References

Aghedo, A. M., *et al.*, 2011: The impact of orbital sampling, monthly averaging and vertical resolution on climate chemistry model evaluation with satellite observations. *Atmos. Chem. Phys.*, **11**, 6493-6514, doi:10.5194/acp-11-6493-2011.

Allen, D. R., *et al.*, 2000: Antarctic polar descent and planetary wave activity observed in ISAMS CO from April to July 1992. *Geophys. Res. Lett.*, **27**, 665-668, doi:10.1029/1999GL010888.

Angell, J. K., *et al.*, 1985: Ground-based and satellite evidence for a pronounced total-ozone minimum in early 1983 and responsible atmospheric layers. *Mon. Weather Rev.*, **113**, 641-646, doi:10.1175/1520-0493(1985)113<0641:GBASEF>2.0.CO;2.

Arijs, E., and G. Brasseur, 1986: Acetonitrile in the stratosphere and implications for positive ion composition. *J. Geophys. Res.*, **91**, 4003-4016, doi: 10.1029/JD091iD03p04003.

Austin, J. and N. Butchart, 2003: Coupled chemistry-climate model simulations for the period 1980 to 2020: Ozone depletion and the start of ozone recovery. *Q. J. Roy. Meteor. Soc.*, **129**, 3225-3249, doi:10.1256/qj.02.203.

Austin, J., *et al.*, 2003: Uncertainties and assessments of chemistry-climate models of the stratosphere. *Atmos. Chem. Phys.*, **3**, 1-27, doi:10.5194/acp-3-1-2003.

Austin, J., and F. Li, 2006: On the relationship between the strength of the Brewer-Dobson circulation and the age of stratospheric air. *Geophys. Res. Lett.*, **33**, L17807, doi:10.1029/2006GL026867.

Baehr, J., *et al.*, 2005: Validation of MIPAS-ENVISAT CH_4, N_2O, CFC-11 and CFC-12 by airborne in situ observations. Proceedings of the 2004 Envisat & ERS Symposium, SP-572, 6-10 September 2004, Salzburg, Austria, published by: ESA Publications Division, ESTEC, Noordwijk, The Netherlands, ISBN: 92-9092-883-2.

Baldwin, M. P., *et al.*, 2001: The quasi-biennial oscillation. *Rev. Geophys.*, **39**, 179-229, doi:10.1029/1999RG000073.

Barath, F. T., *et al.*, 1993: The Upper Atmosphere Research Satellite Microwave Limb Sounder instrument. *J. Geophys. Res.*, **98**, 10751-10762, doi:10.1029/93JD00798.

Baron, P., *et al.*, 2009: HO_2 measurements in the stratosphere and the mesosphere from the sub-millimetre limb sounder Odin/SMR. *Int. J. of Remote Sens.*, **30**, 4195-4208, http://dx.doi.org/10.1080/01431160902822831.

Baron, P., *et al.*, 2011: The Level 2 research product algorithms for the Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES). *Atmos. Meas. Tech.*, **4**, 2105-2124, doi:10.5194/amt-4-2105-2011.

Barth, C. A., 1992: Nitric oxide in the lower thermosphere. *Planet. Space Sci.,* **40**, 315-336, doi:10.1016/0032-0633(92)90067-X.

Bates, D. R., and M. Nicolet, 1950: The photochemistry of atmospheric water vapor. *J. Geophys. Res.*, **55**, 301-327, doi:10.1029/JZ055i003p00301.

Bauer, R., *et al.*, 2012: Validation of SCIAMACHY limb NO_2 profiles using solar occultation measurements. *Atmos. Meas. Tech.*, **5**, 1059-1084, doi:10.5194/amt-5-1059-2012.

Beer, R., *et al.*, 2001: Tropospheric Emission Spectrometer for the Earth Observing System's Aura satellite. *Appl. Opt.*, **40**, 2356-2367, doi:10.1364/AO.40.002356.

Beer, R., 2006: TES on the Aura mission: Scientific objectives, measurements, and analysis overview. *IEEE Trans. Geosci. Remote Sens.*, **44**, 1102-1105, doi:10.1109/TGRS.2005.863716.

Benson, C. M., *et al.*, 2006: Polar stratospheric clouds in the 1998-2003 Antarctic vortex: Microphysical modeling and Polar Ozone and Aerosol Measurement (POAM) III observations. *J. Geophys. Res.*, **111**, D18206, doi:10.1029/2005JD006948.

Bernath, P. F., *et al.*, 2005: Atmospheric Chemistry Experiment (ACE): Mission overview. *Geophys. Res. Lett.*, **32**, L15S01, doi:10.1029/2005GL022386.

Bernath, P., 2006: Atmospheric Chemistry Experiment (ACE): Analytical Chemistry from Orbit. *Trends Anal. Chem.*, **25**, 647-654, doi:10.1016/j.trac.2006.05.001.

Bertaux, J. L., *et al.*, 2010: Global ozone monitoring by occultation of stars: An overview of GOMOS measurements on Envisat. *Atmos. Chem. Phys.*, **10**, 12091-12148, doi:10.5194/acp-10-12091-2010.

Bhartia, P. K., *et al.*, 2004: Solar Backscatter Ultraviolet (SBUV) version 8 profile algorithm. Proceedings of the Quadrennial Ozone Symposium 2004, edited by: C. Zerefos, *Int. Ozone Comm.*, Athens, Greece, pp295-296.

Bodeker, G. E., *et al.*, 2013: A vertically resolved, global, gap-free ozone database for assessing or constraining global climate model simulations. *Earth Syst. Sci. Data*, **5**, 31-43, doi:10.5194/essd-5-31-2013.

Boone, C. D., *et al.*, 2005: Retrievals for the atmospheric chemistry experiment Fourier-transform spectrometer. *Appl. Opt.*, **44**, 7218-7231, doi:10.1364/AO.44.007218.

Bourassa, A. E., *et al.*, 2007: Stratospheric aerosol retrieval with optical spectrograph and infrared imaging system limb scatter measurements. *J. Geophys. Res.*, **112**, D10217, doi:10.1029/2006JD008079.

Bourassa, A. E., *et al.*, 2012: Odin-OSIRIS stratospheric aerosol data product and SAGE III intercomparison. *Atmos. Chem. Phys.*, **12**, 605-614, doi:10.5194/acp-12-605-2012.

Bourassa, A. E., *et al.*, 2014: Trends in stratospheric ozone derived from merged SAGE II and Odin-OSIRIS satellite observations. *Atmos. Chem. Phys.*, **14**, 6983-6994, doi:10.5194/acp-14-6983-2014.

Bovensmann, H., *et al.*, 1999: SCIAMACHY – Mission objectives and measurement modes. *J. Atmos. Sci.*, **56**, 127-150, doi:10.1175/1520-0469(1999)056<0127:SMOAMM>2.0.CO;2.

Bowman, K. W., *et al.*, 2002: Capturing time and vertical variability of tropospheric ozone: A study using TES nadir retrievals. *J. Geophys. Res.*, **107**, 4723, doi:10.1029/2002JD002150.

Bowman, K. W., *et al.*, 2006: Tropospheric Emission Spectrometer: Retrieval method and error analysis. *IEEE Trans. Geosci. Remote Sens.*, **44**, 1297-1307, doi:10.1109/TGRS.2006.871234.

Bowman, K. W., *et al.*, 2013: Evaluation of ACCMIP outgoing longwave radiation from tropospheric ozone using TES satellite observations. *Atmos. Chem. Phys.*, **13**, 4057-4072, doi:10.5194/acp-13-4057-2013.

Boxe, C. S., *et al.*, 2010: Validation of northern latitude Tropospheric Emission Spectrometer stare ozone profiles with ARC-IONS sondes during ARCTAS: Sensitivity, bias and error analysis. *Atmos. Chem. Phys.,* **10**, 9901-9914, doi:10.5194/acp-10-9901-2010.

Bracher, A., *et al.*, 2005: Cross comparisons of O_3 and NO_2 measured by the atmospheric ENVISAT instruments GOMOS, MIPAS, and SCIAMACHY. *Adv. Space Res.*, **36**, 855-867, doi:10.1016/j.asr.2005.04.005.

Brasseur, G. and S. Solomon, 1984: Aeronomy of the middle atmosphere: chemistry and physics of the stratosphere and mesosphere. D. Reidel Publishing Company: Hingham, MA.

Brasseur, G., *et al.*, 1998: MOZART, A global chemical transport model for ozone and related chemical tracers 1. Model description. *J. Geophys. Res.*, **103**, 28265-28289, doi:10.1029/98JD02397.

Brohede, S., *et al.*, 2007a: A Stratospheric NO_2 Climatology from Odin/OSIRIS Limb-Scatter Measurement. *Can. J. Phys.*, **85**, 1253-1274, doi:10.1139/P07-141.

Brohede, S., *et al.*, 2007b: Validation of Odin/OSIRIS Stratospheric NO_2 Profiles. *J. Geophys. Res.*, **112**, D07310, doi:10.1029/2006JD007586.

Brohede, S., *et al.*, 2008: Odin stratospheric proxy NO_y measurements and climatology. *Atmos. Chem. Phys.*, **8**, 5731-5754.

Brown, A. T., *et al.*, 2011: Trends in atmospheric halogen containing gases since 2004. *J. Quant. Spectrosc. Ra.*, **112**, 2552-2566, doi:10.1016/j.jqsrt.2011.07.005.

Bruehl, C., *et al.*, 1996: Halogen Occultation Experiment ozone channel validation. *J. Geophys. Res.*, **101**, 10217, doi:10.1029/95JD02031.

Buehler, S. A., *et al.*, 2005: ARTS, the atmospheric radiative transfer simulator. *J. Quant. Spectros. Rad. Transf.*, **91**, 65-93, http://dx.doi.org/10.1016/j.jqsrt.2004.05.051.

Burrows, J. P., *et al.*, 1995: SCIAMACHY – Scanning Imaging Absorption Spectrometer for Atmospheric Chartography. *Acta Astronautica,* **35**, 445, doi:10.1016/0094-5765(94)00278-T.

Carleer, M. R., *et al.*, 2008: Validation of water vapour profiles from the Atmospheric Chemistry Experiment (ACE). *Atmos. Chem. Phys. Discuss.*, **8**, 4499-4559, doi:10.5194/acpd-8-4499-2008.

