

Dr. rer. nat. FRANK WERNER

WORK EXPERIENCE

02/2020–present Jet Propulsion Laboratory in Pasadena, USA

Scientist

Contributions to the Aura Microwave Limb Sounder science team, instrument development and testing, studies on stratospheric composition with a focus on water vapor, and developing machine learning models to facilitate active research projects.

03/2019–02/2020 Jet Propulsion Laboratory in Pasadena, USA

Postdoctoral Research Associate

Development of a retrieval simulator for a new CubeSat setup for high-resolution tomography of convective hydration, contributions to a new Python-based radiative transfer model, studies on stratospheric humidity, and improving the near-real-time data products of the Microwave Limb Sounder by means of machine learning techniques.

08/2018–03/2019 Leibniz Institute for Tropospheric Research in Leipzig, Germany

Postdoctoral Research Associate

Developed a cloud retrieval algorithm for MSG SEVIRI with increased spatial resolution, using novel pan sharpening techniques.

02/2015–05/2018 Joint Center for Earth Systems Technology in Baltimore, USA

Postdoctoral Research Associate

Studied scale-dependence of cloud products retrieved from MODIS and ASTER, contributed to the development of the first cloud retrieval algorithm for ASTER, and created novel techniques to mitigate retrieval biases due to sub-pixel variability.

09/2009–01/2015 Universität Leipzig in Leipzig, Germany

Research Associate

Planned and developed a compact airborne radiation instrument, characterized the optical inlets and spectrometers in the laboratory, performed numerous experimental field studies to sample data, developed novel retrieval algorithms to mitigate uncertainties in cloud property retrievals, and applied the data to aerosol-cloud-interaction studies.

EDUCATION

09/2009–01/2015 Universität Leipzig in Leipzig, Germany

Doctor rerum naturalium, Grade: 1.0 (*summa cum laude*)

Planned, developed and characterized a lightweight, airborne spectrometer system. Sampled data provide conclusive, experimental evidence of a fundamental connection between aerosol loading in the atmosphere, cloud microphysics, and reflected radiation.

Thesis: *Twomey Effect of Trade Wind Cumuli*

Advisors: Prof. Dr. Manfred Wendisch & Prof. Dr. Peter Pilewskie

04/2004–08/2009 Johannes Gutenberg–Universität Mainz in Mainz, Germany

Master of Science (Meteorology), Grade: 1.2 (*very good*)

Provided truly collocated measurements of optical and microphysical cloud properties, based on a unique measurement setup, which demonstrate a good agreement between remote sensing and in situ data, but strong discrepancies to satellite observations.

Thesis: *Helicopter-based measurement of boundary layer cloud properties and solar radiation*

Advisors: Prof. Dr. Manfred Wendisch & Prof. Dr. Heini Wernli

07/2006–06/2007 Uppsala Universitet in Uppsala, Sweden

Student Exchange via Erasmus Programme

Established a connection between the University of Mainz and the University of Uppsala, which to this day allows students from each university to study abroad as part of the Erasmus Programme (European Community Action Scheme for the Mobility of University Students). Attended courses in Theoretical Physics, Atmospheric Dynamics and Swedish language.

1994–2002 Georg–Christoph–Lichtenberg Gymnasium in Gera, Germany

Abitur (University–entrance Diploma), Grade: 1.7 (*good*)

Main courses: Literature, English, Mathematics, and Economics.

PEER-REVIEWED PUBLICATIONS

2022

[23] Santee, M. L., Lambert, A., Manney, G. L., Livesey, N. J., Froidevaux, L., Neu, J. L., Schwartz, M. J., Millán, L. F., **Werner, F.**, Read, W. G., Park, M., Fuller, R. A., and Ward, B. M. (2022), Prolonged and pervasive perturbations in the composition of the Southern Hemisphere mid-latitude lower stratosphere from the Australian New Year's fires., *Geophys. Res. Lett.*, 49, doi: 10.1029/2021GL096270

2021

[22] **Werner, F.**, Schwartz, M. J., Livesey, N. J., Read, W. G., Santee, M. L., and Wind, G. (2021), Improved cloud detection for the Aura Microwave Limb Sounder: Training an artificial neural network on colocated MLS and Aqua-MODIS data, *Atmos. Meas. Tech.*, 14, 7749–7773, doi: 10.5194/amt-14-7749-2021

