

Articles relevant to enhanced shortwave absorption
Collated by Charles S. Zender. Last updated August 31, 2009.

- Arking, A., 1996: Absorption of solar energy in the atmosphere: Discrepancy between model and observations. *Science*, **273**, 779–782.
- Arking, A., 1998: Bringing climate models into agreement with observations of atmospheric absorption. *Submitted to J. Clim.*
- Arnold, S., 2001: Microspheres, photonic atoms and the physics of nothing. *American Scientist*, **89**, 414–421.
- Barker, H. W. and G. L. Stephens, 2001: An intercomparison of 1D solar radiative transfer codes: From simple to complex cloudy atmospheres. *GEWEX News*, **11**, 7–10.
- Bauer, A., M. Godon, J. Carlier, Q. Ma and R. H. Tipping, 1993: Absorption by H₂O and H₂O–N₂ mixtures at 153 GHz. *J. Quant. Spectrosc. Radiat. Transfer*, **50**(5), 463–475.
- Bishop, J. K. B., W. B. Rossow and E. G. Dutton, 1997: Surface solar irradiance from the International Satellite Cloud Climatology Project 1983–1991. *J. Geophys. Res.*, **102**(D6), 6883–6910.
- Bush, B. C., S. K. Pope, A. Bucholtz, F. P. J. Valero and A. Strawa, 1999: Surface radiation measurements during the ARESE campaign. *J. Quant. Spectrosc. Radiat. Transfer*, **61**(2), 237–247.
- Bush, B. C. and F. P. J. Valero, 1999: Comparison of ARESE clear sky surface radiation measurements. *J. Quant. Spectrosc. Radiat. Transfer*, **61**(2), 249–264.
- Bush, B. C., F. P. J. Valero, A. S. Simpson and L. Bignone, 1998: Characterization of thermal effects in pyranometers: A data correction algorithm for improved measurement of surface insolation. *Submitted to J. Atm. Ocean. Tech.*
- Byrne, R. N., R. C. J. Somerville and B. Subasilar, 1996: Broken-cloud enhancement of solar radiation absorption. *J. Atmos. Sci.*, **53**(6), 878–886.
- Carlson, H. R., 1998: Polymolecular clusters: Water vapor’s “hidden phase?”. Unpublished manuscript.
- Cess, R. D., X. Jing, T. Qian and M. Sun, 1999a: Consistencies and inconsistencies in measured total, direct and diffuse shortwave radiation at the surface. *Draft*.
- Cess, R. D., M. Zhang, F. P. J. Valero, S. K. Pope, A. Bucholtz, B. Bush, C. S. Zender and J. Vitko, Jr., 1999b: Absorption of solar radiation by the cloudy atmosphere: Further interpretations of collocated aircraft measurements. *J. Geophys. Res.*, **104**(D2), 2059–2066.
- Cess, R. D., M. H. Zhang, W. J. Ingram, G. L. Potter, V. Alekseev, H. W. Barker, E. Cohen-Solal, R. A. Colman, D. A. Dazlich, A. D. Del Genio, M. R. Dix, V. Dymnikov, M. Esch, L. D. Fowler, J. R. Fraser, V. Galin, W. L. Gates, J. J. Hack, J. T. Kiehl, H. Le Treut, K. K.-W. Lo, B. J. McAvaney, V. P. Meleshko, J.-J. Morcrette, D. A. Randall, E. Roeckner, J.-F. Royer, M. E. Schlesinger, P. V. Sporyshev, B. Timbal, E. M. Volodin, K. E. Taylor, W. Wang and R. T. Wetherald, 1996a: Cloud feedback in atmospheric general circulation models: An update. *J. Geophys. Res.*, **101**(D8), 12791–12794.

- Cess, R. D., M. H. Zhang, X. Jing and V. Dvortsov, 1996b: Absorption of solar radiation by clouds: Interpretations of satellite, surface, and aircraft measurements. *J. Geophys. Res.*, **101**(D18), 23299–23309.
- Cess, R. D., M. H. Zhang, P. Minnis, L. Corsetti, E. G. Dutton, B. W. Forgan, D. P. Garber, W. L. Gates, J. J. Hack, E. F. Harrison, X. Jing, J. T. Kiehl, C. N. Long, J.-J. Morcrette, G. L. Potter, V. Ramanathan, B. Subasilar, C. H. Whitlock, D. F. Young and Y. Zhou, 1995: Absorption of solar radiation by clouds: Observations versus models. *Science*, **267**, 496–499.
