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Mathieu Morlighem

Evans Family Professor, Dartmouth College

Education

2008-2011 **Ph.D. in Mechanical Engineering**, *École Centrale Paris*, Châtenay-Malabry, France,
Thesis Title: Ice sheet properties inferred by combining numerical modeling and remote sensing data.

2005-2008 **Master's Degree in Engineering**, *École Centrale Paris*, Châtenay-Malabry, France,
A 3-year top level engineering school in France, Major in Mechanical and Aerospace Engineering (Specialization: Computational Mechanics and Design) with first class honors.

2007-2008 **Research Master's Degree in Structural Dynamics and Coupled Systems**, *École Centrale Paris*, France,
Double degree program with honors.

2005-2006 **Bachelor of Science in fundamental physics**, *University of Paris*, Orsay, France,
Double degree program at the University of Paris in partnership with École Centrale with honors.

2003-2005 **Classes préparatoires (preparatory classes)**, *lycée Sainte Geneviève*, Versailles, France,
Intensive two-year preparation for entrance examinations to the Grandes Ecoles (top French higher education institution).

Professional Experiences

2021 - present **Dartmouth College**, *Hanover NH, United States*,
Evans Family Distinguished Professor of Earth Sciences.

2020 - present **Victoria University of Wellington**, *Wellington, New Zealand*,
Honorary Research Associate.

2018 - 2021 **University of California Irvine**, *Irvine CA, United States*,
Associate Professor in the department of Earth System Science.

2014 - 2018 **University of California Irvine**, *Irvine CA, United States*,
Assistant Professor in the department of Earth System Science.

2011 - 2014 **University of California Irvine**, *Irvine CA, United States*,
Project Scientist in the department of Earth System Science.

2008 - 2011 **NASA Jet Propulsion Laboratory**, *Pasadena CA, United States*,
Research Affiliate, Development of the Ice Sheet System Model, a massively parallel finite element ice sheet model.

Research Interests

- Polar climate change
- Ice sheet contribution to sea level rise
- Ice-ocean interactions
- Ice sheet numerical modeling
- Data assimilation and inverse modeling in geosciences
- Finite element method and high-performance computing

Honors and Awards

May 2020 **UCI Physical Sciences**, *Outstanding Contributions to Undergraduate Education Award*.

January 2020 **Guinness World Records**, *Discovery of the deepest point on land underneath Denman Glacier, East Antarctica*.

October 2019 **NASA Honor Award**, *Group achievement award (Ice Sheet System Model Team)*, for achievements in the modeling and projection of the evolution of polar ice sheets and corresponding sea-level change.

April 2018 **European Geosciences Union Award: Arne Richter Award for Outstanding Early Career Scientists**, for his outstanding research in the field of ice-sheet modelling and his contribution to the dissemination of modelling methods and knowledge in the cryospheric community.

April 2015 **International Association of Cryospheric Sciences (IACS) 2015 Early Career Scientist Prize**.

January 2015 **NASA Cryospheric Sciences Most Valuable Player for 2014**, for outstanding work improving our knowledge of the Greenland ice sheet and underlying bed.

July 2011 **NASA Honor Award**, *Group achievement award (Ice Sheet System Model Team)*, for outstanding accomplishment in the development of the Ice Sheet System Model that models and simulates ice sheet systems flowing and melting in our warming environment.

Peer-reviewed Publications

* denotes advised graduate students and postdocs

145. Gong Cheng*, **Mathieu Morlighem**, Jérémie Mouginot, and Daniel Cheng*. Helheim Glacier's Terminus Position Controls Its Seasonal and Inter-Annual Ice Flow Variability. *Geophys. Res. Lett.*, 49(5):e2021GL097085, 2022. [link]

144. Henning Åkesson*, **Mathieu Morlighem**, Johan Nilsson, Christand Stranne, and Martin Jakobsson. Petermann Ice Shelf may not recover after a future breakup. *Nat. Comm.*, 2022, accepted.

143. Y. Fischler, M. Rückamp, C. Bischof, V. Aizinger, **M. Morlighem**, and A. Humbert. A Scalability Study of the Ice-sheet and Sea-level System Model (ISSM, Version 4.18). *Geosci. Model Dev.*, 2022, accepted. [link]

142. D. Felikson, S. Nowicki, I. Nias, **M. Morlighem**, and H. Seroussi. Seasonal tidewater glacier terminus oscillations bias multi-decadal projections of ice mass change. *J Geophys. Res.*, 127(2):e2021JF006249, 2022. [link]

141. T. Frank, H. Åkesson*, B. de Fleurian, **M. Morlighem**, and K. H. Nisancioglu. Geometric controls of tidewater glacier dynamics. *Cryosphere*, 16(2):581–601, 2022. [link]

140. Romain Millan, Jérémie Mouginot, Antoine Rabatel, and **Mathieu Morlighem**. Ice velocity and thickness of the world's glaciers. *Nat. Geosci.*, Feb 2022. [link]

139. T. D. dos Santos*, **M. Morlighem**, and D. Brinkerhoff. A new vertically integrated, MOno-Layer Higher-Order ice flow model (MOLHO). *Cryosphere*, 16(1):179–195, 2022. [link]

138. **Mathieu Morlighem**, Daniel Goldberg, Thiago Dias dos Santos*, Jane Lee, and Max Sagebaum. Mapping the Sensitivity of the Amundsen Sea Embayment to Changes in External Forcings Using Automatic Differentiation. *Geophys. Res. Lett.*, 48(23):e2021GL095440, 2021. [link]

137. Julia Christmann, Veit Helm, Shfaqat Abbas Khan, Thomas Kleiner, Ralf Müller, **Mathieu Morlighem**, Niklas Neckel, Martin Rückamp, Daniel Steinhage, Ole Zeising, and Angelika Humbert. Elastic deformation plays a non-negligible role in Greenland's outlet glacier flow. *Nature Commun. Earth Environ.*, 2(1):232, Nov 2021. [link]

136. Thiago Dias dos Santos*, Jowan M. Barnes, Daniel N. Goldberg, G. Hilmar Gudmundsson, and **Mathieu Morlighem**. Drivers of Change of Thwaites Glacier, West Antarctica, Between 1995 and 2015. *Geophys. Res. Lett.*, 48(20), 2021. [link]