[21] Deneke, H., Barrientos-Velasco, C., Bley, S., Hünerbein, A., Lenk, S., Macke, A., Meirink, J. F., Schroedter-Homscheidt, M., Senf, F., Wang, P., **Werner, F.**, and Witthuhn, J. (2021), Increasing the spatial resolution of cloud property retrievals from Meteosat SEVIRI by use of its high-resolution visible channel: implementation and examples, *Atmos. Meas. Tech.*, 14, 5107–5126, doi: 10.5194/amt-14-5107-2021

2020

[20] Schwartz, M. J., Santee, M. L., Pumphrey, H. C., Manney, G. L., Lambert, A., Livesey, N. J., Millán, L., Neu, J. L., Read, W. G., and **Werner, F.** (2020), Australian new year's pyroCb impact on stratospheric composition., *Geophys. Res. Lett.*, 47, doi: 10.1029/2020GL090831

[19] **Werner, F.**, Schwartz, M. J., Livesey, N. J., Read, W. G., and Santee, M. L. (2020), Extreme outliers in lower stratospheric water vapor over North America observed by MLS: Relation to overshooting convection diagnosed from colocated Aqua-MODIS data., *Geophys. Res. Lett.*, 47, doi: 10.1029/2020GL090131

[18] **Werner, F.**, and Deneke, H. (2020), Increasing the spatial resolution of cloud property retrievals from Meteosat SEVIRI by use of its high-resolution visible channel: evaluation of candidate approaches with MODIS observations, *Atmos. Meas. Tech.*, 13, 1089–1111, doi: 10.5194/amt-13-1089-2020

2018

[17] Grosvenor, D. P., Soudervall, O., Zuidema, P., Ackerman, A. S., Alexandrov, M. D., Cairns, B., Chiu, C., Christensen, M., Feingold, G., Hunerbein, A., Knist, C., McCoy, D., Merk, D., Painemal, D., Rosenfeld, D., Russchenberg, H., Sinclair, K., van Diedenhoven, B., **Werner, F.**, Wood, R., Zhang, Z., and Quaas, J. (2018), Remote sensing of droplet number concentration in warm clouds: A review of the current state of knowledge and perspectives, *Rev. Geophys.*, 56, 409–453, doi: 10.1029/2017RG000593

[16] Miller, D. J., Zhang, Z., Platnick, S., Ackerman, A. S., **Werner, F.**, Cornet, C., and Knobelspiesse, K. (2018), Comparisons of bispectral and polarimetric retrievals of marine boundary layer cloud microphysics: case studies using a LES-satellite retrieval simulator, *Atmos. Meas. Tech.*, 11, 3689–3715, doi: 10.5194/amt-11-3689-2018

[15] **Werner, F.**, Zhang, Z., Wind, G., Miller, D. J., and Platnick, S. (2018), Improving cloud optical property retrievals for partly cloudy pixels using coincident higher-resolution single band measurements: A feasibility study using ASTER observations, *J. Geophys. Res.*, 123, 12253–12276, doi: 10.1029/2018JD028902

[14] **Werner, F.**, Zhang, Z., Wind, G., Miller, D. J., and Platnick, S. (2018), Quantifying the impacts of subpixel reflectance variability on cloud optical thickness and effective radius retrievals based on high-resolution ASTER observations, *J. Geophys. Res.*, 123, 1–20, doi: 10.1002/2017JD027916