- Chagas, J. C. S., D. A. Newnham, K. M. Smith and K. P. Shine, 2002: Impact of new measurements of oxygen collision-induced absorption on estimates of short-wave atmospheric absorption. *Q. J. R. Meteorol. Soc.*, **128**, 2377–2396.
- Charlock, T. P. and T. L. Alberta, 1996: The CERES/ARM/GEWEX experiment (CAGEX) for the retrieval of radiative fluxes with satellite data. *Bull. Am. Meteorol. Soc.*, **77**(11), 2673–2683.
- Chou, M.-D., A. Arking, J. Otterman and W. L. Ridgway, 1995: The effect of clouds on atmospheric absorption of solar radiation. *Geophys. Res. Lett.*, **22**(14), 1885–1888.
- Chýlek, P., Q. Fu, H. C. W. Tso and D. J. W. Geldart, 1999: Contribution of water vapor dimers to clear sky absorption of solar radiation. *Tellus Ser. A*, **51**(2), 304–313.
- Chýlek, P. and D. J. W. Geldart, 1997: Water vapor dimers and atmospheric absorption of electromagnetic radiation. *Geophys. Res. Lett.*, **24**, 2015–2018.
- Chýlek, P., J. T. Kiehl and M. K. W. Ko, 1978a: Narrow resonance structure in the Mie scattering characteristics. *Appl. Opt.*, **17**(19), 3019–3021.
- Chýlek, P., J. T. Kiehl and M. K. W. Ko, 1978b: Optical levitation and partial-wave resonances. *Phys. Rev. A*, **18**(5), 2229–2233.
- Chýlek, P., G. B. Lesins, G. Videen, J. G. D. Wong, R. G. Pinnick, D. Ngo and J. D. Klett, 1996: Black carbon and absorption of solar radiation by clouds. *J. Geophys. Res.*, **101**(D18), 23365–23371.
- Chýlek, P., D. Ngo and R. G. Pinnick, 1992: Resonance structure of composite and slightly absorbing spheres. *J. Opt. Soc. Am. A*, **9**(5), 775–780.
- Chýlek, P., G. Videen and D. Ngo, 1998: Effect of air bubbles on absorption of solar radiation by water droplets. *J. Atmos. Sci.*, **55**(3), 340–343.
- Collins, W. D., 1998: A global signature of enhanced shortwave absorption by clouds. *J. Geophys. Res.*, **103**(D24), 31669–31679.
- Conant, W. C., V. Ramanathan, F. P. J. Valero and J. Meywerk, 1997: An examination of the clear-sky solar absorption over the Central Equatorial Pacific: Observations versus models. *J. Clim.*, **10**(8), 1874–1884.
- Conant, W. C., A. M. Vogelmann and V. Ramanathan, 1998a: Atmospheric H₂O, aerosol and the unexplained solar absorption: A test with data from the Atmospheric Radiation Measurement Enhanced Shortwave Experiment. in *Proceedings of the Seventh Atmospheric Radiation Measurement (ARM) Science Team Meeting*, CONF-970365, pp. 97–100, March 3–7, 1997, San Antonio, Texas. DOE ARM, U.S. Department of Energy, Washington, DC.
- Conant, W. C., A. M. Vogelmann and V. Ramanathan, 1998b: Solar absorption and atmospheric water vapor: Current status of model-observation comparisons. *Tellus*, In Press in *Tellus*.
- Crisp, D., 1997: Absorption of sunlight by water vapor in cloudy conditions: A partial explanation for the cloud absorption anomaly. *Geophys. Res. Lett.*, **24**(5), 571–574.
- Curtiss, L. A., D. J. Frurip and M. Blander, 1979: Studies of molecular association in H₂O and D₂O vapors by measurement of thermal conductivity. *J. Chem. Phys.*, **71**(6), 2703–2711.

- Dang, L. X. and T.-M. Chang, 1997: Molecular dynamics study of water clusters, liquid, and liquid-vapor interface of water with many-body potentials. *J. Chem. Phys.*, **106**(19), 8149–8159.
- Daniel, J. S., S. Solomon, R. W. Sanders, R. W. Portmann, D. C. Miller and W. Madsen, 1999: Implications for water monomer and dimer solar absorption from observations at Boulder. *J. Geophys. Res.*, **104**(D4), 16785–16791.
- Erle, F., K. Pfeilsticker and U. Platt, 1995: On the influence of tropospheric clouds on zenith-scattered-light measurements of stratospheric species. *Geophys. Res. Lett.*, **22**(20), 2725–2728.
