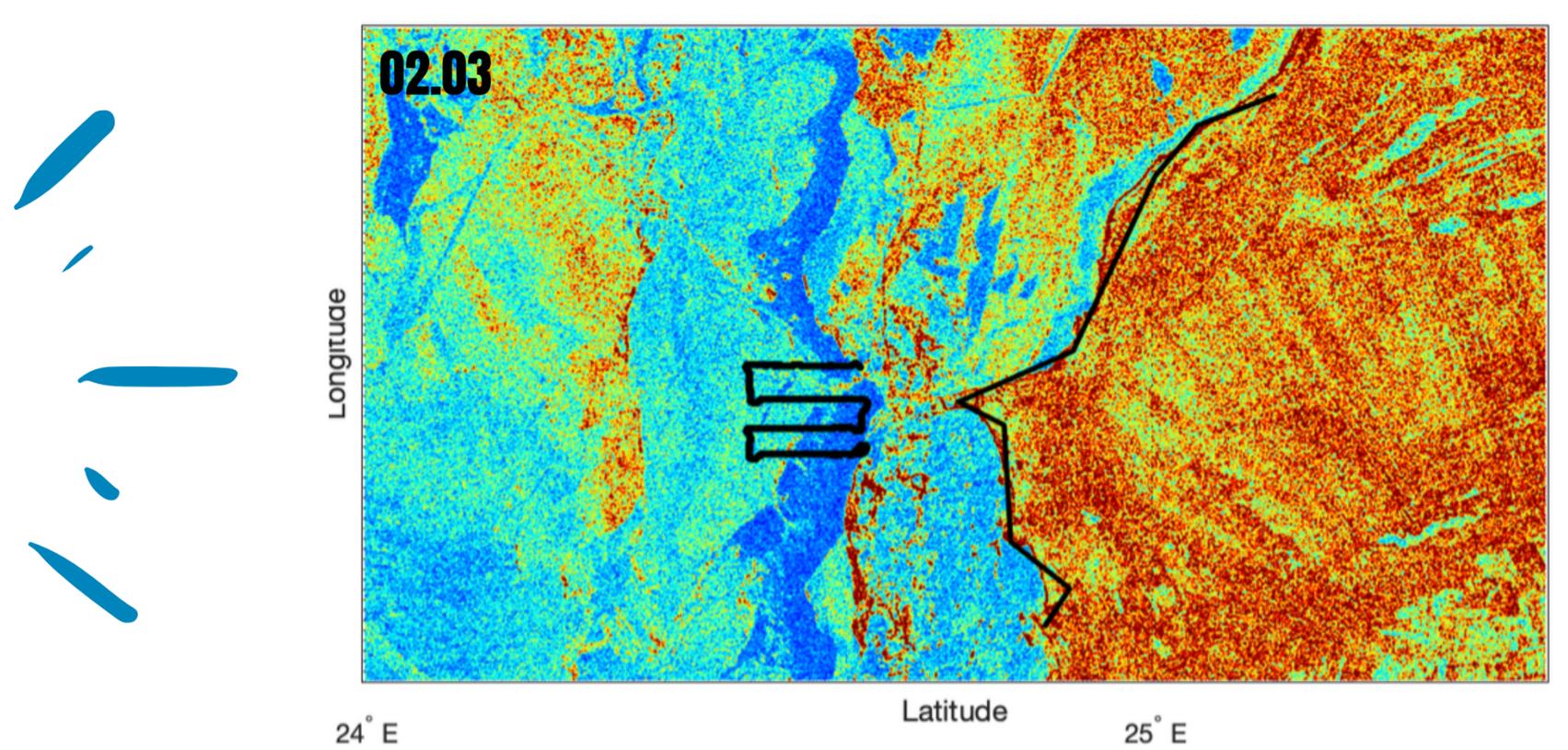
