

Dr. Fabian Hoffmann, Curriculum Vitae

NOAA Earth System Research Laboratory, CSD
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Research Interests

Dr. Fabian Hoffmann is a CIRES Visiting Fellow in the group of Dr. Graham Feingold at the NOAA Earth System Research Laboratory in Boulder, Colorado. Fabian's research focuses on clouds, covering microphysics (rain initiation, aerosol-cloud interactions, mixed-phase processes), cloud dynamics (entrainment, mixing, turbulence), and the modeling of these processes. Besides idealized theoretical work, Fabian applies high-resolution large-eddy simulations with Lagrangian cloud microphysics, a highly detailed and accurate representation of cloud microphysics developed by him. Recently, Fabian also started to use emulators, a machine learning approach, to explore the physics of entire cloud systems.

Education

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| 2014 – 2017 | Ph.D. in Meteorology (<i>summa cum laude</i>), Faculty of Mathematics and Physics, Leibniz Universität Hannover. Committee: Prof. Dr. S. Raasch, Prof. Dr. Y. Noh, Dr. G. Feingold. |
| 2011 – 2014 | M.Sc. in Meteorology (<i>magna cum laude</i>), Faculty of Mathematics and Physics, Leibniz Universität Hannover. |
| 2008 – 2011 | B.Sc. in Meteorology (<i>magna cum laude</i>), Faculty of Mathematics and Physics, Leibniz Universität Hannover. |

Awards

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| 2019 | Outstanding Postdoc Award of the University of Colorado Boulder, Colorado, USA |
| 2019 | Young Scientist Award (<i>Förderpreis</i>) of the German Meteorological Society (<i>Deutsche Meteorologische Gesellschaft</i>). |
| 2017 – 2019 | CIRES Visiting Fellowship: A two-year fellowship at the Cooperative Institute for Research in Environmental Sciences, sponsored by the University of Colorado Boulder and the NOAA Earth System Research Laboratory, both in Boulder, Colorado, USA. |
| 2015 | US Department of Energy (DOE) travel and participation grant for the 1st ARM Summer Training in Norman, OK, USA. |
| 2013 | Best oral presentation at the 2nd International Education Forum on Environment & Energy Science (ACEEES, Tokyo Institute of Technology), 13 – 17 December 2013, Huntington Beach, CA, USA. |

Research and Work Experiences

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| since 08/2017 | CIRES Visiting fellow (group of Dr. G. Feingold), Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, Boulder, Colorado, USA, and NOAA Earth System Research Laboratory, Boulder, Colorado, USA. |
| 08-09/2015, 09/2016 | Visiting scientist (group of Prof. Dr. Y. Noh), Department of Atmospheric Sciences, Yonsei University, Seoul, Republic of Korea. |
| 03/2014 – 07/2017 | Research associate (group of Prof. Dr. S. Raasch), Institute of Meteorology and Climatology, Leibniz Universität Hannover, Germany. |
| 01/2012 – 02/2014 | Student research assistant (group of Prof. Dr. S. Raasch), Institute of Meteorology and Climatology, Leibniz Universität Hannover, Germany. |

09/2010 – 10/2010 Internship at the Max Planck Institute of Meteorology (group of Dr. J.-S. von Storch), Hamburg, Germany.

Teaching

Lectures *Cloud Physics* (advanced undergraduate, jointly held with Prof. Dr. S. Raasch, Leibniz Universität Hannover): winter term 2015/16, summer term 2016, summer term 2017.

Workshops User workshops on the *LES model PALM* (jointly held with Prof. Dr. S. Raasch and other members of the PALM group of the Leibniz Universität Hannover): 4 – 8 August 2014, Enercon, Bremen, Germany; 2 – 6 February 2015, INPE/CPTEC, Cachoeira Paulista, São Paulo, Brazil; 21 – 25 September 2015, Chinese University of Hong Kong, Hong Kong, China; 10 – 14 October 2016, Leibniz Universität Hannover, Germany.