- Evans, W. F. J. and E. Puckrin, 1996: Near-infrared spectral measurements of liquid water absorption by clouds. *Geophys. Res. Lett.*, **23**(15), 1941–1944.
- Fraser, G. T. and W. J. Lafferty, 2001: The 1.27- μm O₂ continuum absorption in O₂/CO₂ mixtures. *J. Geophys. Res.*, **106**(D23), 31749–31753.
- Fu, Q., M. C. Cribb, H. W. Barker, S. K. Krueger and A. Grossman, 2000: Cloud geometry effects on atmospheric solar absorption. *J. Atmos. Sci.*, **57**, 1156–1168.
- Fung, K. K. and V. Ramaswamy, 1999: On shortwave radiation absorption in overcast atmospheres. *J. Geophys. Res.*, **104**(D18), 22233–22241.
- Gao, B.-C. and R. Green, 1995: Presence of terrestrial atmospheric gas absorption bands in standard extraterrestrial solar irradiance curves in the near-infrared spectral region. *Appl. Opt.*, **34**(27), 6263–6268.
- Garratt, J. R., 1994: Incoming shortwave fluxes at the surface—A comparison of GCM results with observations. *J. Clim.*, **7**(1), 72–80.
- Goldstein, R. and S. S. Penner, 1964: Transmission of infrared radiation through liquid water and through water vapor near saturation. *J. Quant. Spectrosc. Radiat. Transfer*, **4**, 359–361.
- Goss, L. M., S. W. Sharpe, T. A. Blake, V. Vaida and J. W. Brault, 1999: Direct absorption spectroscopy of water clusters. *J. Phys. Chem. A*, **103**(43), 8620–8624.
- Grechko, Y. I., V. I. Dianov-Klokov and I. P. Malkov, 1973: Aircraft measurements of photon paths in reflection and transmission of light by clouds in the 0.76 μm Oxygen band. *Izv., Atmospheric and Oceanic Physics*, **9**(5), 471–485.
- Greenblatt, G. D., J. J. Orlando, J. B. Burkholder and A. R. Ravishankara, 1990: Absorption measurements of Oxygen between 330 and 1140 nm. *J. Geophys. Res.*, **95**(D11), 18577–18582.
- Halothore, R. N., S. Nemesure, S. E. Schwartz, D. G. Imre, A. Berk, E. G. Dutton and M. H. Bergin, 1998: Models overestimate diffuse clear-sky surface irradiance: A case for excess atmospheric absorption. *Geophys. Res. Lett.*, **25**(19), 3591–3594.
- Halothore, R. N., S. E. Schwartz, J. J. Michalsky, G. P. Anderson, R. A. Ferrare, B. N. Holben and H. M. Ten Brink, 1997: Comparison of model estimated and measured direct-normal solar irradiance. *J. Geophys. Res.*, **102**(D25), 29991–30002.
- Harder, J. W. and J. W. Brault, 1997: Atmospheric measurements of water vapor in the 442-nm region. *J. Geophys. Res.*, **102**(D5), 6245–6252.
- Imre, D. G., E. H. Abramson and P. H. Daum, 1996: Quantifying cloud-induced shortwave absorption: an examination of uncertainties and or recent arguments for large excess absorption. *J. Appl. Meteorol.*, **35**(11), 1991–2010.
- Jadhav, D. B. and A. D. Tillu, 1985: Variations in the Fraunhofer filling-in for the visible region of day-sky spectra. *Can. J. Phys.*, **63**, 1345–1352.
- Jianhui, B. and W. Gengchen, 2003: UV energy loss in the cloudy atmosphere. *Submitted to J. Geophys. Res.*

- Jing, X. and R. D. Cess, 1998: Comparison of atmospheric clear-sky shortwave radiation models to collocated satellite and surface measurements in Canada. *J. Geophys. Res.*, **103**(D22), 28793–28824.
- Johnston, J. S., M. Paige and F. Yao, 1984: Oxygen absorption cross sections in the Herzberg continuum and between 206 and 307 K. *J. Geophys. Res.*, **89**(D7), 11661–11665.
- Kato, S., T. P. Ackerman, E. E. Clothiaux, J. H. Mather, G. G. Mace, M. L. Wesely, F. Murcray and J. Michalsky, 1997: Uncertainties in modeled and measured clear-sky surface shortwave irradiances. *J. Geophys. Res.*, **102**(D22), 25881–25898.
- Kaufman, Y. J. and R. S. Fraser, 1997: The effect of smoke particles on clouds and climate forcing. *Science*, **277**, 1636–1639.
