Estimation of Dynamic Mass Loss Rates using Unmanned Aircraft

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Aircraft used

CryoWing Mk 1 (2007-)
MTOW: 35 kg
Wingspan: 3.8 m
Range: 400 km
Telemetry: 3G/GSM Iridium, UHF
Payload Capacity: 10 kg
Fuel Capacity: 4.5 kg petrol

CryoWing Micro (2012/2015)
MTOW: 2-9 kg
Wingspan: 1.2-2.7 m
Range: 20-150 km
Telemetry: UHF, C-band
Payload Capacity: 0.8-3 kg
Fuel: Li-Pol Battery
Instrumentation Used

- Cryowing Micro X8 (flight-time 20 minutes)
  - Canon EOS M Digital camera using Magic Lantern Firmware
  - Canon GP-E2 GPS and compass module

- Cryowing Scout (flight-time 90 minutes):
  - Canon EOS M Digital camera using Magic Lantern Firmware
  - Canon GP-E2 GPS and compass module
  - Used Radio Relay from boat.
Study Area

- Kronebreen and Kongsvegen Glaciers

• Canon EOS M Digital camera using Magic Lantern Firmware
• Canon GP-E2 GPS and compass module
• Used Radio Relay from boat.
From NPI map server, Flight Planning SfM
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Data Processing

Norut Cryocore Software
Controls sensors and collects and saves data and meta in local database on aircraft. Transfers data to GCS database as bandwidth allows in near real time or on request.

Norut Cryowing Processor
Extracts data from database and prepares attitude and position information for inclusion in image exif headers. Creates a report on the data from the flight. The processor prepares image files and script as well as selection of area to process.

Agisoft Photoscan
Produces Orthophoto mosaic and DEM using input from the processor, allows user to add GCPs, and filter and remove images, based on attitude position etc.
Data Processing Limitations

No GCPs where used

Correction for dynamic movement during collection not done (about 10 cm over the flight time)

Ocean surface not well treated

Tides not taken into account
Mosaics

April 23, 25, 28 and May 1
Data Collection and Processing Improvements

GCPs, could still be avoided, but better photo meta data synchronization needed.

Use of structures on both sides of glacier as GCPs (tie points) would improve dataset consistency.

Correction for dynamic movement during collection not done (about 10 cm over the flight time, with 13 cm ground resolution it can be ignored).

Ocean surface not well treated, need ground topography to estimate mass loss.
ASUF

- New test facility at Ny-Ålesund
- Excellent conditions; cold, windy, icebergs and severe icing conditions
Regulatory Challenges