Exercises Organization and teaching of exercises on the introductory courses *Meteorology 1 and 2*, as well as the advanced undergraduate course *Cloud Physics* (corresponding lectures held by Prof. Dr. T. Hauf, Leibniz Universität Hannover): summer term 2014, winter term 2014/15.

Tutorials Teaching assistant for the introductory courses *Meteorology 1 and 2* (corresponding lectures held by Prof. Dr. T. Hauf, Leibniz Universität Hannover): winter term 2010/11, summer term 2011, winter term 2011/12, summer term 2012.

Co-Supervised Theses 2017: Erika Urbach, Turbulence effects on the initiation of warm rain: A box-model study with particle-based microphysics (Bachelor's Thesis, Leibniz Universität Hannover).

2016: Johannes Schwenkel, Entwicklung, Implementierung und Validierung eines Algorithmus für das Spalten und Zusammenfassen von Partikeln in einem Langrangeschen-Wolkenphysik-Modell (Master's Thesis, Leibniz Universität Hannover).

2015: Jan-Niklas Weiß, Der Einfluss von Interpolations-Methodiken auf das Tropfenwachstum durch Diffusion bei Lagrangeschen Wolkentropfenmodellen (Bachelor's Thesis, Leibniz Universität Hannover).

Professional Activities and Memberships

Reviewer for journals (*Journal of the Atmospheric Sciences*, *Journal of Advances in Modeling Earth Systems*, *Nonlinear Processes in Geophysics*, *Geoscientific Model Development*, *Atmospheric Chemistry and Physics*, *Quarterly Journal of the Royal Meteorological Society*, *SN Applied Sciences*, *Atmospheric Research*, *Atmospheric Measurement Techniques*) and funding agencies (*National Science Centre*, Poland; *National Science Foundation*, USA).

Member of *Deutsche Meteorologische Gesellschaft* (since 2013), *American Meteorological Society* (since 2015).

Professional Training

03/2016 Good Scientific Practice: 2-day course, Leibniz Universität Hannover.

07/2015 ARM Summer Training: 10-day course on observations and modeling of aerosols, clouds, and precipitation, U.S. Department of Energy, Atmospheric Radiation Measurement (ARM) Climate Research Facility, Norman, OK, USA.

07/2015 Academic Writing: 2-day course, Leibniz Universität Hannover.

10/2012 Bridging the Gap Between Atmospheric Scales: 5-day course on microscale and mesoscale atmospheric dynamics, Wageningen University, Netherlands.

Publications & Academic Work

In Preparation, Submitted, or Under Review

Glassmeier, F., **F. Hoffmann**, J. S. Johnson, T. Yamaguchi, K. S. Carslaw, and G. Feingold, 2019: Novel constraint on liquid-water path response to aerosol perturbations cautions against suitability of ship-track studies for inferring effective forcing. *Science*, to be submitted.

Unterstrasser, S., **F. Hoffmann**, and M. Lerch, 2019: Collection/Aggregation in a Lagrangian cloud microphysical model: Insights from column model applications. *Geosci. Model Dev.*, to be submitted.

Hoffmann, F., 2019: Effects of Entrainment and Mixing on the Wegener-Bergeron-Findeisen Process. *J. Atmos. Sci.*, under review.

Hoffmann, F., F. Glassmeier, T. Yamaguchi, and G. Feingold, 2019: Liquid Water Path Steady States in Stratocumulus: Insights From Process-Level Emulation and Mixed-Layer Theory. *J. Atmos. Sci.*, under review.

Maronga, B., S. Banzhaf, C. Burmeister, T. Esch, R. Forkel, D. Fröhlich, V. Fuka, K. Gehrke, J. Geletič, S. Giersch, G. Groß, W. Heldens, A. Hellsten, **F. Hoffmann**, A. Inagaki, E. Kadasch, F. Kanani-Sühring, K. Ketelsen, B. Ali Khan, C. Knigge, H. Knoop, P. Krč, M. Kurppa, H. Maamari, A. Matzarakis, M. Mauder, M. Pallasch, D. Pavlik, J. Pfafferott, J. Resler, S. Rissmann, E. Russo, M. Salim, M. Schrempf, J. Schwenkel, G. Seckmeyer, S. Schubert, M. Sühring, R. von Tils, L. Vollmer, S. Ward, B. Witha, H. Wurps, J. Zeidler, and S. Raasch, 2019: Overview of the PALM Model System 6.0., *Geosci. Model Dev.*, doi:10.5194/gmd-2019-103, under review.