- Kerr, R. A., 1995: Darker clouds promise brighter future for climate models. *Science*, **267**, 454.
- Kiehl, J. T., J. J. Hack and M. H. Zhang, 1995: Sensitivity of a GCM climate to enhanced shortwave cloud absorption. *J. Clim.*, **8**(9), 2200–2212.
- King, M. D., L. F. Radke and P. V. Hobbs, 1990: Determination of the spectral absorption of solar radiation by marine stratocumulus clouds from airborne measurements within clouds. *J. Atmos. Sci.*, **47**(7), 894–907.
- Knyazikhin, Y., A. Marshak, W. J. Wiscombe, J. Martonchik and R. B. Myneni, 2002: A missing solution to the transport equation and its effect on estimation of cloud absorptive properties. *J. Atmos. Sci.*, **59**(23), 3572–3585.
- Kylling, A., A. Albold and G. Seckmeyer, 1997: Transmittance of a cloud is wavelength-dependent in the UV-range: Physical interpretation. *Geophys. Res. Lett.*, **24**(4), 397–400.
- Lafferty, W. J., A. M. Solodov, C. L. Lugez and G. T. Fraser, 1998: Rotational line strengths and self-pressure-broadening coefficients for the 1.27- μm , $a^1\Delta_g - X^3\Sigma_g^-, v = 0 - 0$ band of O_2 . *Appl. Opt.*, **37**(12), 2264–2270.
- Lafferty, W. J., A. M. Solodov, A. Weber, W. B. Olson and J.-M. Hartmann, 1996: Infrared collision-induced absorption by N_2 near 4.3 μm for atmospheric applications: measurements and empirical modeling. *Appl. Opt.*, **35**(30), 5911–5916.
- Li, Z., 1998: Influence of absorbing aerosols on the inference of solar surface radiation budget and cloud absorption. *J. Clim.*, **11**(1), 5–17.
- Li, Z., H. W. Barker and L. Moreau, 1995a: The variable effect of clouds on atmospheric absorption of solar radiation. *Nature*, **376**, 486–490.
- Li, Z. and H. G. Leighton, 1993: Global climatologies of solar radiation budgets at the surface and in the atmosphere from 5 years of ERBE data. *J. Geophys. Res.*, **98**(D3), 4919–4930.
- Li, Z. and L. Moreau, 1996: Alteration of atmospheric solar absorption by clouds: Simulation and observation. *J. Appl. Meteorol.*, **35**(5), 653–670.
- Li, Z., L. Moreau and A. Arking, 1997: On solar energy disposition: A perspective from observation and modeling. *Bull. Am. Meteorol. Soc.*, **78**(1), 53–70.
- Li, Z., A. Trishchenko, H. W. Barker, G. L. Stephens, P. Partain and P. Minnis, 1998: A consistency analysis of ARESE measurements regarding cloud absorption. in *Proceedings of the Eighth Atmospheric Radiation Measurement (ARM) Science Team Meeting*, pp. 417–421, March 23–27, Tucson, AZ. Department of Energy, DOE Press, Washington, DC.
- Li, Z., A. P. Trishchenko, H. W. Barker, G. L. Stephens and P. Partain, 1999: Analyses of Atmospheric Radiation Measurement (ARM) program’s Enhanced Shortwave Experiment (ARESE) multiple data sets for studying cloud absorption. *J. Geophys. Res.*, **104**(D16), 19127–19134.

- Li, Z., C. H. Whitlock and T. P. Charlock, 1995b: Assessment of the global monthly mean surface insolation estimated from satellite measurements using Global Energy Balance Archive data. *J. Clim.*, **8**(2), 315–328.
- Liepert, B., P. Fabian and H. Grassl, 1994: Solar radiation in germany — Observed trends and an assessment of the causes Part I: Regional approach. *Contr. Atmos. Phys.*, **67**(1), 15–29.
- Liepert, B. G., 1997: Recent changes in solar radiation under cloudy conditions in Germany. *Int. J. Clim.*, **17**, 1581–1593.
- Liou, K. N. and N. Rao, 1996: Radiative transfer in cirrus clouds. Part IV: On cloud geometry, inhomogeneity, and absorption. *J. Atmos. Sci.*, **53**(21), 3046–3065.
- Liu, L. H., H. P. Tan and T. W. Tong, 2002: Internal distribution of radiation absorption in a semitransparent spherical particle. *J. Quant. Spectrosc. Radiat. Transfer*, **72**(6), 747–756.
