

Curriculum vitae for *Peter Hjort Lauritzen*



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Atmospheric Modeling & Predictability Section
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1. Educational information

- 9/2023 UCAR Leadership Academy.
- 11/2005 Ph.D., Department of Meteorology, Oceanography and Geodesy
Niels Bohr Institute, University of Copenhagen, Denmark.
Thesis title: *An Inherently Mass-Conservative Semi-Implicit Semi-Lagrangian Model*.
Advisers: Prof. B. Machenhauer, Prof. E. Kaas and Prof. J. Ray Bates.
- 2/2002 M.Sc., Department of Meteorology, Oceanography and Geodesy
Niels Bohr Institute, University of Copenhagen, Denmark.
Thesis title: *A Study of Semi-Lagrangian Advection Schemes using Least Squares*.
Adviser: Prof. J. Ray Bates
- 1/2000 - 7/2000 Exchange student, Meteorology, University of Bergen, Norway.
- 8/1998 - 1/1999 Firefighter & rescue worker, Danish Emergency Management Agency, Denmark.
- 9/1998 B.Sc., Department of Physics and Astronomy, University of Aarhus, Denmark.
Thesis title: *An Introduction to Non-Linear Dynamics*.
Advisor: Søren Frandsen
- 8/1996 - 7/1997 Music School (lead guitarist in funk/rock band), Byhøjskolen, Aarhus, Denmark.
- 7/1994 Baccalaureate: Mathematics & Languages, European school, Luxembourg.

2. Work History

- 7/2021 - present Senior Scientist, Atmospheric Modeling & Predictability Section, NCAR, Boulder.
- 7/2016 - 6/2021 Scientist III, Atmospheric Modeling & Predictability Section, NCAR, Boulder.
- 1/2011 - 6/2016 Scientist II, Atmospheric Modeling & Predictability Section, NCAR, Boulder.
- 1/2008 - 12/2010 Scientist I, Atmospheric Modeling & Predictability Section, NCAR, Boulder.
- 1/2006 - 12/2007 Postdoctoral fellowship under the Advanced Study Program, NCAR, Boulder.
- 9/2005 - 12/2005 Research Associate in HIRLAM group, Danish Meteorological Institute, Denmark.
Accomplishments: *Coupling new dynamical core with HIRLAM physics module*.
- 9/2002-7/2003 Teaching assistant, Department of Physics, University of Copenhagen, Denmark.
Courses: *Calculus* and *An introduction to numerical weather prediction*.
- 1/2002 - 7/2002 Teaching assistant, Department of Informatics, University of Bergen, Norway.
Course: *Discrete structures*.

3. Scientific/Technical Accomplishments

Contributions to community models

- 2010-2011 Implementation of diffusion operators in CAM-FV to reduce spurious noise problems in CAM-DART and slowing down jets in high resolution climate simulations. Publication [14]. Code availability: https://github.com/ESCOMP/CAM/tree/cam_development
- 2009-2018 Development, implementation of the CSLAM transport scheme and consistent coupling with the spectral-element method. Publications [7,10,27,42,49]. Code availability: https://github.com/ESCOMP/CAM/tree/cam_development
- 2013-2019 Separating physics and dynamics grids in CAM-SE. Publications [49,52]. Code availability: https://github.com/ESCOMP/CAM/tree/cam_development
- 2018-2020 Leading implementation of NOAA's FV3 into CESM and producing coupled-climate simulation competitive with current workhorse dynamical core. Code released with CESM2.2. Code availability: https://github.com/ESCOMP/CAM/tree/cam_development
- 2018-present SIMA (System for Integrated Modeling of the Atmosphere) activities:
- Algorithmic improvements of the spectral-element (SE) dynamical core and setting up new variable resolution configurations (collaboration with NCAR's ACOM).
 - Development of high-top applications (WACCM and WACCM-x) using the SE dynamical core. New sponge layer formulations, implementing horizontal molecular diffusion and thermal conductivity in SE, implementing infrastructure for species dependent thermodynamic variables in CAM physics. Collaboration with HAO and ACOM.
 - Science lead in implementing MPAS in CAM (collaboration with MMM).
- 2019-present Leading effort in comparing dynamical cores in CESM for the development of CESM3.

Evaluation of community models

- 2008-present Development of test cases for evaluating transport schemes and coupling to chemistry parameterizations as well as idealized 3D dynamical core experiments. Publications [8,16,21,32,40,51].
- 2006-2007 Stability analysis of numerical schemes in CAM and HOMME. Publication [2,13].
- 2011-2014 Axial angular momentum analysis of CAM. Publication [14,33].
- 2018-present Total energy diagnostics in CAM dynamical cores and physics packages. Publication [50]. Code availability: https://github.com/ESCOMP/CAM/tree/cam_development

Software

- 2012-2015 *NCAR Global Model Topography Generation Software for Unstructured Grids*. A software package to generate topography and related sub-grid-scale variables for global climate/weather models. Publication [41]. Code availability: <https://github.com/NCAR/Topo>

4. Community Service

2023-present

AMWG (Atmosphere Modeling Working Group) internal co-chair:
<https://www.cesm.ucar.edu/working-groups/co-chairs>

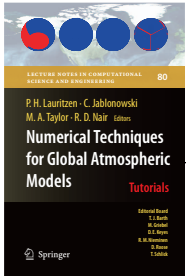
Editorial Activities

2022-present

Associate Editor for *Journal of Advances in Modeling Earth Systems*: selecting referees and reaching decisions on papers.