Peer-Reviewed Articles

Goren, T., J. Kazil, **F. Hoffmann**, T. Yamaguchi, and G. Feingold, 2019: Anthropogenic Air Pollution Delays Marine Stratocumulus Break-up to Open-Cells. *Geophys. Res. Lett.*, accepted.

Glassmeier, F., **F. Hoffmann**, J. S. Johnson, T. Yamaguchi, K. S. Carslaw, and G. Feingold, 2019: An emulator approach to stratocumulus susceptibility. *Atmos. Chem. Phys.*, 19, 10191-10203, doi:10.5194/acp-19-10191-2019.

Giersch, S., M. Brast, **F. Hoffmann**, and S. Raasch, 2019: Toward Large-Eddy Simulations of Dust Devils of Observed Intensity: Effects of Grid Spacing, Background Wind, and Surface Heterogeneities. *J. Geophys. Res.*, 124, 7697-7718, doi:10.1029/2019JD030513.

Maahn, M., **F. Hoffmann**, M. D. Shupe, G. de Boer, S. Y. Matrosov, and E. P. Luke, 2019: Can liquid cloud microphysical processes be used for vertically pointing cloud radar calibration? *Atmos. Meas. Tech.*, 12, 3151-3171, doi:10.5194/amt-12-3151-2019.

Hoffmann, F., and G. Feingold, 2019: Entrainment and Mixing in Stratocumulus: Effects of a New Explicit Subgrid-Scale Scheme for Large-Eddy Simulations with Particle-Based Microphysics. *J. Atmos. Sci.*, 76, 1955-1973, doi:10.1175/JAS-D-18-0318.1.

Hoffmann, F., T. Yamaguchi, and G. Feingold, 2018: Inhomogeneous Mixing in Lagrangian Cloud Models: Effects on the Production of Precipitation Embryos. *J. Atmos. Sci.*, 76, 113-133, doi:10.1175/JAS-D-18-0087.1.

Noh, Y., D. Oh, **F. Hoffmann**, and S. Raasch, 2018: A Cloud Microphysics Parameterization for Shallow Cumulus Clouds Based on Lagrangian Cloud Model Simulations. *J. Atmos. Sci.*, 75, 4031-4047, doi:10.1175/JAS-D-18-0080.1.

Schwenkel, J, **F. Hoffmann**, and S. Raasch, 2018: Improving Collisional Growth in Lagrangian Cloud Models: Development and Verification of a New Splitting Algorithm. *Geosci. Model Dev.*, 11, 3929-3944, doi:10.5194/gmd-11-3929-2018.

Hoffmann, F., 2017: On the Validity of Köhler Activation Theory: How do Collision and Coalescence Affect the Activation of Aerosols? *Atmos. Chem. Phys.*, 17, 8343-8356, doi:10.5194/acp-17-8343-2017.

Hoffmann, F., Y. Noh, and S. Raasch, 2017: The route to raindrop formation in a shallow cumulus cloud simulated by a Lagrangian cloud model, *J. Atmos. Sci.*, 74, 2125-2142, doi:10.1175/JAS-D-16-0220.1.

Unterstrasser, S., **F. Hoffmann**, and M. Lerch 2017: Collection/aggregation algorithms in Lagrangian cloud microphysical models: rigorous evaluation in box model simulations, *Geosci. Model Dev.*, 10, 1521-1548, doi:10.5194/gmd-10-1521-2017.

Spiga, A., E. Barth, Z. Gu, **F. Hoffmann**, J. Ito, B. Jemmett-Smith, M. Klose, S. Nishizawa, S. Raasch, S. Rafkin, T. Takemi, D. Tyler, and W. Wei, 2016: Large-Eddy Simulations of dust devils and convective vortices, *Space Sci. Rev.*, doi:10.1007/s11214-016-0284-x.