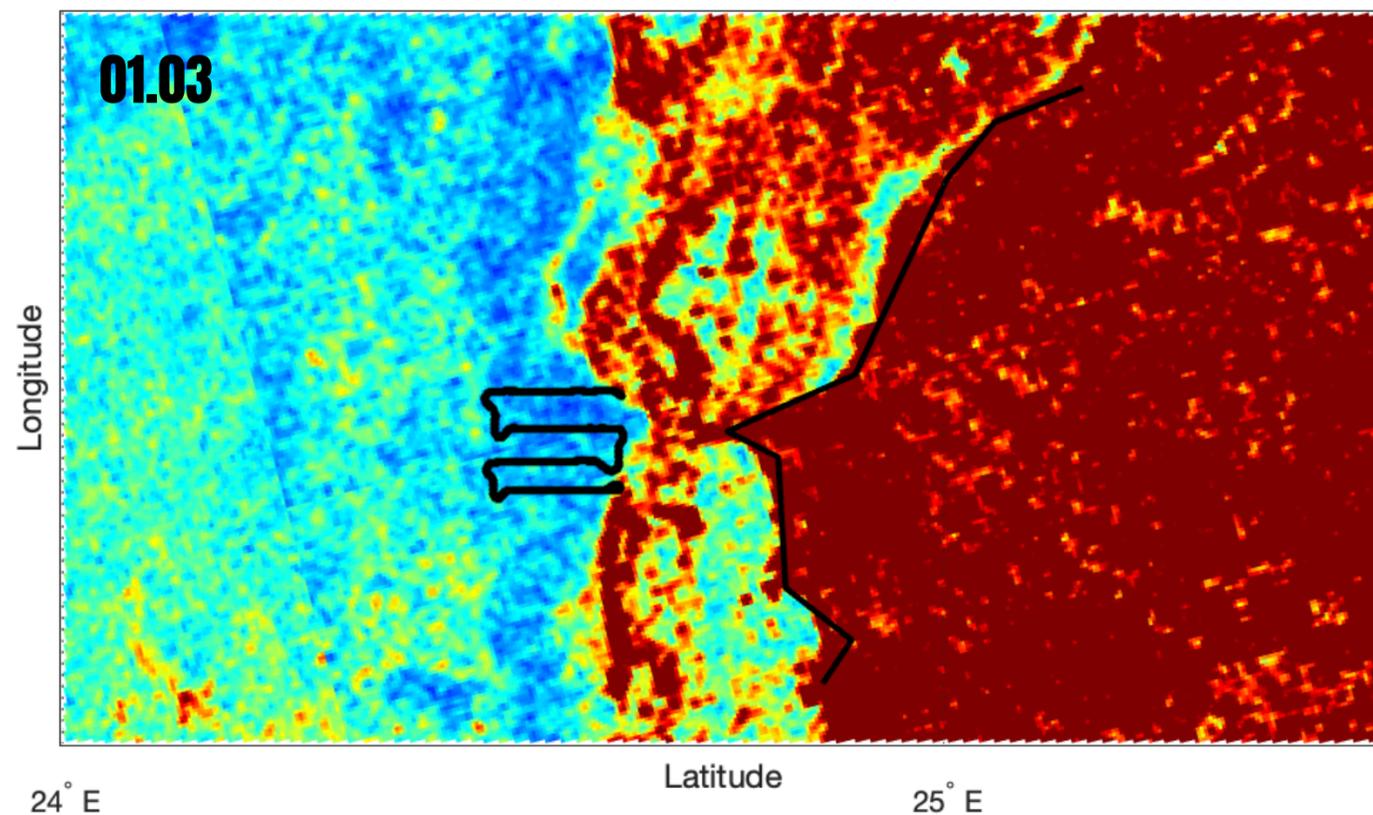
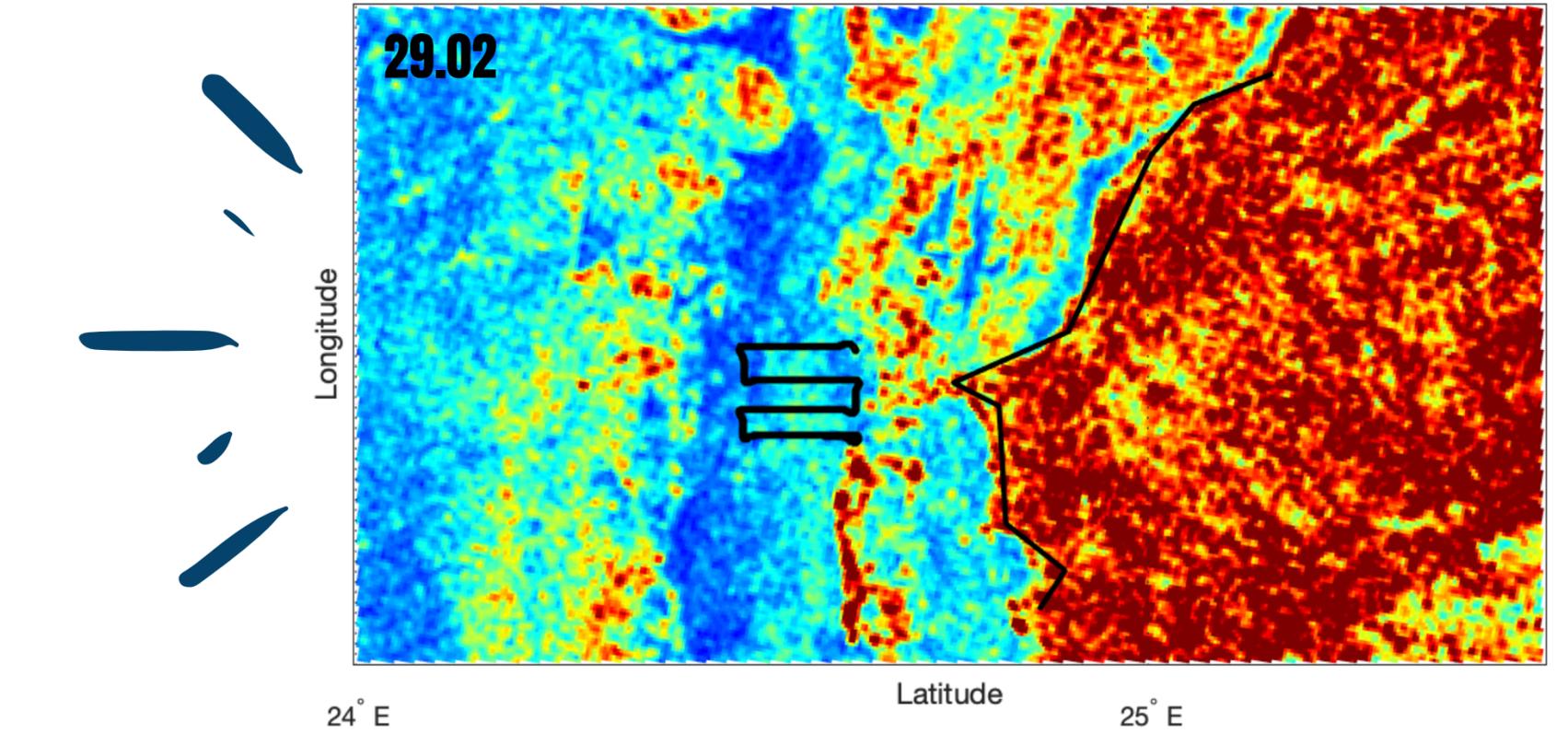