- Lubin, D., J.-P. Chen, P. Pilewskie, V. Ramanathan and F. P. J. Valero, 1996: Microphysical examination of excess cloud absorption in the tropical atmosphere. *J. Geophys. Res.*, **101**(D12), 16961–16972.
- Macke, A., M. I. Mishchenko and B. Cairns, 1996: The influence of inclusions on light scattering by large ice particles. *J. Geophys. Res.*, **101**(D18), 23311–23316.
- Madronich, S., 1987: Photodissociation in the atmosphere 1. Actinic flux and the effects of ground reflections and clouds. *J. Geophys. Res.*, **92**(D8), 9740–9752.
- Major, G., 1998: On surface-absorbed solar radiation. *Bull. Am. Meteorol. Soc.*, **79**(1), 92–93.
- Markel, V. A., 2002: The effects of averaging on the enhancement factor for absorption of light by carbon particles in microdroplets of water. *J. Quant. Spectrosc. Radiat. Transfer*, **72**(6), 765–774.
- Markel, V. A. and V. M. Shalaev, 1999: Absorption of light by soot particles in micro-droplets of water. *J. Quant. Spectrosc. Radiat. Transfer*, **63**(2–6), 321–339, See erratum in *JQSRT* **66**(6):591.
- Marshak, A., A. Davis, W. Wiscombe and R. Cahalan, 1997: Inhomogeneity effects on cloud shortwave absorption measurements: Two-aircraft simulations. *J. Geophys. Res.*, **102**(D14), 16619–16637.
- Marshak, A., A. Davis, W. Wiscombe, W. Ridgway and R. Cahalan, 1998: Biases in shortwave column absorption in the presence of fractal clouds. *J. Clim.*, **11**(3), 431–446.
- Maté, B., C. L. Lugez, A. M. Solodov, G. T. Fraser and W. J. Lafferty, 2000: Investigation of the collision-induced absorption by O₂ near 6.4 μm in pure O₂ and O₂/N₂ mixtures. *J. Geophys. Res.*, **105**(D17), 22225–22230.
- Mayer, B., A. Kylling, S. Madronich and G. Seckmeyer, 1998: Enhanced absorption of UV radiation due to multiple scattering in clouds: Experimental evidence and theoretical explanation. *J. Geophys. Res.*, **103**(D23), 31241–31254.
- Melnikova, I., 2008: Range of application of the scattering theory within the multicomponent turbid media of the cloud atmosphere is the reason for anomalous absorption and incorrectness of climate prediction. *Intl. J. Rem. Sens.*, **29**(9), 2615–2628, doi:10.1080/01431160701767443.
- Mel'nikova, I. N. and V. V. Mikhaylov, 1994: Spectral scattering and absorption coefficients in strati derived from aircraft measurements. *J. Atmos. Sci.*, **51**(7), 925–931.
- Michalsky, J., M. Beauharnois, J. Berndt, L. Harrison, P. Kiedron and Q. Min, 1999: O₂-O₂ absorption band identification based on optical depth spectra of the visible and near-infrared. *Geophys. Res. Lett.*, **26**, 1581–1584.
- Mitchell, D. L., 2000: Parameterization of the Mie extinction and absorption coefficients for water clouds. *J. Atmos. Sci.*, **57**(9), 1311–1326.

- Miziolek, A. W., 1979: Atmospheric spectra and the temperature dependence of collisional cross sections. *Geophys. Res. Lett.*, **6**(7), 563–565.
- Mlawer, E. J., P. D. Brown, S. A. Clough, L. C. Harrison, J. J. Michalsky, P. W. Kiedron and T. Shippert, 2000: Comparison of spectral direct and diffuse solar irradiance measurements and calculations for cloud-free conditions. *Geophys. Res. Lett.*, **27**, 2653–2658.
- Mlawer, E. J., S. A. Clough, P. D. Brown, T. M. Stephen, J. C. Landry, A. Goldman and F. J. Murcray, 1998: Observed atmospheric collision-induced absorption in near-infrared oxygen bands. *J. Geophys. Res.*, **103**(D4), 3859–3863.
- Murcray, F. J., A. Goldman, J. C. Landry and T. M. Stephen, 1997: O₂ continuum: A possible explanation for the discrepancies between measured and modeled shortwave surface irradiances. *Geophys. Res. Lett.*, **24**(18), 2315–2317.
- Nemesure, S., R. D. Cess, E. G. Dutton, J. J. DeLuisi, Z. Li and H. G. Leighton, 1994: Impact of clouds on the shortwave radiation budget of the surface-atmosphere system for snow-covered surfaces. *J. Clim.*, **7**, 579–585.
