Airborne measurements for the validation of satellite sea ice products

Christian Haas et al., University of Alberta
- Ice extent has declined at a rate of 11.2 percent per decade during September
- Thickness changes largely unknown

Ice-albedo-feedback; Polar amplification; Ocean circulation; Ice as platform
• Shipping and offshore operations in ice
• North-West Passage, Beaufort Sea

November 2007, Antarctic Peninsula
• Exploration activities rely on sea ice information, in particular ice thickness, to increase safety and reduce environmental impact
Electromagnetic (EM) thickness sounding
PAM-ARCMIP
Pan-Arctic measurements for Arctic Climate Model Validation

- Polar 5: DC-3 / Basler 67 aircraft of AWI
Pan-Arctic ice thickness snapshot
April 2009

Haas et al., GRL 2010
Launch on April 8, 2010, 15:57 CEST

CryoSat goals

Observe changes of the thickness of the Arctic Sea ice cover and Antarctica’s and Greenland’s ice sheets.

http://news.bbc.co.uk/2/hi/science/nat...
CryoSat Cal/Val

- Adressing major satellite retrieval uncertainties
- Coincident aircraft, helicopter and ground surveys
Airborne Synthetic–Aperture Interferometric Radar System (ASIRAS)

- snow penetration uncertainty

Snow thickness = $H_{\text{radar}} - H_{\text{laser}}$
CryoSat Cal/Val organizational structure

ESA (coordination & funding)

Industry

ASIRAS Radar

Aircraft

Radar processing and evaluation

In-situ validation

Research partners
SAR

- Envisat, TerraSAR-X, ALOS
- Validation of SAR signatures by means of EM and laser profiling
CoReH2O
Cold Regions High-Resolution Hydrology Observatory

- Snow as an essential part of the sea ice mass balance
- Snow as important water resource in western Canada
- Collaboration with Env. Canada microwave radiometers & U. Waterloo Scat.

Validation with TerraSAR-X & in-situ on Miquelon Lake, Alberta
SMOS
Soil Moisture and Ocean Salinity Mission

• Coincident airborne L-band radiometer & EM thickness
Basler BT67 (DC-3): the optimum research platform

• Large payload
• Long endurance; Safe operations
• Many aircraft modifications for science instruments
• Canadian aircraft; already routinely used by NSF in the Arctic and Antarctic
• Most experienced aircraft operator; ready to fly for Canada! 🇨🇦

McMurdo Ice Shelf, Antarctica, Nov. 2009
DC3-Basler can land on unprepared sea ice to support in-situ ice & ocean measurements

March 26, 2010, 89°23’N, 76°08’W
Courtesy underthepole.com / Kenn Borek
Future scenario in Canada

CSA (Earth Observation)

Provision of air time

Basler BT67 (DC-3)

Instrumentation

Satellite missions

Validation

Research partners