Wolfgang Langhans, Ph.D.

Atmospheric scientist
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ResearcherID: J-6437-2014

Education

2009–2012 **Ph.D., ETH Zurich, Institute for Atmospheric and Climate Science**

- Ph.D. in Atmospheric Sciences
- Thesis title: *Multiscale aspects of cloud-resolving simulations of moist summer convection over complex terrain* [pdf]
- Adviser: Prof. Christoph Schär

2003–2008 **B.S. and M.S., University of Innsbruck, Institute of Meteorology and Geophysics**

- Mag.rer.nat. (M.S. equivalent) in Meteorology and Geophysics (with distinction)
- Thesis title: *Cloud-resolving simulations of the August 2005 Alpine flood - The sensitivity to microphysics parameterizations* [pdf]
- Adviser: Prof. Alexander Gohm

Professional experience

09/2018 - present **Senior Meteorological Engineer**, *Vehicle Positioning Department*
Lear Corporation, San Mateo, CA

01/2018 - 07/2018 **Project Scientist**, *Climate and Ecosystem Science Division*
Lawrence Berkeley National Laboratory, Berkeley, CA
Advisor: William Collins (LBL)

01/2013 - 12/2017 **Postdoctoral research**, *Climate and Ecosystem Science Division*
Lawrence Berkeley National Laboratory, Berkeley, CA
Advisors: Prof. David Romps (UC Berkeley) and Prof. William Collins (LBL)

06/2012 - 12/2012 **Postdoctoral research**, *Institute for Atmospheric and Climate Science*
ETH Zurich, Switzerland
Advisor: Prof. Christoph Schär

01/2009 - 05/2012 **Graduate research assistant**, *Institute for Atmospheric and Climate Science*
ETH Zurich, Switzerland
Advisor: Prof. Christoph Schär

Ongoing and selected past projects

- Development of tropospheric and ionospheric corrections for high-precision GPS positioning

  Funding: Lear Corporation

  Role: Development of algorithms and code for operational server deployment with purpose of providing tropospheric corrections based on GFS deterministic and ensemble forecasts. Management of one person working on estimates of ionospheric signal delays and biases of pseudoranges.

- Climate Model Development and Validation (CMDV): Coupling Mechanistically the Convective Motions and Cloud Macrophysics in a Climate Model

  Funding: Department of Energy; DOE SC/BER DE-FOA-0001530; PI: Romps

  Role: Implemented Romps' Stochastic Parcel Model into DOE's E3SM and tested in single-column simulations.

- Multiscale: Multiscale Methods for Accurate, Efficient, and Scale-Aware Models of the Earth System

  Funding: Department of Energy; DOE SC/BER; PI: Collins

  Role: In a collaboration with the Computational Research Division/LBNL a new framework based on surrogate models has been developed for efficient parameter optimization in the shallow-cumulus parameterization EDMF.

- An Integrative Parameterization of Boundary Layer and Convective Mixing: The Eddy-Diffusivity/Mass-Flux (EDMF) Approach

  Funding: Department of Energy; DOE SC/BER (SciDAC DE-FOA-0001036); PI: Teixeira/Collins

  Role: Further developed and coupled an EDMF parameterization for PBL mixing and shallow cumulus to LBNL's dynamical core CHOMBO and the System for Atmospheric Modeling (SAM).

- Interactions among Cloud Processes, Convection, and Climate Change

  Funding: Lab Directed Research and Development (LDRD); PI: Romps

  Role: Used Large-eddy simulations to study the origin of water vapor rings in the oceanic boundary layer impacted by deep convective outflow.

- Atmospheric System Research at Berkeley Lab: Improving the Characterization of Clouds, Aerosols and the Cryosphere in Climate Models

  Funding: Department of Energy; DOE SC/BER ESD08005; PI: Romps

  Role: Developed novel Lagrangian framework to track water molecules in Eulerian Large-eddy simulations including phase changes based on a Monte-Carlo technique.