Carslaw, K. S., *et al.*, 1994: Stratospheric aerosol growth and HNO_3 gas phase depletion from coupled HNO_3 and water uptake by liquid particles. *Geophys. Res. Lett.*, **21**, 2479-2482, doi:10.1029/94GL02799.

Carslaw, K.S. *et al.*, 1997: Modeling the composition of liquid stratospheric aerosols. *Rev. Geophys.*, **35**, 125–154, doi:10.1029/97RG00078.

Chauhan, S., *et al.*, 2009: MIPAS reduced spectral resolution UTLS-1 mode measurements of temperature, O_3, HNO_3, N_2O, H_2O and relative humidity over ice: retrievals and comparison to MLS. *Atmos. Meas. Tech.*, **2**, 337-353, doi:10.5194/amt-2-337-2009.

Chipperfield, M. P., *et al.*, 1994: A two-dimensional model study of the QBO signal in SAGE II NO_2 and O_3. *Geophys. Res. Lett.*, **21**, 589-592, doi: 10.1029/94GL00211.

Choi, W. K, and J. R. Holton, 1991: Transport of N_2O in the stratosphere related to the equatorial semiannual oscillation. *J. Geophys. Res.*, **96**, 22543-22557, doi:10.1029/91JD02263.

Chu, W. P., and M. P. McCormick, 1979: Inversion of stratospheric aerosol and gaseous constituents from spacecraft solar extinction data in the 0.38-1.0 μm wavelength region. *Appl. Opt.*, **18**, 1404-1414, https://doi.org/10.1364/AO.18.001404.

Chu, W. P., *et al.*, 1989: SAGE II Inversion Algorithm. *J. Geophys. Res.*, **94**, 8339-8351, doi:10.1029/JD094iD06p08339.

Clerbaux, C., *et al.*, 2008: CO measurements from the ACE-FTS satellite instrument: data analysis and validation using groundbased, airborne and spaceborne observations. *Atmos. Chem. Phys.*, **8**, 2569-2594, doi:10.5194/acp-8-2569-2008.

Coheur, P.-F., *et al.*, 2007: ACE-FTS observation of a young biomass burning plume: first reported measurements of C_2H_4, C_3H_6O, H_2CO and PAN by infrared occultation from space. *Atmos. Chem. Phys.*, **7**, 5437-5446, doi:10.5194/acp-7-5437-2007.

Collins, W. D., *et al.*, 2004: Description of the NCAR Community Atmosphere Model (CAM3). NCAR Technical Note, NCAR/TN-464+STR, 226 pp.

Connor, B. J., *et al.*, 2007: Comparison of ClO measurements from the Aura Microwave Limb Sounder to ground-based microwave measurements at Scott Base, Antarctica, in spring 2005. *J. Geophys. Res.*, **112**, D24S42, doi:10.1029/2007JD008792.

Conway, R. R., *et al.*, 1999: Middle atmosphere high resolution spectrograph investigation. *J. Geophys. Res.*, **104**, 16327-16348, doi:10.1029/1998JD100036.

Conway, R. R., *et al.*, 2000: Satellite observations of upper stratospheric and mesospheric OH: The HO_x dilemma. *Geophys. Res. Lett.*, **27**, 2613-2616, doi:10.1029/2000GL011698.

Crutzen, P. J., 1970: The influence of nitrogen oxides on the atmospheric ozone content. *Q. J. R. Meteorol. Soc.*, **96**, 320-325, doi:10.1002/qj.49709640815.

Cunnold, D. M., *et al.*, 1991: Validation of SAGE II NO_2 Measurements. *J. Geophys. Res.*, **96**, 12913-12925, doi:10.1029/91JD01344.

Damadeo, R. P., *et al.*, 2013: SAGE version 7.0 algorithm: Application to SAGE II. *Atmos. Meas. Tech.,* **6**, 3539–3561, doi:10.5194/amt-6-3539-2013.

Damiani, A., *et al.*, 2012: Impact of January 2005 solar proton events on chlorine species. *Atmos. Chem. Phys*., **12**, 4159-4179, doi:10.5194/acp-12-4159-2012.

Daniel, J. S., and S. Solomon, 1998: On the climate forcing of carbon monoxide. *J. Geophys. Res.*, **103**, 13249-13260, doi:10.1029/98JD00822.

Degenstein, D., *et al.*, 2002: Volume emission rate tomography from a satellite platform. *Appl. Opt.*, **42**, 1441-1450, https://doi.org/10.1364/AO.42.001441.

Degenstein, D., *et al.*, 2009: Limb scatter ozone retrieval from 10 to 60 km using a multiplicative reconstruction technique. *Atmos. Chem. Phys.*, **9**, 6521-6529, doi:10.5194/acp-9-6521-2009.

de Gouw, J. A., *et al.*, 2003: Emission sources and ocean uptake of aceotnitrile (CH_3CN) in the atmosphere. *J. Geophys. Res.*, **108**(D11), doi:10.1029/2002JD002897.

de la Torre, L., *et al.*, 2012: Climatology and characteristics of stratospheric sudden warmings in the Whole Atmosphere Community Climate Model. *J. Geophys. Res.*, **117**, D04110, doi:10.1029/ 2011JD016840.

De Mazière, M., *et al.*, 2008: Validation of ACE-FTS v2.2 methane profiles from the upper troposphere to the lower mesosphere. *Atmos. Chem. Phys.*, **8**, 2421-2435, doi:10.5194/acp-8-2421-2008.

DeMore, W. B., *et al.*, 1997: Chemical kinetics and photochemical data for use in stratospheric modeling. JPL publication 92-94, Jet Propulsion Laboratory, Pasadena, California.

Douglass, A. R., *et al.*, 1999: Choosing meteorological input for the global modeling initiative assessment of high-speed aircraft. *J. Geophys. Res.*, **104**(D22), 27,545-27,564, doi:10.1029/1999JD900827.

Drummond, J. R., *et al.*, 1980: The stratospheric and mesospheric sounder on NIMBUS-7. *Philos. T. Roy. Soc.*, **A296**, 219-241, doi:10.1098/rsta.1980.0166.

Dufour, G., *et al.*, 2009: Global upper-tropospheric formaldehyde: seasonal cycles observed by the ACE-FTS satellite instrument. *Atmos. Chem. Phys.*, **9**, 3893-3910, doi:10.5194/acp-9-3893-2009.

Dupuy, E., *et al.,* 2004: Strato-mesospheric measurements of carbon monoxide with the Odin Sub-millimetre Radiometer: Retrieval and First Results. *Geophys. Res. Lett.*, **31**, L20101, doi:10.1029/2004GL020558.

Dupuy, E., *et al.*, 2009: Validation of ozone measurements from the Atmospheric Chemistry Experiment (ACE). *Atmos. Chem. Phys.*, **9**, 287-343, doi:10.5194/acp-9-287-2009.

Ejiri, M. K., *et al.*, 2006: Validation of the improved limb atmospheric spectrometer-II (ILAS-II) Version 1.4 nitrous oxide and methane profiles. *J. Geophys. Res.*, **111**, D22S90, doi:10.1029/2005JD006449.

Ekström, M., *et al.*, 2008: Comparison of satellite limb-sounding humidity climatologies of the uppermost tropical troposphere. *Atmos. Chem. Phys.*, **8**, 309-320, doi:10.5194/acp-8-309-2008.

Ekström, M., and Eriksson, P., 2008: Altitude resolved ice-fraction in the uppermost tropical troposphere. *Geophys. Res. Lett.*, **35**, L13822, doi:10.1029/2008GL034305.

Englert, C. R., *et al.*, 2008: First results from the Spatial Heterodyne Imager for Mesospheric Radicals (SHIMMER), Diurnal variation of mesospheric hydroxyl. *Geophys. Res. Lett.*, **35**, L19813, doi:10.1029/2008GL035420.

Englert, C. R., *et al.*, 2010: Spatial Heterodyne Imager for Mesospheric Radicals on STPSat-1. *J. Geophys. Res.*, **115**, D20306, doi:10.1029/2010JD014398.

Eparvier, F. G., *et al.*, 1994: Solar Mesosphere Explorer satellite measurements of El Chichon stratospheric aerosols, 2. Aerosol mass and size parameters. *J. Geophys. Res.*, **99**, 20533-20544, doi:10.1029/94JD01841.

Eriksson, P., C. Jiménez and S. A. Buehler, 2005: Qpack, a tool for instrument simulation and retrieval work. *J. Quant. Spectrosc. Rad. Transf.*, **91**, 47-64, http://dx.doi.org/10.1016/j.jqsrt.2004.05.050.

Ernst, F., *et al.*, 2009: Retrieval of stratospheric aerosol distributions from SCIAMACHY limb measurements: first steps and methodology. Proceedings Atmospheric Science Conference, Barcelona, Spain, 7-11 Sept 2009, ESA Special Publication SP-676.

Eyring, V., *et al.*, 2006: Assessment of temperature, trace species, and ozone in chemistry-climate model simulations of the recent past. *J. Geophys. Res.*, **111**(D22), D22308.

Fahey, D. W., *et al.*, 2001: The detection of large HNO_3-containing particles in the winter Arctic stratosphere. *Science*, **291**, 1026-1031, doi:10.1126/science.1057265.

Fiorucci, I., *et al.*, 2013: Ground-based stratospheric O_3 and HNO_3 measurements at Thule, Greenland: an intercomparison with Aura MLS observations. *Atm. Meas. Tech.*, **6**, 2441-2453, doi:10.5194/amt-6-2441-2013.

Fischer, H., *et al.*, 2008: MIPAS: An instrument for atmospheric and climate research. *Atmos. Chem. Phys.,* **8**, 2151-2188, doi:10.5194/acp-8-2151-200.

Fish, D. J., *et al.*, 2000: Possible causes of stratospheric NO_2 trends observed at Lauder. *Geophys. Res. Lett.*, **20**, 3313-3316, doi:10.1029/2000GL011700.

Flocke, F, *et al.*, 1999: An examination of chemistry and transport processes in the tropical lower stratosphere using observations of long-lived and short-lived compounds obtained during STRAT and POLARIS. *J. Geophys. Res.*, **104**, 26625-26642, doi:10.1029/1999JD900504.

Folkins, I., *et al.*, 2006: Seasonal cycles of O_3, CO, and convective outflow at the tropical tropopause. *Geophys. Res. Lett.*, **33**, L16802, doi:10.1029/2006GL026602.