- Newnham, D. A. and J. Ballard, 1998: Visible absorption cross sections and integrated absorption intensities of molecular oxygen (O₂ and O₄). *J. Geophys. Res.*, **103**(D22), 28801–28815.
- noz Caro, C. M. and A. N. no, 1997: Effect of anharmonicities on the thermodynamic properties of the water dimer. *J. Phys. Chem. A*, **101**(22), 4128–4135.
- Nussenzveig, H. M., 2003: Light tunneling in clouds. *Appl. Opt.*, **42**(9), 1588–1593.
- O’Hirok, W. and C. Gautier, 2003: Absorption of shortwave radiation in a cloudy atmosphere: Observed and theoretical estimates during the second Atmospheric Radiation Measurement Enhanced Shortwave Experiment (ARESE). *J. Geophys. Res.*, **108**(D14), 4412, doi:10.1029/2002JD002818.
- Orlando, J. J., G. S. Tyndall, K. E. Nickerson and J. G. Calvert, 1991: The temperature dependence of collision-induced absorption by oxygen near 6 μm . *J. Geophys. Res.*, **96**(D11), 20755–20760.
- Oshima, Y., Y. Okamoto and S. Koda, 1995: Pressure effect of foreign gases on the Herzberg photoabsorption of Oxygen. *J. Phys. Chem.*, **99**(31), 11830–11833.
- Osterkamp, H., F. Ferlemann, H. Harder, D. Perner, U. Platt, M. Schneider and K. Pfeilsticker, 1998: First measurement of the atmospheric O₄ profile. in N. R. P. Harris, I. Kilbane-Dawe and G. T. Amanatidis, editors, *Proceedings of the Fourth European Symposium on Polar Stratospheric Ozone, Air Pollut. Res. Rep. 66*, pp. 478–481, Brussels. European Commission Environment and Climate Programme.
- Pallé, E., P. R. Goode, P. M. nés Rodriguez and S. E. Koonin, 2004: Changes in Earth’s reflectance over the past two decades. *Science*, **304**, 1299–1301.
- Paynter, D. J., I. V. Ptashnik, K. P. Shine and K. M. Smith, 2007: Pure water vapor continuum measurements between 3100 and 4400 cm^{-1} : Evidence for water dimer absorption in near atmospheric conditions. *Geophys. Res. Lett.*, **34**(12), L12808, doi:10.1029/2007GL029259.
- Perner, D. and U. Platt, 1980: Absorption of light in the atmosphere by collision pairs of oxygen (O₂)₂. *Geophys. Res. Lett.*, **7**(12), 1053–1056.
- Pfeilsticker, K., F. Erle, O. Funk, H. Veitel and U. Platt, 1998: First geometrical pathlengths probability density function derivation of the skylight from spectroscopically highly resolving oxygen A-band observations 1. Measurement technique, atmospheric observations and model calculations. *J. Geophys. Res.*, **103**(D10), 11483–11504.
- Pfeilsticker, K., F. Erle and U. Platt, 1997: Absorption of solar radiation by atmospheric O₄. *J. Atmos. Sci.*, **54**(7), 933–939.

- Pilewskie, P. and F. P. J. Valero, 1995: Direct observations of excess solar absorption by clouds. *Science*, **267**, 1626–1629.
- Pope, S. K., F. P. J. Valero, W. D. Collins and P. Minnis, 2002: Comparison of ScaRaB, GOES 8, aircraft, and surface observations of the absorption of solar radiation by clouds. *J. Geophys. Res.*, **107**(D11), doi:10.1029/2001JD001139.
- Portmann, R. W., S. Solomon, R. W. Sanders, J. S. Daniel and E. G. Dutton, 2001: Cloud modulation of zenith sky oxygen photon path lengths over Boulder, Colorado: Measurement versus model. *J. Geophys. Res.*, **106**(D1), 1139–1155.
- Prasad, S. S., 1998: Potential new atmospheric sources and sinks of odd nitrogen: Sources involving the excited O₂, and the N₂O-O₃ species. *Geophys. Res. Lett.*, **25**(12), 2173–2176.
- Ramanathan, V., B. Subasilar, G. J. Zhang, W. Conant, R. D. Cess, J. T. Kiehl, H. Grassl and L. Shi, 1995: Warm pool heat budget and shortwave cloud forcing: A missing physics? *Science*, **267**, 499–503.
- Ramanathan, V. and A. M. Vogelmann, 1997: Greenhouse effect, atmospheric solar absorption and the Earth's radiation budget: From the Arrhenius-Langley era to the 1990s. *Ambio*, **26**(1), 38–46.