- Towards Kilometer-Scale Climate Modeling

  Funding: Center for Climate Systems Modeling at ETH; CHIRP1; PI: Schär

  Role: Numerical aspects (numerical diffusion, convergence, etc.) of convection-permitting simulations were explored for convective precipitation and valley winds with the goal to push regional-climate modeling to the 1-km scale. Contributed to efforts in the numerical modeling division at MeteoSwiss.

Publications

Refereed Articles

- **Langhans W.**, Muller J., and Collins W. D., 2019: Optimization of the Eddy-Diffusivity/Mass-Flux Shallow Cumulus and Boundary-Layer Parameterization Using Surrogate Models. *J. Adv. Model. Earth Sys.*, 11, 402–416.
- Seeley J., Jeevanjee N., **Langhans W.**, and Romps D. M., 2019: Formation of Tropical Anvil Clouds by Slow Evaporation. *Geophys. Res. Lett.*, 46, 492–501.
- **Langhans, W.**, and Romps, D. M., 2015: The origin of water-vapor rings in tropical oceanic cold pools. *Geophys. Res. Lett.*, 42, 7825–7834.
- Hassanzadeh, H., Schmidli, J., **Langhans, W.**, Schlemmer, L., and Schär, C., 2015: Impact of topography on diurnal cycle of summertime moist convection in idealized simulations. *Meteorol. Z.*, doi: 10.1127/metz/2015/0653.
- Prein, A., **Langhans, W.**, Leung, L. R., and others, 2015: Convection-permitting climate modeling: Demonstrations, prospects, and challenges. *Rev. Geophys.*, 53, 323–361.
- **Langhans, W.**, Yeo, K., and Romps, D. M., 2015: Lagrangian investigation of the precipitation efficiency of convective clouds. *J. Atmos. Sci.*, 72, 1045–1062.
- Froidevaux, P., Schlemmer, L., Schmidli, J., **Langhans, W.**, and Schär, C., 2014: Influence of the background wind on the local soil moisture-precipitation feedback. *J. Atmos. Sci.*, 71, 782–799.
- **Langhans, W.**, Schmidli, J., Fuhrer, O., Bieri, S., and Schär, C., 2013: Long-term simulations of thermally-driven flows and orographic convection at convection-parameterizing and cloud-resolving resolutions. *J. Appl. Clim. and Meteorol.*, 52, 1490–1510.
- **Langhans, W.**, Schmidli, J., and Schär, C., 2012: Bulk convergence of kilometer-scale simulations of moist convection over complex terrain. *J. Atmos. Sci.*, 69, 2207–2228.
- **Langhans, W.**, Schmidli, J., and Schär, C., 2012: Mesoscale impacts of explicit numerical diffusion in a convection-permitting model. *Mon. Wea. Rev.*, 140, 226–244.
- **Langhans, W.**, Gohm, A., and Zängl, G., 2011: The orographic impact on patterns of embedded convection during the August 2005 Alpine flood. *Quart. J. Roy. Meteorol. Soc.*, 137, 2092-2105.
- Hohenegger, C., Walser, A., **Langhans, W.**, and Schär, C., 2008: Cloud-resolving ensemble simulations of the August 2005 Alpine flood. *Quart. J. Roy. Meteorol. Soc.*, 134, 889–904.

Non-refereed Publications

- **Langhans, W.**, 2012: Multiscale aspects of cloud-resolving simulations of moist summer convection over complex terrain . *ETH doctoral thesis*, No. 20363 [available online at `http://e-collection.library.ethz.ch`].
- **Langhans, W.**, Schmidli, J., and Szintai, B., 2012: A Smagorinsky-Lilly turbulence closure for COSMO-LES: Implementation and comparison to ARPS. *COSMO newsletter*, No. 12, 20-31 [available online at `www.cosmo-model.org/content/model/documentation/newsLetters/newsLetter12/`].
- **Langhans, W.**, Fuhrer, O., and Schmidli, J., 2012: Description and application of a budget diagnosis tool in COSMO. *COSMO newsletter*, No. 12, 43-51 [available online at `www.cosmo-model.org/content/model/documentation/newsLetters/newsLetter12/`].
- **Langhans, W.**, 2011: Towards kilometer scale climate modeling. *C2SM newsletter*, No. 5, 4 [available online at `www.c2sm.ethz.ch/news/letter/C2SM_Newsletter_5_March_2011.pdf`].

