Robert Pincus
Lamont Research Professor
Lamont Doherty Earth Observatory, Columbia University
61 Route 9W, Room 205B, Palisades, New York 10964
Phone: 845-365-8393, email robertp@ldeo.columbia.edu
https://crew.ldeo.columbia.edu

Education
B.S., 1986, Physics, University of Washington
Ph.D., 1994, Geophysics, University of Washington (Marcia B. Baker, advising)

Professional experience
07.21-present: Lamont Research Professor, Lamont Doherty Earth Observatory, Columbia University
03.17-06.21: Adjunct Senior Research Scientist, Lamont Doherty Earth Observatory, Columbia University
02.01-06.21: Research scientist, U. Colorado/CIRES and NOAA Physical Sciences Lab
09.98-01.01: Visiting Assistant Professor, Department of Atmospheric & Oceanic Sciences; Assistant Scientist, Cooperative Institute for Satellite Meteorological Studies, University of Wisconsin, Madison
09.97 – 08.98: Assistant Research Scientist, Joint Center for Earth Systems Technology, University of Maryland, Baltimore County
03.95-08.97: National Research Council Research Associate, NASA/Goddard Space Flight Center

Recent community activities
Member, Coupled Model Intercomparision Project (CMIP) Panel (2020-)
Co-organizer, Princeton node of the Digital Earths Global Hackathon (2025)
Member, Advisory Board, EU project CleanCloud (2023-)
Editor-in-Chief, Journal of Advances in Modeling Earth Systems (2015-2020; Associate Editor 2013-2014)

Recent instructional activities
Atmospheric radiation (EESC 6922), Fall 2024, Fall 2022
5th Summer School on Theory, Mechanisms and Hierarchical Modelling of Climate Dynamics: Convection and Clouds (International Center for Theoretical Physics, Trieste), Summer 2024
Idealized models of climate processes (EESC 6926, with Galen McKinley), Spring 2023
Earth's environmental systems: The climate system (EESC 2100), Spring 2022

Student supervision
Postdoctoral fellows: Clare Singer (2023-2024; NOAA Climate & Global Change Fellow with Yi Ming, Boston University) , Guillaume Bertoli (2024-2025, with Pierre Gentine), Sean Cohen (2024-; with Lorenzo Polvani)
PhD advisor: Paulina Czarnecki (Applied Physics and Applied Math, with Lorenzo Polvani, 2021-2025); Dion Ho (Applied Physics and Applied Math, with Kui Ren, 2022-

); Margaret Powell (Earth and Environmental Engineering, 2024-)
Student PhD committee: Haozhe He (U. Miami, 2023)
PhD examiner: Wouter Mol (Wageningen University and Research 2024), Erik Johnson (U. Stockholm, 2019); Peter Hill (U. Reading, 2012); Daniel Klocke (U. Hamburg, 2011)

University service
Graduate admissions committees: Applied Physics and Applied Math (2023-2026); Earth and Environmental Sciences (2022)
Lamont-Doherty Earth Observatory Executive Committee, divisional representative (2023-)
Columbia University Research Computing Faculty Committee (2023-2024)

Publications

Ho, D. J. X., & Pincus, R., 2025. Two-Streams Improved: A Physics-Guided Data-Driven Approach. Submitted to *J. Adv. Model. Earth Syst.* Nov 2025. Preprint at doi:10.22541/essoar.176487419.97424416/v1

Czarnecki, P. and R. Pincus, 2025. How Clear-Sky Spectral Overlap Shapes Radiation in Cloudy Atmospheres. Revised for *J. Clim.* Mar 2026, preprint at doi:10.22541/essoar.176031268.82054152/v1

Cohen, S., R. Pincus, and L. M. Polvani, in press: Why increases in CO2 cool the stratosphere and how this amplifies radiative forcing. *Nature Geosci.*, preprint at doi:10.21203/rs.3.rs-7608058/v1

Singer, C. E. and R. Pincus, 2026: Southern Ocean clear-sky brightening caused by wind-driven sea spray aerosol increase. *Geophys. Res. Lett.* **53**, e2025GL119637. doi:10.1029/2025GL119637

Czarnecki, P., L. M. Polvani, and R. Pincus, 2025. Analytical Models of Instantaneous Radiative Forcing Across Opacity Regimes. *J. Clim.* **38**, 7351–7368, doi:10.1175/JCLI-D-25-0233.1.

