Operation IceBridge

NASA Earth Science Division

Universidad de Magallanes en Punta Arenas
3 November 2011
Ice loss from GRACE Satellite

Antarctic Ice Sheet Mass Evolution

Peninsula

Pine Island/Thwaites Glacier

Credit: Scott Luthcke, NASA/GSFC
Airborne Science Platforms

NSF/NCAR Gulfstream-V
High Altitude Research Aircraft

• ATM laser altimeter (NASA/GSFC/WFF)
• MCoRDS radar sounder (CReSIS/KU)
• Snow radar (CReSIS/KU)
• Ku-band radar altimeter (CReSIS/KU)
• Digital Mapping System (NASA/Ames)
• Gravimeter (Sander Geophysics/CU)

survey altitude: 1500 ft (500 m) above ground

G-V Science Instruments

• LVIS laser altimeter (NASA/Goddard)

survey altitude: 40000 ft above ground

DC-8 Science Instruments

NASA DC-8 Flying Laboratory

NASA DC-8 Flying Laboratory
current scan swath

previous year's scan swath
NASA DC-8 Cockpit during Weddell Sea Mission

Photo: M. Studinger
Airborne Topographic Mapper (laser altimeter)
Ice Penetrating Radars contained in fairing below hull (snow-depth radar antennas in wing roots)
IceBridge Measurements:

sea ice thickness determined from laser altimeter and snow radar measurements

Validation of satellite Measurements:

Oct 13, 2011: sea ice mission over Weddell Sea with ESA’s CryoSat-2 underflight
Sea Ice Conditions along
Weddell Sea CryoSat Profile

Photo: M. Studinger
ATM Airborne Laser Altimeter
Scan of Sea Ice

Freeboard measurement of sea ice for ice thickness estimation

Credit: ATM team
October 18, 2010 – Weddell Sea
Pine Island Glacier:
• one of the largest and fastest-moving glaciers in Antarctica
• rapid thinning
• drains about 10 percent of the West Antarctica ice sheet
• bedrock below sea level

Monitoring of Pine Island Glacier:
IceBridge Flights
2009: DC-8
2010: DC-8
2011: DC-8 and G-V
Monitoring Ice Loss of Pine Island Glacier
IceBridge observed new crack on the DC-8's Oct. 14 flight.

- last big calving event occurred in 2001
- part of natural cycle
- cyclical events that are occurring every few years, very similar in size
- cyclical events are not part of ice-shelf disintegration caused by climate change.
IceBridge discovers new rift in Pine Island Glacier

new rift formed between late September/early October: currently 80 meters wide on average widening 2 meters/day
Size of future iceberg: 880 km² or 310 square miles

Credit: Ian Howat
IceBridge discovers new rift in Pine Island Glacier

Credit: DMS team/NASA

IceBridge Digital Mapping System image from flight over the rift on October 26th, 2011. Credit: DMS team
IceBridge ATM laser scan of the rift from October 26th, 2011. Credit: ATM Team

New rift formed between late September/early October: currently 80 meters wide on average widening 2 meters/day. Size of future iceberg: 880 km$^2$ or 310 square miles. Credit: Ian Howat
Operation IceBridge:
http://www.nasa.gov/icebridge

All IceBridge data is freely available at National Snow and Ice Data Center (NSIDC)
http://nsidc.org/data/icebridge/
Backup Slides
Antarctic Survey Areas