2010-2015

Associate Editor for *Q.J.R. Meteorol. Soc.*: selecting referees and reaching decisions on papers. Taken final decisions on total 62 papers (7th most productive editor at *Q.J.R. Meteorol. Soc.* out of 83 in time period 2010-2015).



Associate Editor for *Mon. Wea. Rev.*: review 6-12 papers a year & assist editor with difficult papers. Years 2009-2013.

Lead editor for book **Numerical Techniques for Global Atmospheric Models**, *Lecture Notes in Computational Science and Engineering* (Tutorials), Vol.80, Springer. Over 28,430 chapter downloads (source: Springer). Published in 2011. Springer URL: <http://www.springer.com/us/book/9783642116391>.

Book summarizes the lectures given at the 2008 ASP Summer Colloquium.

Journal and Grant Reviewer

Reviewed over 100 papers collectively for Monthly Weather Review, Quarterly Journal of the Royal Meteorological Society, Geoscientific Model Development, Tellus, International Journal for Numerical Methods, Journal of Computational Physics, Ocean Modelling, Applied Mathematical Modelling, International Journal for Numerical Methods in Fluids.

NASA, DOE and NERC (Natural Environment Research Council of the UK) proposal reviewer.

Organizer/convener

Local organizer for Working Group on Numerical Experimentation (WGNE) and Working Group on Coupled Modeling (WGCM), November 2022.

Lead organizer of BIRS workshop entitled *Physics-Dynamics Coupling in Earth System Models*, October 13-18, Banff, Canada.

Co-organizer of workshop on *The Solution to Partial Differential Equations on the Sphere* (PDEs on the sphere), April 29 - May 3, 2019, Montreal, Canada.

Co-organizer of workshop on *The Solution to Partial Differential Equations on the Sphere* (PDEs on the sphere), Ecole Normale Supérieure, Paris, April 3-7, 2017.

Co-organizer of *Workshop on Numerical Modeling of Scale Interactions in the Ocean and the Atmosphere*, Paris, August 24-26, 2016.

Local lead organizer of the *Dynamical Core Model Intercomparison Project (DCMIP) 2016*, NCAR, June 6-17, 2016 (sponsored by NCAR, DOE, NSF, NOAA and NASA; endorsed by WGNE, WMO).

Lead organizer of workshop on *The Solution to Partial Differential Equations on the Sphere* (PDEs on the sphere), KIAPS, Seoul, October 19-23, 2015.

Lead organizer of workshop on *The Solution to Partial Differential Equations on the Sphere* (PDEs on the sphere), NCAR, April 7-11, 2014.

Co-convenor at EGU General Assembly 2014 for session *AS1.5: Recent developments in numerical Earth System Modelling*, Vienna, Austria.

Co-convenor at AGU Fall meeting 2013, 2014 and 2015 for session *Advances in Numerical Methods for Atmosphere and Ocean Modeling*, San Francisco.

Local lead organizer of the *2012 NCAR Summer School and Model Intercomparison Workshop on Non-hydrostatic Global Models*, NCAR, August, 2012.

Lead organizer of workshop on *Transport Schemes on the Sphere*, NCAR, March, 2011.

Lead organizer of the 2008 NCAR Advanced Study Program summer colloquium on *Numerical Techniques for Global Atmospheric Models*.

Co-convenor at AGU Fall meeting 2008 for session *Recent Advances in Atmospheric General Circulation Models: Toward Earth System Models*, San Francisco.

Student and postdoctoral fellow supervision

Postdoctoral fellows: A. Herrington (2019-2020, ASP), C. Erath (2010-2014, NCAR-CU), R. Mittal (2009-2010, ASP).

2007-present SIParCS summer students: A. Rahunathan (University of Wyoming), P. Ullrich (UC Davis), L. Harris (University of Washington) and R. Schilt (Colorado University), M. Valera (San Diego State University).

2011-present NCAR ASP graduate visitor: M. Wong (University of British Columbia, 2011), A. Herrington (2017-18)

2011 NCAR SOARS: writing mentor for Matthew Paulus (Colorado State University).

Committees and memberships

2022-present Member of the Common Model Architecture Implementation Team (CMA IP) which is under the Interagency Committee for the Advancement of Meteorological Services (ICAMS). ICAMS is a senior body the White House's Office of Science and Technology Policy (OSTP).

2021-2025 Member of WGNE (Working Group on Numerical Experimentation), World Meteorological Organization (WMO).

2018-2019 Supervisory Ph.D. committee for Aman Gupta (New York University).

2017-2019 Supervisory Ph.D. committee for Adam Herrington (Stony Brook University).