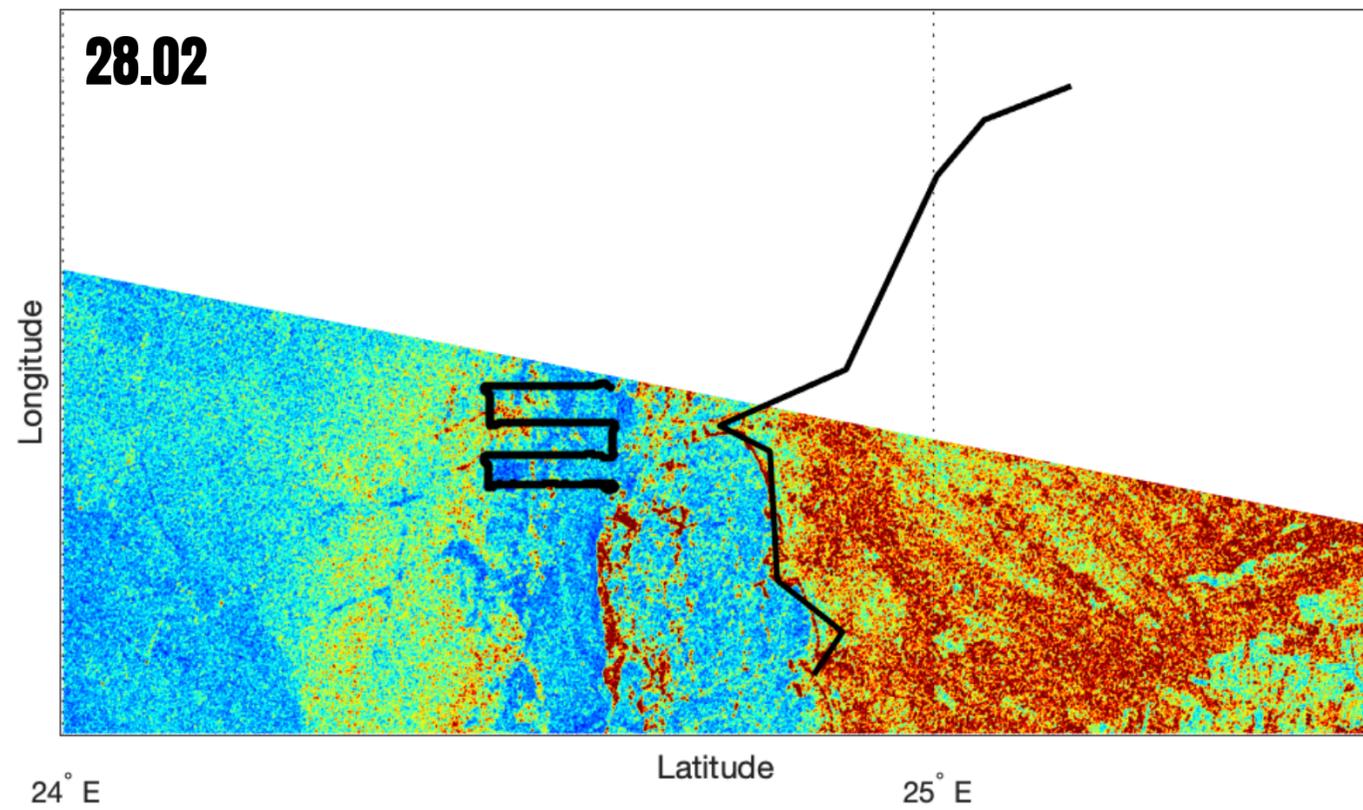
horizontal wind speed and direction
TKE dissipation rate
turbulence proxy