Dunne, J. P. et al., 2025. An evolving Coupled Model Intercomparison Project phase 7 (CMIP7) and Fast Track in support of future climate assessment. *Geosci. Model Dev.*, **18**, 6671–6700. doi:10.5194/gmd-18-6671-2025

Hafner, K., F. Iglesias-Suarez, S. Shamekh, P. Gentine, M.A. Giorgetta, R. Pincus, and V. Eyring, 2025. Interpretable machine learning-based radiation emulation for ICON. *J. Geophys. Res. Machine Learn. Comput.*, **2**, e2024JH000501. doi:10.1029/2024JH000501.

Chen, X. et al., 2025. Impacts of Weak Sea Surface Temperature Warm Anomalies on Trade Wind Cloudiness in Large Eddy Simulations. *J. Adv. Modeling Earth Syst.*, **17**, e2024MS004778. doi:10.1029/2024MS004778.

Cohen, S. and R. Pincus, 2025. A spectroscopic theory for how mean rainfall changes with surface temperature. *Sci. Adv.*, 11, eadv6191. doi:10.1126/sciadv.adv6191

Mlawer, E. J., J. Mascio, D. D. Turner, V. Payne, C. Flynn, and R. Pincus, 2024. A more transparent water vapor window. *J. Geophys. Res. Atmos.* **129**, e2024JD041366 doi:10.1029/2024JD041366

Quaas, J. et al. 2024. Adjustments to climate perturbations - mechanisms, implications, observational constraints. *AGU Adv.*, **5**, e2023AV001144. doi:10.1029/2023AV001144

Ho, D. J. X. and R. Pincus, 2024. Two-streams revisited: General equations, exact coefficients, and optimized closures. *J. Adv. Model. Earth Syst.*, **16**, e2024MS004504, doi:10.1029/2024MS004504

Roemer, F. E., S. A. Buehler, L. Kluft, and R. Pincus, 2024. Effect of uncertainty in water vapor continuum absorption on radiative forcing, longwave feedback, and climate sensitivity, *J. Adv. Model. Earth Syst.*, **16**, e2023MS004157, doi:10.1029/2023MS004157

Veerman, M. A., Pincus, R., Mlawer, E. J., & van Heerwaarden, C. C., 2024. The impact of radiative transfer at reduced spectral resolution in large-eddy simulations of convective clouds. *J. Adv. Modeling Earth Syst*. **16**, e2023MS003699. doi:10.1029/2023MS003699

Chen, X. et al., 2023: Ubiquitous sea surface temperature warm anomalies increase spatial heterogeneity of trade-wind cloudiness on daily timescales. *J. Atmos. Sci.*, **80**, 2969-2987, doi:10.1175/JAS-D-23-0075.1

Črnivec, N, G. Cesana, and R. Pincus, 2023. Evaluating the Representation of Tropical Stratocumulus and Shallow Cumulus Clouds As Well As Their Radiative Effects in CMIP6 Models Using Satellite Observations. *J. Geophys. Res.*, **128**, e2022JD038437, doi:10.1029/2022JD038437

Czarnecki, P., L. M. Polvani, and R. Pincus, 2023. Sparse, empirically optimized quadrature for broadband spectral integration. *J. Adv. Modeling Earth Syst.*, **15**, e2023MS003819. doi:10.1029/2023MS003819

Pincus, R., P. A. Hubanks, S. A. Platnick, K. Meyer, R. E. Holz, D. Botambekov, and C. J. Wall, 2023: Updated observations of clouds by MODIS for global model assessment. *Earth Syst. Sci. Data*, **15**, 2483–2497, doi:10.5194/essd-15-2483-2023.

Fildier, B., C. Muller, R. Pincus, and S. Fueglistaler, 2023: How moisture shapes low-level radiative cooling in subsidence regimes. *AGU Advances*, **4**, e2023AV000880, doi:10.1029/2023AV000880

Cesana, G. V., A. S. Ackerman, N. Črnivec, R. Pincus, and H Chepfer, 2023: An observation-based method to assess tropical stratocumulus and shallow cumulus clouds and feedbacks in CMIP6 and CMIP5 models. *Env. Res. Commun.*, **5**, 045001, doi: 10.1088/2515-7620/acc78a.