- Schmid, B., J. Michalsky, R. Halthore, M. Beauharnois, L. Harrison, J. Livingston and P. Russell, 1999: Comparison of aerosol optical depth from four solar radiometers during the fall 1997 ARM intensive observation period. *In press in Geophys. Res. Lett.*
- Shardanand, 1977: Nitrogen-induced absorption of Oxygen in the Herzberg continuum. *J. Quant. Spectrosc. Radiat. Transfer*, **18**, 525–530.
- Shardanand and A. D. P. Rao, 1977: Collision-induced absorption of O₂ in the Herzberg continuum. *J. Quant. Spectrosc. Radiat. Transfer*, **17**, 433–439.
- Soden, B. J. and V. Ramaswamy, 1998: Variations in atmosphere-ocean solar absorption under clear skies: A comparison of observations and models. *Geophys. Res. Lett.*, **25**(12), 2149–2152.
- Solomon, S., R. W. Portmann, R. W. Sanders and J. S. Daniel, 1998: Absorption of solar radiation by water vapor, oxygen, and related collision pairs in the Earth's atmosphere. *J. Geophys. Res.*, **103**(D4), 3847–3858.
- Solomon, S., R. W. Portmann, R. W. Sanders, J. S. Daniel, W. Madsen, B. Bartram and E. G. Dutton, 1999: On the role of nitrogen dioxide in the absorption of solar radiation. *J. Geophys. Res.*, **104**(D10), 12047–12058.
- Stephens, G. L., 2003: The useful pursuit of shadows. *American Scientist*, **91**, 442–449.
- Stephens, G. L., R. D. Cess, M. H. Zhang, P. Pilewskie and F. P. J. Valero, 1996: How much solar radiation do clouds absorb? *Science*, **271**, 1131–1136.
- Stephens, G. L. and S.-C. Tsay, 1990: On the cloud absorption anomaly. *Q. J. R. Meteorol. Soc.*, **116**, 671–704.
- Tso, H. C. W., J. W. Geldart and P. Chýlek, 1998: Anharmonicity and cross-section for absorption of radiation by water dimer. *J. Chem. Phys.*, **108**, 5319–5329.
- Vaida, V., J. S. Daniel, H. G. Kjaergaard, L. M. Goss and A. F. Tuck, 2001: Atmospheric absorption of near infrared and visible solar radiation by the hydrogen bonded water dimer. *Q. J. R. Meteorol. Soc.*, **127**, 1627–1643.
- Valero, F. P. J., A. Bucholtz, B. C. Bush, S. K. Pope, W. D. Collins, P. Flatau, A. Strawa and W. J. Y. Gore, 1997a: The atmospheric radiation measurements enhanced shortwave experiment (ARESE): Experimental and data details. *J. Geophys. Res.*, **102**(D25), 29929–29937.

- Valero, F. P. J. and B. C. Bush, 1999: Measured and calculated clear-sky solar radiative fluxes during the Subsonic Aircraft Contrail and Cloud Effects Special Study (SUCCESS). *J. Geophys. Res.*, **104**(D22), 27387–27398.
- Valero, F. P. J., R. D. Cess, M. Zhang, S. K. Pope, A. Bucholtz, B. Bush and J. Vitko, Jr., 1997b: Absorption of solar radiation by the cloudy atmosphere: Interpretations of collocated aircraft measurements. *J. Geophys. Res.*, **102**(D25), 29917–29927.
- Valero, F. P. J., S. K. Pope, B. C. Bush, Q. Nguyen, D. Marsden, R. D. Cess, A. S. Simpson-Leitner, A. Bucholtz and P. M. Udelhofen, 2003: The absorption of solar radiation by the clear and cloudy atmosphere during the Atmospheric Radiation Measurements Enhanced Shortwave Experiments (ARESE) I and II: Observations and models. *J. Geophys. Res.*, **108**(D1), 4016, doi:10.1029/2001JD001384.
- Videen, G. and P. Chýlek, 1998: Scattering by a composite sphere with an absorbing inclusion and effective medium approximations. *Opt. Comm.*, **158**, 1–6.
- Vogelmann, A. M., V. Ramanathan and W. C. Conant, 1998a: Comparison of water vapor data at the Southern Great Plains site and its implications for water vapor continuum absorption in the near-infrared during the ARM Enhanced Shortwave Experiment period. in *Proceedings of the Seventh Atmospheric Radiation Measurement (ARM) Science Team Meeting*, CONF-970365, pp. 203–206, March 3–7, 1997, San Antonio, Texas. DOE ARM, U.S. Department of Energy, Washington, DC.
