The INTAROS 2018 cruise with KV Svalbard has been successfully carried out. The operations were planned and carried out in excellent collaboration with KV Svalbard crew members and cadets. In total 17 Scientists from Nansen Center in Bergen, three institutes at the University of Bergen (Geophysical Institute, Department of Physics and Technology, and Institute of Earth Science), Institute of Oceanology Polish Academy of Science (IOPAN), and Centre National de la Recherche Scientifique (CNRS). The scientific personnel consisted of experienced scientific and technical personnel as well as early career scientist.

The cruise started out from Longyearbyen 30 July and ended same place 20 August. The scientists are targeting a wide spectrum of observations, ranging from atmospheric data, ocean and sea ice properties, to seismic activity. Some measurements are made from fixed installations at the sea floor while other installations were bottom anchored moorings with instruments distributed along a wire in the water column. The bottom anchored moorings are kept in an as vertical position as possible by floatation spheres. A significant measurement program was carried out taking water samples and lowering instruments into the ocean from the small boat. Water vapor measurements were taken underway during the whole cruise onboard KV Svalbard.

During the first leg three ocean bottom seismometers (OBS) were deployed at around 2000 m depth near the Mid Atlantic Rigde to learn more about the current level of seismicity activity in the area between Svalbard and Greenland. Three OBSes combined with the on-land seismometers will make it possible to localize the seismic activity.

During the cruise four oceanographic moorings were recovered, and seven moorings were deployed. Out of the seven moorings, six were deployed along the 22 E. The deployments are in an area with coarse bathymetric maps and therefore the crew at KV Svalbard performed a detailed bathymetric mapping of the area around the deployment sites. This was necessary to get the moorings at the right spot so that the instruments were measuring at the right depths. All moorings are equipped with sensors to measure physical parameters (e.g. temperature, salinity, pressure, and ocean currents), and one mooring is heavily equipped with instruments for biogeochemical parameters. The instruments are programmed to provide data for a whole year. Data from the recovered instruments have been downloaded and will be processed after the cruise. Responsible for the different moorings were Marie-Noelle Houssais from CNRS and Agnieszka Beszczynska-Möller from IOPAN. Tor Einar de Lange from GFI was responsible for the biogeochemical instruments. The actual deployments of the moorings were led by Piotr Wieczorek (IOPAN) and Herve Le Goff (CNRS)

The most important tool for oceanographers is the CTD system, built of CTD sensors combined with a rosette of bottles to take water samples. The direct measurements made by the CTD system are conductivity, temperature, and pressure from this salinity and depth can be calculated. In our case we used a small version of a SeaBird CTD system with a rosette of 6 bottles that could go down to 1000 m. However, this provided us with very important information. In particular CTD casts with water samples were carried out after recovery and prior to deployments of moorings to ensure that the measurements from the moored instruments are accurate. Furthermore, 36 CTD stations were carried out along 22 E from the ice edge and far into the shelf area close to the opening of the Rijpfjorden. The preliminary analysis of the CTD section shows very clearly the contrast between the temperature and salinity distribution near the ice edge and the area across the continental slope. Intensive small scale variability was observed in the transition zone between ice-covered and open waters.

The water vapor measurements were carried out from KV Svalbard during the whole cruise by Alexandra Touzeau. Alexandra is a Post Doc at UiB-GFI employed for the INTAROS project. She was assisted by Harald Sodemann and Nick Roden also from UiB GFI. Alexandra was collecting weather information and surface water samples during the whole period of the cruise. The isotopic measurements of vapor were running continuously from the 31st of July to the 17th of August, except for a short failure of 7 hours in the morning of the 6th of August. Each day, one hour was dedicated to calibration of the instrument. Weather information was collected every 3 hours during day-time (including air temperature, sea-level pressure, relative humidity, wind speed and direction) together with the ship