Chen, T.-C., S. G. Penny, J. S. Whitaker, S. Frolov, R. Pincus, and S. Tulich, 2022: Correcting systematic and state-dependent errors in the NOAA FV3-GFS using neural networks. *J. Adv. Modeling Earth Syst.*, **14**, e2022MS003309, doi:10.1029/2022MS003309

Buehler, S. A. et al., 2022: A new halocarbon absorption model based on HITRAN cross-section data and new estimates of halocarbon instantaneous clear-sky radiative forcing. *J. Adv. Modeling Earth Syst.*, **14**, e2022MS003239, doi:10.1029/2022MS003239

Giorgetta, M.A. et al, 2022: The ICON-A model for direct QBO simulations on GPUs (version icon-cscs:baf28a514). To appear in *Geosci. Model Dev.*, preprint doi: 10.5194/egusphere-2022-152.

George, G. et al., 2021: JOANNE: Joint dropsonde Observations of the Atmosphere in tropical North atlaNtic meso-scale Environments. *Earth Syst. Sci. Data.* **13**, 5253–5272, doi:10.5194/essd-13-5253-2021

Stevens, B., S. Bony, D. Farrell et al., 2021: EUREC^{4}A, *Earth Syst. Sci. Data*, **13**, 4067–4119, doi:10.5194/essd-13-4067-2021

Pincus, R. et a., 2021: Observations from the NOAA P-3 aircraft during ATOMIC, *Earth Syst. Sci. Data*, **13**, 3281–3296, doi:10.5194/essd-13-3281-2021.

Quinn, P. K. et al., 2021: Measurements from the RV Ronald H. Brown and related platforms as part of the Atlantic Tradewind Ocean-Atmosphere Mesoscale Interaction Campaign (ATOMIC). *Earth Syst. Sci. Data*, **13**, 1759–1790, doi:10.5194/essd-13-1759-2021.

Albright, A. L. et al., 2021: Atmospheric Radiative Profiles during EUREC^{4}A. *Earth Syst. Sci. Data*, **13**, 617–630, doi:10.5194/essd-13-617-2021.

Veerman, M. A. et al., 2020: Predicting atmospheric optical properties for radiative transfer computations using neural networks. *Phil. Trans. Royal Soc. A,* **379**, 20200095, doi:10.1098/rsta.2020.0095.

Pincus, R. et al., 2020: Benchmark calculations of radiative forcing by greenhouse gases, *J. Geophys. Res. – Atmos.*, **125**, e2020JD033483, doi:10.1029/2020JD033483.

Ukkonen, P., R. Pincus, R. J. Hogan, K. P. Nielsen, and E. Kaas, 2020: Accelerating radiation computations for dynamical models with targeted machine learning and code optimization. *J. Adv. Modeling Earth Syst*., **12**, e2020MS002226, doi:10.1029/2020MS002226.

Pincus, R. and H. Chepfer, 2020: Clouds as light. In A. Siebesma, S. Bony, C. Jakob, & B. Stevens (Eds.), *Clouds and Climate: Climate Science's Greatest Challenge* (pp. 99-122). Cambridge: Cambridge University Press. doi:10.1017/9781107447738.005.

Smith, C. J. et al., 2020: Effective radiative forcing and adjustments in CMIP6. *Atmos. Chem. Phys.,* **20**, 9591–9618, doi:10.5194/acp-20-9591-2020.

Pincus, R, E. J. Mlawer, and J. S. Delamere, 2019: Balancing accuracy, efficiency, and flexibility in radiation calculations for dynamical models. *J. Adv. Modeling Earth Syst*., **11**, 3074-3089, doi:10.1029/2019MS001621.

Randall, DA et al., 2019: 100 years of model development. *Meteor. Monographs*, **59**, 12.1-12.66, doi:10.117/AMSMONOGRAPHS-D-18-0018.1

Mauritsen, T. et al., 2019: Developments in the MPI-M Earth System Model version 1.2 (MPI-ESM 1.2) and its response to increasing CO_2. *J. Adv. Modeling Earth Syst*., **11**, 998-1138, doi:10.1029/2018MS001400.

Abramowitz, G. et al., 2019: ESD Reviews: Model dependence in multi-model climate ensembles: weighting, sub-selection and out-of-sample testing. *Earth Syst. Dyn*. **10**, 91-105, doi:10.5194/esd-10-91-2019.

Eyring, V. et al., 2019: Taking climate model evaluation to the next level. *Nature Clim. Change*. **9**, 102-110, doi:10.1038/s41558-018-0355-y.

Marvel, K., Pincus, R., Schmidt, G. A., & Miller, R. L. 2018. Internal variability and disequilibrium confound estimates of climate sensitivity from observations. *Geophys.*

Res. Lett., **45**, 1595–1601, doi:10.1002/2017GL076468.