2017-present CGD representative for NCAR's Advanced Study Program (ASP) postdoctoral fellow selection.

2008-present NCAR's Advanced Study Program (ASP) postdoctoral fellow selection.

2012-2015 Supervisory Ph.D. committee for Christopher Eldred (Colorado State University).

2011-2014 Supervisory Ph.D. committee for May Wong (University of British Columbia).

2009-present Various internal search committees (CGD Scientist I, chair of reclassification committee, postdocs, etc.).

Outreach

2009 - present Lecturer at the CESM (Community Earth System Model) tutorial.

5/2018 5 lectures at the 2nd WCRP Summer School on Climate Model Development: Scale-aware parameterizations for representing sub-grid scale processes, *Center for Weather Forecast and Climate studies*, Brazil.

5/2008 - present Lecturer at the DCMIP summer school series (every 4 years).

5/2012 4 lectures at summer school on Climate Modeling, *MISU*, Stockholm, Sweden.

2009, 2014 Panelist in *Panel of Early Career Scientists* on career development topics for postdocs and graduate students, ASP, NCAR.

5. Honors and Awards

2023 2023 UCAR Outstanding Accomplishment Award in Publication [63].

2023 2023 CESM Distinguished Achievement Award.

2014 The inaugural *WCRP (World Climate Research Programme)/WWRP (World Weather Research Programme) International Prize for Model Development*, WMO.

2007 EGU (European Geophysical Union) *Young Scientists Outstanding Poster Paper (YSOPP)* Award in the Atmospheric Science Division.

2006 NCAR's Advanced Study Program (ASP) fellowship award.

6. Proposals and Grants

2018 - 2020 Leading effort in the integration of FV3 into CESM (NOAA funded IDIQ).

2019 Banff International Research Station for Mathematical Innovation and Discovery (BIRS) proposal for fully funded workshop on *Physics-dynamics coupling in Earth System models* funded (October 13-18, 2019).

2015 - 2018 PI of subcontract of NSF grant: 'Developing and Testing of a Global Quasi-3D Multi-Scale Modeling Framework'. PI: Joon-Hee Jung, Colorado State University (CSU). Co-PI: Celal S. Konor (CSU), Co-PI: David A. Randall.

2012 - 2015 Collaborator on DOE-lab grant: 'Applying Computationally Efficient Schemes for Bio-Geochemical Cycles (ACES4BGC)'. PI: Forrest Hoffman (ORNL).

2010 - 2013 Co-Investigator on DOE grant: 'Toward a Non-Hydrostatic HOMME'. PI: Henry M. Tofu (University of Colorado). Co-I: Ramachandran D. Nair (NCAR).

2010 - 2013 Co-Investigator on DOE grant: 'Regional Projections of Climate at Decadal Time Scales: High resolution global predictions and regionally resolved source-response studies'. PI: Joseph Tribbia (NCAR), Co-PI: Minghua Zhang. Co-I: Mark Taylor (Sandia National Laboratories), Gokhan Danabasolu (NCAR), James Hurrell (NCAR).

2011 - 2014 Collaborator on DOE SciDAC grant: 'Physics and Dynamics Coupling Across Scales in the Next Generation CESM: Meeting the Challenge of High-Resolution'.

- 2011 - 2015 Collaborator on DOE SciDAC grant: ‘Chemistry in CESM-SE: Evaluation, Performance and Optimization’. PI: Jean-Francois Lamarque (NCAR).
- 2011 - 2015 Collaborator on DOE SciDAC grant: ‘Evaluating the climate sensitivity of dissipative subgrid-scale mixing processes in NCAR’s CESM’. PI: Christian Jablonowski (University of Michigan). Co-PI: Richard B. Rood (University of Michigan).
- 2008 NCAR’s Advanced Study Program (ASP) colloquium award. Additional support was provided by NASA, DOE and University of Michigan.

7. Publication List

7.1 Thesis

- 9/2005 An Inherently Mass-Conservative Semi-Implicit Semi-Lagrangian Model. Ph.d. thesis: University of Copenhagen, Denmark, 164 pp. (available from University of Copenhagen: http://www.nbi.ku.dk/english/research/phd_theses/phd_theses_2005/2005/peter_hjort_lauritzen.pdf)
- 1/2002 A Study of Semi-Lagrangian Advection Schemes using Least Squares Interpolation. M.Sc. thesis: Department of Geophysics, University of Copenhagen, Denmark, 81 pp. (available from University of Copenhagen).
- 7/1998 An Introduction to Non-Linear Dynamics. B.Sc. thesis: Department of Physics and Astronomy, University of Aarhus, Denmark (available from University of Aarhus).

