

Curriculum Vitae

Lars Nerger

Affiliation

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Education

- 2004 PhD in Applied Mathematics, Alfred Wegener Institute, Bremerhaven, and University of Bremen, Germany
Thesis title: “Parallel Filter Algorithms for Data Assimilation in Oceanography”
Advisors: Prof. Dr. Wolfgang Hiller and Dr. Jens Schröter
- 2000 MSc (“Diplom”) in Physics, Albert Einstein Institute, Golm, and University of Bremen, Germany
Thesis title: “Investigations of 3D Binary Black Hole Systems”
Advisor: Dr. Bernd Brügmann
- 1996-1997 Year abroad at the University of Maryland at College Park, USA. Attending courses in physics.
- 1995 BSc (“Vordiplom”) in Physics, University of Bremen, Germany

Professional experience

- 2014-
present Work package speaker of the research program PACES-II of the Alfred Wegener Institute and the Helmholtz Center Geesthacht (work package 4.1 ‘Operational Analysis and Forecasting’), Germany
- 2008-
present Lead Consultant, Bremen Supercomputing Competence Center BremHLR, University of Bremen, Germany
- 2007-
present Research Scientist, since 5/2012 Senior Research Scientist, Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany
- 2005-2007 Research Associate, NASA Goddard Space Flight Center, Global Modeling and Assimilation Office, Greenbelt, Maryland, USA and University of Maryland Baltimore County, Goddard Earth Sciences and Technology Center, Baltimore, Maryland, USA (Group of Dr. Watson W. Gregg)
- 2004-2005 Postdoc, Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany (Project “Community Ocean Model/Finite Element Ocean model” lead by Dr. Jens Schröter)

2000-2004 Scientist (Ph.D. position), Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany (Groups of Dr. Jens Schröter and Prof. Wolfgang Hiller)

1999-2000 Research for Diploma thesis, Max Planck Institute for Gravitational Physics (Albert Einstein Institute), Potsdam, Germany (Group of Dr. Edward Seidel)

Awards

Editors Citation for Excellence in Refereeing for JGR-Oceans, 2008

Fellowship of the graduate program “Complex Dynamical Systems”, University of Bremen, 2000

Scholarship of the “German Academic Exchange Service” (Deutscher Akademischer Austauschdienst, DAAD) to study Physics at the University of Maryland at College Park, USA, 1996-1997.

Professional Service

Associate Editor, *Monthly Weather Review*, 2017 – present

Guest Associate Editor, *Ocean Dynamics*, 2015 – 2016

Member of NEMO data assimilation group, 2016 – present

Scientific Advisory Committee and Organization Committee of Liège Colloquium on Oceanography 2015, ‘*Marine Environmental Monitoring and Prediction*’, May 4–8, 2015

Local organizer of HLRN/VI-HPS Workshop on tuning of parallel programs on supercomputers, Bremen, Germany, September 9–11, 2009

Reviewer for Biogeochemistry, Computers and Fluids, Computers and Geosciences, Computational Geosciences, Environmental Modelling & Software, Journal of Geophysical Research - Oceans, Tellus-A, Journal of Marine Systems, Monthly Weather Review, Ocean Dynamics, Ocean Modeling, Quarterly Journal of the Royal Meteorological Society

Published Software

PDAF – *Parallel Data Assimilation Framework*, Open-source software for ensemble-based data assimilation, accessible via <http://pdaf.awi.de>

Teaching experience

2011-2018 Lecturer, Parallel programming with MPI and OpenMP, Jacobs University Bremen, 1-week course, annually in January 2011 and 2013 to 2018. With Dr. H. Stüben, University of Hamburg.

2014 Lecturer, Parallel programming with MPI and OpenMP, University of Bremen, 1-week course, March 24 - 28, 2014. With Dr. H. Stüben, University of Hamburg.

Student supervision

Paul Kirchgessner - PhD, 8/2012 – 4/2016

Charlotte Breitzkreuz - MSc, University of Bremen, jointly with A. Bunse-Gerstner, 10/2015 – 2/2016

Andrea Klus - MSc (German “Diplom”), University of Bremen, jointly with A. Bunse-Gerstner, 5/2012 – 1/2013

Svenja Schulte - MSc (German “Diplom”), University of Bremen, jointly with A. Bunse-Gerstner, 7/2011 – 7/2012

Paul Kirchgessner - MSc (German “Diplom”), University of Bremen, jointly with A. Bunse-Gerstner, 7/2011 – 5/2012

