Farewell to IceBridge: 10 years of polar sea ice remote sensing

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NASA’s Operation IceBridge (OIB) was a multi-year, multi-platform, airborne mission which took place between 2009-2019. OIB was designed and implemented to continue monitoring the changing sea ice and ice sheets in both the Arctic and Antarctic by ‘bridging the gap’ between NASA's ICESat (2003–2009) and ICESat-2 (launched September 2018) satellite missions. OIB's instrument suite most often consisted of laser altimeters, radar sounders, gravimeters and multispectral imagers. These instruments were selected to study polar sea ice thickness, ice sheet elevation, snow and ice thickness, surface temperature and bathymetry. With the launch of ICESat-2, the final year of OIB consisted of three campaigns designed to under fly the satellite: 1) the end of the Arctic growth season (spring), 2) during the Arctic summer to capture many different types of melting surfaces, and 3) the Antarctic spring to cover an entirely new area of East Antarctica. Over this ten-year period a coherent picture of Arctic and Antarctic sea ice and snow thickness and other properties have been produced and monitored. Specifically, OIB has changed the community’s perspective of snow on sea ice in the Arctic. Over the decade, OIB has also been used to validate other satellite altimeter missions like ESA’s CryoSat-2. Since the launch of ICESat-2, coincident OIB under flights with the satellite were crucial for measuring sea ice properties. With sea ice constantly in motion, and the differences in OIB aircraft and ICESat-2 ground speed, there can substantial drift in the sea ice pack over the same ground track distance being measured. Therefore, we had to design and implement sea ice drift trajectories based on low level winds measured from the aircraft in flight, adjusting our plane's path accordingly so we could measure the same sea ice as ICESat-2. This was implemented in both the Antarctic 2018 and Arctic 2019 campaigns successfully. Specifically, the Spring Arctic 2019 campaign allowed for validation of ICESat-2 freeboards with OIB ATM freeboards proving invaluable to the success of ICESat-2 and the future of sea ice research to come from these missions.