135. M. O'Regan, T. M. Cronin, B. Reilly, A. K. O. Alstrup, L. Gemery, A. Golub, L. A. Mayer, **M. Morlighem**, M. Moros, O. L. Munk, J. Nilsson, C. Pearce, H. Detlef, C. Stranne, F. Vermassen, G. West, and M. Jakobsson. The holocene dynamics of ryder glacier and ice tongue in north greenland. *Cryosphere*, 15(8):4073–4097, 2021. [link]

134. T. Pelle*, **M. Morlighem**, Y. Nakayama, and H. Seroussi. Widespread Grounding Line Retreat of Totten Glacier, East Antarctica, Over the 21st Century. *Geophys. Res. Lett.*, 48(17), 2021. [link]

133. Henning Åkesson*, **Mathieu Morlighem**, Matt O'Regan, and Martin Jakobsson. Future Projections of Petermann Glacier Under Ocean Warming Depend Strongly on Friction Law. *J. Geophys. Res. - Earth Surface*, 126(6):e2020JF005921, 2021. [link]

132. Felicity S. McCormack, Jason Roberts, D. Gwyther, **Mathieu Morlighem**, Tyler Pelle*, and Benjamin Galton-Fenzi. The Impact of Variable Ocean Temperatures on Totten Glacier Stability and Discharge. *Geophys. Res. Lett.*, 48(10), 2021. [link]

131. T. D. dos Santos*, **M. Morlighem**, and H. Seroussi. Assessment of numerical schemes for transient, finite-element ice flow models using ISSM v4.18. *Geosci. Model Dev.*, 14(5):2545–2573, 2021. [link]

130. J. M. Barnes, T. D. dos Santos*, D. Goldberg, G. H. Gudmundsson, **M. Morlighem**, and J. De Rydt. The transferability of adjoint inversion products between different ice flow models. *Cryosphere*, 15(4):1975–2000, 2021. [link]

129. T. Payne, S. Nowicki, A. Abe-Ouchi, C. Agosta, P. Alexander, T. Albrecht, X. S. Asay-Davis, A. Barthel, R. Calov, C. Chambers, Y. Choi*, R. Cullather, J. Cuzzone*, C. Dumas, T. Edwards, D. Felikson, X. Fettweis, H. Goelzer, R. Gladstone, N. Golledge, J. Gregory, R. Greve, T. Hatterman, M. Hoffman, A. Humbert, P. Huybrechts, N. C. Jourdain, T. Kleiner, E. Larour, S. Le Clec'h, V. Lee, G. Leguy, W. Lipscomb, C. Little, D. Lowry, **M. Morlighem**, I. Nias, F. Pattyn, T. Pelle*, S. Price, A. Quiquet, R. Reese, M. Rückamp, N. Schlegel, H. Seroussi, A. Shepherd, E. Simon, R. Smith, D. Slater, F. Straneo, et al.. Future sea level change under coupled model intercomparison project phase 5 and phase 6 scenarios from the Greenland and Antarctic ice sheets. *Geophys. Res. Lett.*, 48, 2021. [link]

128. Christine Indrigo, Christine F. Dow, Jamin S. Greenbaum, and **Mathieu Morlighem**. Drygalski Ice Tongue stability influenced by rift formation and ice morphology. *J. Glaciol.*, 67(262):243–252, 2021. [link]

127. Eric Rignot, Lu An, Nolwenn Chauché, **Mathieu Morlighem**, Seongsu Jeong, Michael Wood, Jeremie Mouginot, Josh K. Willis, Ingo Klaucke, Wilhelm Weinrebe, and Andreas Muenchow. Retreat of Humboldt Gletscher, North Greenland, Driven by Undercutting From a Warmer Ocean. *Geophys. Res. Lett.*, 48(6):e2020GL091342, 2021. e2020GL091342 2020GL091342. [link]

126. Youngmin Choi*, **Mathieu Morlighem**, Eric Rignot, and Michael Wood. Ice dynamics will remain a primary driver of Greenland ice sheet mass loss over the next century. *Nature Commun. Earth Environ.*, 2(1):26, Feb 2021. [link]

125. T. Edwards, S. Nowicki, H. Goelzer, H. Seroussi, B. Marzeion, C. E. Smith, N. C. Jourdain, D. Slater, C. McKenna, E. Simon, A. Abe-Ouchi, J. Gregory, R. Hock, E. Larour, W. Lipscomb, A. Payne, A. Shepherd, C. Agosta, P. Alexander, T. Albrecht, B. Anderson, X. Asay-Davis, A. Aschwanden, A. Barthel, R. Calov, C. Chambers, N. Golledge, R. Greve, T. Hatterman, M. Hoffman, A. Humbert, M. Huss, P. Huybrechts, W. Immerzeel, T. Kleiner, P. Kraaijenbrink, S. Le Clec'h, V. Lee, G. Leguy, C. Little, D. Lowry, J.-H. Malles, F. Maussion, **M. Morlighem**, I. Nias, F. Pattyn, T. Pelle*, S. Price, A. Quiquet, V. Radic, et al.. Quantifying uncertainties in the land ice contribution to sea level rise this century. *Nature*, 593, 2021. [link]

124. William Colgan, Joseph A. MacGregor, Kenneth D. Mankoff, Ryan Haagenson, Harihar Rajaram, Yasmina M. Martos, **Mathieu Morlighem**, Mark A. Fahnestock, and Kristian K. Kjeldsen. Topographic Correction of Geothermal Heat Flux in Greenland and Antarctica. *J. Geophys. Res.*, 126(2):e2020JF005598, 2021. [link]

123. Daniel Farinotti, Douglas J. Brinkerhoff, Johannes J. Fürst, Prateek Gantayat, Fabien Gillet-Chaulet, Matthias Huss, Paul W. Leclercq, Hansruedi Maurer, **Mathieu Morlighem**, Ankur Pandit, Antoine Rabatel, RAAJ Ramsankaran, Thomas J. Reerink, Ellen Robo*, Emmanuel Rouges, Erik Tamre, Ward J. J. van Pelt, Mauro A. Werder, Mohod Farooq Azam, Huilin Li, and Liss M. Andreassen. Results from the Ice Thickness Models Intercomparison eXperiment Phase 2 (ITMIX2). *Front. Earth Sci.*, 8:484, 2021. [link]