- Vogelmann, A. M., V. Ramanathan, W. C. Conant and W. E. Hunter, 1998b: Observational constraints on the non-lorentzian continuum effects in the near-infrared solar spectrum using ARM ARESE data. *J. Quant. Spectrosc. Radiat. Transfer*, **60**(2), 231–246.
- Waliser, D. E., W. D. Collins and S. P. Anderson, 1996: An estimate of the surface shortwave cloud forcing over the western Pacific during TOGA COARE. *Geophys. Res. Lett.*, **23**, 519–522.
- Waliser, D. E., R. A. Weller and R. D. Cess, 1999: Comparisons between buoy-observed, satellite-derived and modeled surface shortwave flux over the subtropical North Atlantic during the subduction experiment. *In Press in J. Geophys. Res.*
- Wendisch, M. and A. Keil, 1999: Discrepancies between measured and modeled solar and UV radiation within polluted boundary layer clouds. *J. Geophys. Res.*, **104**(D22), 27373–27385.
- Whitlock, C. H., T. P. Charlock, W. F. Staylor, T. T. Pinker, I. Laszlo, A. Ohmura, H. Gilgen, T. Konzelman, R. C. DiPasquale, C. C. M. S. R. LeCroy and N. A. Ritchey, 1995: First global WCRP shortwave surface radiation budget dataset. *Bull. Am. Meteorol. Soc.*, **76**(6), 905–922.
- Wild, M., 1999: Discrepancies between model-calculated and observed shortwave atmospheric absorption in areas with high aerosol loadings. *J. Geophys. Res.*, **104**(D22), 27361–27371.
- Wild, M. and B. Liepert, 1998: Excessive transmission of solar radiation through the cloud-free atmosphere in GCMs. *Geophys. Res. Lett.*, **25**(12), 2165–2168.
- Wild, M., A. Ohmura and H. Gilgen, 1995: Validation of general circulation model radiative fluxes using surface observations. *J. Clim.*, **8**(5), 1309–1324.
- Wiscombe, W. J., 1979, edited/revised 1996: Mie scattering calculations: Advances in technique and fast, vector-speed computer codes. Tech. Rep. NCAR/TN-140+STR, National Center for Atmospheric Research, Boulder, Colo.
- Wiscombe, W. J., 1980: Improved Mie scattering algorithms. *Appl. Opt.*, **19**(9), 1505–1509.
- Wiscombe, W. J., 1995: An absorbing mystery. *Nature*, **376**, 466–467.
- Wiscombe, W. J., R. M. Welch and W. D. Hall, 1984: The effects of very large drops on cloud absorption. Part I: Parcel models. *J. Atmos. Sci.*, **41**(8), 1336–1355.

- Yu, R., M. Zhang and R. D. Cess, 1999: Analysis of the atmospheric energy budget: A consistency study of available data sets. *J. Geophys. Res.*, **104**(D8), 9655–9661.
- Zender, C. S., 1999: Global climatology of abundance and solar absorption of oxygen collision complexes. *J. Geophys. Res.*, **104**(D20), 24471–24484.
- Zender, C. S., B. Bush, S. K. Pope, A. Bucholtz, W. D. Collins, J. T. Kiehl, F. P. J. Valero and J. Vitko, Jr., 1997: Atmospheric absorption during the Atmospheric Radiation Measurement (ARM) Enhanced Shortwave Experiment (ARESE). *J. Geophys. Res.*, **102**(D25), 29901–29915.
- Zender, C. S. and P. Chýlek, 1998: A global climatology of $O_2 \cdot O_2$, $O_2 \cdot N_2$, and $(H_2O)_2$ abundance and absorption. in *Proceedings of the Eighth Atmospheric Radiation Measurement (ARM) Science Team Meeting*, DOE/ER-0738, pp. 837–841, March 23–27, Tucson, AZ. Department of Energy, U.S. Department of Energy, Washington, DC.
- Zhang, M., R. D. Cess and X. Jing, 1997: Concerning the interpretation of enhanced cloud shortwave absorption using monthly mean Earth Radiation Budget Experiment/Global Energy Balance Archive measurements. *J. Geophys. Res.*, **102**(D22), 25899–25905.
- Zhang, M. H., W. Y. Lin and J. T. Kiehl, 1998: Bias of atmospheric shortwave absorption in the NCAR Community Climate Models 2 and 3: Comparison with monthly ERBE/GEBA measurements. *J. Geophys. Res.*, **103**(D8), 8919–8925.