7.2 Refereed Journal Articles (h-index of 30 from *Web of Science*)

- 1* **Lauritzen, P. H.**, E. Kaas, and B. Machenhauer, 2006: A mass-conservative semi-implicit semi-Lagrangian limited area shallow water model on the sphere, *Mon. Wea. Rev.*, **134**(4), 1205-1221, doi: <http://dx.doi.org/10.1175/MWR3115.1>.
- 2 **Lauritzen, P. H.**, 2007: A stability analysis of finite-volume advection schemes permitting long time steps. *Mon. Wea. Rev.*, **135**(7), 2658-2673, doi:10.1175/MWR3425.1.
- 3 **Lauritzen, P. H.** and R. D. Nair, 2008: Monotone and conservative Cascade Remapping between Spherical grids (CaRS): Regular latitude-longitude and cubed-sphere grids. *Mon. Wea. Rev.*, **136**(4), 1416-1432, doi:10.1175/2007MWR2181.1.
- 4* **Lauritzen, P. H.**, E. Kaas, B. Machenhauer, K. Lindberg, 2008: A mass-conservative version of the semi-implicit semi-Lagrangian HIRLAM, *Q.J.R. Meteorol. Soc.*, **134**(635), 1583-1595, doi:10.1002/qj.307.
- 5 Ullrich, P. A., **P. H. Lauritzen** and C. Jablonowski, 2008: Geometrically Exact Conservative Remapping (GECORE): Regular latitude-longitude and cubed-sphere grids. *Mon. Wea. Rev.*, **137**(6), 1721-1741, doi:10.1175/2008MWR2817.1. (SIParCS student paper)
- 6 Gettelman, A., **P. H. Lauritzen**, M. Park and J. Kay, 2009: Processes Regulating Short Lived Species in the TTL, *J. Geo. Res.*, **114**(D13303), doi:10.1029/2009JD011785.

- 7 **Lauritzen, P. H.**, R. D. Nair and P. A. Ullrich, 2010: A Conservative Semi-Lagrangian Multi-Tracer Transport scheme on the cubed sphere (CSLAM), *J. Comput. Phys.*, **229**(5), 1401-1424, doi:10.1016/j.jcp.2009.10.036.
- 8 **Lauritzen, P. H.**, C. Jablonowski, M.A. Taylor, R. D. Nair, 2010: Rotated versions of the Jablonowski steady-state and baroclinic wave test case: Results from 8 models, *J. Adv. Model. Earth Syst.*, **2**, Art. # 15, 34 pp, doi:10.3894/JAMES.2010.2.15.
- 9 Nair, R. D. and **P. H. Lauritzen**, 2010: A Class of Deformational Flow Test-Cases for the Advection Problems on the Sphere. *J. Comput. Phys.*, **229**(23), 8868-8887, doi:10.1016/j.jcp.2010.08.014.
- 10 Harris, L. M. and **P. H. Lauritzen** and R. Mittal, 2011: A Flux-Form version of the Conservative Semi-Lagrangian Multi-tracer transport scheme (CSLAM) on the cubed sphere grid, *J. Comput. Phys.*, **230**(4), 1215-1237, doi:10.1016/j.jcp.2010.11.001. (SIParCS student paper)
- 11 Mishra, S. K., M. A. Taylor, R. D. Nair, **P. H. Lauritzen**, H. M. Tufo and J. J. Tribbia, 2011: Evaluation of the HOMME Dynamical Core in the Aquaplanet Configuration of NCAR CAM4: Rainfall. *J. Climate*, **24**(15), 4037-4055, doi:10.1175/2011JCLI3860.1.
- 12 Whitehead, J., C. Jablonowski, R. B. Rood and **P. H. Lauritzen**, 2011: A stability analysis of divergence damping on a latitude-longitude grid. *Mon. Wea. Rev.*: **139**(9), 2976-2993, doi:10.1175/2011MWR3607.1.
- 13 **Lauritzen, P. H.**, C. Erath and R. Mittal, 2011: On simplifying ‘incremental remap’-type transport schemes. *J. Comput. Phys.*, **230**, 7957-7963, doi:10.1016/j.jcp.2011.06.030.
- 14 **Lauritzen, P. H.**, A. Mirin, J. Truesdale, K. Raeder, J. L. Anderson, J. Bacmeister and R. B. Neale, 2011: Implementation of new diffusion/filtering operators in the CAM-FV dynamical core. *Int. J. High. Perform. C.*: **26**(1), 63-73.
- 15 Dennis, J., J. Edwards, K. J. Evans, O. N. Guba, **P. H. Lauritzen**, A. A. Mirin, A. St-Cyr, M. A. Taylor, P. H. Worley, 2012: CAM-SE: A scalable spectral element dynamical core for the Community Atmosphere Model. *Int. J. High. Perform. C.*: **26**(1), 74-89, doi:10.1177/1094342011428142.
- 16 **Lauritzen, P. H.**, J. Thuburn, 2012: Evaluating advection/transport schemes using interrelated tracers, scatter plots and numerical mixing diagnostics. *Q.J.R. Meteorol. Soc.*, **138**(665), 906-918, doi:10.1002/qj.986.
- 17 Raeder, K., J. L. Anderson, N. Collins, T. J. Hoar, J. E. Kay, **P. H. Lauritzen**, R. Pincus, 2012: DART/CAM: An Ensemble Data Assimilation System for CESM Atmospheric Models. *J. Climate*, **25**(18), 6304-6317, doi:10.1175/JCLI-D-11-00395.1.
- 18 Evans, K., **P. H. Lauritzen**, S. Mishra, R. Neale, M. A. Taylor, J. J. Tribbia, 2013: AMIP Simulations with the CAM4 Spectral Element Dynamical Core. *J. Climate*, **26**(3), 689-709, doi:10.1175/JCLI-D-11-00448.1.
- 19 Lamarque, J.-F., L. K. Emmons, P. G. Hess, D. E. Kinnison, S. Tilmes, F. Vitt, C. L. Heald, E. A. Holland, **P. H. Lauritzen**, J. Neu, J. J. Orlando, P. J. Rasch, and G. K. Tyndall, 2012: CAM-chem: description and evaluation of interactive atmospheric chemistry in the Community Earth System Model. *Geosci. Model Dev.*: **5**, 369-411, doi:10.5194/gmd-5-369-2012.