Seminars and conference talks

- **Langhans, W.**, Mueller, J., and Collins, W.D.: Alternatives to the EDMF parameterization uncovered through parameter optimization, Naval Research Laboratory, 2018, Monterey, USA **(invited)**

- **Langhans, W.**, Mueller, J., and Collins, W.D.: Alternatives to the EDMF parameterization uncovered through parameter optimization, California Institute of Technology, 2018, Pasadena, USA **(invited)**
- **Langhans, W.**: Using CRMs and LESs to advance our understanding of cloud processes. Cloud Processes Research Group, Lawrence Livermore National Lab, 2016, Livermore, USA **(invited)**
- **Langhans, W.**: The origin of water vapor rings in tropical oceanic cold pools. Workshop on Cloud and Boundary Layer Closures: The Next Decade, 2016, Zurich, Switzerland **(invited)**
- **Langhans, W.**: The origin of water vapor rings in tropical oceanic cold pools. HD(CP)^2 conference on Understanding Clouds and Precipitation, 2016, Berlin, Germany
- **Langhans, W.**: Deep convection, cold pools, and moist rings. Department of Meteorology and Climate Science, San Jose State University, 2015, San Jose, USA **(invited)**
- **Langhans, W.**: On the origin and pathway of water in cumulus clouds. School of Atmospheric Science at Nanjing University, 2015, Nanjing, China **(invited)**
- **Langhans, W.**, and Romps, D. M.: Lagrangian investigation of the precipitation efficiency of convective clouds. 20th Conference on Atmospheric and Oceanic Fluid Dynamics, 2015, Minneapolis, USA (June 2015)
- **Langhans, W.**: The origin and pathway of water molecules in maritime convective clouds. Center for Climate Sciences, JPL, 2015, Pasadena, USA **(invited)**
- **Langhans, W.** and Jeevanjee, N.: Initiation of deep tropical convection by cold pools: mechanics versus thermodynamics. Berkeley Atmospheric Sciences Center Symposium, 2015, Berkeley, USA **(invited)**
- Hassanzadeh, H., Schmidli, J., **Langhans, W.**, and Schär, C.: Far- and near-field influence of a mesoscale mountain on the diurnal cycle of summertime moist convection. 16th AMS Conference on Mountain Meteorology, 2014, San Diego, USA
- **Langhans, W.**, Yeo, K., and Romps, D. M.: Lagrangian investigation of the water processing by cumulus clouds. HOT Seminar Max-Planck Institute, 2014, Hamburg, Germany **(invited)**
- **Langhans, W.**, Yeo, K., Romps, D. M.: Lagrangian investigation of the precipitation efficiency of convective clouds. 31st AMS Conference on Hurricanes and Tropical Meteorology, 2014, San Diego, USA
- **Langhans, W.**, Yeo, K., and Romps, D. M.: Precipitation efficiency of cumulus clouds studied using a stochastic Lagrangian water-particle framework. ASR Science Team Meeting, 2014, Potomac, USA
- Schmidli, J., **Langhans, W.**, Fuhrer, O., Bieri, S., and Schär, C.: Evaluation of thermally driven flows and orographic convection at cloud-resolving resolutions. AGU, 2013, San Francisco, USA
- **Langhans, W.**, Yeo, K., Romps, D. M.: Tracking water using stochastic Lagrangian particles. LBNL Climate Sciences Department Seminar, 2013, Berkeley, USA (**invited**)
- **Langhans, W.**, Schmidli, J., and Schär, C.: Bulk convergence of cloud-resolving simulations of diurnal moist convection over complex terrain. European Geosciences Union General Assembly, 2013, Vienna, Austria
- Schär, C., **Langhans, W.**, Schmidli, J., and Nikolina, B.: Do cloud-resolving climate models converge? 5th International Workshop on Cloud-Resolving Global Modelling, 2012, Schloss Ringberg, Germany
- Nikolina, B., Schmidli, J., **Langhans, W.**, and Schär, C.: Evaluation of a 10-year cloud-resolving climate simulation driven by ERA-Interim, 2012, AGU Fall Meeting, San Francisco, CA
- Schmidli, J., Nikolina, B., **Langhans, W.**, and Schär, C.: Cloud-resolving climate change scenarios: Challenges and first results. 1st International Conference on Frontiers in Computational Physics: Modeling the Earth System, 2012, Boulder, CO
- **Langhans, W.**: Numerical weather prediction: Factors governing convergence. Computational Science and Engineering ETH, 2012, Zurich, Switzerland **(invited)**
- **Langhans, W.**, Schmidli, J., and Schär, C.: Multiscale aspects of cloud-resolving simulations over complex terrain, Federal Office of Meteorology and Climatology MeteoSwiss, 2012, Zurich, Switzerland **(invited)**

