IceBird

Arctic Sea Ice Mass Balance Observatory


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Areas of contribution

User-aspects and verification

Observations

Sea ice processes

Summary

Arctic sea ice extent and thickness are rapidly decreasing, mainly due to anomalously high surface air temperatures and changes in the atmospheric circulation regime. As a consequence of the strong decline and thinning of the ice cover, ice drift accelerates and deformation increases. Consequently, ice-area exports increase out of the Arctic through Fram Strait, the main flux gate of the Arctic Ocean for sea ice. The main aim of the IceBird campaign is to determine the thickness of the sea ice that leaves the Fram Strait during summer months based on combined measurements of ice draft and total freeboard. IceBird complements the sea-ice surveys that were made in previous years, such as the TIFAX campaigns 2010, 2011, 2012, 2016, and 2017, and is thus an established monitoring campaign. The thickness measurements also have considerable potential value for satellite calibration as well as sea-ice model evaluation and development. In addition, a number of buoys will be deployed in the High Arctic, contributing to the YOPP Arctic SOP2, and basic meteorological quantities (temperature, humidity, wind) will be collected by aircraft sensors. We consider the
IceBird measurements highly relevant for the YOPP mission to improve polar environmental prediction capacity.

Description

Aim of the aircraft campaign IceBird is to conduct sea-ice surveys over different ice regimes when sea ice is close to its minimum extent. The surveys complement earlier measurements carried out in Fram Strait, the central Arctic Ocean and the Lincoln Sea with RV Polarstern and aircraft Polar 5/6 between 2001 and 2017. To minimize payload and extend flight range, measurements will be restricted to a determination of sea-ice thickness and freeboard using the EM-Bird and a laser scanner. In addition, a hyperspectral camera will document melt pond depth and fraction. Moreover, a set of buoys deployed during previous campaigns will be revisited and new ones deployed; the latter will collect data through a large part of YOPP Arctic SOP2, including submission to the GTS (to be confirmed). Basic meteorological quantities (temperature, humidity, wind) will be collected by aircraft sensors. If possible, flight patterns will be coordinated with RV Polarstern activities.

The main base will be at Station Nord (81°36’N, 16°40’W), planned from 29th July to 14th August 2018. Note that the exact dates of all transit flights between Longyearbyen and Station Nord are strongly dependent on weather conditions and may change. The campaign includes approximately 10 to 15 research flights in an area of interest located between 77°N - 90°N and 60°W - 30°E. If weather conditions are suitable, additional research flights will be performed from Alert, Canada.

Results from IceBird serve different scientific purposes such as:

a) Investigation of the thinning of sea ice due to a reduction of old multi-year ice.
b) Documentation of the decline in thickness in Fram Strait area: Together with information on sea-ice trajectories and source areas, measurements provide inside into Arctic-wide mass balance changes of sea ice.
c) How is the sea-ice export out of Fram Strait changing in summer when reliable satellite-based estimates are missing? Is the observed increase in area flux rates compensated by a decrease in sea-ice thickness?
d) How does the recirculation of Atlantic Water impact observed thickness gradients?
e) Investigation of melt pond fraction and depth development in summer over different ice types.
f) Investigation of sea-ice deformation in summer and impact on the thickness distribution.
g) Upscale measurements made on board of RV Polarstern.
h) Calibration of satellite-thickness products.
i) Evaluation of sea-ice model performance and thus contribution to model development.

Many of these points are of high relevance to YOPP.

In addition, it is planned to document the use of weather forecasts in the daily flight planning, and to submit a corresponding report to YOPP Polar Prediction Matters.

Timeline

2018-07-29 - 2018-08-16
**User relevant aspects**

Considering the IceBird crew and scientists as users of polar weather forecasts, it is planned to document how forecasts are used for flight planning. The experience shall be summarised in a brief article that will be submitted as a contribution to the YOPP Polar Prediction Matters.

**Regional emphasis**

Northern hemisphere: Yes

Southern hemisphere: No

**Further specification**

Flights from Station North (Greenland) and Alert (Canada) covering the region between Fram Strait, Alert, and the North Pole.

**Key project deliverables**

Observational data:
* Sea-ice thickness transects from approximately 10-15 research flights in an area of interest located between 77°N - 90°N and 60°W - 30°E
* Deployment of four Iridium-equipped SVP-Bs over sea ice
* Basic meteorological measurements from the aircraft

Additional:
Report on use of weather forecasts for flight planning, to be submitted to Polar Prediction Matters

**Data management**

The data will be stored in the publicly and freely available PANGAEA database, which is part of the World Data System (WDS) and a data hub for the YOPP Data Portal. The data will also be made available through the AWI Sea Ice Portal.

**Is data provided to WMO Global Telecommunication System**

Yes
Real-time provision

No more than 30 days from the end date of the cruise. In addition, buoy data are submitted in real time to the GTS.

Timelines

<table>
<thead>
<tr>
<th>Location</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Start date</th>
<th>End date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arctic Ocean around northern Greenland</td>
<td>85</td>
<td>-15</td>
<td>2018-07-29</td>
<td>2018-08-16</td>
<td>10-15 aircraft flights to measure ice thickness and more</td>
</tr>
<tr>
<td>north of Greenland</td>
<td>85</td>
<td>-15</td>
<td>2018-08-01</td>
<td>2019-12-31</td>
<td>Measurements from four SVP-Bs that will be deployed from the aircraft.</td>
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</tbody>
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