- 20 Bacmeister, J. T., **P. H. Lauritzen**, Aiguo Dai and J. E. Truesdale, 2012: Assessing possible dynamical effects of condensate in high resolution climate simulations. *Geophys. Res. Lett.*, **39**(L04806), 5 PP, doi:10.1029/2011GL050533.
- 21 **Lauritzen, P. H.**, W. C. Skamarock, M. J. Prather and M. A. Taylor, 2012: A standard test case suite for two-dimensional linear transport on the sphere. *Geosci. Model Dev.*, **5**, 887-901, doi:10.5194/gmd-5-887-2012.
- 22 Ullrich, P. A., **P. H. Lauritzen**, and C. Jablonowski, 2013: Some considerations for high-order ‘incremental remap’-based transport schemes: edges, reconstructions and area integration. *Int. J. Numer. Meth. Fluids*, **71**, 1131-1151, doi:10.1002/fld.3703.
- 23 Erath, C., **P. H. Lauritzen**, J. H. Garcia and H. M. Tufo, 2012: Integrating a scalable and efficient semi-Lagrangian multi-tracer transport scheme in HOMME. *Procedia Computer Science*, **9**, 994-1003, doi:10.1016/j.procs.2012.04.106.
- 24 Lebonnois, S, C. Curvey, A. Grossman, H. Parish, G. Shubert, R. Walterscheid, **P. H. Lauritzen**, and C. Jablonowski, 2012: Angular Momentum Budget in General Circulation Models of Superrotating Atmospheres: A Critical Diagnostic. *J. Geophys. Res. - Planets*, **117**(E12), doi:10.1029/2012JE004223.
- 25 Neale, R. B., J. Richter, S. Park, **P. H. Lauritzen**, S. J. Vavrus, P. J. Rasch, and M. Zhang, 2013: The Mean Climate of the Community Atmosphere Model (CAM4) in Forced SST and Fully Coupled Experiments. *J. Climate*, **26**, 5150-5168, doi:10.1175/JCLI-D-12-00236.1.
- 26 Wong, M., W. C. Skamarock, **P. H. Lauritzen**, and R. B. Stull, 2013: A cell-integrated semi-Lagrangian semi-implicit shallow-water model (CSLAM-SW) with conservative and consistent transport. *Mon. Wea. Rev.*, **141**, 2545-2560, doi:10.1175/MWR-D-12-00275.1.
- 27 Erath, C., **P. H. Lauritzen**, and H.M. Tufo, 2013: On mass-conservation in high-order high-resolution rigorous remapping schemes on the sphere. *Mon. Wea. Rev.*, **141**, 2128-2133, doi:10.1175/MWR-D-13-00002.1.
- 28 Kaas, E., B. Sørensen, **P. H. Lauritzen**, and A. B. Hansen, 2013: A hybrid Eulerian Lagrangian numerical scheme for solving prognostic equations in fluid dynamics. *Geosci. Model Dev.*: **6**, 2023-2047, doi:10.5194/gmd-6-2023-2013.
- 29 Wong, M., W. C. Skamarock, **P. H. Lauritzen**, J. B. Klemp, and R. B. Stull, 2014: A compressible nonhydrostatic cell-integrated semi-Lagrangian semi-implicit solver (CSLAM-NH) with consistent and conservative transport. *Mon. Wea. Rev.*, **142**, 1669-1687, doi:10.1175/MWR-D-13-00210.1.
- 30 Bacmeister, J. T., R. B. Neale, A. Gettelman, C. Hannay, **P. H. Lauritzen**, J. Caron, J. Truesdale, and M. Wehner, 2014: Exploratory high-resolution climate simulations using the Community Atmosphere Model (CAM). *J. Climate*, **27**, 3073-3099, doi:10.1175/JCLI-D-13-00387.1.
- 31 Ullrich, P. A., **P. H. Lauritzen**, and C. Jablonowski, 2014: A high-order fully explicit flux-form semi-Lagrangian shallow-water model. *Int. J. Numer. Meth. Fluids*: **75**, 103-133, doi:10.1002/fld.3887.