- [13] Schäfer, M., Bierwirth, E., Ehrlich, A., Jäkel, E., **Werner, F.**, and Wendisch, M. (2017), Directional, horizontal inhomogeneities of cloud optical thickness fields retrieved from ground-based and airborne spectral imaging, *Atmos. Chem. Phys.*, 17, 2359–2372, doi: 10.5194/acp-17-2359-2017
- [12] Krisna, T. C., Wendisch, M., Ehrlich, A., Jäkel, E., **Werner, F.**, Weigel, R., Borrmann, S., Mahnke, C., Pöschl, U., Meinrat, O. A., Voigt, C., and Machado, L. A. T. (2017), Comparing airborne and satellite retrievals of cloud optical thickness and particle effective radius using a spectral radiance ratio technique: two case studies for cirrus and deep convective clouds, *Atmos. Chem. Phys.*, 18, 4439–4462, doi: 10.5194/acp-18-4439-2018
- [11] Voigt, C., Schumann, U., Minikin, A., Abdelmonem, A., Afchine, A., Borrmann, S., Boettcher, M., Buchholz, B., Bugliaro, L., Costa, A., Curtius, J., Dollner, M., Dörnbrack, A., Dreiling, V., Ebert, V., Ehrlich, A., Fix, A., Forster, L., Frank, F., Fütterer, D., Giez, A., Graf, K., Groß, J.-U., Groß, S., Heimerl, K., Heinold, B., Hüneke, T., Järvinen, E., Jurkat, T., Kaufmann, S., Kenntner, M., Klingebiel, M., Klimach, T., Kohl, R., Krämer, M., Krisna, T. C., Luebke, A., Mayer, B., Mertes, S., Molleker, S., Petzold, A., Pfeilsticker, K., Port, M., Rapp, M., Reutter, P., Rolf, C., Rose, D., Sauer, D., Schäfler, A., Schlage, R., Schnaiter, M., Schneider, J., Spelten, N., Spichtinger, P., Stock, P., Walser, A., Weigel, R., Weinzierl, B., Wendisch, M., **Werner, F.**, Wernli, H., Wirth, M., Zahn, A., Ziereis, H., and Zöger, M. (2017), ML—CIRRUS – The airborne experiment on natural cirrus and contrail cirrus with the high-altitude long-range research aircraft HALO, *Bull. Amer. Meteor. Soc.*, 98, 271–288, doi: 10.1175/BAMS-D-15-00213.1
- [10] Wolf, K., Ehrlich, A., Hüneke, T., Pfeilsticker, K., **Werner, F.**, Wirth, M., and Wendisch, M. (2017), Potential of remote sensing of cirrus optical thickness by airborne spectral radiance measurements in different viewing angles and nadir geometry, *Atmos. Chem. Phys.*, 17, 4283–4303, doi: 10.5194/acp-17-4283-2017

- [9] Finger, F., **Werner, F.**, Klingebiel, M., Ehrlich, A., Jäkel, E., Voigt, M., Borrmann, S., Spichtinger, P., and Wendisch, M. (2016), Spectral optical layer properties of cirrus from collocated airborne measurements – a feasibility study, *Atmos. Chem. Phys.*, 16, 7681–7693, doi: 10.5194/acp-16-7681-2016
- [8] Wendisch, M., Pöschl, U., Andreae, M. O., Machado, L. A. T., Albrecht, R., Schlager, H., Rosenfeld, D., Martin, S. T., Abdelmonem, A., Afchine, A., C. Araújo, A. C., Artaxo, P., Aufmhoff, H., Barbosa, H. M. J., Borrmann, S., Braga, R., Buchholz, B., Cecchini, M. A., Costa, A., Curtius, J., Dollner, M., Dorf, M., Dreiling, V., Ebert, V., Ehrlich, A., Ewald, F., Fisch, G., Fix, A., Frank, F., Fütterer, D., Heckl, C., Heidelberg, F., Hüneke, T., Jäkel, E., Järvinen, E., Jurkat, T., Kanter, S., Kästner, U., Kenntner, M., Kesselmeier, J., Klimach, T., Knecht, M., Kohl, R., Kölling, T., Krämer, M., Krüger, M., Krisna, T. C., Lavric, J. V., Longo, K., Mahnke, C., Manzi, A. O., Mayer, B., Mertes, S., Minikin, A., Molleker, S., Münch, S., Nillius, B., Pfeilsticker, K., Pöhlker, C., Roiger, A., Rose, D., Rosenow, D., Sauer, D., Schnaiter, M., Schneider, J., Schulz, C., de Souza, R. A. F., Spanu, A., Stock, P., Vila, D., Voigt, C., Walser, A., Walter, D., Weigel, R., Weinzierl, B., **Werner, F.**, Yamasoe, M. A., Ziereis, H., Zinner, T., and Zöger, M. (2016), The ACRIDICON-CHUVA campaign: Studying tropical deep convective clouds and precipitation over Amazonia using the new German research aircraft HALO, *Bull. Amer. Meteor. Soc.*, 97, 1885–1908, doi: 10.1175/BAMS-D-14-00255.1
- [7] **Werner, F.**, Wind, G., Zhang, Z., Platnick, S., Di Girolamo, L., Zhao, G., Amarasinghe, N., and Meyer, K. (2016), Marine boundary layer cloud property retrievals from high-resolution ASTER observations: case studies and comparison with Terra MODIS, *Atmos. Meas. Tech.*, 9, 5869–5894, doi: 10.5194/amt-9-5869-2016
- [6] Zhang, Z., **Werner, F.**, Cho, H.-M., Wind, G., Platnick, S., Ackerman, A. S., Girolamo, L. D., Marshak, A., and Meyer, K. (2016), A framework based on 2-D Taylor expansion for quantifying the impacts of subpixel reflectance variance and covariance on cloud optical thickness and effective radius retrievals based on the bispectral method, *J. Geophys. Res.*, 121, 7007–7025, doi: 10.1002/2016JD024837