Hoffmann, F., 2016: The effect of spurious cloud edge supersaturations in Lagrangian cloud models: An analytical and numerical study, *Mon. Wea. Rev.*, 144, 107-118, doi:10.1175/MWR-D-15-0234.1.

Maronga, B., M. Gryschka, R. Heinze, **F. Hoffmann**, F. Kanani-Sühring, M. Keck, K. Ketelsen, M. O. Oliver Letzel, M. Sühring, and S. Raasch, 2015: The Parallelized Large-Eddy Simulation Model (PALM) version 4.0 for atmospheric and oceanic flows: model formulation, recent developments, and future perspectives, *Geosci. Model Dev.*, 8, 2515-2551, doi:10.5194/gmd-8-2515-2015.

Hoffmann, F., S. Raasch, and Y. Noh, 2015: Entrainment of aerosols and their activation in a shallow cumulus cloud studied with a coupled LCM-LES approach, *Atmos. Res.*, 156, 43-57, doi:10.1016/j.atmosres.2014.12.008.

Hoffmann, F., H. Siebert, J. Schumacher, T. Riechelmann, J. Katzwinkel, B. Kumar, P. Götzfried, and S. Raasch, 2014: Entrainment and mixing at the interface of shallow cumulus clouds: Results from a combination of observations and simulations, *Met. Zet.*, doi:10.1127/0941-2948/2014/0597.

Invited Talks and Seminars

Hoffmann, F., 2019: Lagrangian Cloud Modeling: Foundations and Recent Developments, 14 November 2019, Environmental and Climate Sciences Department Seminar, Brookhaven National Laboratory, Upton, New York, USA.

Hoffmann, F., 2019: Lagrangian Cloud Modeling: Foundations and Recent Developments, 24 May 2019, Pi Chamber Workshop, Michigan Technological University, Houghton, Michigan, USA.

Hoffmann, F., 2019: Entrainment and Mixing in Warm Boundary Layer Clouds, 4 March 2019, Meteorology and Air Quality Group, Wageningen University and Research, Wageningen, The Netherlands.

Hoffmann, F., 2018: Entrainment and Mixing in Warm Boundary Layer Clouds: Development and Results of an Explicit Subgrid-Scale Scheme for Large-Eddy Simulations with Particle-Based Microphysics, 18 December 2018, Meteorologisches Institut München, Ludwig-Maximilians-Universität München, Germany.

Hoffmann, F., 2018: Entrainment and Mixing in Warm Boundary Layer Clouds: Development and Results of an Explicit Subgrid-Scale Scheme for Large-Eddy Simulations with Particle-Based Microphysics, 15 November 2018, Department of Atmospheric Sciences, Yonsei University, Seoul, Republic of Korea.

Presentations (held)

Hoffmann, F., and G. Feingold, 2019: Entrainment and Mixing in Mixed-Phase Clouds (poster), Gordon Research Conference on Radiation and Climate, July 21 – 26, Bates College, Lewiston, ME, USA.

Hoffmann, F., and G. Feingold, 2019: Entrainment and Mixing in Mixed-Phase Clouds (poster), Gordon Research Seminar on Radiation and Climate, July 20 – 21, Bates College, Lewiston, ME, USA.

Hoffmann, F., and G. Feingold, 2019: Bridging the Gap between LES and DNS: An Explicit Subgrid Scale Scheme for LES with Particle-Based Cloud Physics (poster), CIRES Rendezvous, May 17, University of Colorado, Boulder, CO, USA.

Hoffmann, F., and G. Feingold, 2019: Bridging the Gap between LES and DNS: An Explicit Subgrid Scale Scheme for LES with Particle-Based Cloud Physics (poster), Understanding Clouds and Precipitation 2019, February 25 – March 1, Berlin, Germany.

Hoffmann, F., 2018: The Linear Eddy Model as a Subgrid-Scale Model for Lagrangian Cloud models (talk), Workshop on particle-based modeling of cloud microphysics, November 19 – 20, Kobe, Japan.