122. Michael Wood, Eric Rignot, Ian Fenty, Lu An, Anders Bjørk, Michiel van den Broeke, Cilan Cai, Emily Kane, Dimitris Menemenlis, Romain Millan, **Mathieu Morlighem**, Jeremie Mouginot, Brice Noël, Bernd Scheuchl, Isabella Velicogna, Josh K. Willis, and Hong Zhang. Ocean forcing drives glacier retreat in Greenland. *Sci. Adv.*, 7(1), 2021. [link]

121. Denis Felikson, Ginny Catania, Timothy C. Bartholomaus, **Mathieu Morlighem**, and Brice P. Y. Noël. Steep glacier bed knickpoints mitigate inland thinning in Greenland. *Geophys. Res. Lett.*, 48(2):e2020GL090112, 2021. [link]

120. D. N. Goldberg, T. A. Smith, S. H. K. Narayanan, P. Heimbach, and **M. Morlighem**. Bathymetric influences on Antarctic ice-shelf melt rates. *J. Geophys. Res.*, 125(11), 2020. [link]

119. Shfaqat A. Khan, Anders A. Bjørk, Jonathan L. Bamber, **Mathieu Morlighem**, Michael Bevis, Kurt H. Kjær, Jérémie Mouginot, Anja Løkkegaard, David M. Holl and, Andy Aschw anden, Bao Zhang, Veit Helm, Niels J. Korsgaard, William Colgan, Nicolaj K. Larsen, Lin Liu, Karina Hansen, Valentina Barletta, Trine S. Dahl-Jensen, Anne Sofie Søndergaard, Beata M. Csatho, Ingo Sasgen, Jason Box, and Toni Schenk. Centennial response of greenland's three largest outlet glaciers. *Nature Comms.*, 11(1):5718, Nov 2020. [link]

118. X. Cui, H. Jeofry, J. S. Greenbaum, J. Guo, L. Li, L. E. Lindzey, F. A. Habbal, W. Wei, D. A. Young, N. Ross, **M. Morlighem**, L. M. Jong, J. L. Roberts, D. D. Blankenship, S. Bo, and M. J. Siegert. Bed topography of Princess Elizabeth Land in East Antarctica. *Earth Syst. Sci. Data*, 12(4):2765–2774, 2020. [link]

117. E. Larour, S. Adhikari, T. Frederikse, L. Caron, B. Hamlington, N.-J. Schlegel, E. Ivins, R. Kopp, **M. Morlighem**, and S. Nowicki. ISSM-SLPS: geodetically compliant Sea-Level Projection System for the Ice-sheet and Sea-level System Model v4.17. *Geosci. Model Dev.*, 13(10):4925–4941, 2020. [link]

116. M. Rückamp, A. Humbert, T. Kleiner, **M. Morlighem**, and H. Seroussi. Extended enthalpy formulations in the Ice-sheet and Sea-level System Model (ISSM) version 4.17: discontinuous conductivity and anisotropic streamline upwind Petrov–Galerkin (SUPG) method. *Geosci. Model Dev.*, 13(9):4491–4501, 2020. [link]

115. Jason P. Briner, Joshua K. Cuzzone*, Jessica A. Badgeley, Nicolás E. Young, Eric J. Steig, **Mathieu Morlighem**, Nicole-Jeanne Schlegel, Gregory J. Hakim, Joerg M. Schaefer, Jesse V. Johnson, Alia J. Lesnek, Elizabeth K. Thomas, Estelle Allan, Ole Bennike, Allison A. Cluett, Beata Csatho, Anne de Vernal, Jacob Downs, Eric Larour, and Sophie Nowicki. Rate of mass loss from the greenland ice sheet will exceed holocene values this century. *Nature*, 586(7827):70–74, Oct 2020. [link]

114. Sainan Sun, F. Pattyn, E. Simon, T. Albrecht, S. Cornford, R. Calov, C. Dumas, F. Gillet-Chaulet, H. Goelzer, N. R. Golledge, R. Greve, M. Hoffman, A. Humbert, E. Kazmierczak, T. Kleiner, G. R. Leguy, W. M. J. Lazeroms, W. H. Lipscomb, D. Martin, **M. Morlighem**, S. Nowicki, D. Pollard, S. Price, A. Quiquet, H. Seroussi, T. Schlemm, J. Sutter, R. S. W. Van De Wal, and T. Zhang. Antarctic ice sheet response to sudden and sustained ice shelf collapse (ABUMIP). *J. Glaciol.*, pages 1–14, 2020. [link]

113. H. Goelzer, S. Nowicki, A. Payne, E. Larour, H. Seroussi, W. H. Lipscomb, J. Gregory, A. Abe-Ouchi, A. Shepherd, E. Simon, C. Agosta, P. Alexander, A. Aschwanden, A. Barthel, R. Calov, C. Chambers, Y. Choi*, J. Cuzzone*, Dumas C., T. Edwards, D. Felikson, X. Fettweis, N. R. Golledge, R. Greve, A. Humbert, P. Huybrechts, S. Le clec'h, V. Lee, G. Leguy, C. Little, D. P. Lowry, **M. Morlighem**, I. Nias, A. Quiquet, M. Rückamp, D. A. Schlegel, N.-J.and Slater, R. S. Smith, F. Straneo, L. Tarasov, R. van de Wal, and M. van den Broeke. The future sea-level contribution of the Greenland ice sheet: a multi-model ensemble study of ISMIP6. *The Cryosphere*, 2020. [link]

112. H. Seroussi, S. Nowicki, A. J. Payne, H. Goelzer, W. H. Lipscomb, A. Abe-Ouchi, C. Agosta, T. Albrecht, X. Asay-Davis, A. Barthel, R. Calov, R. Cullather, C. Dumas, B. K. Galton-Fenzi, R. Gladstone, N. R. Golledge, J. M. Gregory, R. Greve, T. Hattermann, M. J. Hoffman, A. Humbert, P. Huybrechts, N. C. Jourdain, T. Kleiner, E. Larour, G. R. Leguy, D. P. Lowry, C. M. Little, **M. Morlighem**, F. Pattyn, T. Pelle*, S. F. Price, A. Quiquet, R. Reese, N.-J. Schlegel, A. Shepherd, E. Simon, R. S. Smith, F. Straneo, S. Sun, L. D. Trusel, J. Van Breedam, R. S. W. van de Wal, R. Winkelmann, C. Zhao, T. Zhang, and T. Zwinger. ISMIP6 Antarctica: a multi-model ensemble of the Antarctic ice sheet evolution over the 21st century. *The Cryosphere*, 14:3033–3070, 2020. [link]

