Preliminary Science Flight Report
Operation IceBridge Arctic 2011

Flight: **F05**
Mission: **Sea Ice – ICEX Camp Survey / Fairbanks**

Flight Report Summary

Aircraft	**P-3B (N426NA)**
Flight Number	TBD
Flight Request	11P006
Date	Wednesday, March 23, 2011 (Z)
Purpose of Flight	Mission Sea Ice – ICEX Camp Survey / Fairbanks
Take off time	16:02 Zulu from Fairbanks, AK (PAFA)
Landing time	22:07 Zulu at Fairbanks, AK (PAFA)
Flight Hours	TBD
Aircraft Status	Airworthy.
Sensor Status	All installed sensors operational.
Significant Issues	None
Accomplishments	• Low-altitude survey (1,500 ft AGL) of a sea ice transects and ground-truth survey line near the ICEX2011 camp. • ATM, snow and Ku-band radars, accumulation radar, gravimeter, magnetometer, POS/AV, and DMS were operated on the survey lines. • MCoRDS was not in operation on this flight due to the sea ice mission. Instrument team used time on the aircraft during the flight to work on the system.
Geographic Keywords	Arctic Ocean, Beaufort Sea
ICESat/CryoSat Track	None
Repeat Mission	No

Science Data Report Summary

Instrument	Instrument Operational			Data Volume	Instrument Issues
	Survey Area	Entire Flight	High-alt. Transit		
ATM	☑	☒	☒	30 GB	None
MCoRDS	☒	☒	☒	N/A	None
Snow Radar	☑	☒	☒	188 GB	None
Ku-band Radar	☑	☒	☒	188 GB	None
Accumulation Radar	☒	☒	☒	115 GB	None
DMS	☑	☒	☒	11.4 GB	None
POS/AV	☑	☑	☑	2 GB	None
Gravimeter	☑	☑	☑	80 MB	None
Magnetometer	☑	☑	☑	TBD	None

Mission Report (Michael Studinger, Mission Scientist)

Today's mission is a new mission designed to overfly the ICEX2011 camp north of Prudhoe Bay. The following organizations are involved in the ICEX2011 Ice Thickness and Snow Depth Survey: the Arctic Submarine Laboratory (ASL), the Applied Physics Laboratory, University of Washington (APL/UW), the Polar Science Center, APL/UW, The Alfred Wegener Institute (AWI), the Navy Research Laboratory (NRL), and the Cold Regions Research and Engineering Laboratory (CRREL). Our main scientific partners for today's flight are CRREL and NRL. CRREL is collecting data along the ice-based survey line using an ice-based EM31 (snow and ice thickness), a magnaprobe (snow depth), mechanical and hot water drills. NRL has accomplished a very successful airborne survey of the same ground survey line yesterday from Prudhoe Bay. The NRL Twin Otter is equipped with a laser altimeter (Riegl Q560), a photogrammetric camera (Applanix DSS-439) and a 10 GHz pulse-limited precision radar altimeter sensor.

The survey line is 10 kilometers long and roughly oriented north-south. Four corner reflectors are installed along the survey line at equidistant intervals. The beginning and the end of the survey line have been marked with snow-filled orange garbage bags as a visual aid for the pilots. The garbage bags have been clearly visible from the air, but the best visual aid where the snow mobile tracks along the line, because of a good sun illumination on today's flight. In overcast conditions the orange garbage bags will probably be better visible than snow mobile tracks.

The weather forecast for today was good over the camp but with clouds along the line from the ICEX camp to Barrow. After de-icing the P-3 before takeoff we transited to the survey area and descended after the coast north of Prudhoe Bay, where we started data collection. At 17:36 Z, 33 nm before the ground survey line, we descended to 700 ft for the first 3 passes. At 17:42 Z we reached the ICEX camp and saw the cargo plane taking off and clearing the area. We saw a group of people and snow mobiles standing to the east of the survey line between the camp and the line. After 3 passes at 700 ft, we climbed to 1500 ft and flew 8 passes with sufficient overlap to make sure we cover the area east and west of the survey line. We added more lines to the east to the survey line, because we found out that we had a hard time getting ahead of the east-ward drift of the line while we were flying over it. The ice must have picked up some speed compared to the last position we got. Kyle Krabill from the ATM team stayed back in Thule and reported hourly GPS positions of the start and end points of the survey line to us over Iridium phone. Without Kyle's excellent and reliable support and John Sonntag's constant updates of the navigation system we would not have been able to accomplish this complex survey today.