- 32 **Lauritzen, P. H.**, and 20 co-authors, 2014: A standard test case suite for two-dimensional linear transport on the sphere: results from a collection of state-of-the-art schemes. *Geosci. Model Dev.*: **7**, 105-145, doi:10.5194/gmd-7-105-2014.
- 33 **Lauritzen, P. H.**, J. T. Bacmeister, T. Dubos, S. Lebonnois, and Mark A. Taylor, 2014: Held-Suarez simulations with the Community Atmosphere Model Spectral Element (CAM-SE) dynamical core: A global axial angular momentum analysis using Eulerian and floating Lagrangian vertical coordinates. *J. Adv. Model. Earth Syst.*, **6**, doi:10.1002/2013MS000268.
- 34 Dubey, S., R. Mittal, and **P. H. Lauritzen**, 2014: A Flux-Form Conservative Semi-Lagrangian multi-tracer transport scheme (FF-CSLAM) for Icosahedral Hexagonal grids. *J. Adv. Model. Earth Syst.*: **6**, doi:10.1002/2013MS000259.
- 35 Liu, H.-L., J. M. McInerney, S. Santos, **P. H. Lauritzen**, M. A. Taylor, N. M. Pedatella, 2014: Gravity waves simulated by high-resolution Whole Atmosphere Community Climate Model. *J. Geo. Res.*: **41**(24), 9106-9112, doi:10.1002/2014GL062468.
- 36 Wong, M., W. C. Skamarock, **P. H. Lauritzen**, J. B. Klemp, and R. B. Stull, 2014: Testing of a cell-integrated semi-Lagrangian semi-implicit nonhydrostatic atmospheric solver (CSLAM-NH) with idealized topography. *Mon. Wea. Rev.*: **143**(4), 1382-1398, doi: 10.1175/MWR-D-14-00059.1.
- 37 Reed, K. A., B. Madeiros, J. T. Bacmeister, and **P. H. Lauritzen**, 2015: Global radiative-convective equilibrium in the Community Atmosphere Model 5. *J. Atm. Sci.*: **72**(5), 2183-2197, doi:10.1175/JAS-D-14-0268.1
- 38 Reed, K. A., Bacmeister, J. T., Rosenbloom, N. A., Wehner, M. F., Bates, S. C., **P. H. Lauritzen**, and Truesdale, J. E., 2015: Impact of the dynamical core on the direct simulation of tropical cyclones in a high-resolution global model. *Geophys. Res. Lett.*: **42**(9), 3603-3608. doi:10.1002/2015GL063974
- 39 Sakaguchi, K, L.-R. Leung, C. Zhao, Q. Yang, J. Lu, S. Hagos, S. A. Rauscher, L. Dong, T. D. Ringler, and **P. H. Lauritzen**, 2015: Exploring a multi-resolution approach using AMIP simulations. *J. Climate*, **28**, 5549-5574, doi:10.1175/JCLI-D-14-00729.1.
- 40 **Lauritzen, P. H.**, A. J. Conley, J. F. Lamarque, F. Vitt, and M. A. Taylor, 2015: The terminator ‘toy’-chemistry test: A simple tool to assess errors in transport schemes. *Geosci. Model Dev.*: **8**, 1299-1313, doi:10.5194/gmd-8-1299-2015.
- 41 **Lauritzen, P. H.**, J. T. Bacmeister, P. F. Callaghan, and M. A. Taylor, 2015: NCAR Global Model Topography Generation Software for Unstructured Grids. *Geosci. Model Dev.*: **8**, 3975-3986, doi:10.5194/gmd-8-3975-2015.
- 42 **Lauritzen, P. H.**, M. A. Taylor, J. Overfelt, P. A. Ullrich, S. Goldhaber and R. Kelly, 2016: CAM-SE-CSLAM: Consistent coupling of a conservative semi-Lagrangian finite-volume method with spectral-element dynamics. doi:10.1175/MWR-D-16-0258.1. *Mon. Wea. Rev.*.
- 43 Ullrich, P. A., C. Jablonowski, J. Kent, **Lauritzen, P. H.** and 28 co-authors, 2017: DCMIP2016: A Review of Non-hydrostatic Dynamical Core Design and Intercomparison of Participating Models. 10.5194/gmd-10-4477-2017. *Geosci. Model Dev.*

