

Jeremy N. Bassis

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Education

Ph.D	Geophysics (Earth Sciences), Scripps Institution of Oceanography, University of California, San Diego <i>Advisors: J.B. Minster and H.A. Fricker</i>	2000-2007
B.S., with distinction	Major <i>Physics</i> with a Minor in <i>Mathematics</i> , Pennsylvania State University, University Park, PA	1996-2000

Dissertation

Title: Dynamics of Ice Shelf Rift Propagation Inferred from Geodetic and Seismic Monitoring

Dissertation Advisors: Bernard Minster and Helen Fricker

Research Interests

My research focuses on understanding the physical mechanisms by which ice sheets respond to climate change. One of the processes on which I have focused is iceberg calving. Because iceberg calving accounts for up to two thirds of the mass discharged from the cryosphere into the ocean, this has important implications for sea level rise. Moreover, new insight into ice fracture may also provide interesting information about other geophysical processes, such as earthquakes, lithospheric rifting and dyke propagation. In my work, I often combine a variety of field observations (e.g. deploying GPS and seismometers) with remote satellite imagery and theoretical and numerical analysis. My theoretical work has targeted improving the approximations that we use to model the large-scale flow of ice sheets. To this end, I have been experimenting with Hamilton's principle as an alternative starting point for analytic and numerical approximation that conserve mass and momentum.

Appointments

2007-2008	University of Chicago, Department of the Geosciences	Visiting Scholar
2007-2008	Scripps Institution of Oceanography, University of California, San Diego	Postdoctoral Researcher
2000-2007	Scripps Institution of Oceanography, University of California, San Diego	Graduate Researcher
1997-2000	Department of Meteorology, Pennsylvania State University	Undergraduate Researcher

Professional Experience

Postdoc-Researcher, Department of the Geophysical Sciences, University of Chicago, 2008-Now

Advisor: Dr. D.R. MacAyeal

- Developing Lagrangian “particle” based numerical methods that conserve mass exactly and allow accurate tracking of grounding line migration.
- Developed new approximations to the equations of ice sheet flow that include both vertical shear and longitudinal stretching using Hamilton’s principle.
- Developed numerical models that incorporate empirical parameterizations of iceberg calving

Postdoc-Researcher, Scripps Institution of Oceanography, UC San Diego, 2007-2008

Advisor: Dr. H.A. Fricker

- Developing theoretical models of the rapid retreat of glaciers by iceberg calving
- Developing statistical models of ice shelf rift propagation
- Processing and analyzing ICESat laser altimetry over ice shelves to identify ice shelf grounding zones
- Analyzing satellite images over ice shelves to measure ice shelf rift propagation rates and identifying areas with surface melt-water

Graduate Researcher, Scripps Institution of Oceanography, UC San Diego, 2000-2007

Advisors: Dr. J.B. Minster

Dr. H.A. Fricker

Dissertation title: Dynamics of Ice Shelf Rift Propagation Inferred from Geodetic and Seismic Monitoring

- Conducted the first *in situ* measurement campaign of ice shelf rift propagation using GPS and seismometers
- Developed computer code and algorithms for “icequake” event detection and location

- Determined that ice shelf rift propagation on the Amery Ice Shelf occurs episodically in rapid bursts accompanied by swarms of seismicity
- Demonstrated that rift propagation is not controlled by either tides or winds
- Developed an empirical stability criterion for calving glaciers that predicts when glacier retreat (by iceberg calving) will occur

Undergraduate researcher, Department of Meteorology, Pennsylvania State University 1997-2000

Advisor: Dr. W. Brune

- Participated in two three month field campaigns in Michigan and in Nashville measuring the concentration of the hydroxyl radicals in the atmosphere
- Developed software to analyze data collected in the field

Teaching Experience

Guest Lecturer	Ice Age Earth	University of Chicago	2007
Teaching Assistant	Natural Disasters	University of California, San Diego	2004
Teaching Assistant	Natural Disasters	University of California, San Diego	2003
Teaching Assistant	Introduction to Geophysics	University of California, San Diego	2000

Field Experience

Australian National Antarctic Research Expedition	Deployed GPS and seismometers for three months on the Amery Ice Shelf, East Antarctica	2002-2003
Salt Lake Utah GPS survey	Performed kinematic survey of the Utah Salt Flat using GPS for ICESat calibration	2001
PROPHET field campaign for Atmospheric chemistry, Pellston, Michigan	Participated in field campaign to measure OH and HO ₂ in a rural environment	2000
SOS Atmospheric chemistry, Nashville, Tennessee	Participated in field campaign to measure OH and HO ₂ in an urban environment	1999

Academic Service and Activities

Dissertation examination committee for Kelly Brunt (thesis advisor: Douglas MacAyeal, University of Chicago), 2008