The weather over the camp was good, but fog was obscuring the view of the ice surface just immediately outside the camp area. A thin layer of haze was moving over the survey line for a short time but dissolved quickly and didn't pose any difficulties for our instruments.

After finished the 11 parallel passed (8 were planned) we decided to add two perpendicular passes through the start and end of the line. The pilots used the garbage bags as visual aid. After the first 3 passes, which were flown with the autopilot coupled to the ATM navigation, that had the latest line coordinate, the pilots hand-flew the aircraft using the SOXCDI system for navigation. It takes tremendous skill to steer the P-3 with such precision onto the survey line, each time slightly offset. Well done Mike and Scott!

At 20:56 Z we finished surveying and cleared the area. The line from the ICEX camp to Barrow was completed clouded in as expected from the satellite image.

Today's mission was the most complex mission of the entire Arctic 2011 campaign. We had numerous, meetings, telecons over the past couple of weeks to coordinate the various activities between the organizations that have been involved in this project. I would like to thank everyone who made this happen. The ground data, NRL and NASA airborne data combined are a legacy data set for sea ice research. Thanks everyone!

Individual instrument reports from experimenters on board the aircraft:

ATM: Both systems worked well. The line from the ICEX camp to Barrow was clouded in.

MCoRDS: The MCoRDS system was not operated on this flight due to the sea ice mission, but the instrument team used the flight for testing, configuring the system.

Snow and Ku-band radar: The snow and Ku-band radars worked well.

Accumulation radar: worked well.

Gravimeter: Worked well. No issues.

Magnetometer: worked well.

DMS: DMS worked well and collected 10,759 images.