Swales, D. J., R. Pincus, and A. Bodas-Salcedo, 2018: The Cloud Feedback Model Intercomparison Project Observational Simulator Package: Version 2. *Geosci. Model Dev.*, **11**, 77-81, doi:10.5194/10.5194/gmd-11-77-2018

Jones, A. L. et al., 2017: A new paradigm for diagnosing contributions to model aerosol forcing error. *Geophys. Res. Lett.*, **44**, 12004–12012, doi:10.1002/2017GL075933

Pincus, R. et al., 2017: The representation of tropospheric water vapor over low-latitude oceans in (re-)analysis: Errors, impacts, and the ability to exploit current and prospective observations. *Surv. Geophys.*. **38**, 1399-1423, doi:10.1007/s10712-017-9437-z.

Klein, S. A., A. Hall, J. R. Norris, and R. Pincus, 2017: Low-cloud feedbacks from cloud-controlling factors: A review. *Surv. Geophys.*. **38**, 1307-1329, doi:10.1007/s10712-017-9433-3

Lebsock, M., T. S. L'Ecuyer, and R. Pincus, 2017: An observational view of relationships between moisture aggregation, cloud, and radiative heating profiles. *Surv. Geophys.*. **38**, 1237-1254, doi:10.1007/s10712-017-9443-1

Mauritsen, T. and R. Pincus, 2017: Committed warming inferred from observations. *Nature Clim. Change*, **7**, 652–655, doi:10.1038/nclimate3357.

Voigt, A. et al., 2017: Fast and slow shifts of the zonal-mean intertropical convergence zone in response to an idealized anthropogenic aerosol. *J. Adv. Model. Earth Syst.,* **9**, 870-892, doi:10.1002/2016MS000902.

Forster, P. M., T. Richardson, A. C. Maycock, C. J. Smith, B. H. Samset, G. Myhre, T. Andrews, R. Pincus, and M. Schulz, 2016: Recommendations for diagnosing effective radiative forcing from climate models for CMIP6, *Geophys. Res. Lett.*, 42, 5485–5492, doi: 10.1002/2016JD025320.

Pincus, R., P. M. Forster, and B. Stevens, 2016: The Radiative Forcing Model Intercomparison Project (RFMIP): experimental protocol for CMIP6. *Geosci. Model Dev.*, 9, 3447-3460 doi: 10.5194/gmd-9-3447-2016.

Seifert, A., T. Heus, R. Pincus, and B. Stevens, 2015: Large-eddy simulation of the transient and near-equilibrium behavior of precipitating shallow convection, *J. Adv. Model. Earth Syst.,* **7**, 1918-1937, doi:10.1002/2015MS000489.

Pincus, R., et al., 2015: Radiative flux and forcing parameterization error in aerosol-free clear skies, Geophys. Res. Lett., 42, 5485–5492, doi: 10.1002/2015GL064291.

Bony, S., et al., 2015: Clouds, circulation, and climate sensitivity *Nature Geosci.*, **8**, 261–268, doi:10.1038/ngeo2398.

Bozzo, A., R. Pincus, I. Sandu, and J.-J. Morcrette, 2014: Impact of a spectral sampling technique for radiation on ECMWF weather forecasts *J. Adv. Model. Earth Syst.*, **6**, 1288–1300, doi:10.1002/2014MS000386.

Feldman, D., W. D. Collins, R. Pincus, X. Huang, and X. Chen, 2014: Far-infrared surface emissivity and climate. *Proc. Nat. Acad. Sci.*, **111**, 16297-16302, doi:10.1073/pnas.1413640111.

Pincus, R. and B. Stevens, 2013: Paths to accuracy for radiation parameterizations in

atmospheric models. *J. Adv. Model Earth Syst.*, **5**, 225-233, doi:10.1002/jame.20027.

Stevens, B. and co-authors, 2013: The Atmospheric Component of the MPI-M Earth System Model: ECHAM6. *J. Adv. Model Earth Syst.*, **5**, 146-172, doi:10.1002/jame.20015.

Schirber, S., D. Klocke, R. Pincus, J. Quaas, and J. L. Anderson, 2013: Parameter estimation using data assimilation in an atmospheric general circulation model: From a perfect towards the real world. *J. Adv. Model Earth Syst.*, **5**, 58-70, doi: 10.1029/2012MS000167.

Klein, S. A., Y. Zhang, M. D. Zelinka, R. Pincus, J. Boyle, and P. J. Glecker, 2013: Are climate model simulations of clouds improving? An evaluation using the ISCCP simulator. *J. Geophys. Res. - Atmos.*, **118**, 1329-1342, doi:10.1002/jgrd.50141.