Forkman, P., *et al.*, 2012: Six years of mesospheric CO estimated from ground-based frequency-switched microwave radiometry at 57°N compared with satellite instruments. *Atmos. Meas. Tech.*, **5**, 2827-2841, doi:10.5194/amt-5-2827-2012.

Forster, P. M. and K. P. Shine, 2002: Assessing the climate impacts of trends in stratospheric water vapour. *Geophys. Res. Lett.,* **29**, 1086-1089, doi:10.1029/2001GL013909.

Frisk, U., *et al.*, 2003: The Odin satellite: I. Radiometer design and test. *Astron. Astrophys.*, **402**, L27(34), doi:10.1051/0004-6361:20030335.

Froidevaux, L., *et al.*, 2006: Early validation analyses of the atmospheric profiles from EOS MLS on the Aura satellite. *IEEE Trans. Geosci. Remote Sens.*, **44**, 1106-1121, doi:10.1109/TGRS.2006.864366.

Froidevaux, L., *et al.*, 2008a: Validation of Aura Microwave Limb Sounder stratospheric ozone measurements. *J. Geophys. Res.*, **113**, D15S20, doi:10.1029/2007JD008771.

Froidevaux, L., *et al.*, 2008b: Validation of Aura Microwave Limb Sounder HCl measurements. *J. Geophys. Res.*, **113**, D15S25, doi:10.1029/2007JD009025.

Froidevaux, L., *et al.*, 2015: Global Ozone Chemistry And Related trace gas Data records for the Stratosphere (GOZCARDS): methodology and sample results with a focus on HCl, H_2O, and O_3. *Atmos. Chem. Phys.*, **15**, 10471-10507, doi:10.5194/acp-15-10471-2015.

Fueglistaler, S., *et al.*, 2009: The tropical tropopause layer. *Rev. Geophys.*, **47**, RG1004, doi:10.1029/2008RG000267.

Fujiwara, M., *et al.*, 2010: Seasonal to decadal variations of water vapour in the tropical lower stratosphere observed with balloon-borne cryogenic frost point hygrometers. *J. Geophys. Res.*, **115**, D18304, doi:10.1029/2010JD014179.

Funke, B., *et al.*, 2001: A new non-LTE retrieval method for atmospheric parameters from MIPAS-Envisat emission spectra. *Adv. Space Res.*, **27**, 1099-1104, doi:10.1016/S0273-1177(01)00169-7.

Funke, B., *et al.*, 2005a: Retrieval of stratospheric NO_x from 5.3 and 6.2 μm nonlocal thermodynamic equilibrium emissions measured by Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) on Envisat. *J. Geophys. Res.*, **110**, D09302, doi:10.1029/2004JD005225.

Funke, B., *et al.*, 2005b: Downward transport of upper atmospheric NO_x into the polar stratosphere and lower mesosphere during the Antarctic 2003 and Arctic 2002/2003 winters. *J. Geophys. Res.,* **110**, D24308, doi:10.1029/2005JD006463.

Funke, B., *et al.*, 2009: Carbon monoxide distributions from the upper troposphere to the mesosphere inferred from 4.7 μm nonlocal thermal equilibrium emissions measured by MIPAS on Envisat. *Atmos. Chem. Phys.*, **9**, 2387-2411, doi:10.5194/acp-9-2387-2009.

Funke, B. and von Clarmann, T., 2012: How to average logarithmic retrievals? *Atmos. Meas. Tech.*, **5**, 831-841, doi:10.5194/amt-5-831-2012.

Funke, B., *et al.*, 2014: Mesospheric and stratospheric NO_Y produced by energetic particle precipitation during 2002-2012. *J. Geophys. Res. Atmos.*, **119**, 4429-4446, doi:10.1002/2013JD021404.

Fussen, D., *et al.,* 2001: Evolution of stratospheric aerosols in the post-Pinatubo period measured by the occultation radiometer experiment ORA. *Atmos. Env.*, **35**, 5067-5078.

Garcia, R. R., *et al.*, 2007: Simulation of secular trends in the middle atmosphere, 1950-2003. *J. Geophys. Res.*, **112**, D09301, doi:10.1029/2006JD007485.

Garcia, R. R., *et al.*, 2011: On the Determination of Age of Air Trends from Atmospheric Trace Species. *J. Atmos. Sci.*, **68**, 139-154, doi:10.1175/2010JAS3527.1.

Geller, L.S., *et al.,* 1997: Tropospheric SF_6: Observed latitudinal distribution and trends, derived emissions, and interhemispheric exchange time. *Geophys. Res.*, **24**, 675-678, doi:10.1029/97GL00523.

Gettelman, A., *et al.*, 2010: Multimodel assessment of the upper troposphere and lower stratosphere: Tropics and global trends. *J. Geophys. Res.*, **115**, D00M08, doi:10.1029/2009JD013638.

Gettelman, A., *et al.*, 2011: The extra tropical upper troposphere and lower stratosphere. *Rev. Geophys.*, **49**, RG3003, doi:10.1029/2011RG000355.

Gille, J., and J. M. Russell III, 1984: The Limb Infrared Monitor of the Stratosphere (LIMS) experiment: Experiment description, performance, and results. *J. Geophys. Res.*, **88**, 5125-5140.

Gille, J., and J. Barnett, 1992: The High-Resolution Dynamics Limb Sounder (HIRDLS). An instrument for the study of global change. The Use of EOS for Studies of Atmospheric Physics, J. Gille and G. Visconti (Eds.), North-Holland, pp433-450.

Gille, J., *et al.*, 2008: The High Resolution Dynamics Limb Sounder (HIRDLS): Experiment overview, results and validation of initial temperature data. *J. Geophys. Res.*, **113**, D16S43, doi:10.1029/2007JD008824.

Gille, J., and L. Gray, 2011: High Resolution Dynamics Limb Sounder, Earth Observing System (EOS), Data Description and Quality. Version 6 (V6), available from **www.eos.ucar.edu/hirdls/**, **http://disc.sci.gsfc.nasa.gov/data-holdings**, or **http://badc.nerc.ac.uk/browse/badc/hirdls**.

Gille, J., *et al.*, 2014: The role of midlatitude mixing barriers in creating the annual variation of total ozone in high northern latitudes. *J. Geophys. Res. Atmos.*, **119**, 9578-9595, doi:10.1002/2013JD021416.

Glaccum, W., *et al.*, 1996: The Polar Ozone and Aerosol Measurement (POAM II) Instrument. *J. Geophys. Res.*, **101**, 14479-14487, doi:10.1029/96JD00576.

Glatthor, N., *et al.*, 1998: Airborne remote sensing of NO_2 in the Arctic winter of 1994-1995 and comparison with a three-dimensional chemical transport model. *J. Geophys. Res.*, **103**, 13315-13326., doi:10.1029/98JD00521.

Glatthor, N., *et al.,* 1999: Intercomparison of the KOPRA and the RFM radiative transfer codes. Proc. European Symposium on Atmospheric Measurements from Space, ESAMS'99, 18-22 Jan 1999, Noordwijk, European Space Agency, ESTEC, Noordwijk, The Netherlands, pp757-764.

Glatthor, N., *et al.*, 2004: Spaceborne ClO observations by the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) before and during the Antarctic major warming in September/October 2002. *J. Geophys. Res.*, **109**, D11307, doi:10.1029/2003JD004440.

Glatthor, N., *et al.*, 2005: Mixing processes during the Antarctic vortex split in September/October 2002 as inferred from source gas and ozone distributions from ENVISAT-MIPAS. *J. Atmos. Sci.*, **62**, 787-800, doi:10.1175/JAS-3332.1.

Glatthor, N., *et al.*, 2006: Retrieval of stratospheric ozone profiles from MIPAS/ENVISAT limb emission spectra: A sensitivity study. *Atmos. Chem. Phys.*, **6**, 2767-2781, doi:10.5194/acp-6-2767-2006.

Gordley, L. L., *et al.*, 1996: Validation of nitric oxide and nitrogen dioxide measurements made by the Halogen Occultation Experiment for UARS platform. *J. Geophys. Res.*, **101**, 10241-10266, doi:10.1029/95JD02143.

Griesfeller, A., *et al.*, 2008: Intercomparison of ILAS-II Version 1.4 and Version 2 target parameters with MIPAS-Envisat measurements. *Atmos. Chem. Phys.*, **8**, 825-843, doi:10.5194/acp-8-825-2008.

Grooß, J.-U., and J. M. Russell III, 2005: Technical note: A stratospheric climatology for O_3, H_2O, CH_4, NO_x, HCl and HF derived from HALOE measurements. *Atmos. Chem. Phys.*, **5**, 2797-2807, doi:10.5194/acp-5-2797-2005.

Gunson, M., *et al.*, 1996: The Atmospheric Trace Molecule Spectroscopy (ATMOS) experiment: Deployment on the ATLAS Space Shuttle missions. *Geophys. Res. Lett.*, **23**, 2333-2336, doi:10.1029/96GL01569.

Haley, C., *et al.*, 2004: Retrievals of stratospheric O_3 and NO_2 profiles from Odin Optical Spectrograph and InfraRed Imager System (OSIRIS) limb-scattered sunlight measurements. *J. Geophys. Res.*, **109**, D16303, doi:10.1029/2004JD004588.

Haley, C. and S. Brohede, 2007: Status of the Odin/OSIRIS Stratospheric O_3 and NO_2 Data Products. *Can. J. Phys.*, **85**, 1177-1194, doi:10.1139/P07-114.

Hanson, D. R. and K. Mauersberger, 1988: Laboratory studies of the nitric acid trihydrate: implications for the south polar stratosphere. *Geophys. Res. Lett.*, **15**, 855-858, doi:10.1029/GL015i008p00855.

Harries, J. E., *et al.*, 1996: Validation of water vapor measurements from the Halogen Occultation Experiment. *J. Geophys. Res.*, **101**, 10205, doi:10.1029/95JD02933.

Harrison, J. J. and P. F. Bernath, 2013: ACE-FTS observations of acetonitrile in the lower stratosphere. *Atmos. Chem. Phys.*, **13**, 7405-7413, doi:10.5194/acp-13-7405-2013.