Michael Kühl - intern, AWI, 8/2008 – 9/2008

Postdoc supervision

Himansu Pradhan (2016-present), Qi Tang (2017-present), Michael Goodliff (2017-2018), Svetlana Losa (2011-2015)

Research Contracts and Grants

ESM – Advanced Earth System Modeling Capacity, Helmholtz Association, Co-Investigator and task team leader for work package 2, 2017-2020

IPSO – Improving the prediction of photo-physiology in the Southern Ocean by accounting for iron limitation, optical properties and spectral satellite data, AWI Strategy Fund, Co-Principal Investigator, 2016-2019

MeRamo, Supporting the implementation of the EU marine strategy framework directive by an assimilative ecosystem model, BMVI, Co-Principal Investigator, 2016-2018

DeMarine2; sub-project 2: 4D State Variables, BMWi, Co-Principal Investigator, 2012-2015

SANGOMA, Stochastic Assimilation for the next generation ocean model applications, EU FP7, Co-Principal Investigator and leader of work package 2, 2011-2015

Research Grant of German Federal Maritime and Hydrographic Agency (BSH), Extension of data assimilation system for the North and Baltic Seas, Principal Investigator, 2011-2013

Publications

Refereed Journals

Androsov, A., Nerger, L., Schnur, R., Schröter, J., Albertella, A., Rummel, R., Savcenko, R., Bosch, W., Skachko, S., Danilov, S. (2018) On the assimilation of absolute geodetic dynamic topography in a global ocean model: impact on the deep ocean state. *Journal of Geodesy*, **93**, 141-157, doi:10.1007/s00190-018-1151-1

Pradhan, H.K., Voelker, C., Losa, S.N., Bracher, A., Nerger, L. (2019) Assimilation of global total chlorophyll OC-CCI data and its impact on individual phytoplankton fields. *J. Geophys. Res. Oceans*, **124**, 470-490, doi:10.1029/2018JC014329

- Liu, J., Chan, Z., Hu, Y., Zhang, Y., Ding, Y., Cheng, Y., Cheng, X., Yang, Q., Nerger, L., Spreen, G., Horton, R., Inoue, R., Yang, C., Li, M., Song, M. (2019) Towards reliable Arctic sea ice prediction using multivariate data assimilation. *Science Bulletin*, **64**, 63-72, doi:10.1016/j.scib.2018.11.018
- Mu, L., Losch, M., Yang, Q., Ricker, R., Losa, S., Nerger, L., and Zhang, J. (2018) Arctic-wide sea-ice thickness estimates from combining satellite remote sensing data and a dynamic ice-ocean model with data assimilation during the CryoSat-2 period. *J. Geophys. Res. Oceans*, **123**, 7763-7780
- Vetra-Carvalho, S., van Leeuwen, P. J., Nerger, L., Barth, A., Altaf, M. U., Brasseur, P., Kirchgessner, P., Beckers, J.-M. (2018) State-of-the-art stochastic data assimilation methods for high-dimensional non-Gaussian problems. *Tellus A*, **70:1**, 1445364
- Mu, L., Q. Yang, M. Losch, S.N. Losa, R. Ricker, L. Nerger, X. Liang (2018) Improving sea ice thickness estimates by assimilating CryoSat-2 and SMOS sea ice thickness data simultaneously. *Q. J. Roy. Met. Soc.*, **144**, 529-538
- Barth, A., Y. Yan, L. Nerger, J.-M. Beckers (2017) The 47th Liege Colloquium: marine environmental monitoring, modelling and prediction (Editorial) *Oce. Dyn.*, **67**, 1367–1368
- Liang, X., Q. Yang, L. Nerger, S. N. Losa, B. Zhao, F. Zheng, L. Zhang, L. Wu (2017) Assimilating Copernicus SST data into a pan-Arctic ice-ocean coupled model with a local SEIK filter. *Journal of Atmospheric and Oceanic Technology*, **34**, 1985–1999
- Kirchgessner, P., J. Tödter, B. Ahrens, L. Nerger (2017) The smoother extension of the nonlinear ensemble transform filter. *Tellus A*, **69:1**, 1327766
- Yang, Q., M. Losch, S. Losa, T. Jung, L. Nerger, T. Lavergne (2016) Brief communication: The challenge and benefit of using sea ice concentration satellite data products with uncertainty estimates in summer sea ice data assimilation. *The Cryosphere*, **10**, 761–774
- Yang, Q., M. Losch, S. N. Losa, T. Jung, L. Nerger (2016) Taking into account atmospheric uncertainty improves sequential assimilation of SMOS sea ice thickness data in an ice-ocean model. *J. Atm. & Oce. Tech.*, **33**, 397–497
- J. Tödter, P. Kirchgessner, L. Nerger, and B. Ahrens (2016) Assessment of a nonlinear ensemble transform filter for high-dimensional data assimilation. *Mon. Wea. Rev.*, **144**, 409–427
- S. Brune, L. Nerger, and J. Baehr (2015) Assimilation of oceanic observations in a global coupled Earth system model with the SEIK filter, *Oce. Mod.*, **96**, 254–264
- Q. Yang, S. N. Losa, M. Losch, T. Jung, L. Nerger (2015) The role of atmospheric uncertainty in Arctic summer sea ice data assimilation and prediction. *Q. J. Roy. Met. Soc.*, **141**, 2314–2323
- L. Nerger (2015) On serial observation processing in localized ensemble Kalman filters. *Mon. Wea. Rev.*, **143**, 1554–1567
- Q. Yang, S. N. Losa, M. Losch, J. Liu, Z. Zhang, L. Nerger, H. Yang (2015) Assimilating summer sea ice concentration into a coupled ice-ocean model using a local SEIK filter. *Annals of Glaciology*, **56(69)**, 38–44