Zhang, Z., A. S. Ackerman, G. Feingold, S. Platnick, R. Pincus and H. Xue, 2012: Effects of drizzle and cloud horizontal inhomogeneity on cloud effective radius remote sensing: Case study based on large-eddy simulations. *J. Geophys. Res. - Atmos.*, **117**, D19208, doi:10.1029/2012JD017655.

Raeder, K., J. L. Anderson, N. Collins, T. Hoar, J. E. Jay, P. H. Lauritzen, and R. Pincus, 2012: DART/CAM: An Ensemble Data Assimilation System for CESM Atmospheric Models. *J. Climate*, **25**, 6304-6317, doi:10.1175/JCLI-D-11-00395.1

Mauritsen, T. et al., 2012: Tuning the climate of a global model. *J. Adv. Model Earth Syst.*, **4,** M00A01. doi:10.1029.2012MS000154.

Kay, J. E. et al., 2012: Exposing global cloud biases in the Community Atmosphere Model (CAM) using satellite observations and their corresponding instrument simulators. *J. Climate*, **25**, 5190-5207, doi:10.1175/JCLI-D-11-00469.1

Pincus, R., S. Platnick, S. A. Ackerman, R. S. Hemler, and R. J. P. Hofmann, 2012: Reconciling simulated and observed views of clouds: MODIS, ISCCP, and the limits of instrument simulators. *J. Climate*, **25**, 4699-4720, doi:10.1175/JCLI-D-11-00267.1.

Klocke, D., R. Pincus and J. Quaas, 2011: On constraining estimates of climate sensitivity with present-day observations through model weighting. *J. Climate*, **24**, 6092-6099. doi:10.1175/2011JCLI4193.1

Bodas-Salcedo, A. et al., 2011: COSP: Satellite simulation software for model assessment. *Bull. Amer. Met. Soc*, **92**, 1023-1043. doi:10.1175/2011BAMS2856.1.

Donner, L. J. et al., 2011: The Dynamical Core, Physical Parameterizations, and Basic Simulation Characteristics of the Atmospheric Component AM3 of the GFDL Global Coupled Model CM3. *Journal of Climate,*, **24**, 3484-3519. doi:10.1175/2011JCLI3955.1.

Pincus, R., R. J. P. Hofmann, J. L. Anderson, K. Raeder, N. Collins, and J. S. Whitaker, 2011: Can fully accounting for clouds in data assimilation improve short-term forecasts? *Mon. Wea. Rev.,* **139**, 946-957. doi:10.1175/2010MWR3412.1

Sandu, I., B. Stevens and R. Pincus, 2010: On the transitions in marine boundary layer cloudiness. *Atmos. Chem. Phys.*, **10**, 2377-2391. doi:10.5194/acp-10-2377-2010.

Pincus, R. and K. F. Evans, 2009: Computational cost and accuracy in calculating three-dimensional radiative transfer: Results for new implementations of Monte Carlo and

SHDOM. *J. Atmos. Sci.*, **66,** 3131-3146. doi:10.1175/2009JAS3137.1.

Henderson, P. W. and R. Pincus, 2009: Multiyear evaluations of a cloud model using ARM data. *J. Atmos. Sci.*, **66,** 2925-2936. doi:10.1175/2009jas2957.1.

Pincus, R. and B. Stevens, 2009: Monte Carlo Spectral Integration: a consistent approximation for radiative transfer in large eddy simulations. *J. Adv. Model Earth Syst.*, **1,** 9. doi:10.3894/JAMES.2009.1.1.

Pincus, R., C. P. Batstone, R. J. P. Hofmann, K. E. Taylor, and P. J. Glecker, 2008: Evaluating the present-day simulation of clouds, precipitation, and radiation in climate models. *J. Geophys. Res. - Atmos.*, **113**. doi:10.1029/2007jd009334.

Morcrette, J. J., H. W. Barker, J. N. S. Cole, M. J. Iacono, and R. Pincus, 2008: Impact of a new radiation package, McRad, in the ECMWF Integrated Forecasting System. *Mon. Wea. Rev.*, **136,** 4773-4798. doi:10.1175/2008mwr2363.1.

Barker, H. W., J. N. S. Cole, J. J. Morcrette, R. Pincus, P. Räisäenen, K. von Salzen, and P. A. Vaillancourt, 2008: The Monte Carlo Independent Column Approximation: An assessment using several global atmospheric models. *Q. J. Royal Met. Soc.*, **134,** 1463-1478. doi:10.1002/qj.303.