111. S. Nowicki, H. Goelzer, H. Seroussi, A. J. Payne, W. H. Lipscomb, A. Abe-Ouchi, C. Agosta, P. Alexander, X. S. Asay-Davis, A. Barthel, T. J. Bracegirdle, R. Cullather, D. Felikson, X. Fettweis, J. M. Gregory, T. Hattermann, N. C. Jourdain, P. Kuipers Munneke, E. Larour, C. M. Little, **M. Morlighem**, I. Nias, A. Shepherd, E. Simon, D. Slater, R. S. Smith, F. Straneo, L. D. Trusel, M. R. van den Broeke, and R. van de Wal. Experimental protocol for sea level projections from ISMIP6 stand-alone ice sheet models. *The Cryosphere*, 14(7):2331–2368, 2020. [link]

110. S. L. Cornford, H. Seroussi, X. S. Asay-Davis, G. H. Gudmundsson, R. Arthern, C. Borstad, J. Christmann, T. Dias dos Santos*, J. Feldmann, D. Goldberg, M. J. Hoffman, A. Humbert, T. Kleiner, G. Leguy, W. H. Lipscomb, N. Merino, G. Durand, **M. Morlighem**, D. Pollard, M. Rückamp, C. R. Williams, and H. Yu. Results of the third Marine Ice Sheet Model Intercomparison Project (MISMIP+). *The Cryosphere*, 14(7):2283–2301, 2020. [link]

109. Romain Millan, Pierre St-Laurent, Eric Rignot, **Mathieu Morlighem**, Jeremie Mouginot, and Bernd Scheuchl. Constraining an Ocean Model Under Getz Ice Shelf, Antarctica, Using A Gravity-Derived Bathymetry. *Geophys. Res. Lett.*, 47(13):e2019GL086522, 2020. [link]

108. Martin Jakobsson, Larry A. Mayer, Caroline Bringensparr, Carlos F. Castro, Rezwan Mohammad, Paul Johnson, Tomer Ketter, Daniela Accettella, David Amblas, Lu An, Jan Erik Arndt, Miquel Canals, José Luis Casamor, Nolwenn Chauché, Bernard Coakley, Seth Danielson, Maurizio Demarte, Mary-Lynn Dickson, Boris Dorschel, Julian A. Dowdeswell, Simon Dreutter, Alice C. Fremand, Dana Gallant, John K. Hall, Laura Hehemann, Hanne Hodnesdal, Jongkuk Hong, Roberta Ivaldi, Emily Kane, Ingo Klaucke, Diana W. Krawczyk, Yngve Kristoffersen, Boele R. Kuipers, Romain Millan, Giuseppe Masetti, **Mathieu Morlighem**, Riko Noormets, Megan M. Prescott, Michele Rebesco, Eric Rignot, Igor Semiletov, Alex J. Tate, Paola Travaglini, Isabella Velicogna, Pauline Weatherall, Wilhelm Weinrebe, Joshua K. Willis, Michael Wood, Yulia Zarayskaya, Tao Zhang, et al.. The international bathymetric chart of the arctic ocean version 4.0. *Nature Sci. Data.*, 7(1):176, Jul 2020. [link]

107. Tyler Pelle*, **Mathieu Morlighem**, and Felicity S. McCormack. Aurora Basin, the Weak Underbelly of East Antarctica. *Geophys. Res. Lett.*, 47(9):e2019GL086821, 2020. [link]

106. V. Brancato, E. Rignot, P. Milillo, **M. Morlighem**, J. Mouginot, L. An, B. Scheuchl, S. Jeong, P. Rizzoli, J. L. Bueso Bello, and P. Prats-Iraola. Grounding line retreat of Denman Glacier, East Antarctica, measured with COSMO-SkyMed radar interferometry data. *Geophys. Res. Lett.*, 47(7):e2019GL086291, 2020. [link]

105. Frank Pattyn and **Mathieu Morlighem**. The uncertain future of the Antarctic Ice Sheet. *Science*, 367(6484):1331–1335, 2020. [link]

104. D. A. Slater, D. Felikson, F. Straneo, H. Goelzer, C. M. Little, **M. Morlighem**, X. Fettweis, and S. Nowicki. Twenty-first century ocean forcing of the Greenland ice sheet for modelling of sea level contribution. *Cryosphere*, 14(3):985–1008, 2020. [link]

103. **Mathieu Morlighem**, Eric Rignot, Tobias Binder, Donald Blankenship, Reinhard Drews, Graeme Eagles, Olaf Eisen, Fausto Ferraccioli, René Forsberg, Peter Fretwell, Vikram Goel, Jamin S. Greenbaum, Hilmar Gudmundsson, Jingxue Guo, Veit Helm, Coen Hofstede, Ian Howat, Angelika Humbert, Wilfried Jokat, Nanna B. Karlsson, Won Sang Lee, Kenichi Matsuoka, Romain Millan, Jeremie Mouginot, John Paden, Frank Pattyn, Jason Roberts, Sebastian Rosier, Antonia Ruppel, Helene Seroussi, Emma C. Smith, Daniel Steinhage, Bo Sun, Michiel R. van den Broeke, Tas D. van Ommen, Melchior van Wessem, and Duncan A. Young. Deep glacial troughs and stabilizing ridges unveiled beneath the margins of the Antarctic ice sheet. *Nat. Geosci.*, 13(2):132–137, 2020. [link]

102. A. Levermann, R. Winkelmann, T. Albrecht, H. Goelzer, N. R. Golledge, R. Greve, P. Huybrechts, J. Jordan, G. Leguy, D. Martin, **M. Morlighem**, F. Pattyn, D. Pollard, A. Quiquet, C. Rodehacke, H. Seroussi, J. Sutter, T. Zhang, J. Van Breedam, R. DeConto, C. Dumas, J. Garbe, G. H. Gudmundsson, M. J. Hoffman, A. Humbert, T. Kleiner, W. Lipscomb, M. Meinshausen, E. Ng, M. Perego, S. F. Price, F. Saito, N.-J. Schlegel, S. Sun, and R. S. W. van de Wal. Projecting Antarctica's contribution to future sea level rise from basal ice-shelf melt using linear response functions of 16 ice sheet models (LARMIP-2). *Earth Syst. Dynam.*, 11(1):35–76, 2020. [link]