Hoffmann, F., T. Yamaguchi, and G. Feingold, 2018: Inhomogeneous Mixing in Lagrangian Cloud Models: Effects on the Production of Precipitation Embryos (talk), 15th Conference on Cloud Physics, July 9 – 13, Vancouver, BC, Canada.

Hoffmann, F., T. Yamaguchi, and G. Feingold, 2018: Inhomogeneous Mixing in Lagrangian Cloud Models: Effects on the Production of Precipitation Embryos (poster), CIRES Rendezvous, May 18, University of Colorado, Boulder, CO, USA.

Hoffmann, F.: Particle-Based Cloud Microphysics for Investigating Entrainment and Mixing in Shallow Convective Clouds (talk), Aerosols, Clouds, Precipitation and Climate (ACPC) Workshop, April 3 – 6, 2018, University of Colorado, Boulder, CO, USA.

Hoffmann, F., and S. Raasch: How do collision and coalescence contribute to the activation of droplets? (poster), 17th International Conference on Clouds and Precipitation (ICCP), July 25 – 29, 2016, Manchester, UK.

Hoffmann, F., and S. Raasch: Spurious Cloud Edge Supersaturations in Lagrangian Cloud Models (talk), Workshop on Eulerian vs. Lagrangian Methods for Cloud Microphysics, April 20 – 22, 2015, Warsaw, Poland.

Hoffmann, F., S. Raasch, and Y. Noh, 2015: Aerosol-Cloud Interactions Studied With a Lagrangian Cloud Model (talk), Atmospheric Boundary Layer and Cloud Studies in the Amazon Basin, February 9 – 10, 2015, São José dos Campos, Brazil.

Hoffmann, F., Y. Noh, and S. Raasch 2014: On the Initiation of Rain In an Idealized Shallow Cumulus Cloud (talk), 3rd International Education Forum on Environment & Energy Science (ACEEES, Tokyo Institute of Technology), December 12 – 16, 2014, Perth, Western Australia, Australia.

Hoffmann, F., S. Raasch, and Y. Noh, 2014: Entrainment of Aerosols and Their Activation in a Shallow Cumulus Cloud Studied with a Coupled LCM-LES Approach (talk), 14th Conference on Cloud Physics, 7 – 11 July 2014, Boston, MA, USA.

Hoffmann, F., and S. Raasch, 2013: The Entrainment of Aerosols and their Activation in an Idealized Shallow Cumulus Cloud Studied with a Combined LES/LPM Approach (poster), AGU Fall Meeting 2013, 9 – 13 December 2013, San Francisco, CA, USA.

Hoffmann, F., and S. Raasch, 2012: Numerical Impacts on the Strength of Simulated Dust Devils (poster), Bridging the Gap Between Atmospheric Scales, 8 – 12 October 2012, Wageningen, Netherlands.

Presentations (contributed)

Goren, T., J. Kazil, **F. Hoffmann**, T. Yamaguchi, and G. Feingold, 2019: Attributing marine stratocumulus cloud break-up timing to anthropogenic aerosols (poster, contributed), AGU Fall Meeting, December 9 – 13, San Francisco, Ca, USA.

Glassmeier, F., **F. Hoffmann**, J. Johnson, T. Yamaguchi, K. Carslaw, G. Feingold, 2019: An Emulator Approach to the Radiative Effect of Stratocumulus Clouds (poster and talk, contributed), Gordon Research Conference on Radiation and Climate, July 21 – 26, Bates College, Lewiston, ME, USA.

Glassmeier, F., **F. Hoffmann**, J. Johnson, T. Yamaguchi, K. Carslaw, G. Feingold, 2019: An Emulator Approach to the Radiative Effect of Stratocumulus Clouds (poster, contributed), Gordon Research Seminar on Radiation and Climate, July 20 – 21, Bates College, Lewiston, ME, USA.

Giersch, S., M. Brast, **F. Hoffmann**, S. Raasch, 2019: Toward Large-Eddy Simulations of Dust Devils of Observed Intensity: Effects of Grid Spacing, Background Wind, and Surface Heterogeneities (talk, contributed), European Postgraduate Fluid Dynamics Conference, July 16 – 19, Ilmenau, Germany.