Pincus, R., R. Hemler, and S. A. Klein, 2006: Using stochastically generated subcolumns to represent cloud structure in a large-scale model. *Mon. Wea. Rev.*, **134,** 3644-3656. doi:10.1175/MWR3257.1.

Zhang, M. H. and co-authors, 2005: Comparing clouds and their seasonal variations in 10 atmospheric general circulation models with satellite measurements. *J. Geophys. Res. - Atmos.*, **110**. doi:10.1029/2004jd005021.

Pincus, R., C. Hannay, S. A. Klein, K. M. Xu, and R. Hemler, 2005: Overlap assumptions for assumed probability distribution function cloud schemes in large-scale models. *J. Geophys. Res. - Atmos.*, **110**. doi:10.1029/2004jd005100.

Pincus, R., C. Hannay, and K. F. Evans, 2005: The accuracy of determining three-dimensional radiative transfer effects in cumulus clouds using ground-based profiling instruments. *J. Atmos. Sci.*, **62,** 2284-2293. doi:10.1175/JAS3464.1.

Klein, S. A., R. Pincus, C. Hannay, and K. M. Xu, 2005: How might a statistical cloud scheme be coupled to a mass-flux convection scheme? *J. Geophys. Res. - Atmos.*, **110**. doi:10.1029/2004jd005017.

Cahalan, R. F. and co-authors, 2005: The I3RC - Bringing together the most advanced radiative transfer tools for cloudy atmospheres. *Bull. Amer. Met. Soc.*, **86,** 1275-+. doi:10.1175/bams-86-9-1275.

Jakob, C., R. Pincus, C. Hannay, and K. M. Xu, 2004: Use of cloud radar observations for model evaluation: A probabilistic approach. *J. Geophys. Res. - Atmos.*, **109**. doi:10.1029/2003jd003473.

Pincus, R., 2003: Wine, place, and identity in a changing climate. *Gastronomica*, **3,** 87-93. doi:10.1525/gfc.2003.3.2.87.

Pincus, R., H. W. Barker, and J. J. Morcrette, 2003: A fast, flexible, approximate technique for computing radiative transfer in inhomogeneous cloud fields. *J. Geophys. Res. - Atmos.*, **108**. doi:10.1029/2002jd003322.

King, M. D. and co-authors, 2003: Cloud and aerosol properties, precipitable water, and profiles of temperature and water vapor from MODIS. *IEEE Trans. Geosci. Rem. Sens.*, **41,** 442-458. doi:10.1109/tgrs.2002.808226.

Pincus, R. and S. A. Klein, 2000: Unresolved spatial variability and microphysical process rates in large-scale models. *J. Geophys. Res. - Atmos.*, **105,** 27059-27065.

Pincus, R., S. A. McFarlane, and S. A. Klein, 1999: Albedo bias and the horizontal variability of clouds in subtropical marine boundary layers: Observations from ships and satellites. *J. Geophys. Res. - Atmos.*, **104,** 6183-6191.

Pincus, R., M. B. Baker, and C. S. Bretherton, 1997: What controls stratocumulus radiative properties? Lagrangian observations of cloud evolution. *J. Atmos.Sci.*, **54,** 2215-2236. doi:10.1175/1520-0469(1997)054<2215:WCSRPL>2.0.CO;2.

Pincus, R., M. Szczodrak, J. J. Gu, and P. Austin, 1995: Uncertainty in cloud optical depth estimates made from satellite radiance measurements. *J. Clim.*, **8,** 1453-1462. doi:10.1175/1520-0442(1995)008<1453:UICODE>2.0.CO;2.

Bretherton, C. S. and R. Pincus, 1995: Cloudiness and marine boundary-layer dynamics in the ASTEX Lagrangian experiments. 1. Synoptic setting and vertical structure. *J. Atmos. Sci.*, **52,** 2707-2723. doi:10.1175/1520-0469(1995)052<2707:CAMBLD>2.0.CO;2.

Austin, P., Y. N. Wang, R. Pincus, and V. Kujala, 1995: Precipitation in stratocumulus clouds - observational and modeling results. *J. Atmos. Sci.*, **52,** 2329-2352. doi:10.1175/1520-0469(1995)052<2329:PISCOA>2.0.CO;2.

Pincus, R. and M. B. Baker, 1994: Effect of precipitation on the albedo susceptibility of clouds in the marine boundary layer. *Nature*, **372,** 250-252. doi:10.1038/372250a0.