- [5] Wehner, B., **Werner, F.**, Ditas, F., Shaw, R. A., Kulmala, M., and Siebert, H. (2015), Observations of new particle formation in enhanced UV irradiance zones near cumulus clouds, *Atmos. Chem. Phys.*, 15, 11701–11711, doi: 10.1002/jgrd.50334

2014

- [4] **Werner, F.**, F. Ditas, H. Siebert, M. Simmel, B. Wehner, P. Pilewskie, T. Schmeissner, R. A. Shaw, S. Hartmann, H. Wex, G. C. Roberts, and M. Wendisch (2014), Twomey effect observed from collocated microphysical and remote sensing measurements over shallow cumulus, *J. Geophys. Res.*, 119, 1534–1545, doi: 10.5194/acp-15-11701-2015

2013

- [3] Siebert, H., Bethke, J., Bierwirth, E., Conrath, T., Dieckmann, K., Ditas, F., Ehrlich, A., Farrell, D., Hartmann, S., Izaguirre, M. A., Katzwinkel, J., Nuijens, L., Roberts, G., Schäfer, M., Shaw, R. A., Schmeissner, T., Serikov, I., Stevens, B., Stratmann, F., Wehner, B., Wendisch, M., **Werner, F.**, and Wex, H. (2013), The fine-scale structure of the trade wind cumuli over Barbados – an introduction to the CARRIBA project, *Atmos. Chem. Phys.*, 13, 10061–10077, doi: 10.5194/acp-13-10061-2013

- [2] **Werner, F.**, H. Siebert, P. Pilewskie, T. Schmeissner, R. A. Shaw, and M. Wendisch (2013), New airborne retrieval approach for trade wind cumulus properties under overlying cirrus, *J. Geophys. Res.*, 118, 3634–3649, doi: 10.1002/jgrd.50334

2010

- [1] **Henrich***, F., Siebert, H., Jäkel, E., Shaw, R. A., and Wendisch, M. (2010), Collocated measurements of boundary layer cloud microphysical and radiative properties: A feasibility study, *J. Geophys. Res.*, 115, D24214, doi: 10.1029/2010JD013930

OTHER PUBLICATIONS

2012

- [1] Wendisch, M. and Yang, P. (2012), Theory of Atmospheric Radiative Transfer - A Comprehensive Introduction, *Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany*, ISBN: 978-3-527-40836-8

PRESENTATIONS

2021

- [18] **Werner, F.**, Schwartz, M. J., Livesey, N. J., Read, W. G., Santee, M. L., and Milán, L. V. (05/2021), Training an artificial neural network to improve the near-real-time retrieval products derived from observations of the Microwave Limb Sounder, *Talk at the Limb Workshop 2021*, Pasadena, USA

2020

- [17] **Werner, F.**, Schwartz, M. J., Livesey, N. J., Read, W. G., and Santee, M. L. (12/2020), Extreme outliers in lower stratospheric water vapor over North America observed by MLS: Relation to overshooting convection diagnosed from colocated Aqua-MODIS data, *Talk at the Virtual Fall Meeting of the American Geophysical Union*, Pasadena, USA

2018

- [16] **Werner, F.** (09/2018), Improving cloud optical property retrievals using coincident higher-resolution band measurements, *Talk at the Atmospheric Chemistry, Dynamics and Radiation Seminar Series*, Pasadena, USA

(* Surname changed from Henrich to Werner in 2011.)

2017

[15] **Werner, F.**, Wind, G., Zhang, Z., Platnick, S., and Meyer, K. (12/2017), Partially cloudy retrievals: Case studies with high-resolution ASTER data and applicability to MODIS observations, *Poster at the Fall Meeting of the American Geophysical Union*, New Orleans, USA

[14] **Werner, F.**, Wind, G., and Zhang, Z. (06/2017), Cloud property retrievals for partially cloudy pixels: Case studies with high-resolution ASTER data for future MODIS applications, *Poster at the NASA AeroCenter Meeting*, Greenbelt, USA

[13] **Werner, F.**, Zhang, Z., Wind, G., Platnick, S., Cho, H.-M., and Di Girolamo, L. (01/2017), Quantifying the impact of subpixel reflectance variability on cloud property retrievals using high-resolution ASTER observations, *Talk at the NASA Climate and Radiation Laboratory Seminar Series*, Greenbelt, USA