- Q. Yang, S. N. Losa, M. Losch, X. Tian-Kunze, L. Nerger, J. Liu, L. Kaleschke, Z. Zhang (2014) Assimilating SMOS sea ice thickness into a coupled ice-ocean model using a local SEIK filter. *J. Geophys. Res. Oceans*, **119**, 6680–6692
- L. Nerger, S. Schulte, A. Bunse-Gerstner (2014) On the influence of model nonlinearity and localization on ensemble Kalman smoothing. *Q. J. Roy. Met. Soc.*, **141**, 2249–2259
- S. N. Losa, S. Danilov, J. Schröter, T. Janjić, L. Nerger, F. Janssen (2014) Assimilating NOAA SST data into the BSH operational circulation model for the North and Baltic Seas: Part 2. Sensitivity of the forecast’s skill to the prior model error statistics. *J. Mar. Syst.*, **129**, 259–270
- P. Kirchgessner, L. Nerger, A. Bunse-Gerstner (2014) On the choice of an optimal localization radius in ensemble Kalman filter methods. *Mon. Wea. Rev.*, **142**, 2165–2175
- A. Fournier, L. Nerger, J. Aubert (2013) An ensemble Kalman filter for the time-dependent analysis of the geomagnetic field. *Geochemistry, Geophysics, Geosystems*, **14**, 4035–4053
- L. Nerger, W. Hiller (2013) Software for ensemble-based data assimilation systems – implementation strategies and scalability. *Computers & Geosciences*, **55**, 110–118
- S. N. Losa, S. Danilov, J. Schröter, L. Nerger, S. Massmann, F. Janssen (2012) Assimilating NOAA SST data into the BSH operational circulation model for the North and Baltic Seas: Inference about the data. *J. Mar. Syst.*, **105-108**, 152–162
- L. Nerger, T. Janjić, J. Schröter, and W. Hiller (2012) A unification of ensemble square-root Kalman filters. *Mon. Wea. Rev.*, **140**, 2335–2345
- L. Nerger, T. Janjić, J. Schröter, and W. Hiller (2012) A regulated localization scheme for ensemble-based Kalman filters. *Q. J. Roy. Met. Soc.*, **138**, 802–812
- T. Janjić, L. Nerger, A. Albertella, J. Schröter, and S. Skachko (2011) On domain localization in ensemble based Kalman filter algorithms. *Mon. Wea. Rev.*, **139**, 2046–2060
- L. Nerger and W. W. Gregg (2008) Improving Assimilation of SeaWiFS Data by the Application of Bias Correction with a Local SEIK Filter. *J. Mar. Syst.*, **73**, 87–102
- L. Nerger and W. W. Gregg (2007) Assimilation of SeaWiFS Data into a Global Ocean-biogeochemical Model using a local SEIK filter. *J. Mar. Syst.*, **68**, 237–254
- L. Nerger, S. Danilov, G. Kivman, W. Hiller, and J. Schröter (2007) Data Assimilation with the Ensemble Kalman Filter and the SEIK Filter applied to a Finite Element Model of the North Atlantic. *J. Mar. Syst.*, **65**, 288–298
- L. Nerger, S. Danilov, W. Hiller, and J. Schröter (2006) Using sea level data to constrain a finite-element primitive-equation ocean model with a local SEIK filter. *Ocean Dynamics* **56**, 634–649
- L. Nerger, W. Hiller, and J. Schröter (2005) A Comparison of Error Subspace Kalman Filters. *Tellus* **57A**, 715–735
- M. Alcubierre, W. Bengert, B. Brüggemann, G. Lanfermann, L. Nerger, E. Seidel, and R. Takahashi (2001) 3D Grazing Collision of Two Black Holes. *Physical Review Letters* **87**, 271103