Hartmann, G. K., *et al.*, 1996: Measurements of O_3, H_2O and ClO in the middle atmosphere using the Millimeter-Wave Atmospheric Sounder (MAS). *Geophys. Res. Lett.*, **23**, 2313-2316, doi:10.1029/96GL01475.

Hasebe, F., 1994: Quasi-biennial oscillations of ozone and diabatic circulation in the equatorial stratosphere. *J. Atmos. Sci.*, **51**, 729-745, doi:10.1175/1520-0469(1994)051<0729:QBOOOA>2.0.CO;2.

Hassler, B., G.E. Bodeker, and M. Dameris, 2008: Technical Note: A new global database of trace gases and aerosols from multiple sources of high vertical resolution measurements. *Atmos. Chem. Phys.*, **8**, 5403-5421, doi:10.5194/acp-8-5403-2008.

Hauchecorne, A., *et al.*, 2005: First simultaneous global measurements of nighttime stratospheric NO_2 and NO_3 observed by Global Ozone Monitoring by Occultation of Stars (GOMOS)/ENVISAT in 2003. *J. Geophys. Res.*, **110**, D18301, doi:10.1029/2004JD005711.

Hauchecorne, A., *et al.*, 2010: Response of tropical stratospheric O_3, NO_2 and NO_3 to the equatorial Quasi-Biennial Oscillation and to temperature as seen from GOMOS/Envisat. *Atmos. Chem. Phys.*, **10**, 8873-8879, doi:10.5194/acp-10-8873-2010.

Hedin, A. E., 1991: Extension of the MSIS thermosphere model into the middle and lower atmosphere. *J. Geophys. Res.*, **96**(A2), 1159, Document ID: 19910040911.

Hegglin, M. I., *et al.*, 2008: Validation of ACE-FTS satellite data in the upper troposphere/lower stratosphere (UTLS) using non-coincident measurements. *Atmos. Chem. Phys.*, **8**, 1483-1499, doi:10.5194/acp-8-1483-2008.

Hegglin, M. I., *et al.*, 2009: A global view of the extratropical tropopause transition layer from Atmospheric Chemistry Experiment Fourier Transform Spectrometer O_3, H_2O, and CO. *J. Geophys. Res.*, **114**, D00B11, doi:10.1029/2008JD009984.

Hegglin, M. I., *et al.,* 2010: Multimodel assessment of the upper troposphere and lower stratosphere: Extratropics. *J. Geophys. Res.*, **115**, D00M09, doi:10.1029/2010JD013884.

Hegglin, M. I., *et al.*, 2013: SPARC Data Initiative: Comparison of water vapor climatologies from international limb satellite sounders. *J. Geophys. Res. Atmos.*, **118**, doi:10.1002/jgrd.50752.

Hegglin, M. I., *et al.*, 2014: Vertical structure of stratospheric water vapour trends derived from merged satellite data. *Nature Geoscience*, **7** (10), 768-776, ISSN 1752-0894 doi:10.1038/ngeo2236.

Hegglin, M. I., *et al.*, in prep.: SPARC Data Initiative: Comparison of aerosol climatologies from international limb satellite sounders.

Hervig, M. E., *et al.*, 1996a: Validation of temperature measurements from the Halogen Occultation Experiment. *J. Geophys. Res.*, **101**, 10277-10285, doi:10.1029/95JD01713.

Hervig, M. E., *et al.*, 1996b: Validation of aerosol measurements from the Halogen Occultation Experiment. J. *Geophys. Res.*, **101**, 10267-10275, doi:10.1029/95JD02464.

Hervig, M. E., and T. Deshler, 2002: Evaluation of aerosol measurements from SAGE II, HALOE, and balloonborne optical particle counters. *J. Geophys. Res.*, **107**, 4031, doi:10.1029/2001JD 000703.

Hocke, K., *et al.*, 2007: Comparison and synergy of stratospheric ozone measurements by satellite limb sounders and the ground-based microwave radiometer SOMORA. *Atmos. Chem. Phys.*, **7**, 4117-4131, doi:10.5194/acp-7-4117-2007.

Hofmann, D. J., and S. Solomon,1989: Ozone destruction through heterogeneous chemistry following the eruption of El Chichón. *J. Geophys. Res.*, **94**, 5029-5041, Paper No.: 88JD04231.

Holton, J. R., and W.-K. Choi, 1988: Transport circulation deduced from SAMS trace species data. *J. Atmos. Sci.*, **45**, 1929–1939.

Höpfner, M., *et al.*, 2004: First spaceborne observations of Antarctic stratospheric $ClONO_2$ recovery: Austral spring 2002. *J. Geophys. Res.*, **109**, doi:10.1029/2004JD004609.

Höpfner, M., *et al.*, 2007: Validation of MIPAS $ClONO_2$ measurements. *Atmos. Chem. Phys.*, **7**, 257-281, doi:10.5194/acp-7-257-2007.

Hoor, P., *et al.*, 2010: Transport timescales and tracer properties in the extratropical UTLS. *Atmos. Chem. Phys.*, **10**, 7929-7944, doi:10.5194/acp-10-7929-2010.

Hubert, D., *et al.*, 2016: Ground-based assessment of the bias and long-term stability of 14 limb and occultation ozone profile data records. *Atmos. Meas. Tech.*, **9**, 2497-2534, doi:10.5194/amt-9-2497-2016.

Hurst, D. F., *et al.*, 2011: Stratospheric water vapour trends over Boulder, Colorado: Analysis of the 30 year Boulder record. *J. Geophys. Res.*, **116**, D02306, doi:10.1029/2010JD015065.

Isaksen, I. S. A., *et al.*, 2009: Atmospheric composition change: Chemistry-climate interactions. *Atmos. Env.,* **43**, 5138-5192, doi:10.1016/j.atmosenv.2009.08.003.

Jackman, C. H., *et al.*, 2008: Short and medium-term atmospheric constituent effects of very large solar proton events. *Atmos. Chem. Phys.*, **8**, 765-785, doi:10.5194/acp-8-765-2008.

Jiang, J. H., *et al.*, 2005: Comparison of GPS/SAC-C and MIPAS/ENVISAT temperature profiles and its possible implementation for EOS MLS observations. Earth Observation with CHAMP: Results from Three Years in Orbit, C. Reigber, H. Lühr, P. Schwintzer, and J. Wickert (Eds.), Springer-Verlag Berlin Heidelberg New York, pp573-578.

Jiang, Y. B., *et al.*, 2007: Validation of aura microwave limb sounder ozone by ozonesonde and lidar measurements. *J. Geophys. Res.*, **112**, D24S34, doi:10.1029/2007JD008776.

Jin, J. J., *et al.*, 2009: Comparison of CMAM simulations of carbon monoxide (CO), nitrous oxide (N_2O), and methane (CH_4) with observations from Odin/SMR, ACE-FTS, and Aura/MLS. *Atmos. Chem. Phys.*, **9**, 3233-3252, doi:10.5194/acp-9-3233-2009.

Johnson, D. G., *et al.*, 1995: Estimating the abundance of ClO from simultaneous remote sensing measurements of HO_2, OH, and HOCl.*Geophys. Res. Lett.*, **22**, 1869-1871, doi:10.1029/95GL01249.

Johnston, H., 1971: Reduction of stratospheric ozone by nitrogen oxide catalysts from supersonic transport exhaust. *Science*, **173**, 517-522, doi:10.1126/science.173.3996.517.

Jones, R. L., and J. A. Pyle, 1984: Observations of CH_4 and N_2O by the NIMBUS 7 SAMS: A comparison with *in situ* data and two-dimensional numerical model calculations. *J. Geophys. Res.*, **89**, 5263-5279, doi:10.1029/JD089iD04p05263.

Jones, R. L., *et al.*, 1986: The water vapour budget of the stratosphere studied using LIMS and SAMS satellite data. *Quarterly J. Royal Meteorol. Soc.*, **112**, doi:10.1256/smsqj.47411.

Jones, A., *et al.*, 2009: Evolution of stratospheric ozone and water vapor time series studied with satellite measurements. *Atmos. Chem. Phys.*, **9**, 6055-6075, doi:10.5194/acp-9-6055-2009.

Jones, D. B. A., *et al.*, 2009: The zonal structure of tropical O_3 and CO as observed by the Tropospheric Emission Spectrometer in November 2004. Part I. Inverse modeling of CO emissions. *Atmos. Chem. Phys.*, **9**, 3547-3562, doi:10.5194/acp-9-3547-2009.

Jones, A., *et al.*, 2011: A global inventory of stratospheric NO_y from ACE-FTS. *J. Geophys. Res.*, **116**, D17304, doi:10.1029/2010JD015465.

Jones, A., *et al.*, 2012: Technical Note: A trace gas climatology derived from the Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS) dataset. *Atmos. Chem. Phys.*, **12**, 5207-5220, doi:10.5194/acp-12-5207-2012.

Jucks, K. W., *et al.,* 1998: Observations of OH, HO_2, H_2O, and O_3, in the upper stratosphere: Implications for HO_x photochemistry. *Geophys. Res. Lett.*, **25**, 3935-3938, doi:10.1029/1998GL900009.

Junge, C. E., C. W. Chagnon, and J. E. Manson, 1961: Stratospheric aerosols. *J. Meteorol.*, **18**, 81-108., http://dx.doi.org/10.1175/1520-0469(1961)018<0081:SA>2.0.CO;2

Kanzawa, H., *et al.*, 2003: Validation and data characteristics of nitrous oxide and methane profiles observed by the Improved Limb Atmospheric Spectrometer (ILAS) and processed with the Version 5.20 algorithm. *J. Geophys. Res.*, **108**, 8003, doi:10.1029/2002JD002458.

Kar, J., *et al.*, 2007: Initial comparison of ozone and NO_2 profiles from ACE-MAESTRO with balloon and satellite data. *J. Geophys. Res.*, **112**, D16301, doi:10.1029/2006JD008242.

Kasai, Y., *et al.*, 2013: Validation of stratospheric and mesospheric ozone observed by SMILES from International Space Station. *Atmos. Meas. Tech.*, **6**, 2311-2338, doi:10.5194/amt-6-2311-2013.

Kellmann, S., *et al.*, 2012: Global CFC-11 (CCl_3F) and CFC-12 (CCl_2F_2) measurements with the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS): Retrieval, climatologies and trends. *Atmos. Chem. Phys.*, **12**, 11857-11875, doi:10.5194/acp-12-11857-2012.