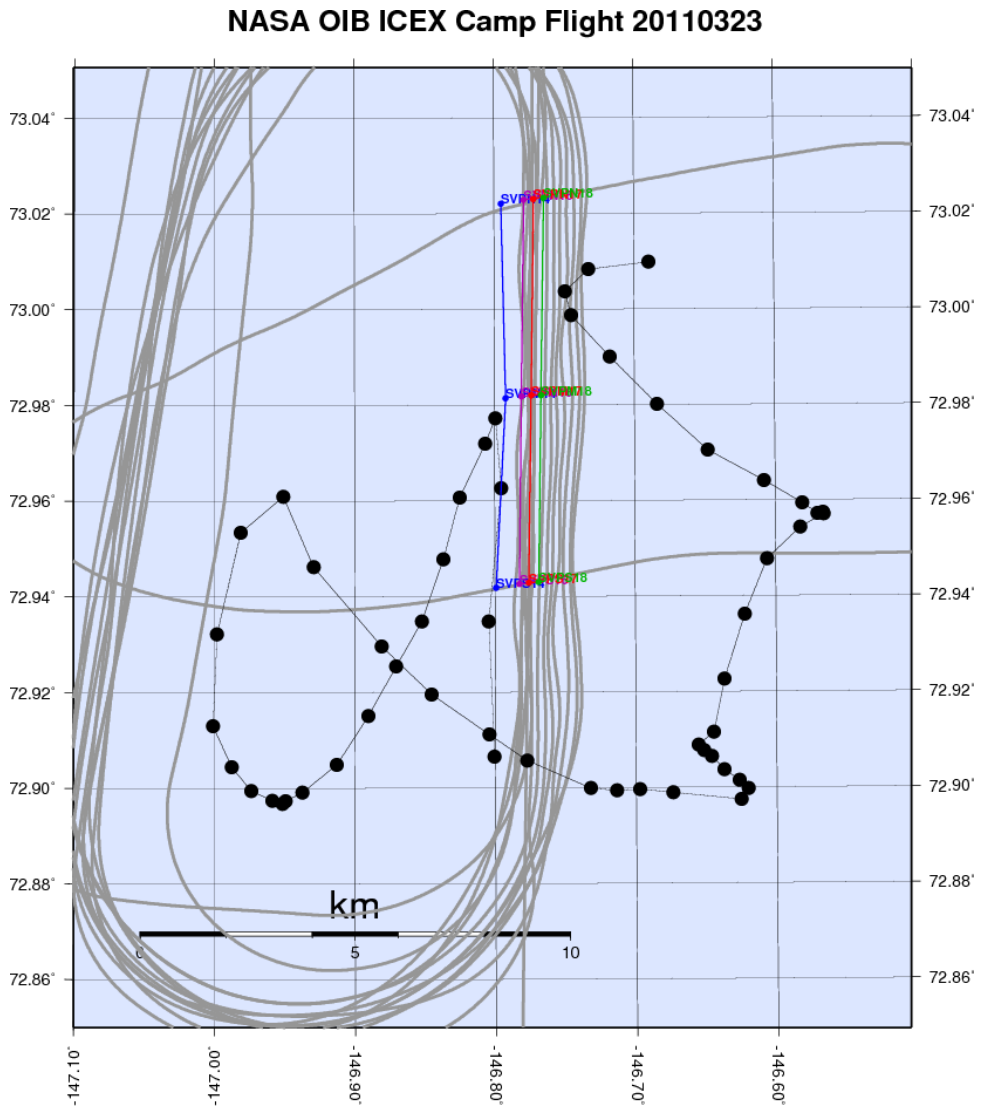

Figure 1: Trajectories of today's ICEX survey line passes from John Sonntag.

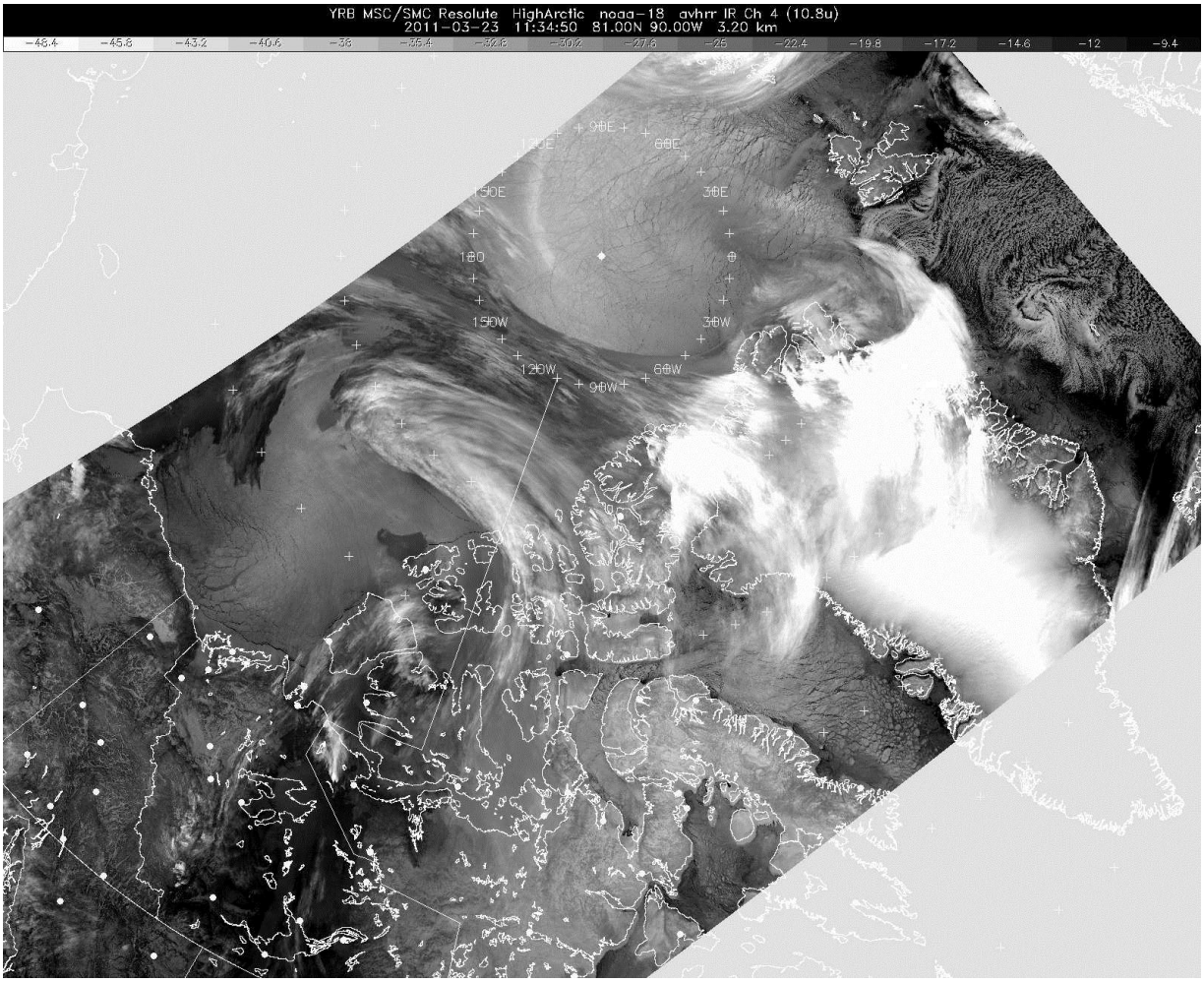

Figure 2: IR satellite image downloaded shortly before takeoff, showing significant cloud cover along the route from the ICEX camp to Barrow. The ICEX camp area was clear.