101. Hongju Yu, Eric Rignot, Helene Seroussi, **Mathieu Morlighem**, and Youngmin Choi*. Impact of iceberg calving on the retreat of Thwaites Glacier, West Antarctica over the next century with different calving laws and ocean thermal forcing. *Geophys. Res. Lett.*, 46(24):14539–14547, 2019. [link]

100. Lu An, Eric Rignot, Nolwenn Chauche, David Holland, Denise Holland, Martin Jakobsson, Emily Kane, Michael Wood, Ingo Klaucke, **Mathieu Morlighem**, Isabella Velicogna, Wilhelm Weinrebe, and Josh K. Willis. Bathymetry of Southeast Greenland from Ocean Melting Greenland (OMG) data. *Geophys. Res. Lett.*, 46, 2019. [link]

99. H. Seroussi, S. Nowicki, E. Simon, A. Abe-Ouchi, T. Albrecht, J. Brondex, S. Cornford, C. Dumas, F. Gillet-Chaulet, H. Goelzer, N. R. Golledge, J. M. Gregory, R. Greve, M. J. Hoffman, A. Humbert, P. Huybrechts, T. Kleiner, E. Larour, G. Leguy, W. H. Lipscomb, D. Lowry, M. Mengel, **M. Morlighem**, F. Pattyn, A. J. Payne, D. Pollard, S. F. Price, A. Quiquet, T. J. Reerink, R. Reese, C. B. Rodehacke, N.-J. Schlegel, A. Shepherd, S. Sun, J. Sutter, J. Van Breedam, R. S. W. van de Wal, R. Winkelmann, and T. Zhang. initMIP-Antarctica: an ice sheet model initialization experiment of ISMIP6. *Cryosphere*, 13(5):1441–1471, 2019. [link]

98. E. Larour, H. Seroussi, S. Adhikari, E. Ivins, L. Caron, **M. Morlighem**, and N. Schlegel. Slowdown in Antarctic mass loss from solid Earth and sea-level feedbacks. *Science*, 2019. [link]

97. Jérémie Mouginot, Eric Rignot, Anders A. Bjørk, Michiel van den Broeke, Romain Millan, **Mathieu Morlighem**, Brice Noël, Bernd Scheuchl, and Michael Wood. Forty-six years of greenland ice sheet mass balance from 1972 to 2018. *Proc. Natl. Acad. Sci.*, 2019. [link]

96. T. Pelle*, **M. Morlighem**, and J. H. Bondzio*. Brief communication: PICOP, a new ocean melt parameterization under ice shelves combining PICO and a plume model. *Cryosphere*, 13(3):1043–1049, 2019. [link]

95. J. K. Cuzzone*, N.-J. Schlegel, **M. Morlighem**, E. Larour, J. P. Briner, H. Seroussi, and L. Caron. The impact of model resolution on the simulated Holocene retreat of the southwestern Greenland ice sheet using the Ice Sheet System Model (ISSM). *Cryosphere*, 13(3):879–893, 2019. [link]

94. **M. Morlighem**, M. Wood, H. Seroussi, Y. Choi*, and E. Rignot. Modeling the response of northwest Greenland to enhanced ocean thermal forcing and subglacial discharge. *Cryosphere*, 13:723–734, 2019. [link]

93. Eric Rignot, Jérémie Mouginot, Bernd Scheuchl, Michiel van den Broeke, Melchior J. van Wessem, and **Mathieu Morlighem**. Four decades of Antarctic Ice Sheet mass balance from 1979–2017. *Proc. Natl. Acad. Sci.*, 116(4):1095–1103, 2019. [link]

92. T. D. dos Santos*, **M. Morlighem**, H. Seroussi, P. R. B. Devloo, and J. C. Simões. Implementation and performance of adaptive mesh refinement in the Ice Sheet System Model (ISSM v4.14). *Geosci. Model Dev.*, 12(1):215–232, 2019. [link]

91. H. Yu, E. Rignot, H. Seroussi, and **M. Morlighem**. Retreat of Thwaites Glacier, West Antarctica, over the next 100 years using various ice flow models, ice shelf melt scenarios and basal friction laws. *Cryosphere*, 12(12):3861–3876, 2018. [link]

90. J. H. Bondzio*, **M. Morlighem**, H. Seroussi, M. Wood, and J. Mouginot. Control of ocean temperature on Jakobshavn Isbræ's present and future mass loss. *Geophys. Res. Lett.*, 2018. [link]

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10. R. A. Bindschadler, S. Nowicki, A. Abe-Ouchi, A. Aschwanden, H. Choi*, J. Fastook, G. Granzow, R. Greve, G. Gutowski, U. Herzfeld, C. Jackson, J. Johnson, C. Khroulev, A. Levermann, W. H. Lipscomb, M. A. Martin, **M. Morlighem**, B. R. Parizek, D. Pollard, S. F. Price, D. Ren, F. Saito, T. Sato, H. Seddik, H. Seroussi, K. Takahashi, R. Walker, and W. L. Wang. Ice-Sheet Model Sensitivities to Environmental Forcing and Their Use in Projecting Future Sea-Level (The SeaRISE Project). *J. Glaciol.*, 59(214):195–224, 2013. [link]

9. F. Pattyn, L. Perichon, G. Durand, L. Favier, O. Gagliardini, R. C. A. Hindmarsh, T. Zwinger, T. Albrecht, S. Cornford, D. Docquier, J. Fuerst, D. Goldberg, H. Gudmundsson, A. Humbert, M. Hutten, P. Huybrechts, G. Jouvet, T. Kleiner, E. Larour, D. Martin, **M. Morlighem**, A. Payne, D. Pollard, M. Ruckamp, O. Rybak, H. Seroussi, M. Thoma, and N. Wilkens. Grounding-line migration in plan-view marine ice-sheet models: results of the ice2sea MISMIP3d intercomparison. *J. Glaciol.*, 59 (215):410–422, 2013. [link]