Kerzenmacher, T., *et al.*, 2008: Validation of NO_2 and NO from the Atmospheric Chemistry Experiment (ACE). *Atmos. Chem. Phys.*, **8**, 5801-5841, doi:10.5194/acp-8-5801-2008.

Khosravi, R., *et al.*, 2009: Overview and characterization of retrievals of temperature, pressure, and atmospheric constituents from the High Resolution Dynamics Limb Sounder (HIRDLS) measurements. *J. Geophys. Res.*, **114**, D20304, doi:10.1029/2009JD011937.

Khosravi, M., *et al.*, 2013: Diurnal variation of stratospheric and lower mesospheric HOCl, ClO and HO_2 at the equator: comparison of 1-D model calculations with measurements by satellite instruments. *Atmos. Chem. Phys.*, **13**, doi:10.5194/acp-13-7587-2013.

Kiefer, M., *et al.,* 2010: Impact of temperature field inhomogeneities on the retrieval of atmospheric species from MIPAS IR limb emission spectra. *Atmos. Meas. Tech.*, **3**, 1487-1507, doi:10.5194/amt-3-1487-2010.

Kikuchi, K., *et al.*, 2010: Overview and early results of the Superconducting Submillimeter-Wave Limb-Emission Sounder (SMILES). *J. Geophys. Res.*, **115**, D23306, doi:10.1029/2010JD014379.

Kinnison, D.E., *et al.*, 2007: Sensitivity of chemical tracers to meteorological parameters in the MOZART-3 chemical transport model. J. *Geophys. Res.*, **112**, D20302, doi:10.1029/2006JD007879.

Ko, M. K. W., *et al.*, 1993: Atmospheric sulfur hexafluoride: Sources, sinks and greenhouse warming. *J. Geophys. Res.*, **98**, 10499-10507, doi:10.1029/93JD00228.

Kohri, W.J., 1981: LRIR Observations of the Structure and Propagation of the Stationary Planetary Waves in the Northern Hemisphere during December 1975. Cooperative Thesis No. 63, Drexel University and National Center for Atmospheric Research.

Konopka, P., *et al.*, 2010: Annual cycle of ozone at and above the tropical tropopause: observations versus simulations with the Chemical Lagrangian Model of the Stratosphere (CLaMS). *Atmos. Chem. Phys.*, **10**, 121-132, doi:10.5194/acp-10-121-2010.

Kreyling, D., *et al.*, 2013: SMILES zonal and diurnal variation climatology of stratospheric and mesospheric trace gasses: O_3, HCl, HNO_3, ClO, BrO, HOCl, HO_2, and temperature. *J. Geophys. Res. Atmos.*, **118**, 11888-11903, doi:10.1002/2012JD019420.

Krüger, K., B. Naujokat, and K. Labitzke, 2005: The unusual midwinter warming in the Southern Hemisphere stratosphere of 2002: A comparison to Northern Hemisphere phenomena. *J. Atmos. Sci*., **62**, 603-613, doi:10.1175/JAS-3316.1.

Kulawik, S. S., *et al.*, 2006a: TES atmospheric profile retrieval characterization: An orbit of simulated observations. *IEEE Trans. Geosci. Remote Sens.*, **44**, 1324– 1333, doi:10.1109/TGRS.2006.871207.

Kulawik, S. S., *et al.*, 2006b: Calculation of altitude-dependent Tikhonov constraints for TES nadir retrievals. *IEEE Trans. Geosci. Remote Sens.*, **44**, 1334–1342, doi:10.1109/TGRS.2006.871206.

Kuribayashi, K., *et al.,* 2014: Direct estimation of the rate constant of the reaction ClO + HO_2 -> HOCl +O_2 from SMILES atmospheric observations. *Atmos. Chem. Phys.*, **14**, 255-266, doi:10.5194/acp-14-255-2014.

Kyrölä, E., *et al.*, 2006: Night-time ozone profiles in the stratosphere and mesosphere by the Global Ozone Monitoring by Occultation of Stars on Envisat. *J. Geophys. Res.*, **111**, D24306, doi:10.1029/2006JD007193.

Kyrölä, E., *et al.*, 2010a: GOMOS O_3, NO_2, and NO_3 observations in 2002-2008. *Atmos. Chem. Phys.*, **10**, 7723-7738, doi:10.5194/acp-10-7723-2010.

Kyrölä, E., *et al.*, 2010b: Retrieval of atmospheric parameters from GOMOS data. *Atmos. Chem. Phys.*, **10**, 11881-11903, doi:10.5194/acp-10-11881-2010.

Laaksonen, A., *et al.*, 2000: Upper tropospheric SO_2 conversion into sulfuric acid aerosols and cloud condensation nuclei. *J. Geophys. Res.*, **105**, 1459-1469, doi:10.1029/1999JD900933.

Labitzke, K., and M. P. McCormick, 1992: Stratospheric temperature increases due to Pinatubo aerosols. *Geophys. Res. Lett*., **19**, 207-210, doi:10.1029/91GL02940.

Laeng, A., *et al.*, 2014: Validation of MIPAS IMK/IAA V5R_O3_224 ozone profiles. *Atmos. Meas. Tech.*, **7**, 3971-3987, doi:10.5194/amt-7-3971-2014.

Lambert, A., *et al.*, 1993: Measurements of the evolution of the Mount Pinatubo aerosol clouds by ISAMS. *Geophys. Res. Lett*., **20**, 1287-1290, doi:10.1029/93GL00827.

Lambert, A., *et al.*, 2007: Validation of the Aura Microwave Limb Sounder middle atmosphere water vapor and nitrous oxide measurements. *J. Geophys. Res.*, **112**(D24S36), doi:10.1029/2007JD008724.

Lary, D. J., *et al.*, 2007: Variations in stratospheric inorganic chlorine between 1991 and 2006. *Geophys. Res. Lett.*, **34**, L21811, doi:10.1029/2007GL030053.

Leblanc, T., *et al.*, 2011: Measurements of Humidity in the Atmosphere and Validation Experiments (MOHAVE)-2009: Review of campaign operations and results. *Atmos. Meas. Tech.*, **4**, 2579-2605, doi:10.5194/amt-4-2579-2011.

Ling, X.-D., and J. London, 1986: The quasi-biennial oscillation of ozone in the tropical middle stratosphere: A one-dimensional model. *J. Atmos. Sci*., **43**, 3122-3137, doi:10.1175/1520-0469(1986)043<3122:TQBOOO>2.0.CO;2.

Livesey, N. J., and W. G. Read, 2000: Direct retrieval of line-of-sight atmospheric structure from limb sounding observations. *Geophys. Res. Lett.*, **27**, 891-894, doi:10.1029/1999GL010964.

Livesey, N. J., et al., 2001: Stratospheric CH_3CN from the UARS Microwave Limb Sounder. *Geophys. Res. Letts.*, **28**, 779-782, doi:10.1029/2000GL012144.

Livesey, N. J., *et al.*, 2003: The UARS Microwave Limb Sounder version 5 dataset: Theory, characterization and validation. *J. Geophys. Res.,* **108**, 4378, doi:10.1029/2002JD002273.

Livesey, N. J., *et al.*, 2004: Enhancements in lower stratospheric CH_3CN observed by UARS MLS following boreal forest fires. *J. Geophys. Res.*, **109**, D06308, doi:10.1029/2003JD004055.

Livesey, N. J., *et al.*, 2006: Retrieval algorithms for the EOS Microwave Limb Sounder (MLS) instrument. *IEEE Trans. Geosci. Remote Sens.*, **44**, 1144-1155, doi:10.1109/TGRS.2006.872327.

Livesey, N. J., *et al.*, 2008: Validation of Aura Microwave Limb Sounder O_3 and CO observations in the upper troposphere and lower stratosphere. *J. Geophys. Res.*, **113**, D15S02, doi:10.1029/2007JD008805.

Livesey, N. J., *et al.*, 2011: EOS MLS Version 3.3 Level 2 data quality and description document. Tech. rep., D-33509, Jet Propulsion Laboratory.

Livesey, N. J., *et al.,* 2013: EOS MLS Version 3.3/3.4 Level 2 data quality and description document. Tech. rep., Jet Propulsion Laboratory, available from **http://mls.jpl.nasa.gov/**.

Llewellyn, E., *et al.*, 2004: The OSIRIS Instrument on the Odin Spacecraft. *Can. J. Phys.*, **82**, 411-422, doi:10.1139/p04-005.

Logan, J.A., 1999: An analysis of ozonesonde data for the troposphere: Recommendations for testing 3-D models, and development of a gridded climatology for tropospheric ozone. *J. Geophys. Res.*, **104**, 16115-16149, doi:10.1029/1998JD100096.

Lossow, S., *et al.*, 2009: Wintertime water vapor in the polar upper mesosphere and lower thermosphere – first satellite observations by Odin/SMR. *J. Geophys. Res.*, **114**, D10304, doi:10.1029/2008JD011462.

Lowe, D., and R. MacKenzie, 2008: Review: Polar stratospheric cloud microphysics and chemistry. *J. Atmos. Sol.-Terr. Phys.*, **70**, 13-40, http://dx.doi.org/10.1016/j.jastp.2007.09.011.

Lucke, R. L., *et al.*, 1999: The Polar Ozone and Aerosol Measurement (POAM III) Instrument and Early Validation Results. *J. Geophys. Res.*, **104**, 18785-18799, doi:10.1029/1999JD900235.

Lumpe, J. D., *et al.*, 1997: POAM II Retrieval Algorithm and Error Analysis. *J. Geophys. Res.*, **102**, 23593-23614, doi:10.1029/97JD00906.

Lumpe, J. D., *et al.*, 2002: POAM III retrieval algorithm and error analysis. *J. Geophys. Res.*, **107**, 4575, doi:10.1029/2002JD002137.

Lumpe, J., *et al.*, 2006: Validation of Polar Ozone and Aerosol Measurement (POAM) III version 4 stratospheric water vapour. *J. Geophys. Res.*, **111**, D11301, doi:10.1029/2005JD006763.

Mahieu, E., *et al.*, 2008: Validation of ACE-FTS v2.2 measurements of HCl, HF, CCl_3F and CCl_2F_2 using space-, balloon- and ground-based instrument observations. *Atmos. Chem. Phys.*, **8**, 6199-6221, doi:10.5194/acp-8-6199-2008.