- Hassanzadeh, H., Schmidli, J., **Langhans, W.**, and Schär, C.: Mountain size and atmospheric conditions' impact on the diurnal cycle of clouds and precipitation. 10th Swiss Geoscience Meeting, 2012, Bern, Switzerland
- Hassanzadeh, H., Schmidli, J., **Langhans, W.**, and Schär, C.: Sensitivity of the diurnal cycle of moist convection to terrain geometry. CLM-Community Assembly, 2012, Leuven, Belgium
- **Langhans, W.**, Schmidli, J., and Schär, C.: Bulk convergence of kilometer-scale simulations of moist convection over complex terrain. 31th International Conference on Alpine Meteorology, 2011, Aviemore, Scotland
- **Langhans, W.**, Schmidli, J., and Schär, C.: Bulk convergence of kilometer-scale simulations of moist convection over complex terrain. 9th International SRNWP-Workshop on Nonhydrostatic Modelling, 2011, Bad Orb, Germany
- **Langhans, W.**, Schmidli, J., and Schär, C.: Horizontal resolution in a convection-permitting model: Convergence of bulk flow properties over complex terrain. 14th AMS Conference on Mountain Meteorology, 2010, Squaw Valley, CA
- **Langhans, W.**, Schmidli, J., and Schär, C.: Horizontal resolution in a convection-permitting model: Convergence of bulk flow properties over complex terrain. 10th EMS Annual Meeting, 2010, Zurich, Switzerland
- **Langhans, W.**, Schmidli, J., and Schär, C.: Mesoscale impacts of explicit numerical diffusion in a convection-permitting model. European Geosciences Union General Assembly, 2010, Vienna, Austria
- **Langhans, W.**, Schmidli, J., and Schär, C.: Convection-permitting simulations using explicit numerical diffusion. 8th International SRNWP-Workshop on Nonhydrostatic Modelling, 2009, Bad Orb, Germany

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Conference posters

- **Langhans, W.**, J. Müller, and Collins. B. D.: Alternatives to the Eddy-Diffusivity/Mass-Flux boundary-layer and shallow-cumulus scheme uncovered through parameter optimization. 2nd Pan-GASS meeting on Understanding and Modeling of Atmospheric Processes, Lorne, Australia.
- **Langhans, W.**, J. Müller, and Collins. B. D.: Multi-modal solution of Eddy-Diffusivity/Mass-Flux approach through parameter optimization. 21st Conference on Atmospheric and Oceanic Fluid Dynamics, Portland, USA.
- **Langhans, W.**, and Romps, D. M.: The origin of water-vapor rings in tropical cold pools. AGU, 2014, San Francisco, USA
- **Langhans, W.**, Yeo, K., and Romps, D. M.: A new framework to study convective transport of non-conserved quantities using stochastic Lagrangian particles. AGU, 2013, San Francisco, USA
- **Langhans, W.**, Bieri, S., Schmidli, J., and Schär, C.: Observations and numerical simulations of Alpine pumping and its interaction with moist convection. 31th International Conference on Alpine Meteorology, 2011, Aviemore, Scotland
- **Langhans, W.**, Schmidli, J., and Schär, C.: Kilometer-scale simulations of Alpine summertime convection. CLM-Community Assembly, 2009, Karlsruhe, Germany
- **Langhans, W.**, Gohm, A., and Zängl, G.: The orographic impact on patterns of embedded convection during the August 2005 Alpine flood. 30th International Conference on Alpine Meteorology, 2009, Rastatt, Germany.
- **Langhans, W.**, Gohm, A., and Zängl, G.: Numerical sensitivity study of August 2005 Alpine flood. 13th AMS Conference on Mountain Meteorology, 2008, Whistler, Canada