8. C. P. Borstad, A. Khazendar, E. Larour, **M. Morlighem**, E. Rignot, M. P. Schodlok, and H. Seroussi. A damage mechanics assessment of the Larsen B ice shelf prior to collapse: Toward a physically-based calving law. *Geophys. Res. Lett.*, 39(L18502):1–5, 2012. [link]

7. E. Larour, **M. Morlighem**, H. Seroussi, J. Schiermeier, and E. Rignot. Ice flow sensitivity to geothermal heat flux of Pine Island Glacier, Antarctica. *J. Geophys. Res. - Earth Surface*, 117(F04023):1–12, NOV 16 2012. [link]

6. E. Larour, J. Schiermeier, E. Rignot, H. Seroussi, **M. Morlighem**, and J. Paden. Sensitivity Analysis of Pine Island Glacier ice flow using ISSM and DAKOTA. *J. Geophys. Res.*, 117, F02009:1–16, 2012. [link]

5. E. Larour, H. Seroussi, **M. Morlighem**, and E. Rignot. Continental scale, high order, high spatial resolution, ice sheet modeling using the Ice Sheet System Model (ISSM). *J. Geophys. Res.*, 117(F01022):1–20, Mar 2012. [link]

4. H. Seroussi, H. Ben Dhia, **M. Morlighem**, E. Rignot, E. Larour, and D. Aubry. Coupling ice flow models of varying order of complexity with the Tiling Method. *J. Glaciol.*, 58 (210):776–786, 2012. [link]

3. **M. Morlighem**, E. Rignot, H. Seroussi, E. Larour, H. Ben Dhia, and D. Aubry. A mass conservation approach for mapping glacier ice thickness. *Geophys. Res. Lett.*, 38(L19503):1–6, 2011. [link]

2. H. Seroussi, **M. Morlighem**, E. Rignot, E. Larour, D. Aubry, H. Ben Dhia, and S. S. Kristensen. Ice flux divergence anomalies on 79north Glacier, Greenland. *Geophys. Res. Lett.*, 38(L09501):1–5, 2011. [link]

1. **M. Morlighem**, E. Rignot, H. Seroussi, E. Larour, H. Ben Dhia, and D. Aubry. Spatial patterns of basal drag inferred using control methods from a full-Stokes and simpler models for Pine Island Glacier, West Antarctica. *Geophys. Res. Lett.*, 37(L14502):1–6, JUL 2010. [link]

Other Publications

3. **Mathieu Morlighem**. The secrets hidden under the antarctic ice sheet. The Science Breaker, 2020. [link]

2. **Mathieu Morlighem**. The landscape under Antarctica revealed. Nature Research Sustainability Community, 2020. [link]

1. E. Larour, N. Schlegel, and **M. Morlighem**. Modeling the Evolution of Polar Ice Sheets. *Eos*, 95(45):411, 2014. [link]

Presentations

Dec. 2021 **American Geophysical Union**, *New Orleans LA, USA*, Investigating the role of Marine Ice Cliff Instability for glacier retreat in the Amundsen Sea Sector over the next century.

Dec. 2021 **Scientific Computing Seminar (invited)**, *Technische Universität Kaiserslautern, Germany*, The challenges of modeling the ice sheets in a changing climate.

Oct. 2021 **TEDx**, *Vienna, Austria*, The secret landscape buried under the Antarctic ice sheet, (invited).

Sep. 2021 **Interagency Arctic Research Policy Committee (IARPC) - Meeting**, *Virtual*, Using mass conservation to inform ice penetrating radar campaigns, (invited).

Feb. 2021 **NASA Goddard Institute for Space Studies, sea level seminar series**, *Remote seminar*, Can we (yet) predict how fast Greenland is going to melt?, (invited seminar).

Jan. 2021 **IceCube Polar Science Workshop**, *Remote conference*, BedMachine: mapping the bed under the Antarctic ice sheet by combining sparse radar data and mass conservation, (invited).

Dec. 2020 **American Geophysical Union**, *Remote conference*, Sensitivity of the Amundsen Sea Embayment to changes in external forcings using Automatic Differentiation.

Nov. 2020 **Denman-Scott: Observations, Modeling, and Future Change**, *Remote conference*, How deep is the bed under Denman Glacier?.

Aug. 2020 **Dartmouth College, Earth Sciences Geolunch Series Seminar**, *Hanover, NH*, Can we (yet) predict how fast the ice sheets are going to melt?, (invited seminar).

Jan. 2020 **Mathematical Modeling in Glaciology Workshop**, *Banff, Canada*, From optimal control to automatic differentiation: challenges in data assimilation in ice sheet modeling, (invited).

Dec. 2019 **American Geophysical Union**, *San Francisco CA, USA*, Deep glacial troughs and stabilizing ridges hidden beneath the ice around the coast of Antarctica.

Jul. 2019 **International Symposia on Antarctic Earth Sciences**, *Incheon, South Korea*, BedMachine Antarctica v1, a new subglacial bed topography and ocean bathymetry dataset of Antarctica, (keynote).

Jul. 2019 **International Union of Geodesy and Geophysics**, *Montreal, Canada*, BedMachine Antarctica v1, a new subglacial bed topography and ocean bathymetry dataset of Antarctica.

Jun. 2019 **University of Grenoble Alpes, Institut des Géosciences de l'Environnement**, *Grenoble, France*, To understand how ice sheets respond to climate change, look at the bed..., (invited seminar).

May 2019 **Land-Ice/Ocean Network Exploration with Semiautonomous Systems (LIONESS) project meeting**, *Incheon, South Korea*, Can basal melting under ice shelves be parameterized?.

Apr. 2019 **California Institute of Technology Environmental Science and Engineering Seminar Series**, *Pasadena, CA*, To understand how ice sheets respond to climate change, look at the bed..., (invited seminar).

Jan. 2019 **Program for Arctic Regional Climate Assessment**, *University of Maryland MD, USA*, Modeling the response of Northwest Greenlandto enhanced ocean thermal forcing and subglacial discharge.

Dec. 2018 **American Geophysical Union**, *Washington DC, USA*, BedMachine Antarctica v1: a new subglacial bed topography and ocean bathymetry dataset of Antarctica combining mass conservation, gravity inversion and streamline diffusion.

Dec. 2018 **American Geophysical Union**, *Washington DC, USA*, Modeling the response of Northwest Greenland to enhanced ocean thermal forcing and subglacial discharge, (invited).