Manabe, S., and R. T. Wetherald, 1967: Thermal equilibrium of the atmosphere with a given distribution of relative humidity. *J. Atmos. Sci.*, **24**, 241 pp., http://dx.doi.org/10.1175/1520-0469(1967)024<0241:TEOTAW>2.0.CO;2.

Manney, G. L., *et al.*, 2009: Satellite observations and modelling of transport during the 2006 major stratospheric sudden warming. *Atmos. Chem. Phys.*, **9**, 4775-4795.

Manney, G. L., *et al.*, 2011: Jet characterization in the upper troposphere/lower stratosphere (UTLS): Applications to climatology and transport studies. *Atmos. Chem. Phys.*, **11**, 6115-6137, doi:10.5194/acp-11-6115-2011.

McCormick, M. P., *et al.*, 1979: Satellite studies of the stratospheric aerosol. *Bull. Am. Meteor. Soc.*, **60**, 1038-1046, http://dx.doi.org/10.1175/1520-0477(1979)060<1038:SSOTSA>2.0.CO;2.

McCormick, M. P., *et al.*, 1981: High-latitude stratospheric aerosols measured by the SAM II satellite system in 1978 and 1979. *Science*, **214**, 328-331, doi:10.1126/science.214.4518.328.

McCormick, M. P., *et al.*, 1989: An overview of SAGE-I and II ozone measurements. *Planetary and Space Science*, **37**, 1567-86, doi:10.1016/0032-0633(89)90146-3.

McCormick, M. P., *et al.*, 1995: Atmospheric effects of the Mt. Pinatubo eruption. *Nature*, **373**, 399-404, doi:10.1038/373399a0.

McElroy, C. T., *et al.*, 2007: The ACE-MAESTRO instrument on SCISAT: description, performance, and preliminary results. *Appl. Opt.*, **46**, 4341-4356, doi:10.1364/AO.46.004341.

McHugh, M. J., *et al.*, 2003: Improved mesospheric temperature, water vapor and polar mesospheric cloud extinctions from HALOE. *Geophys. Res. Lett.*, **30**, 1440, doi:10.1029/2002GL016859.

McHugh, M., *et al.*, 2005: Comparison of atmospheric retrievals from ACE and HALOE. *Geophys. Res. Lett.*, **32**, L15S10, doi:10.1029/2005GL022403.

McLinden, C. A., *et al.*, 2000: Stratospheric ozone in 3-D models: A simple chemistry and the cross-tropopause flux. *J. Geophys. Res.*, **105**, 14653-14665, doi:10.1029/2000JD900124.

McLinden, C. A., *et al.*, 2001: Understanding trends in stratospheric NO_y and NO_2. *J. Geophys. Res.*, **106**, 27787-27793, doi:10.1029/2000JD000100.

McLinden, C. A., S. Tegtmeier, and V. Fioletov, 2009: Technical Note: A SAGE-corrected SBUV zonal-mean ozone data set. *Atmos. Chem. Phys.*, **9**, 7963-7972, doi:10.5194/acp-9-7963-2009.

McLinden, C. A., *et al.*, 2010: Odin/OSIRIS observations of stratospheric BrO: Retrieval methodology, climatology, and inferred Br_y. *J. Geophys. Res.*, **115**, D15308, doi:10.1029/2009JD012488.

Mengistu Tsidu, G., *et al.*, 2004: Stratospheric N_2O_5 in the austral spring 2002 as rerieved from limb emission spectra recorded by the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS). *J. Geophys. Res.*, **109**, D18301, doi:10.1029/2004JD004856.

Mengistu Tsidu, G., *et al.*, 2005: NO_y from Michelson Interferometer for Passive Atmospheric Sounding on Environmental Satellite during the southern hemisphere polar vortex split in September/October 2002. *J. Geophys. Res.,* **110**, D11301, doi:10.1029/2004JD005322.

Mieruch, S., *et al.,* 2012: Global and long-term comparison of SCIAMACHY limb ozone profiles with correlative satellite data (2002-2008). *Atmos. Meas. Tech.*, **5**, 771-788, doi:10.5194/amt-5-771-2012.

Millán, L., 2012: New Aura Microwave Limb Sounder observations of BrO and implications for Bry. *Atmos. Meas. Tech.*, **5**, 1741–1751, doi:10.5194/amt-5-1741-2012.

Milz, M., *et al.*, 2005: Water vapor distributions measured with the Michelson Interferometer for Passive Atmospheric Sounding on board Envisat (MIPAS/Envisat). *J. Geophys. Res*., **110**, D24307, doi:10.1029/2005JD005973.

Milz, M., *et al.*, 2009: Validation of water vapour profiles (version 13) retrieved by the IMK/IAA scientific retrieval processor based on full resolution spectra measured by MIPAS on board Envisat. *Atmos. Meas. Tech*., **2**, 379-399, doi:10.5194/amt-2-379-2009.

Millán, L., *et al.*, 2015: Stratospheric and mesospheric HO_2 observations from the Aura Microwave Limb Sounder. *Atmos. Chem. Phys.*, **15**, 2889-2902, doi:10.5194/acp-15-2889-2015.

Molina, L. T. and M.J. Molina, 1987: Production of Cl_2O_2 from the self-reaction of the ClO radical. *J. Phys. Chem*. **91**, 433-436, doi: 10.1021/j100286a035.

Moré, J. J., 1977: The Levenberg-Marquardt algorithm: Implementation and theory. *Proc. Biennial Conf. Numerical Analysis*, pp105-116, doi:10.1007/BFb0067700.

Morris, R. A., *et al.*, 1995: Effects of electron and ion reactions on atmospheric lifetimes of fully fluorinated compounds. *J. Geophys. Res.,* **100**, 1287-1294, doi:10.1029/94JD02399.

Mote, P.W., *et al.*, 1996: An atmospheric tape recorder: The imprint of tropical tropopause temperatures on stratospheric water vapour. *J Geophys. Res.*, **101**, 3989-4006, doi:10.1029/95JD03422.

Murtagh, D., *et al.*, 2002: An overview of the Odin atmospheric mission. *Can. J. Phys.*, **80**, 309-319, doi:10.1139/p01-157.

Nardi, B., *et al.*, 2008: Initial validation of ozone measurements from the High Resolution Dynamics Limb Sounder. *J. Geophys. Res.*, **113**, D16S36, doi:10.1029/2007JD008837.

Nassar, R., *et al.*, 2008: Validation of Tropospheric Emission Spectrometer (TES) nadir ozone profiles using ozonesonde measurements. *J. Geophys. Res.*, **113**, D15S17, doi:10.1029/2007JD008819.

Nedoluha, G. E., *et al.*, 2007: A comparison of middle atmospheric water vapour as measured by WVMS, E_S-MLS, and HALOE. *J. Geophys. Res.*, **112**, D24S39, doi:10.1029/2007JD008757.

Nedoluha, G. E., *et al.*, 2009: Water vapour measurements in the mesosphere from Mauna Loa over solar cycle 23. *J. Geophys. Res.*, **114**, D23303, doi:10.1029/2009JD012504.

Nedoluha, G. E., *et al.*, 2011: Ground-based measurements of ClO from Mauna Kea and intercomparisons with Aura and Uars MLS. *J. Geophys. Res.*, **116**, D02307, doi:10.1029/2010JD014732.

Neu, J. L., *et al.*, 2014a: The SPARC Data Initiative: Comparison of upper troposphere / lower stratosphere ozone climatologies from limb-viewing instruments and the nadir-viewing Tropospheric Emission Spectrometer (TES). *J. Geophys. Res.*, **119**, 6971-6990, doi:10.1002/2013JD020822.

Neu, J. L., *et al.*, 2014b: Tropospheric ozone variations governed by changes in stratospheric circulation. *Nature Geosci.*, **7**, 340-344, doi:10.1038/ngeo2138.

Newman, P. A., *et al.*, 2006: When will the Antarctic ozone hole recover? *Geophys. Res. Lett*., **33**, L12814, doi:10.1029/2005GL025232.

Niwano, M., *et al.*, 2003: Seasonal and QBO variations of ascent rate in the tropical lower stratosphere as inferred from UARS HALOE trace gas data, *J. Geophys. Res.*, **108**, 4794, doi:10.1029/2003JD003871.

Olberg, M., *et al.*, 2003: The Odin satellite: II. Radiometer data processing and calibration. *Astron. Astrophys.,* **402**, L35, http://dx.doi.org/10.1051/0004-6361:20030336.

Orsolini, Y., *et al.*, 2010: Descent from the polar mesosphere and anomalously high stratopause observed in 8 years of water vapor and temperature satellite observations by the Odin Sub-Millimeter Radiometer. *J. Geophys. Res.*, **115**, doi:10.1029/2009JD013501.

Pardo, J. R., *et al.*, 2001: Submillimeter atmospheric transmission measurements on Mauna Kea during extremely dry El Niño conditions: Implications for broadband opacity contributions. *J. Quant. Spectrosc. Rad. Transf.*, **68**, 419-433, doi:10.1016/S0022-4073(00)00034-0.

Park, J. H., *et al.*, 1996: Validation of halogen occultation experiment CH_4 measurements from the UARS. *J. Geophys. Res.*, **101**, 10183-10204, doi:10.1029/95JD02736.

Park, M., *et al.*, 2004: Seasonal variations of methane, water vapor, ozone, and nitrogen dioxide near the tropopause: Satellite observations and model simulations. *J. Geophys. Res.*, **109**, D03302, doi:10.1029/2003JD003706.

Park, M., *et al.*, 2007: Transport above the Asian summer monsoon anticyclone inferred from Aura MLS tracers. *J. Geophys. Res.*, **112**, D16309, doi:10.1029/2006JD008294.

Peevey, T. R., *et al.*, 2012: Investigation of double tropopause spatial and temporal global variability utilizing High Resolution Dynamics Limb Sounder temperature observations. *J. Geophys. Res.*, **117**, D01105, doi:10.1029/2011JD016443.

Peter, T., 1997: Microphysics and heterogeneous chemistry of polar stratospheric clouds. *Annu. Rev. Phys. Chem.*, **48**, 785-822, doi:10.1146/annurev.physchem.48.1.785.

Pickett, H. M., *et al.*, 2006: Validation of Aura MLS HO_x measurements with remote-sensing balloon instruments. *Geophys. Res. Lett.*, **33**, doi:10.1029/2005GL024048.