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Awards

- Best Poster Award, 31th International Conference on Alpine Meteorology, Aviemore, Scotland, 2011
- European Meteorological Society Youth Scientist Travel Award, AMS Mountain Meteorology, Whistler, 2008

Teaching experience

Department of Earth & Planetary Science, University of California, Berkeley

2013 **Discussion leader**, *Pizza, Beer, & Thermodynamics (PBT)*

Institute for Atmospheric and Climate Science, ETH Zurich

2010-2011 **Teaching assistant**, *Numerical prediction of weather and climate* (Prof. C. Schär)

2009-2011 **Teaching assistant**, *Boundary Layer Meteorology & Air Pollution Modeling* (Prof. M. Rotach/Dr. J. Schmidli)

Institute of Meteorology and Geophysics, University of Innsbruck

2008 **Teaching assistant**, *Geophysical Fluid Dynamics and Theoretical Meteorology* (Priv.-Doz. Dr. H. Weber)

Mentoring experience

Institute for Atmospheric and Climate Science, ETH Zurich

2012-2015 **Ph.D. thesis co-advisor**, *Hanieh Hassanzadeh*

2013 **M.S. thesis co-advisor**, *Paul Froidevaux*

2011 **M.S. thesis co-advisor**, *Susanne Bieri*

Teaching training

2014 - Intensive course on evidence-based teaching, Postdoc Teaching Opportunities Program (PTOP), Berkeley, CA

Additional professional training

2011 - Parallel Programming Summer School at the Swiss Center for Scientific Computing, Manno, Switzerland

2010 - ECMWF training course *Numerical methods and adiabatic formulation of models*, Reading, UK
- Took classes *Turbulent Flows* (Prof. Kleiser) and *Turbulence Modeling* (Prof. Jenny), Institute of Fluid Dynamics, ETH Zurich

2009 - COSMO training course on *Model dynamics and physics*, Langen, Germany

2008
- 8th International NCCR Climate Summer School *Climate variability, forcings, feedbacks and responses: the long-term perspective*, Grindelwald, Switzerland
- ECMWF training course *Parameterizations of diabatic processes*, Reading, UK
- AMS/COMET/MSC Mountain Weather Workshop *Bridging the gag between Research and Forecast*, Whistler, Canada

2007
- COPS summer school *Convective and Orographically-induced Precipitation Study*, Black Forest, Germany
- Internship under the guidance of Dr. Daniela Jacob at MPI on *Intercomparison of ECHAM5 and REMO simulations*, Hamburg, Germany
- Internship under the guidance of Dr. Cathy Hohenegger at ETH on *Dynamical aspects of the August 2005 Alpine flood*, Zurich, Switzerland

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Community service and outreach

Service and outreach

06/2014-06/2015
- Organizer of the weekly CESD Brownbag seminar series

10/2013
- Scientist in NOVA-LABS's cloud lab: Online Q&A with students and other participants [`pbs.org/wgbh/nova/labs/`]

06/2012
- Interview for ETH Globe on "Gewitter im Rechner" (thunderstorm in a computer): *ETH Globe*, No. 2, pp. 26-28 [pdf available online (in German)]

Review activity

- Journal of the Atmospheric Sciences
- Monthly Weather Review
- Quarterly Journal of the Royal Meteorological Society
- Climate Dynamics
- Geophysical Research Letters
- Advances in Science and Research
