SUMMARY

PS122-5 (or Leg 5) was the fifth and last leg of the International Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC). The main scientific focus of Leg 5 was to study the transition from melting to freezing conditions in late summer. Since the original MOSAiC ice floe had ended its life cycle at the ice edge in the Fram Strait at the end of Leg 4, Leg 5 selected a new ice floe in the vicinity of the North Pole. Leg 5 started on August 12, 2020, after a transfer of the Leg 5 team on board of Akademik Tryoshnikov to Polarstern, which was located at the ice edge in the Fram Strait. First RV Polarstern travelled across the North Pole in just six days from the ice edge and selected a new ice floe on August 21, 2020. A new drifting research camp was set up on this floe and operated until September 20, when the journey back to Bremerhaven started, which was reached on October 12, after additional scientific work on temporary ice stations along the way. During the drift of the Polarstern during Leg 5 a comprehensive, interdisciplinary measurement program of atmosphere, ice, ocean, and ecosystem properties and processes was carried out above, in, and under the ice. The unprecedented observational program was very successful and fully reached the goals of Leg 5. Together with the continued measurements during all other legs these observations will lay the foundation for adequately improving climate models to pave the way for a better understanding and prediction of Arctic and global climate change.

ZUSAMMENFASSUNG

PS122-5 (oder Leg 5) war die fünfte und letzte Etappe des internationalen multidisziplinären driftenden Observatoriums zur Untersuchung des arktischen Klimas (MOSAiC). Das wissenschaftliche Hauptaugenmerk von Leg 5 lag auf der Untersuchung des Übergangs vom sommerlichen Schmelzen zum Gefrieren im Spätsommer. Da die ursprüngliche MOSAiC-Eisscholle am Ende von Leg 4 ihren Lebenszyklus an der Eiskante in der Framstraße beendet hatte, wurde für Leg 5 eine neue Eisscholle in der Nähe des Nordpols ausgewählt. Die 5. Etappe begann am 12. August 2020, nachdem das Team an Bord der Akademik Tryoshnikov bei RV Polarstern eingetroffen war, die sich an der Eiskante in der Framstraße befand. Zunächst stieß RV Polarstern direkt über den Nordpol in nur sechs Tagen wieder tief in das Meereis vor und wählte am 21. August 2020 eine neue Eisscholle. Auf dieser Scholle wurde ein neues driftendes Forschungscamp eingerichtet, das bis zum 20. September in Betrieb war. Dann begann die Rückreise nach Bremerhaven, welches am 12. Oktober nach weiteren wissenschaftlichen Arbeiten an temporären Eisstationen auf dem Weg erreicht wurde. Während der Drift der Polarstern auf Fahrtabschnitt 5 wurde ein umfassendes, interdisziplinäres Messprogramm von Eigenschaften und Prozessen der Atmosphäre, des Eises, des Ozeans und des Ökosystems über, im und unter dem Eis durchgeführt. Das beispiellose Beobachtungsprogramm war sehr erfolgreich und hat die Ziele von Leg 5 voll erreicht. Zusammen mit den fortgesetzten Messungen während aller anderen Fahrtabschnitte werden diese Beobachtungen die Grundlage für eine angemessene Verbesserung der Klimamodelle bilden, um den Weg für ein besseres Verständnis und eine bessere Vorhersage des arktischen und globalen Klimawandels zu ebnen.

1. OVERVIEW, DRIFT AND SET UP

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The Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) is an international Arctic Research initiative that is broadly motivated by the dramatic changes in the Arctic climate system over the last few decades, highlighted by significant losses of sea ice, and generally deficient model representations of the important processes responsible for, and responding to, these changes. The ultimate goal of the initiative is to enhance understanding of central Arctic coupled atmosphere-ice-ocean-ecosystem processes to improve numerical models for sea ice forecasting, extended-range weather forecasting, climate projections, and climate change assessment. This goal is achieved by carrying out the most comprehensive, most accurate, most continuous, and most systematic interdisciplinary in-situ and airborne observations in the Arctic Ocean to date, and by obtaining these over a full seasonal cycle including the winter freezing and summer melting seasons.

At the core of MOSAiC the German research icebreaker Polarstern was frozen into the ice for a full year, during which it drifted passively with the natural drift of the sea ice. MOSAiC took place in five Legs (PS122-1 to PS122-5), which are each summarized in separate cruise reports, the current document representing the report for Leg 5 (PS122-5).

The main scientific focus of Leg 5 was to study the onset of the freezing season at the end of Arctic summer. Leg 5 started after the original MOSAiC ice floe had reached the ice edge in the Fram Strait and broke up there. Just before the start of Leg 5 the Leg 4 team had recovered instrumentation from the distributed network, staying broadly in the area where the floe broke up at the ice edge and met Akademik Tryoshnikov with the incoming Leg 5 team there. After rotating the teams Leg 5 started on August 12. On August 13 RV Polarstern and Akademik Tryoshnikov parted and RV Polarstern headed north back into the sea ice. Based on ice conditions in mid-August 2020 Leg 5 selected a route north of Greenland crossing the North Pole. Through large stretches of open water and areas of thin and soft sea ice RV Polarstern reached the North Pole on August 19, after only six days of transfer, which also included time for a couple of research stations on the way. After additional station work at the North Pole RV Polarstern followed the 120deg East longitudinal circle southward, selected a new ice floe on August 21 and started to drift with that floe while the research camp was again set up, though in a more mobile set up, adapted to the volatile and dynamic late summer ice conditions. Leg 5 successfully studied conditions during the transition from melting to freezing conditions which occurred in several intermittent phases during late August and the first half of September.

On September 20, when the lower border of the sun just touched the horizont and the fall sunset started, RV Polarstern begun the transfer back out of the ice and to Bremerhaven. During the journey through the ice research continued in several temporary ice stations along the way. After leaving the ice north of Svalbard Leg 5 briefly stopped in the Kongsfjord of Svalbard for logistical reasons and then arrived in Bremerhaven on October 12, the end of the MOSAiC expedition.