Pickett, H. M., *et al.*, 2008: Validation of Aura Microwave limb sounder OH and HO_2 measurements. *J. Geophys. Res.*, **113**, doi:10.1029/2007JD008775.

Ploeger, F., *et al.*, 2012: Horizontal transport affecting trace gas seasonality in the Tropical Tropopause Layer (TTL). *J. Geophys. Res.*, **117**, 1-16, doi:10.1029/2011JD017267.

Plummer, D. A., *et al.*, 2010: Quantifying the contributions to stratospheric ozone changes from ozone depleting substances and greenhouse gases. *Atmos. Chem. Phys.*, **10**, 8803-8820, doi:10.5194/acp-10-8803-2010.

Prather, M. J., 1992: Catastrophic loss of stratospheric ozone in dense volcanic clouds. *J. Geophys. Res.*, **97**, 10187-10191, doi:10.1029/92JD00845.

Pumphrey, H. C., 1999: Validation of a new prototype water vapor retrieval for the UARS Microwave Limb Sounder. *J. Geophys. Res.*, **104**, 9399-9412, doi:10.1029/1998JD200113.

Pumphrey, H. C., *et al.*, 2000: Lower stratospheric water vapor measured by UARS MLS. *Geophys. Res. Lett.*, **27**, 1691-1694, doi:10.1029/1999GL011339.

Pumphrey, H. C., *et al.*, 2007: Validation of middle-atmosphere carbon monoxide retrievals from the Microwave Limb Sounder on Aura. *J. Geophys. Res.*, **112**, doi:10.1029/2007JD008723.

Pumphrey, H. C., *et al.*, 2011: Microwave Limb Sounder observations of biomass-burning products from the Australian bush fires of February 2009. *Atmos. Chem. Phys.*, **11**, 6285-6296, doi:10.5194/acp-11-6285-2011.

Pumphrey, H. C., *et al.*, 2013: EOS MLS Version 3.3/3.4 Level 2 data quality and description document. Tech. Rep., Jet Propulsion Laboratory, available from **http://mls.jpl.nasa.gov/**.

Randall, C. E., *et al.*, 1998: POAM II measurements of stratospheric NO_2, 1993-1996. *J. Geophys. Res.*,**103**, 28361-28371, doi:10.1029/98JD02092.

Randall, C. E., *et al.*, 2000: Comparison of Polar Ozone and Aerosol measurement (POAM) II and Stratospheric Aerosol and Gas Experiment (SAGE) II aerosol extinction measurements from 1994 to 1996. *J. Geophys. Res.*, **105**, 3929-3942, doi: 10.1029/1999JD901024.

Randall, C. E., *et al.*, 2001: Validation of POAM III Aerosols: Comparison to SAGE II and HALOE. *J. Geophys. Res.*, **106**, 27525-27536, doi:10.1029/2001JD000528.

Randall, C. E., *et al.*, 2002: Validation of POAM III NO_2 measurements. *J. Geophys. Res.*, **107**, 4432, doi:10.1029/2001JD001520.

Randall, C. E., *et al.*, 2003: Validation of POAM III ozone: Comparisons with ozonesonde and satellite data. *J. Geophys. Res.*, **108**, 4367, doi:10.1029/2002JD002944.

Randel, W. J., 1990: Kelvin wave induced trace constituent oscillations in the equatorial stratosphere. *J. Geophys. Res.*, **95**, 18641-18652, doi:10.1029/JD095iD11p18641.

Randel, W. J., 1993: Global variations of zonal mean ozone during stratospheric warming events. *J. Atmos. Sci.*, **50**, 3308-3321.

Randel, W. J., *et al.*, 1998: Seasonal cycles and QBO variations in stratospheric CH_4 and H_2O observed in UARS HALOE data. *J. Atmos. Sci.,* **55**, 163-185, doi:10.1175/1520-0469(1998)055<0163:SCAQVI>2.0.CO;2.

Randel, W. J., *et al.*, 2004: Interannual changes of stratospheric water vapor and correlations with tropical tropopause temperatures. *J. Atmos. Sci.*, **61**, 2133-2148, http://dx.doi.org/10.1175/1520-0469(2004)061<2133:ICOSWV>2.0.CO;2.

Randel, W. J., *et al.*, 2006: Decreases in stratospheric water vapor since 2001: Links to changes in the tropical tropopause and the Brewer-Dobson circulation. *J. Geophys. Res.*, **111**, D12312, doi:10.1029/2005JD006744.

Randel,W. J., *et al.*, 2007: A large annual cycle in ozone above the tropical tropopause linked to the Brewer-Dobson circulation. *J. Atmos. Sci.*, **64**, 4479-4488, doi:10.1175/2007JAS2409.1.

Ravishankara, A. R., *et al.*, 1993: Atmospheric lifetimes of long-lived halogenated species. *Science*, **259**, 194-199, doi:10.1126/science.259.5092.194.

Ravishankara, A. R., *et al.*, 2009: Nitrous Oxide (N_2O): The dominant ozone-depleting substance emitted in the 21st century. *Science*, **326**, 123-125, doi:10.1126/science.1176985.

Ray, E. A., *et al.*, 1994: The tropical semiannual oscillation in temperature and ozone as observed by MLS. *J. Atmos. Sci.*, **51**, 3045-3052, doi:10.1175/1520-0469(1994)051<3045:TTSOIT>2.0.CO;2.

Read, W. G., *et al.*, 2006: The clear-sky unpolarized forward model for the EOS Microwave Limb Sounder (MLS). *IEEE Trans. Geosci. Remote Sens.*, **44**, 1367-1379.

Read, W. G., *et al.*, 2007: Aura Microwave Limb Sounder upper tropospheric and lower stratospheric H_2O and relative humidity with respect to ice validation. *J. Geophys. Res.*, **112**, D24S35, doi:10.1029/2007JD008752.

Reber, C. A., *et al.*, 1993: The Upper Atmosphere Research Satellite (UARS) mission. *J. Geophys. Res.*, **98**, 10643-10647, doi:10.1029/92JD02828.

Reddmann, T., *et al.*, 2001: Three-dimensional model simulations of SF_6 with mesospheric chemistry. *J. Geophys. Res.*, **106**, 14525-14537, doi:10.1029/2000JD900700.

Reddmann, T., *et al.*, 2010: Modeling disturbed stratospheric chemistry during solar-induced NO_x enhancements observed with MIPAS/ENVISAT. *J. Geophys. Res.*, **115**, D00I11, doi:10.1029/2009JD012569.

Remsberg E. E., et. al., 1990: Estimation of synopic fields of middle atmosphere parameters from Nimbus-7 LIMS profile data. *J. Atmos. Oceanic Tech.*, **7**, 689-705, doi:10.1175/1520-0426(1990)007<0689:EOSFOM>2.0.CO;2.

Remsberg, E. E., *et al.*, 2004: The Nimbus 7 LIMS Version 6 radiance conditioning and temperature retrieval methods and results. *J. Quant. Spectrosc. Rad. Transf.*, **86**, 395-424, doi:10.1016/j.jqsrt.2003.12.007.

Remsberg, E. E., *et al.*, 2007: On the quality of the Nimbus 7 LIMS version 6 ozone for studies of the middle atmosphere. *J. Quant. Spectrosc. Rad. Transf.*, **105**, 492-518, doi:10.1016/j.jqsrt.2006.12.005.

Remsberg, E. E., *et al.*, 2009: On the quality of the Nimbus 7 LIMS Version 6 water vapor profiles and distributions. *Atmos. Chem. Phys.*, **9**, 9155-9167, doi:10.5194/acp-9-9155-2009.

Remsberg, E. E., *et al.*, 2010: Improvements in the profiles and distributions of nitric acid and nitrogen dioxide with the LIMS version 6 dataset. *Atmos. Chem. Phys.*, **10**, 4741-4756, doi:10.5194/acp-10-4741-2010.

Remsberg, E. E., 2015: Methane as a diagnostic tracer of changes in the Brewer–Dobson circulation of the stratosphere. *Atmos. Chem. Phys.*, **15**, 3739-3754, doi:10.5194/acp-15-3739-2015.

Ricaud, P., *et al.*, 2007: Measurements of mid-stratospheric formaldehyde from the Odin/SMR instrument. *J. Quant. Spectroscop. Radiat. Transfer*, **107**, 91-104, http://dx.doi.org/10.1016/j.jqsrt.2007.01.058.

Riese, M., *et al.*, 1999: Cryogenic Infrared Spectrometers and Telescopes for the Atmosphere (CRISTA) data processing and atmospheric temperature and trace gas retrieval. *J. Geophys. Res.*, **104**, 16349-16368, doi:10.1029/1998JD100057.

Roche, A. E., *et al.*, 1993: The Cryogenic Limb Array Etalon Spectrometer (CLAES) on UARS: Experiment description and performance. *J. Geophys. Res.,* **98**, 10763-10775, doi:10.1029/93JD00800.

Rodgers, C. D., 1976: Retrieval of atmospheric temperature and composition from remote measurements of thermal radiation. *Rev. Geophys.*, **14**, 609-624, doi:10.1029/RG014i004p00609.

Rodgers, C., 2000: Inverse Methods for Atmospheric Sounding: Theory and Practice. World Scientific, London.

Rodgers, C. D., and B. J. Connor, 2003: Intercomparison of remote sounding instruments. *J. Geophys. Res.*, **108**, 4116, doi:10.1029/2002JD002299.

Rothman, L. S., *et al.*, 2005: The HITRAN 2004 molecular spectroscopic database. *J. Quant. Spectrosc. Rad. Transf.*, **96**, 139-204, doi:10.1016/j.jqsrt.2004.10.008.

Rousseeuw, P. J., and Croux, C., 1993: Alternatives to the median absolute deviation. *J. Amer. Statist. Assoc.,* **88**, 1273-1283, http://dx.doi.org/10.1080/01621459.1993.10476408.

Rozanov, A., *et al.*, 2005: NO_2 and BrO vertical profile retrieval from SCIAMACHY limb measurements: Sensitivity studies. *Advances in Space Research*, **36**, 846-854, doi:10.1016/j.asr.2005.03.013.

Rozanov, A., *et al.*, 2011a: BrO vertical distributions from SCIAMACHY limb measurements: comparison of algorithms and retrieval results. *Atmos. Meas. Tech.*, **4**, 1319-1359, doi:10.5194/amt-4-1319-2011.