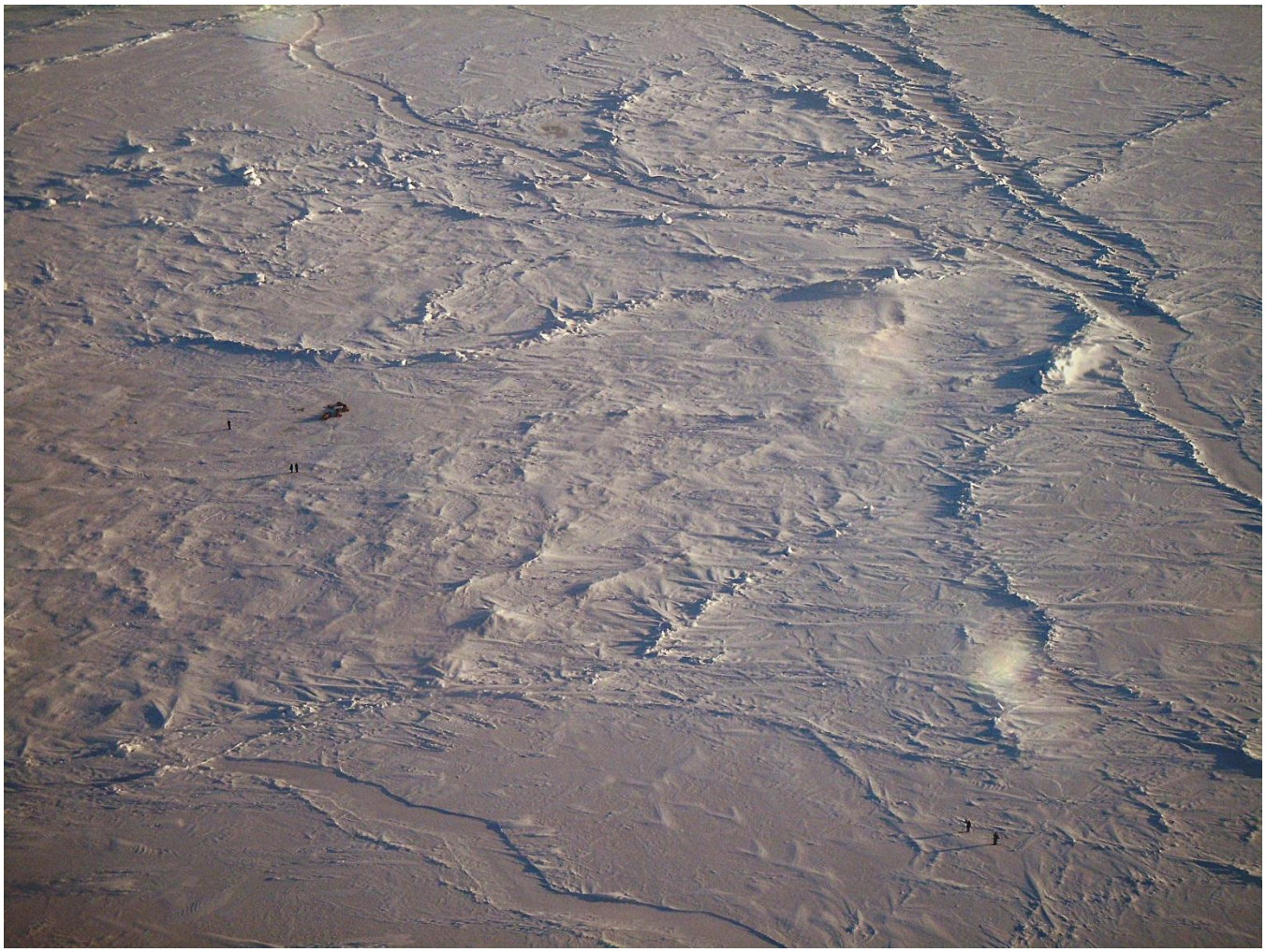

Figure 3: Scientists on the ICEX survey line. Photo: M. Studinger