- 44 Liu, H.-L. C. G. Bardeen, B. T. Foster, **P. H. Lauritzen**, and 12 co-authors, 2018: Development and Validation of the Whole Atmosphere Community Climate Model with Thermosphere and Ionosphere Extension (WACCM-X). *J. Adv. Model. Earth Syst.*, doi:10.1002/2017MS001232.
- 45 Gettelman, A., P. Callaghan, V. E. Larson, C. M. Zarzycki, J. Bacmeister, **P. H. Lauritzen**, P. A. Bogenschutz, R. Neale, 2018: Regional Climate Simulations with the Community Earth System Model. *J. Adv. Model. Earth Syst.*, doi:10.1002/2017MS001227.
- 46 **P. H. Lauritzen** and 19 co-authors, 2018: NCAR release of CAM-SE in CESM2.0: A reformulation of the spectral-element dynamical core in dry-mass vertical coordinates with comprehensive treatment of condensates and energy. *J. Adv. Model. Earth Syst.*, doi:10.1029/2017MS001257.
- 47 M. Gross and co-authors, 2018: Review of Physics-Dynamics coupling in weather, climate and Earth system models: Challenges and recent progress. *Mon. Wea. Rev.*, 146, 3505-3544, doi:10.1175/MWR-D-17-0345.
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- 66 H-L. Liu, W. Wan, J. Huba, **P.H. Lauritzen**, and Francis Vitt, 2023: Atmospheric and Ionospheric Responses to Hunga-Tonga Volcano Eruption Simulated by WACCM-X, *Geo. Res. Lett.*, DOI: 10.1029/2023GL103682.

- 67 O. Guba, M.A. Taylor, P.A. Bosler, C. Eldred and **P.H. Lauritzen**, 2023: Energy conserving physics for nonhydrostatic dynamics in mass coordinate models, *Geosci. Model Dev.*, DOI:10.5194/gmd-2023-184.
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7.3 Other Refereed Publications

P. H. Lauritzen, P. A. Ullrich and R. D. Nair, 2011: Atmospheric transport schemes: Desirable properties and a semi-Lagrangian view on finite-volume discretizations. Chapter in **Numerical Techniques for Global Atmospheric Models**, *Lecture Notes in Computational Science and Engineering* (Tutorials), Vol. 80, **Springer**, pp.185-250, doi:10.1007/978-3-642-11640-7_8.

R. D. Nair, M. Levy and **P. H. Lauritzen**, 2011: Emerging methods for conservation laws. Chapter in **Numerical Techniques for Global Atmospheric Models**, *Lecture Notes in Computational Science and Engineering* (Tutorials), Vol. 80, **Springer**, pp.251-311, doi:10.1007/978-3-642-11640-7_9.

B. Machenhauer, E. Kaas and **P. H. Lauritzen**, 2009: Finite-Volume Methods in Meteorology, *Computational Methods for the Atmosphere and the Oceans*, Special Vol. 14, **Elsevier Press**, pp.3-120, doi:10.1016/S1570-8659(08)00201-9.

7.4. Internally Refereed Publications

Neale, R. B., J. H. Richter, A. J. Conley, S. Park, **P. H. Lauritzen**, A. Gettelman, D. L. Williamson, P. J. Rasch, S. J. Vavrus, M. A. Taylor, W. D. Collins, M. Zhang, S.-J. Lin, 2010: Description of the NCAR Community Atmosphere Model (CAM 4.0), NCAR Tech. Note TN-485.

7.5. Non-refereed Publications

Jablonowski, C., **P. H. Lauritzen**, M. A. Taylor and R. D. Nair, 2008: Idealized test cases for the dynamical cores of Atmospheric General Circulation Models: A proposal for the NCAR ASP 2008 summer colloquium. Available at http://www-personal.umich.edu/~cjablono/NCAR_ASP_2008_idealized_testcases_29May08.pdf

Ullrich, P. A., C. Jablonowski, J. Kent, **P. H. Lauritzen**, R. D. Nair, M. A. Taylor, 2012: Mark A. Taylor Dynamical Core Model Intercomparison Project (DCMIP) Test Case Document. Available at https://www.earthsystemcog.org/site_media/docs/DCMIP-TestCaseDocument_v1.7.pdf

Ullrich, P. A., C. Jablonowski, K. A. Reed, C. Zarzycki, P. H. Lauritzen, R. D. Nair, J. Kent, and A. Verlet-Banide, 2016: Dynamical Core Model Intercomparison Project (DCMIP2016): Test Case Document. <https://github.com/ClimateGlobalChange/DCMIP2016>