Theses

L. Nerger (2004) Parallel Filter Algorithms for Data Assimilation in Oceanography, Ph.D. Thesis, University of Bremen (Available online at <http://elib.suub.uni-bremen.de/>)

L. Nerger (2000) Investigations of 3D Binary Black Hole Systems, Diploma Thesis, University of Bremen

Proceedings

L. Nerger, S. N. Losa, T. Brüning, F. Janssen (2016) The HBM-PDAF assimilation system for operational forecasts in the North and Baltic Seas, in *Operational Oceanography for Sustainable Blue Growth. Proceedings of the Seventh EuroGOOS International Conference. 28-30 October 2014, Lisbon, Portugal* / Eds. E. Buch, Y. Antoniou, D. Eparkhina, G. Nolan. ISBN 978-2-9601883-1-8

L. Nerger, W. Hiller, and J. Schröter (2005) PDAF - The Parallel Data Assimilation Framework: Experiences with Kalman Filtering, in *Use of High Performance Computing in Meteorology - Proceedings of the 11th ECMWF Workshop* / Eds. W. Zwiefelhofer, G. Mozdzynski. Singapore: World Scientific, pp. 63–83

P. Michler, M. F. Pereira Jr., O. Homburg, L. Nerger, J. Gutowski, H. Wensch, and D. Hommel (1999) Gain characteristics of ZnSe/(Zn,Mg)(S,Se)/(Zn,Mg)(S,Se) quantum-well lasers, in *Proceedings SPIE 3625, Physics and Simulation of Optoelectronic Devices* / Eds. P. Blood et al., pp. 117–126

P. Michler, M. F. Pereira Jr., O. Homburg, L. Nerger, J. Gutowski, H. Wensch, and D. Hommel (1998) Temperature dependent gain characteristics of ZnSe based separate-confinement heterostructure lasers with binary wells, in *Proceedings of the 2nd International Symposium on Blue Laser and Light Emitting Diodes*, Kisarazu, Chiba, Japan / Eds. A. Yoshikawa et al., Ohmsha Ltd., Tokyo, pp. 528–531

Invited Presentations

L. Nerger, M. Goodliff, F. Schwichtenberg, I. Lorkowski, T. Brüning (2018). Integration von Sentinel-3-Daten in Modellvorhersagen für die Meeresstrategierahmenrichtlinie (in German, “Integration of Sentinel-3 data in model predictions for the Marine Strategy Framework Directive”), Nationales Forum für Fernerkundung und Copernicus (National forum for remote sensing and Copernicus), Berlin, November 29, 2018

L. Nerger (2018) Ensemble Data Assimilation - Algorithms, Software, Applications, University of Reading, Department of Meteorology, Reading, UK, October 29, 2018

L. Nerger, Q. Tang, D. Sidorenko (2018). Building a Scalable Ensemble Data Assimilation System for Coupled Models with PDAF. University of Reading, Data Assimilation Research Center, Reading, UK, June 13, 2018

L. Nerger (2018) A Hybrid Kalman-nonlinear Ensemble Transform Filter. Seminar at NASA Goddard Space Flight Center, Greenbelt, USA, February 8, 2018