Nov. 2018 **The Future of Earth System Modeling: Polar Climates**, *California Institute of Technology, Pasadena CA*, Modeling the Future of the Ice Sheets: Lessons Learned from the Development of ISSM, (invited).

Oct. 2018 **Korea Polar Research Institute (KOPRI)**, *Incheon, South Korea*, Can we (yet) predict how fast Greenland is going to melt?, (invited seminar).

Jul. 2018 **13th World Congress in Computational Mechanics**, *New-York City, NY*, Implementation of higher-order vertical finite elements in ISSM for improved ice sheet flow modeling over paleoclimate timescales, (invited).

May 2018 **Scripps Institution of Oceanography, UC San Diego**, *La Jolla, CA*, Can we (yet) predict how fast Greenland is going to melt?, (invited seminar).

Apr. 2018 **European Geosciences Union**, *Vienna, Austria*, Modeling the response of Northwest Greenland to enhanced ocean thermal forcing and subglacial discharge, (award lecture).

Dec. 2017 **American Geophysical Union**, *New Orleans LA, USA*, Modeling the response of Northwest Greenland to enhanced ocean thermal forcing and subglacial discharge.

Sept. 2017 **NSF Workshop: How Stable is the Greenland Ice Sheet?**, *Buffalo, NY*, Modeling the response of Northwest Greenland to enhanced ocean thermal forcing and subglacial discharge.

Jun. 2017 **Oceans Melting Greenland science team meeting**, *University of California, Irvine*, BedMachine Greenland v3.

Jun. 2017 **IceBridge Land Ice science team meeting**, *University of California, Irvine*, BedMachine Greenland v3, an update.

Jan. 2017 **Program for Arctic Regional Climate Assessment**, *Goddard Space Flight Center MD, USA*, Modeling ice front Dynamics of Northwest Greenland in response to ocean thermal forcing using ISSM and OIB/OMG data.

Dec. 2016 **American Geophysical Union**, *San Francisco CA, USA*, Modeling ice front Dynamics of Northwest Greenland in response to ocean thermal forcing, using ISSM and OMG data.

Sep 2016 **University of Texas, Institute for Geophysics**, *Austin, TX*, The challenge of modeling the ice sheets in a changing climate, (invited seminar).

May 2016 **Institute for Marine and Antarctic Studies**, *Hobart, Tasmania, Australia*, The challenge of modeling the ice sheets in a changing climate, (invited seminar).

Dec. 2015 **American Geophysical Union**, *San Francisco CA, USA*, Modeling ice front Dynamics of Greenland outlet glaciers using ISSM.

Dec. 2015 **American Geophysical Union**, *San Francisco CA, USA*, Bed topography under Antarctic outlet glaciers revealed by mass conservation and radar data, (invited).

Jun. 2015 **International Union of Geodesy and Geophysics**, *Prague, Czech Republic*, The present and future challengesof modeling ice sheetsin a changing climate, (invited).

Jun. 2015 **International Union of Geodesy and Geophysics**, *Prague, Czech Republic*, Modeling ice front dynamics of Greenland outlet glaciers using the Ice Sheet System Model.

Mar. 2015 **SIAM Conference on Computational Science and Engineering**, *Salt Lake City, USA*, Assessment of Finite Element Schemes for Accurate Modeling of the Grounding Line.

Jan. 2015 **IceBridge Land Ice science meeting**, *Goddard Space Flight Center MD, USA*, OIB BedMachine for Greenland and Antarctica, and update.

Sept. 2014 **Nansen Environmental and Remote Sensing Center Seminar**, *NERSC, Bergen, Norway*, Modeling ice sheets in a changing climate, (invited).

Jun. 2014 **International Glaciological Society - Symposium on Observations, Modelling and Prediction of the Cryospheric Contribution to Sea Level Change**, *Chamonix, France*, Bed topography under the Greenland ice sheet.

Mar. 2014 **Earth System Science Seminar**, *UC Irvine, Irvine, CA, USA*, The challenges of modeling ice sheets in a changing climate, (invited seminar).

Jan. 2014 **IceBridge Land Ice science meeting**, *Goddard Space Flight Center MD, USA*, OIB BedMachine for the Greenland Ice Sheet, (invited).

Dec. 2013 **American Geophysical Union**, *San Francisco CA, USA*, Bed topography under the Greenland outlet glaciers based on mass conservation.

Sep. 2013 **International Glaciological Society - Symposium on Radioglaciology**, *Lawrence KS, USA*, Bed topography under Greenland outlet glaciers revealed by Operation IceBridge data.

Jun. 2013 **SIAM Conference on Mathematical and Computational Issues in the Geosciences**, *Padua, Italy*, Ice Sheet Properties Inferred by Combining Numerical Modeling and Remote Sensing Data.

Mar. 2013 **Dix Seismo Lab Seminar**, *California Institute of Technology, Pasadena CA, USA*, Modeling the Ice Sheets in a changing climate, (invited seminar).

Jan. 2013 **Program for Arctic Regional Climate Assessment**, *Goddard Space Flight Center MD, USA*, Bed topography under Greenland outlet glaciers.

Dec. 2012 **American Geophysical Union**, *San Francisco CA, USA*, Bed topography under Greenland outlet glaciers, revealed by Operation IceBridge data.

Nov. 2012 **ECCO2 meeting**, *Pasadena CA, USA*, Modeling the response of Pine Island Glacier, West Antarctica, to external forcings for the next 50 years.

Mar. 2012 **Radar forum - Jet Propulsion Laboratory**, *Pasadena CA, USA*, Monitoring and Modeling the Ice Sheets in a Changing Climate, (invited seminar).

Feb. 2012 **Community Earth System Model (CESM) - Land Ice Working Group meeting**, *Boulder CO, USA*, The Ice Sheet System Model: an update, (invited).

Dec. 2011 **American Geophysical Union**, *San Francisco CA, USA*, Enhanced inverse method for ice-sheet model calibration technique based on mass conservation, (invited).

Dec. 2011 **American Geophysical Union**, *San Francisco CA, USA*, A mass conservation approach for mapping glacier ice thickness, (invited).

Jul. 2011 **11th US National Congress for Computational Mechanics**, *Minneapolis MN, USA*, Basal drag estimation of Antarctic glaciers using inverse method.

Jan. 2011 **Program for Arctic Regional Climate Assessment**, *Goddard Space Flight Center MD, USA*, Jakobshavn balance thickness.