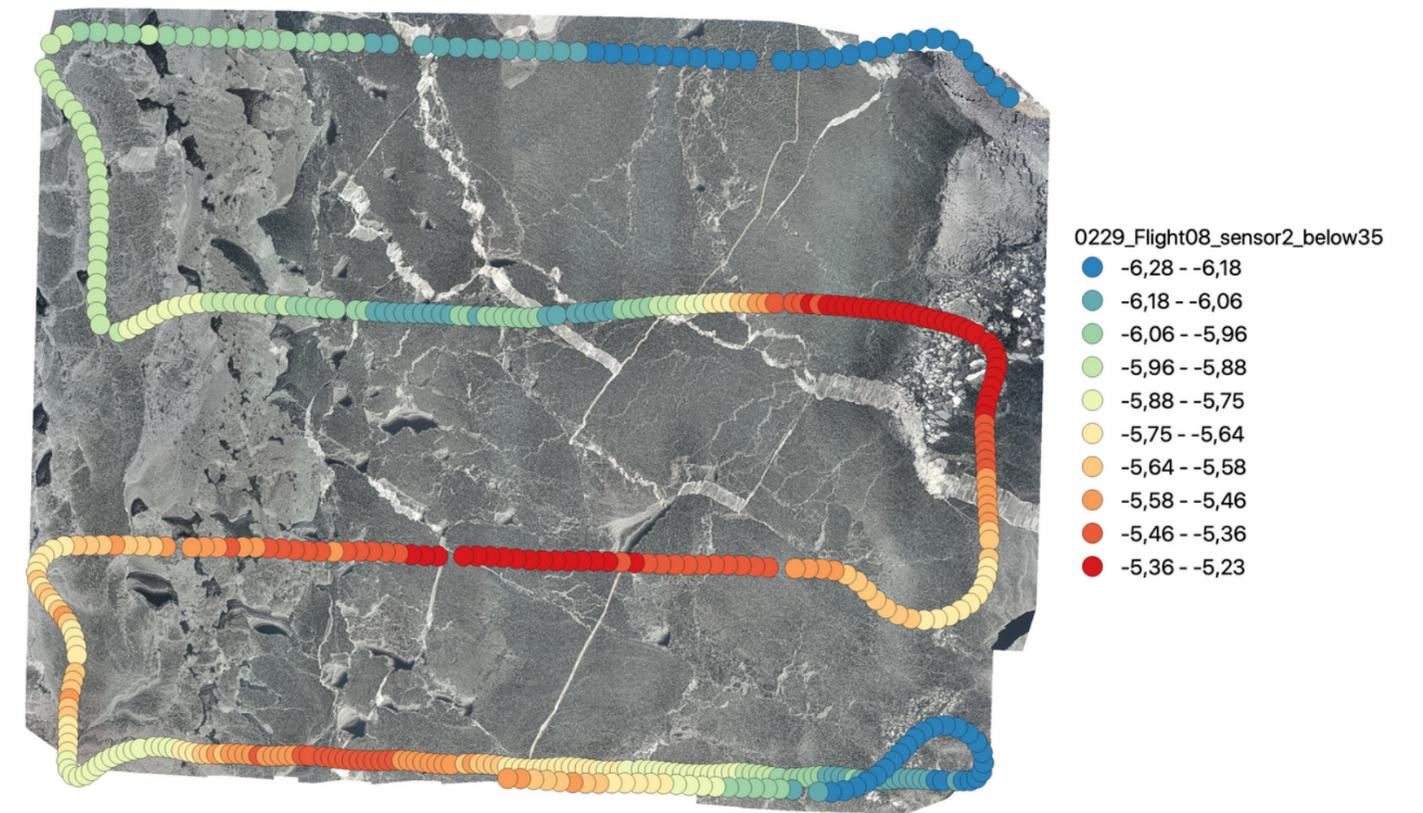
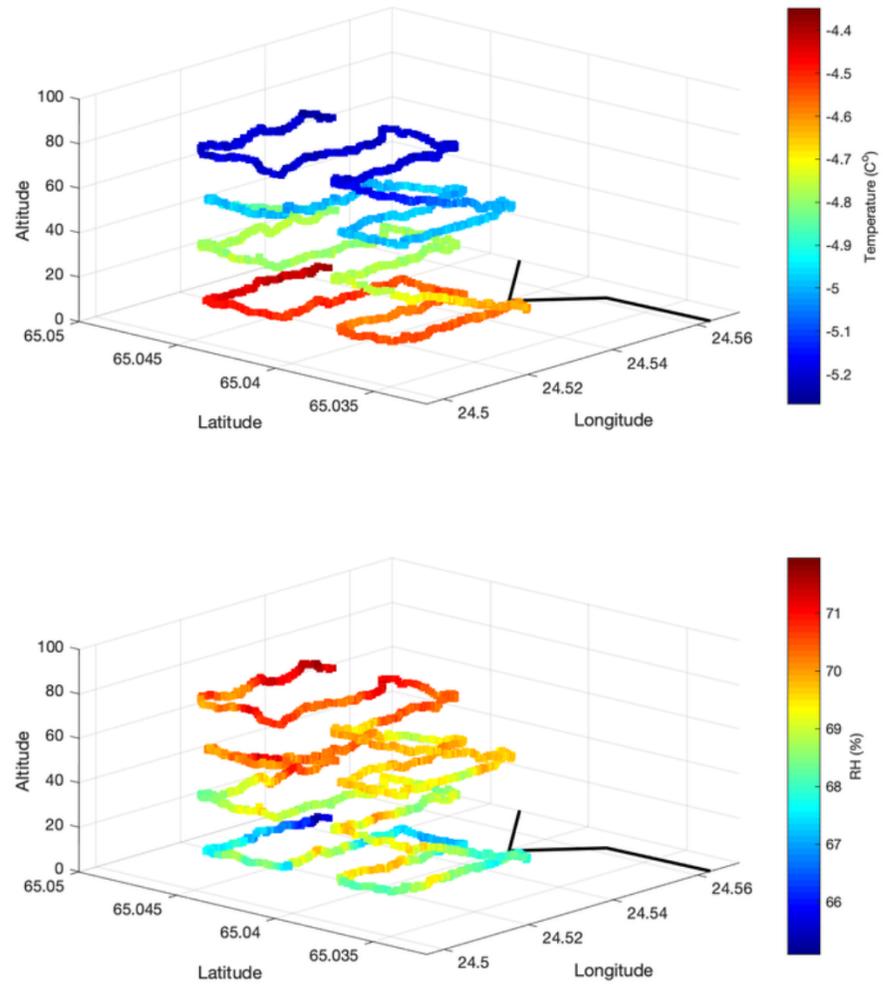
MEASURED PROPERTIES