- L. Nerger, P. Kirchgessner, T. Tödter, B. Ahrens (2017) High-Dimensional Nonlinear Data Assimilation with the Nonlinear Ensemble Transform Filter (NETF) and its Smoother Extension, National Marine Environmental Forecasting Center, Beijing, China, November 9, 2017
- L. Nerger (2017) Introduction of Ensemble Data Assimilation, Lecture at fall school “Terrestrial Modeling and High-performance Computing”, Bonn, Germany, September 28, 2017
- L. Nerger (2017) Ensemble Data Assimilation with the Parallel Data Assimilation Framework PDAF. German Weather Service DWD), Offenbach, Germany, September 25, 2017
- L. Nerger (2016) Introduction of Ensemble Data Assimilation, Lecture at fall school “Terrestrial Modeling and High-performance Computing”, Bonn, Germany, October 13, 2016
- L. Nerger (2016) Ensemble Data Assimilation with the Parallel Data Assimilation Framework PDAF. General Meeting of the Transregional Collaborative Research Center 32, Cologne, Germany, April 15, 2016
- L. Nerger (2016) The Parallel Data Assimilation Framework PDAF: Status and Future Developments. Blueprints for Next-Generation Data Assimilation Systems. NCAR, Boulder, USA, March 8–10, 2016
- L. Nerger (2016) What is a good Ensemble Kalman Filter? Seminar at NASA Goddard Space Flight Center, Greenbelt, USA, February 18, 2016.
- L. Nerger (2015), Ensemble Data Assimilation with the Parallel Data Assimilation Framework, National Marine Environmental Forecasting Center, Beijing, China, November 16, 2015
- L. Nerger (2015), Ensemble Data Assimilation with the Parallel Data Assimilation Framework, First Institute of Oceanography, Qingdao, China, November 13, 2015
- L. Nerger (2015), The HBM-PDAF assimilation system for forecasts of physics and biogeochemistry in the North and Baltic Seas. University of Reading, Data Assimilation Research Center, Reading, UK, August 5, 2015
- L. Nerger (2014) Ensemble Data Assimilation: Algorithms and Software. National Marine Environmental Forecasting Center, Beijing, China, October 10, 2014
- L. Nerger (2014), Aspects of Localization in Ensemble Kalman Filters. University of Reading, Data Assimilation Research Center, Reading, UK, July 3, 2014
- L. Nerger (2013) Ensemble Data Assimilation: Algorithmic and Practical Aspects. University of Frankfurt, Institute of Meteorology, Germany, November 21, 2013
- L. Nerger (2013) Ensemble Smoothers under the Influence of Nonlinearity. University of Reading, Data Assimilation Research Center, Reading, UK, July 2, 2013
- L. Nerger (2013) Using Ensemble Kalman Filters to Assimilate Dynamic Ocean Topography Data into a Global Ocean Model. University of Bonn, Institute for Geodesy and Geo-information, Germany, June 20, 2013
- L. Nerger (2013) Data Assimilation – Theoretical and Algorithmic Aspects. Korea Institute of Atmospheric Prediction Systems (KIAPS), Seoul, Korea, May 28, 2013

- L. Nerger (2013) Data Assimilation – Practical Aspects and Case Studies. Korea Institute of Atmospheric Prediction Systems (KIAPS), Seoul, Korea, May 30, 2013
- L. Nerger, W. Hiller, J. Schröter (2012) Numerical Aspects of Ensemble Square-root Kalman Filters. NUMDIFF-13: Numerical treatment of differential equations, Halle (Saale), Germany, September 11, 2012
- L. Nerger (2011) The Data Assimilation Zoo. Section: Kalman Filters. University of Maryland, Department of Atmospheric and Oceanographic Science, College Park, MD, USA, March 9, 2011.
- L. Nerger (2011) The Parallel Data Assimilation Framework for scalable sequential data assimilation. Workshop on Programming Environments for Data Assimilation: Software and Applications, Deltares, Delft, Netherlands, January 31, 2011
- L. Nerger (2009) Ensemble Data Assimilation. NERC FREE (Flood Risk From Extreme Events) Ensemble Workshop, Reading, UK, September 23-24, 2009.
- L. Nerger (2009) An Overview on Data Assimilation. GKSS Research Center, Geesthacht, Germany, March 10, 2009.
- L. Nerger (2008) The local SEIK filter and its application for state estimation in a global ocean-biogeochemical model. University of Reading, Environmental Systems Science Centre, Reading, UK, November 6, 2008.
- L. Nerger (2008) Improving Assimilation of SeaWiFS Data by the Application of Bias Correction with a Local SEIK Filter. Global Modeling and Assimilation Office. NASA Goddard Space Flight Center, Greenbelt, USA, March 10, 2008.
- L. Nerger (2007) The SEIK Filter and its Application in Oceanography. Norwegian Meteorological Institute, Oslo, Norway, November 8, 2007.
- L. Nerger (2007) Data Assimilation into Ocean-biogeochemical Models. University of Kiel, Germany, February 1, 2007.
- L. Nerger (2006) Assimilation with the Ensemble Kalman Filter and the SEIK filter in the North Atlantic. Johns Hopkins University, Department of Earth and Planetary Sciences, Baltimore, MD, USA, April 12, 2006.
- L. Nerger, W. Hiller, and J. Schröter (2004) Parallel Error Subspace Kalman Filters. Global Modeling and Assimilation Office, NASA Goddard Space Flight Center, Greenbelt, USA, September 7, 2004.