2016

[12] **Werner, F.**, Wind, G., Zhang, Z., Platnick, S., Di Girolamo, L., Zhao, G., Amarasinghe, N., and Meyer, K. (12/2016), Quantifying the impact of subpixel reflectance variability on cloud property retrievals from high-resolution ASTER observations, *Poster at the Fall Meeting of the American Geophysical Union*, San Francisco, USA

[11] **Werner, F.**, Wind, G., Zhang, Z., Platnick, S., Di Girolamo, L., Zhao, G., Amarasinghe, N., and Meyer, K. (06/2016), Marine boundary layer cloud property retrievals from high-resolution ASTER observations: Case studies and comparison with Terra-MODIS, *Poster at NASA's 2016 MODIS Science Team Meeting*, Silver Spring, USA

2015

[10] **Werner, F.**, Wind, G., Zhang, Z., Platnick, S., Di Girolamo, L., Zhao, G., Amarasinghe, N., and Meyer, K. (12/2015), The resolution-dependence of satellite-based cloud retrievals: First results from ASTER and MODIS observations, *Poster at the Fall Meeting of the American Geophysical Union*, San Francisco, USA

[9] **Werner, F.**, Wind, G., and Zhang, Z. (05/2015), Comparing retrieval products of MODIS and ASTER: First results, *Poster at NASA's 2015 MODIS Science Team Meeting*, Silver Spring, USA

2014

[8] **Werner, F.**, Schmeissner, T., Shaw, R. A., Siebert, H., and Wendisch, M. (06/2014), Analyzing inhomogeneity of trade wind cumuli from collocated radiation and microphysical observations, *Poster at the Annual Meeting of the American Meteorological Society*, Boston, USA

[7] **Werner, F.**, Ditas, F., Siebert, H., Simmel, M., Wehner, B., Pilewskie, P., Schmeissner, T., Shaw, R. A., Hartmann, S., Wex, H., Roberts, G. C., and Wendisch, M. (06/2014), Twomey effect observed from collocated microphysical and remote sensing measurements over shallow cumulus, *Talk at the Annual Meeting of the American Meteorological Society*, Boston, USA

2012

[6] **Werner, F.** (12/2012), Aerosol and radiative effects of shallow cumulus clouds, *Talk at the Leibniz Institute for Tropospheric Research*, Leipzig, Germany

[5] **Werner, F.**, Siebert, H., Pilewski, P., and Wendisch, M. (08/2012), New helicopter-borne retrieval of trade wind cumuli properties underneath cirrus, *Talk at the International Radiation Symposium*, Berlin, Germany

[4] **Werner, F.**, Siebert, H., Ditas, F., Macke, A., and Wendisch, M. (08/2012), New helicopter-borne retrieval of trade wind cumuli under cirrus and verification of indirect aerosol effect, *Poster at the International Conference on Clouds and Precipitations*, Leipzig, Germany

2011

[3] **Werner, F.** (10/2011), Radiation measurements and microphysical retrievals of trade wind cumuli, *Talk at the Leibniz Institute for Tropospheric Research*, Leipzig, Germany

2010

[2] **Werner, F.**, Siebert, H., Jäkel, E., Shaw, R. A., and Wendisch, M. (01/2010), Collocated measurements of boundary-layer cloud microphysical and radiative properties and comparison with satellite retrievals, *Talk and poster at the ERCA Winter School, Grenoble, France*

2008

[1] **Henrich*, F.**, Jäkel, E., Siebert, H., Wehner, B., and Wendisch, M. (10/2008), Helicopter-borne radiation measurements during IMPACT 2008, *Talk at the EUCAARI Workshop, Toulouse, France*

EXPERIMENTAL FIELD STUDIES

- 2014 ACRIDICON-CHUVA (Manaus, Brasil)
 ML-CIRRUS (Oberpfaffenhofen, Germany)
- 2013 NARVAL (Oberpfaffenhofen, Germany)
 AIRTOSS (North Sea, Germany)
- 2011 CARRIBA (Grantley Adams International Airport, Barbados)
- 2010 CARRIBA (Grantley Adams International Airport, Barbados)
- 2009 MEGACITIES (Zhongshan, China)
- 2008 EGER (Fichtelgebirge, Germany)
 EUCAARI (Cabauw, Netherlands)
- 2007 SPEEDY (Kiel, Germany)
- 2006 PRINCE (Black Forrest, Germany)

(* Surname changed from Henrich to Werner in 2011.)