SENTINEL-1 SYNTHETIC APERTURE RADAR (SAR)





RESULTS

Presented dataset gives us a thorough description of atmospheric conditions over newly formed sea ice near Hailuoto island.

Detailed orthomosaic maps provide us an unique and extremely detailed view on the newly formed sea ice and its changes in the span of 4 days.

Considering the scarcity of recent ABL observations over diminishing sea ice over in the Bay of Bothnia presented dataset may be considered as valuable source of information and the basis for further studies on sea ice-atmospheric interactions in this region.



FUTURE

- ARTICLE DESCRIBING IN DETAIL THE MEASUREMENTS AND DATASETS CREATED DURING HAOS CAMPAIGN IS CURRENTLY UNDER PREPARATION.
- DATA ANALYSIS AND CONCLUSIONS WILL BE PUBLISHED AND PRESENTED LATER IN 2020.
- NEXT YEAR WE PLAN TO REPEAT THE CAMPAIGN IN THE SAME LOCATION.

DATA+MODEL

- COMPARE MEASUREMENTS WITH 1D MODEL RESULTS.
- ANALYZE WHETHER MODELS SIMULATES WELL THE DIURNAL CHANGES OF THE ABL ABOVE SEA ICE.
- VERIFY WHETHER THE ABL RESPONSE TO CHANGES IN SEA ICE SURFACE STRUCTURE (SNOW, ALBEDO) ARE REFLECTED IN MODEL RESULTS.
- IF THERE ARE DIFFERENCES, CHECK WHETHER THEY ARE CAUSED BY INSUFFICIENT PARAMETRIZATIONS OR INPUT CONDITIONS?





**THANK YOU FOR
YOUR ATTENTION!**