Invited presentations

- 10/2020 Atmosphere dycores. *CESM Scientific Steering Committee*.
- 4/2020 Atmosphere dycores. *CESM Scientific Steering Committee*.
- 1/2020 Atmosphere dycores. *CESM Advisory Board Meeting*.
- 11/2018 The challenge of Energy budget closure in Earth system models. Solicited talk at WCRP workshop on *The Earth's Energy Imbalance and its implications*, Toulouse.
- 10/2018 Update/Plans on High resolution Atmospheric Modeling. *CESM Scientific Steering Committee meeting*.
- 7/2018 Physics-dynamics coupling with element-based high-order Galerkin methods: quasi equal-area physics grid. Invited talk at *3rd workshop on Physics Dynamics Coupling (PDC18)*, ECMWF, Reading, U.K.
- 4/2018 5 invited talks at *2nd WCRP Summer School on Climate Model Development*, Center for Weather Forecasts and Climate Studies, Brazilian National Institute for Space Research, Cachoeira Paulista (January 22-31).
- 4/2016 Separating dynamics, physics and tracer transport grids in a global climate model. Invited talk at workshop *Multiscale modeling and its applications: from weather and climate models to models of materials defects*, Fields Institute, Toronto (April 25-29).
- 9/2015 Desired properties of transport schemes for coupled atmospheric-chemistry models. Invited talk at conference *Meteorology and Climate - Modeling for Air Quality (MAC-MAQ)*, Sacramento, California (September 16-18).
- 12/2014 Preparing CAM-SE for multi-tracer applications: CAM-SE-CSLAM. Invited talk at session on *Climatology and Trends of Extreme Events in Climate Models Capable of Resolving Regional-Scale* at *AGU Fall meeting 2014*, San Francisco.
- 12/2014 Physics-dynamics coupling with Galerkin methods: equal-area physics grid. Keynote speaker at conference *Physics dynamics coupling in geophysical models - bridging the gap*, CICESE, Baja California, Mexico.
- 10/2014 NCAR global climate model development: dynamical core, performance, and physics-dynamics coupling. Invited talk at *Atmospheric Modeling Seminar at Centre for Weather Forecasting and Climate Studies (CPTEC)*, Cachoeira Paulista, São Paulo, Brazil.
- 6/2014 NCAR climate model developments with focus on dynamics, consistency and coupling to parameterizations. Visiting professorship at *Laboratoire de Météorologie Dynamique, École Polytechnique*, Paris, France.
- 2/2014 CAM dynamics and CSLAM update. *ACES4BGC (Applying Computationally Efficient Schemes for BioGeochemical Cycles) - All Hands Project Meeting*, Boulder, Colorado.
- 11/2013 Dynamical cores and climate modeling. *DFD/GPC Minisymposium: Global Climate Models: Dynamical Cores, Strengths and Weaknesses, 66th Annual Meeting of the American Physical Society's Division of Fluid Dynamics (DFD)*, Pittsburgh, Pennsylvania.
- 8/2013 Panelist at modeling session. *AMS Summer Community Meeting*, Boulder, Colorado.

- 7/2013 Results from a transport scheme intercomparison and design of a new non-linear transport-chemistry test. *MPI-M*, Hamburg, Germany.
- 7/2013 Conservative Semi-Lagrangian Multi-tracer scheme (CSLAM): a semi-implicit shallow-water and a fully compressible non-hydrostatic solver with fully consistent transport. *ECMWF*, Reading, U.K.
- 2/2012 NCAR efforts on transport in global climate models. *Oak Ridge National Laboratories*.
- 12/2011 The CSLaM transport scheme and new numerical mixing diagnostics. *CESM Ocean Model Working Group Meeting*, Boulder.
- 9/2011 Evaluating advection/transport schemes using interrelated tracers, scatter plots and numerical mixing diagnostics. *University of Oslo*, Norway.
- 8/2011 Evaluating advection/transport schemes using interrelated tracers, scatter plots and numerical mixing diagnostics. Poster presentation at *Global-to-Regional Climate Simulation Workshop (DOE)*, Santa Fe.
- 3/2011 Tracer transport in global climate models: a new multi-tracer algorithm and a new testing methodology. Seminar at the *Department of informatics and mathematical modelling*, Danish Technical University.
- 11/2010 Panelist on ‘Pushing the Frontiers of Climate and Weather Models: High-Performance Computing, Numerical Techniques and Physical Consistency’. *Supercomputing 2010 (SC10)*, New Orleans.
- 10/2010 Tracer transport: A new multi-tracer scheme, a new idealized test case suite, and a new methodology for quantifying numerical mixing. *University of Michigan*, Ann Arbor.
- 5/2010 Non-traditional spherical grids and resolved scale dynamics. *International Centre for Theoretical Physics (ICTP)*, Trieste, Italy.
- 4/2010 A geometrically flexible conservative semi-Lagrangian scheme for multi-tracer transport. Workshop on *Numerical Hierarchies for Climate Modeling*. Institute for Pure & Applied Mathematics (IPAM), *University of California Los Angeles (UCLA)*.
- 3/2010 Conservative Tracer Transport in HOMME. *Integrated Science Team Meeting of DOE’s Climate Change Modeling Program*, Washington DC.
- 3/2010 Transport in global climate models: (a) desirable properties, (b) CSLAM, (c) proposal for test case suite. *DOE-BER transport project meeting*, Sandia National Laboratories, Albuquerque, New Mexico.
- 8/2009 Some NCAR activities on next generation global dynamical cores. *Danish Meteorological Institute*, Copenhagen, Denmark.
- 8/2009 Extension of CSLAM to icosahedral grids (triangles and hexagons/pentagons) and a flux-form version of CSLAM, *Max Planck Institute for Meteorology (MPI)*, Hamburg.
- 6/2009 Numerical methods for atmospheric dynamical cores, *International Centre for Theoretical Physics (ICTP)*, Trieste, Italy.
- 10/2008 Some algorithmic challenges in climate modeling, *2008 Young Investigators Symposium*, Oak Ridge National Laboratory (ORNL), Tennessee.

3/2007

Numerical methods for computational modeling of weather and climate that respect important physical properties, University of Exeter, Exeter, UK.