position. Rainfall was rare during the cruise, so only 10 1mL vials were used to collect precipitation and among them only half were totally full. Collection of surface sea-water was realized from the deck of the ship or from the small boat, depending on time available, using a bucket: 27 samples were collected for salinity and 25 for d18O. Yi-Chun Chen and Håkon Sandven provided samples of surface water and sub-surface water (down to 20 m) for several sites (total of 19 d18O sea-water samples). Scientists operating the CTD collected sea-water samples for d18O measurements from 6 levels at 8 sites, and also surface water at 32 other sites, with a total of 92 sea-water vials from the CTD rosette. Lastly, in some cases it was possible to collect glacier ice or sea-ice from the small boat (17 samples) or by walking on thick sea-ice (16 samples).

Measurements focused on optical properties of water were carried out at nine different locations in different environmental conditions, ranging from full ice cover (at 83 N), open lead surrounded by first year ice, open area within the diffuse ice edge, open area at the ice edge, open ocean and in front of two different glaciers (around Rijpfjorden and Hinlopen). Several instruments were used in the upper water column to measure profiles of particle size distribution and optical properties such as volume scattering function and absorption. More than 200 liters were filtered to obtain concentration of Chlorophyll-a and concentration of inorganic particles. The results show large contrasts between locations. In the marginal ice zone and under the ice cover, the particle concentration was low, which made the water extremely clear. In the sea ice leads, initial results indicate the presence of phytoplankton growth in the upper 15 meters of water. Glacier water has a very high turbidity, which tested the upper limits of the optical instruments. This part of the measurement program is carried out by PhD student Håkon Sandven and scientist Yi-Chun Chen from the Department of Physics and Technology.

Waldemar Walczowski from IOPAN was responsible for measuring ocean microstructure under different environmental conditions. The measurements are done by a free-falling microstructure probe. To ensure a smooth free-falling, the instrument carries a ‘brush-like’ collar to prevent turbulent eddies, generated by an instrument itself. During the KV SVALBARD cruise in August 2018 the microstructure measurements were collected in the water column with Rockland Scientific VMP-250 vertical profiler, recording data internally. The profiler is dedicated to measurements down to the 250 m depth. Two fast shear probes and one fast temperature sensor were installed on the profiler together with one slow CTD sensor. During the cruise 34 microstructure profiles were collected in different regions of the southern Nansen Basin and Svalbard fjords: deep ocean, Svalbard slope and shelf, and inner areas of the fjords. The main attention was paid to the Marginal Ice Zone in the deep ocean and areas close to the tidewater glaciers in the fjords.

Most of the data were collected from the small-boat, during short (1.5-2 hour) expeditions. Two casts (3 profiles) were obtained during experiment from the sea ice, using a hole drilled through the large ice floe. Most of the data from deep ocean was obtained directly from the vessel, in parallel to measurements along the CTD transect. Data were downloaded from the profiler and preliminary processed. Early results show low level of turbulence in most of the profiles. There are interesting step-like structures in CTD profiles obtained in the Marginal Ice Zone. They may be an indication of the intensive double-diffusion processes and heat transfer from deeper layers towards the sea surface.

The Nansen Center was responsible for planning and coordination of the cruise in collaboration with KV Svalbard. Cruise leader was Hanne Sagen, assisted by Espen Storheim from NERSC and Tor de Lange from Geophysical Institute at University in Bergen. During the cruise NERSC and UiB-GFI were providing instrumentation, technical and logistical support. Effort has been put into documentation of the cruise activities through film and photos. This work has been carried out by Håvard Sagen (NTNU), Espen Storheim and Tor de Lange. Many thanks for all support from the crew and cadets onboard KV Svalbard. Special thanks to the Commander G.M. Leinebø, and Lieutenant T. Vaular for all facilitation and support during planning and implementation of the cruise. Lieutenant Sletta and Lieutenant Andersen are thanked for their outstanding support during the implementation of small boat operations and operations on deck.