Member of the Community Ice Sheet Model (CISM) IPCC assessment committee

Contributing author for the Scientific Committee on Ice Sheet Research (SCAR) Ice Shelf Modeling Report
Member of the West Antarctic Ice Sheet (WAIS) education and outreach committee (2007-2008)
Served on the NASA ROSES cryospheric review panel, 2008
Contributing author for special International Polar Year (IPY) issue of *Physics Education* (2008)
Chair of faculty evaluation committee, (2002)
Served on faculty evaluation committee, (2001)

Professional Societies and Awards

Outstanding Student Paper Award, Fall AGU, (2005)
California Space Grant Consortium Climate Change Scholarship (2004)
John and Elizabeth Holmes Teas Scholarship (1998-2000)
John, Annie, John Seme II Memorial Scholarship (1996)
AGU Member (2000-Present)

Current Funded Proposals

An Investigation into the Initiation and Propagation of Ice Shelf Rifts	NASA
An investigation into the fingerprint of seismicity associated with iceberg calving and ice shelf rifting	NSF

Publications

Bassis, J.N. and J.V. Johnson, *in preparation*, A smoothed particle approximation for ice sheet modeling: Mass and momentum conservation, *Journal of Geophysical Research-Earth Surfaces*.

Bassis, J.N. and D.R. MacAyeal, *in preparation*, Hamilton's Principle Applied to Ice Sheet Dynamics: New approximations for the large-scale flow of ice sheets, *Journal of Glaciology*.

Bassis, J.N., H.A. Fricker, J.B. Minster, *submitted*, A Dynamic Stability Criterion for Calving Glaciers, *Geophysical Research Letters*

Alley, I. Joughin, H.J. Horgan, T.K. Dupont, B.R. Parizek, S. Anandakrishan, K.M. Cuffey, **J.N. Bassis**, *accepted*, A first law for ice-shelf calving, *Science*

D.R. MacAyeal, E.A. Okal, R. Aster and **J.N. Bassis**, *in revision*, Seismic Observations of Glaciogenic Ocean Waves (Micro-Tsunamis) on Icebergs and Ice Shelves, *Journal of Glaciology*

Bassis, J.N., The Physics of Ice Sheets, (2008), in special International Polar Year edition of *Physics Education*, 43(4).

MacAyeal, D.R., E. Okal, R. Aster, **J.N. Bassis**, (2008), Seismic and Hydro-Acoustic Tremor Generated by Colliding Icebergs, *Journal of Geophysical Research*, 113, doi:10.1029/2008JF001005

Bassis, J.N., H.A. Fricker, R. Coleman, Y. Bock, J. Behrens, D. Darnell, M. Okal, J.B. Minster, (2008), An Investigation Into the Forces that Drive Ice Shelf Rift Propagation, *Journal of Glaciology*. 184(54), 17-27. **Chosen to be highlighted**

Bassis, J.N., H.A. Fricker, J.B. (2007), Seismicity and Deformation Associated with Ice Shelf Rift Propagation, *Journal of Glaciology*, 183(53), 523-536. **Chosen to be highlighted**

Jansen, V., Coleman, R., **J.N. Bassis**, *in press*, GPS-derived Strain Rates on an Active Ice Shelf Rift, *Survey Review*

MacAyeal, D., E. Okal, **J.N. Bassis**, et al., (2006), Transoceanic wave propagation links iceberg calving margins of Antarctica with storms in Tropics and Northern Hemisphere, *Geophysical Research Letters* 33, doi:10.1029/2006GL027235

Fricker, H.A., N. W. Young, R. Coleman, **J. N. Bassis**, J.B. Minster (2005), Multi-year monitoring of rift propagation on the Amery Ice Shelf, East Antarctica, *Geophysical Research Letters*., 32, L02502, doi: 10.1029/2004GL021036.

Bassis, J. N., R. Coleman, H. A. Fricker, J. B. Minster (2005), Episodic propagation of a rift on the Amery Ice Shelf, East Antarctica, *Geophysical Research Letters*, 32, L06502, doi: 10.1029/2004GL022048.

Fricker H. A., **J.N. Bassis**, J.B. Minster, D. R. MacAyeal (2005), ICESat's new perspective on ice shelf rifts: The vertical dimension, *Geophysical Research Letters*, 32, L23S08, doi:10.1029/2005GL025070.

Martinez, M., H. Harder, T.A. Kovacs, J.B. Simpas, **J.N. Bassis**, et al., (2003) OH and HO₂ concentrations, sources, and loss rates during the Southern Oxidants Study in Nashville, Tennessee, summer 1999, *Journal of Geophysical Research*, 108 (D19), 4617, doi:10.1029/2003JD003551.