Giersch, S., M. Brast, **F. Hoffmann**, S. Raasch, 2019: Large-Eddy Simulationen von Staubteufeln mit beobachtbarer Intensität: Auswirkungen von Gitterweite, Hintergrundwind und Oberflächenheterogenitäten (talk, contributed), DACH, March 18 – 22, Garmisch-Partenkirchen, Germany .

Glassmeier, F., **F. Hoffmann**, J. Johnson, T. Yamaguchi, K. Carslaw, G. Feingold, 2018: Beyond Case Studies—an Emulator Approach to Stratocumulus (talk, contributed), Understanding Clouds and Precipitation 2019, February 25 – March 1, Berlin, Germany.

Noh, Y., D. Oh, **F. Hoffmann**, and S. Raasch, 2018: Cloud Microphysics Parameterization in Shallow Cumulus Clouds Simulated by a Lagrangian Cloud Model (talk, contributed), 15th Conference on Cloud Physics, 9 – 13 July, Vancouver, BC, Canada.

Glassmeier, F., **F. Hoffmann**, J. Johnson, T. Yamaguchi, K. Carslaw, G. Feingold, 2018: Beyond Case Studies—an Emulator Approach to Stratocumulus (poster, contributed), 15th Conference on Cloud Physics, 9 – 13 July, Vancouver, BC, Canada.

Glassmeier, F., **F. Hoffmann**, T. Yamaguchi, J. Johnson, J. Kazil, K. Carslaw, G. Feingold, 2018: Capturing the Complexity of Clouds (poster, contributed), Dynamics Days 2018, 4 – 6 January, Denver, CO, USA.

Oh, D., Y. Noh, **F. Hoffmann**, and S. Raasch, 2017: Cloud Microphysics Parameterization in a Shallow Cumulus Cloud Simulated by a Lagrangian Cloud Model (poster, contributed), AGU Fall Meeting 2017, 11 – 15 December 2017, New Orleans, LA, USA.

Noh, Y., **F. Hoffmann**, and S. Raasch, 2017: The Route to Raindrop Formation in a Shallow Cumulus Cloud Simulated by a Lagrangian Cloud Model (talk, contributed), Annual Meeting of the APS Division of Fluid Dynamics, 19 – 21 November 2017, Denver, CO, USA.

Jemmett-Smith, B., P. Knippertz, J. Marsham, C. Gilkeson, S. Raasch, M. Weismüller, and **F. Hoffmann**, 2015: Towards a Parameterization of Dust Devils for Weather and Climate models (poster, contributed), EGU General Assembly, 12 – 17 April 2015, Vienna, Austria.

Jemmett-Smith, B., J. Marsham, P. Knippertz, C. Gilkeson, S. Raasch, M. Weismüller, and **F. Hoffmann**, 2015: Towards a Parameterization of Dust-Devil Effects in Weather and Climate Models Using Large-Eddy Simulations (talk, contributed), ISSI Dust Devil Workshop, 16 – 20 February 2015, Bern, Switzerland.

Weismüller, M., S. Raasch, and **F. Hoffmann**, 2014: Towards large-eddy simulations of dust devils with observed intensity: Effects of surface heterogeneities and numerics (talk, contributed), 21st Symposium on Boundary Layers and Turbulence, 9 – 13 June 2014, Leeds, UK.

AV Media

Maronga, B., **F. Hoffmann**, T. Riechelmann, and S. Raasch, 2013: Large-eddy simulation of dust devils: Animation of dust devils in the convective boundary layer using a virtual dust source. Computer Animation. doi:10.5446/9352.

Theses

Doctoral thesis, 2017 – Validations, Further Developments, and Applications of a Lagrangian Cloud Model. urn:nbn:de:gbv:089-8907912283.

Master's thesis, 2013 – The Activation of Aerosols in Shallow Cumulus Clouds.

Bachelor's thesis, 2011 – Impacts of Numerical Methods on the Strength of Simulated Dust Devils (in German).