Dec. 2010 **American Geophysical Union**, *San Francisco CA, USA*, Constructing high-resolution, consistent and seamless ice thicknesses using a new data assimilation technique based on mass conservation.

Dec. 2009 **American Geophysical Union**, *San Francisco CA, USA*, Spatial patterns of basal drag inferred using control methods from three ice flow models for Pine Island Glacier, West Antarctica.

Nov. 2009 **ECCO2 meeting**, *Pasadena CA, USA*, Ice Sheet System Model, (invited seminar).

Dec. 2008 **American Geophysical Union**, *San Francisco CA, USA*, Basal drag evolution of Pine Island Glacier in the wake of its retreat.

Grants

2022-2026 **NSF - Harnessing the Data Revolution**, *HDR Institute: HARP- Harnessing Data and Model Revolution in the Polar Regions*, (Co-I, Dartmouth: $1,000,000 Award #2118285).

2021-2025 **NSF - Cyberinfrastructure for Sustained Scientific Innovation (CSSI)**, *Collaborative Research: Frameworks: Convergence of Bayesian inverse methods and scientific machine learning in Earth system models through universal differentiable programming*, (Co-I, Dartmouth: $462,000 Award #2147601).

2021-2025 **NSF - ARCSS-Arctic System Science**, *Collaborative Research: GRate – Integrating data and modeling to quantify rates of Greenland Ice Sheet change, Holocene to future*, (Co-I, Dartmouth: $175,000 Award #2105960).

2021-2024 **NASA Research Opportunities in Space and Earth Sciences (ROSES) - Studies With ICESat-2**, *BedMachine v4: Using ICESat-2 observations to reduce uncertainty in bed mapping and reassess Greenland's vulnerability to ocean warming*, (PI, $530,000).

2019-2023 **Heising Simons Foundation**, *Eyes at the Front: numerical modeling of Helheim's ice-ocean-atmosphere interactions*, (PI, $403,000).

2018-2023 **NSF-NERC - International Thwaites Glacier Collaboration**, *International Thwaites Glacier Collaboration: PROcesses, drivers, Prediction: modeling the History and Evolution of Thwaites (PROPHET)*, (PI, $1,157,000 Award #1739031).

2015-2019 **NSF - ARCSS-Arctic System Science**, *Collaborative Research: Ice sheet sensitivity in a changing Arctic system - using data and modeling to test the stable Greenland Ice Sheet hypothesis*, (Co-I, $692,000 Award #1504230).

2015-2018 **NASA Jet Propulsion Laboratory**, *Assimilation of Altimetry Data in NE Greenland using ISSM*, (PI, $215,005).

2015-2019 **NSF - Antarctic Glaciology**, *Collaborative Research: Evaluating retreat in the Amundsen Sea Embayment: Assessing controlling processes, uncertainties, and projections*, (Co-I, UCI $117,000 Award #1443229).

2014-2018 **NASA Research Opportunities in Space and Earth Sciences (ROSES) - Cryospheric Science**, *Greenland Bed Mapping using mass conservation, IceBridge and InSAR data*, (PI, $304,000).

2014-2016 **NASA Research Opportunities in Space and Earth Sciences (ROSES) - Sea Level Rise**, *Mass balance and bed topography datasets of ice sheets for sea level studies*, (Co-I, $263,158).

2014-2016 **NASA Operation IceBridge Science Definition Team (ROSES)**, *Coastal land ice dynamics with OIB data*, (co-I, $150,000).

2012-2015 **NASA Research Opportunities in Space and Earth Sciences (ROSES) - IceBridge Research**, *Improved mapping of glacier thickness using IceBridge data combined with radar interferometry data*, (co-I, $330,000).

Teaching

ESS 19 **Introduction to modeling the Earth System**, *General Education*, taught yearly since 2015 (∼80 students enrolled).

ESS 30B **Environmental Issues Affecting the Sustainability of Societies I**, *(co-taught with 3 other instructors)*, Winter 2018.

ESS 30C **Environmental Issues Affecting the Sustainability of Societies II**, *(co-taught with 3 other instructors)*, Spring 2018.

ESS 40C **Earth System Physics**, Spring 2021 (∼70 students enrolled).

ESS 116 **Introduction to Data Analysis in Earth Science**, taught yearly since 2015 (∼60 students enrolled).

ESS 191 **Introduction to Research in Earth System Science**, *Lecture on "Modeling ice sheets in a changing climate"*, Fall 2014, Spring 2017, Spring 2018.

ESS 280 **Cryosphere Topics**, since 2014.

Professional activities

Since 2019 Editor for Geophysical Research Letters

Since 2008 Co-founder, core developer and user support of the Ice-sheet and Sea-level System Model (ISSM)

Since 2011 Co-organizer of the annual Ice-sheet and Sea-level System Model workshop

Since 2012 Development of NASA's BedMachine Greenland, a high-resolution bed topography dataset of the Greenland ice sheet (first public release in 2014)

Since 2018 Development of BedMachine Antarctica, a high-resolution bed topography dataset of the Antarctic ice sheet (first public release in 2019)

Since 2016 Participating in the Ice Sheet Model Intercomparison for CMIP6 (ISMIP6) project to explore the sea level rise contribution from the Greenland and Antarctic ice sheets

Since 2016 Participating in the MISMIP+: 3rd Marine Ice Sheet Model Intercomparison Project to improve our understanding of grounding line dynamics and its representation in numerical models

2010 – 2012 Participating in the SeaRISE experiments, which consists of assessing ice sheet contributions to Sea Level through the 21st Century with numerical models

Since 2008 Member of the American Geophysical Union

Since 2016 Member of the European Geosciences Union

Since 2021 Member of the NASA ICESat-2 Science Team

Since 2021 Full Member of Sigma Xi

Since 2022 Member of AAAS

Journal review Science Magazine, Nature, Nature Geoscience, Geophysical Research Letters, Earth and Planetary Science Letters, Journal of Geophysical Research, Frontiers in Geoscience, Journal of Glaciology, Annals of Glaciology, The Cryosphere, Geoscientific Model Development, and Research in Geophysics

Proposal review NASA Earth and Space Science Fellowship, National Science Foundation, Natural Environment Research Council (UK), Belgian Remote Sensing Research Programme, Icelandic Research Fund

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