Selected Abstracts - Invited Talks

Bassis, J.N., *Iceberg calving, ice shelf rifting and iceberg jazz: What can seismology tell us about iceberg calving*, University of Texas, El Paso, 2008

Bassis, J.N., *Dynamics of Iceberg Calving and Ice Shelf Rifting Inferred from Geodetic and Seismic Monitoring*, University of Chicago, 2007

Bassis, J.N., *New Insight into Iceberg Calving and Tidewater Glacier Retreat: A Unified Approach*, Northwestern University, 2007

Bassis, J.N., H.A. Fricker, J.B. Minster, *A Dynamic Stability Criterion for Ice Shelves and Tidewater Glaciers*, presented at Fall AGU meeting, San Francisco, 2006

Selected Abstracts - Oral Presentations

Bassis, J.N., H.A. Fricker (2007), *Can we model iceberg calving with an empirical calving law?*, presented at WAIS Workshop, Algonkian Regional Park, VA.

Bassis, J.N., H.A. Fricker, R. Coleman, J.B. Minster (2006), *New Insight Into Mechanisms of Ice Shelf Rifting Inferred from Seismic and Geodetic Analysis*, presented at Fall AGU meeting, San Francisco

Bassis, J.N., H.A. Fricker, R. Coleman, J.B. Minster (2005), *New Insight into Ice Shelf Rift Propagation from Geodetic and Seismic Monitoring*, EOS. Trans. AGU, 86(52), Fall Meet. Suppl.

Bassis, J.N., H.A. Fricker, J.B. Minster (2005), *Interaction of the Great Sumatra Earthquake with an Antarctic Ice Shelf Rift: Preliminary Results from GPS and Seismic Observations of a Rift on the Amery Ice Shelf 2004-2005*, 12th Annual WAIS Workshop, Algonkian Regional Park, VA.

Bassis, J.N., H.A. Fricker, J.B. Minster (2004), *The Role of Plastic Necking in Ice Shelf Rifting: A Comparison with Lithospheric Rifts*, EOS. Trans. AGU, 85(47), Fall Meet. Suppl.

Bassis, J.N., H.A. Fricker, R. Coleman, J.B. Minster (2003), *An Investigation Into the Causes and Limiting Factors of Propagation of an Active Rift on the Amery Ice Shelf: Fieldwork and Modeling Results*, EOS. Trans. AGU, 84(46). Fall Meet. Suppl.

Bassis, J.N., H.A. Fricker, R. Coleman, J.B. Minster (2003), *Tooth Fairies Visit the Loose Tooth: Results from Fieldwork on the Amery Ice Shelf, East Antarctica*, 10th Annual WAIS Workshop, Algonkian Regional Park, VA.

Bassis, J.N., R. Coleman, H.A. Fricker, N. Young, J.B. Minster (2003) *Dynamics of a propagating rift on the Amery Ice Shelf, East Antarctica*, *Seventh International Symposium on Antarctic Glaciology*, ISAG-7, Milano, Italy

Selected Abstracts - Posters

J.N. Bassis and H.A. Fricker, (2007), *The Iceberg Calving Problem: Can we Model Iceberg Calving with an Empirical Calving Law?*, Presented at Fall AGU meeting, San Francisco, 2007

J. Behrens, **J.N. Bassis**, H.A. Fricker, R. Coleman, D. Darnell, (2007), *Radar, electromagnetic and active seismic investigation of a propagating ice shelf rift tip.*, Presented at Fall AGU meeting, San Francisco, 2007

MacAyeal, D.R., M.A. King, **J.N. Bassis**, K.M. Brunt, (2007), *All Quiet on the Seaward Front?*, Presented at Fall AGU meeting, San Francisco, 2007

Cathles, L.M., R.C. Aster, E.A. Okal, **J.N. Bassis**, D.R. MacAyeal, (2007), *Comparison and Calibration of Sea-Swell with Microseism Observations on Ice-Shelf and Land Based Seismometer Stations.*, Presented at Fall AGU meeting, San Francisco, 2007

Bassis, J.N., H.A. Fricker, J.B. Minster, R. Coleman, J. Behrens (2006) , *New Insight Into Mechanisms of Ice Shelf Rifting Inferred from Seismic and Geodetic Analysis*, Fall AGU meeting, San Francisco

Bassis, J.N., H.A. Fricker, J.B. Minster (2004), *Are Rifts Brittle Fractures?*, 11th Annual WAIS Workshop, Algonkian Regional Park, VA.

Bassis, J.N., A. Borsa, J.B. Minster (2001), *Estimating Surface Slope and Roughness over the Greenland Ice Sheet Through Deconvolution of Laser Altimeter Waveforms*, EOS. Trans. AGU, 82(47). Fall Meet. Suppl.