Rozanov, A., *et al.*, 2011b: Retrieval of water vapor vertical distributions in the upper troposphere and the lower stratosphere from SCIAMACHY limb measurements. *Atmos. Meas. Tech.*, **4**, 933-954, doi:10.5194/amt-4-933-2011.

Rusch, D. W., *et al.*, 1994: Solar Mesosphere Explorer satellite measurements of El Chichon stratospheric aerosols 1. Cloud morphology. *J. Geophys. Res.*, **99**, 20525-20532, doi:10.1029/94JD01842.

Rusch, D.W., *et al.*, 1997: Validation of POAM II Ozone Measurements with Coincident MLS, HALOE, and SAGE II Observations. *J. Geophys. Res.*, **102**, 23615-23627, doi:10.1029/97JD00458.

Russell III, J. M., *et al.*, 1984: The variability of stratospheric and mesospheric NO_2 in the polar winter night observed by LIMS. *J. Geophys. Res.*, **89**, 7267-7275, doi:10.1029/JD089iD05p07267.

Russell III, J. M., *et al.*, 1993: The Halogen Occultation Experiment. *J. Geophys. Res.*, **98**, 10777-10797, doi:10.1029/93JD00799.

Russell III, J. M., *et al.*, 1996a: Validation of hydrogen fluoride measurements made by the Halogen Occultation Experiment from the UARS platform. *J. Geophys. Res.*, **101**, 10163-10174, doi:10.1029/95JD01705..

Russell III, J. M., *et al.*, 1996b: Validation of hydrogen chloride measurements made by the Halogen Occultation Experiment from the UARS platform. *J. Geophys. Res.*, **101**, 10151-10162, doi:10.1029/95JD01696..

Ruth, S., *et al.*, 1997: Seasonal, semiannual, and interannual variability seen in measurements of methane made by the UARS Halogen Occultation Experiment. *J. Geophys. Res.,* **102**, 16189-16199, doi:10.1029/97JD00868.

Sagawa, H., *et al.*, 2013: Comparison of SMILES ClO profiles with satellite, balloon-borne and ground-based measurements. *Atmos. Meas. Tech.*, **6**, 3325-3347, doi:10.5194/amt-6-3325-2013.

SAGE-III, 2002: SAGE III Algorithm Theoretical Base Document, Solar and Lunar Algorithm, Earth Observing System Project science Office web site, **http://eospso.gsfc.nasa.gov**.

Salby, M. L., *et al.*, 1990: Chemical fluctuations associated with vertically propagating equatorial Kelvin waves. *J. Geophys. Res.*, **95**, 20491-20505, doi:10.1029/90JD01371.

Santee, M. L., *et al.*, 1998: UARS Microwave Limb Sounder HNO_3 observations: Implications for Antarctic polar stratospheric clouds. *J. Geophys. Res.*, **103**(D11), 13285-13313, doi:10.1029/98JD00365.

Santee, M. L., *et al.*, 2003: Variations and climatology of ClO in the polar lower stratosphere from UARS Microwave Limb Sounder measurements. *J. Geophys. Res.*, **108**, D15, 4454 pp., doi:10.1029/2002JD003335.

Santee, M. L., *et al.*, 2007: Validation of Aura Microwave Limb Sounder HNO_3 Measurements. *J. Geophys. Res.*, **112**, D24S40, doi:10.1029/2007JD008721.

Santee, M.L., *et al.*, 2008: A study of stratospheric chlorine partitioning based on new satellite measurements and modeling. *J. Geophys. Res.*, **113**, D12307, doi:10.1029/2007JD009057.

Sasano, Y., *et al.*, 1999: Improved Limb Atmospheric Spectrometer (ILAS) for stratospheric ozone layer measurements by solar occultation technique. *Geophys. Res. Lett.*, **26**, 197-200, doi:10.1029/1998GL900276.

Sasano, Y., 2002: Preface. *J. Geophys. Res.*, **107**, 8204, doi:10.1029/2002JD002155.

Sato, T. O., *et al.*, 2012: Strato-mesospheric ClO observations by SMILES: Error analysis and diurnal variation. *Atmos. Meas. Tech.*, **5**, 2809-2825, doi:10.5194/amt-5-2809-2012.

Schneider, N., *et al.*, 2005: Seasonal and diurnal ozone variations: observations and modeling. *J. Atmos. Chem.*, **50**, 25-47, doi:10.1007/s10874-005-1172-z.

Schwartz, M. J., *et al.*, 2006: EOS MLS forward model polarized radiative transfer for Zeeman-split oxygen lines. *IEEE Trans. Geosci. Remote Sens.,* **44**, 1182-1191, doi:10.1109/TGRS.2005.862267.

Seinfeld, J. H., and S. N. Pandis, 2006: Atmospheric chemistry and physics: From air pollution to climate change. 2nd ed., John Wiley&Sons, New York, NY.

Seppälä, A., *et al.*, 2007: Arctic and Antarctic polar winter NO_x and energetic particle precipitation in 2002-2006. *Geophys. Res. Lett.*, **34**, L12810, doi:10.1029/2007GL029733.

Sheese, *et al.*, 2013: Odin observations of Antarctic nighttime NO densities in the mesosphere-lower thermosphere and observations of a lower NO layer, *J. Geophys. Res.*, **118**, 7414–7425, doi:10.1002/jgrd.50563.

Siddaway, J. M., and S. V. Petelina, 2011: Transport and evolution of the 2009 Australian Black Saturday bushfire smoke in the lower stratosphere observed by OSIRIS on Odin. *J. Geophys. Res.*, **116,** D06203, doi:10.1029/2010JD015162.

Sinnhuber, B.-M., *et al.*, 2009: The contribution of anthropogenic bromine emissions to past stratospheric ozone trends: a modelling study. *Atmos. Chem. Phys.*, **9**, 2863–2871, doi:10.5194/acp-9-2863-2009.

Siskind, D. E., *et al.*, 2013: Comparison of a photochemical model with observations of mesospheric hydroxyl and ozone. *J. Geophys. Res. Atmos.*, **118**, 195-207, doi:10.1029/2012JD017971.

Sofieva, V. F., *et al.*, 2004: Ozone profile smoothness as a priori information in the inversion of limb measurements. *Ann. Geophys.*, **22**, 3411-3420, doi:10.5194/angeo-22-3411-2004.

Sofieva, V., *et al.*, 2009: Influence of scintillation on quality of ozone monitoring by GOMOS. *Atmos. Chem. Phys.*, **9,** 9197-9207, doi:10.5194/acp-9-9197-2009.

Sofieva, V. F., *et al.*, 2010: Retrievals from GOMOS stellar occultation measurements using characterization of modeling errors. *Atmos. Meas. Tech.*, **3**, 1019-1027, doi:10.5194/amt-3-1019-2010.

Sofieva, V. F., *et al.*, 2014: Validation of GOMOS ozone precision estimates in the stratosphere. *Atmos. Meas. Tech.*, **7**, 2147-2158, doi:10.5194/amt-7-2147-2014.

Solomon, S., *et al.*, 1982: Photochemical coupling between the thermosphere and the lower atmosphere, I. Odd nitrogen from 50 to 120 km. *J. Geophys. Res.*, **87**, 7206-7220, doi:10.1029/JC087iC09p07206.

Solomon, S., *et al.*, 1986: On the depletion of Antarctic ozone. *Nature*, **321**, 755-758, doi:10.1038/321755a0.

Solomon, S., *et al.*, 1996: The role of aerosol variability in anthropogenic ozone depletion at northern midlatitudes. *J. Geophys. Res.*, **101**, 6713-6727, doi:10.1029/95JD03353.

Solomon, S., 1999: Stratospheric ozone depletion: A review of concepts and history. *Rev. Geophys.*, **37**, 275-316, doi:10.1029/1999RG900008.

Solomon, S., *et al.* (eds), 2007: Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge Univ. Press, Cambridge.

Sonkaew, T., *et al.*, 2009: Cloud sensitivity studies for stratospheric and lower mesospheric ozone profile retrievals from measurements of limb-scattered solar radiation. *Atmos. Meas. Tech.*, **2**, 653-678, doi:10.5194/amt-2-653-2009.

SPARC, 2000: Upper Tropospheric and Stratospheric Water Vapour (WAVAS). D. Kley, J. M. Russell III, and C. Phillips (eds.), SPARC Report No. 2, WMO/TD-No. 1043, **www.sparc-climate.org/publications/sparc-reports/sparc-report-no2**.

SPARC, 2006: Assessment of stratospheric aerosol properties (ASAP). L. Thomason and T. Peter (eds.), SPARC Report No. 4, WCRP-124, WMO/TD-No. 1295., **www.sparc-climate.org/publications/sparc-reports/sparc-report-no4**.

SPARC, 2010: SPARC Report on the Evaluation of Chemistry-Climate Models. V. Eyring, T. G. Shepherd, D. W. Waugh (eds.), SPARC Report No. 5, WCRP-132, WMO/TD-No. 1526, **www.sparc-climate.org/publications/sparc-reports/sparc-report-no5**.

Steck, T., and T. von Clarmann, 2001: Constrained profile retrieval applied to the observation mode of the Michelson Interferometer for Passive Atmospheric Sounding. *Appl. Opt.,* **40**, 3559-3571, https://doi.org/10.1364/AO.40.003559.

Steck, T., *et al.*, 2007: Bias determination and precision validation of ozone profiles from MIPAS-Envisat retrieved with the IMK-IAA processor. *Atmos. Chem. Phys.*, **7**, 3639-3662, doi:10.5194/acp-7-3639-2007.

Steck, T., *et al.*, 2008: Retrieval of global upper tropospheric and stratospheric formaldehyde (H_2CO) distributions from high-resolution MIPAS-Envisat spectra. *Atmos. Chem. Phys.*, **8**, 463-470, doi:10.5194/acp-8-463-2008.

Stephens, G. L., *et al.*, 2002: The CloudSat mission and the A-train: A new dimension of space-based observations of clouds and precipitation. *Bull. Amer. Meteor. Soc.*, **83**, 1771-1790, http://dx.doi.org/10.1175/BAMS-83-12-1771.

Stiller, G. P., *et al.*, 2002: Sensitivity of trace gas abundances retrievals from infrared limb emission spectra to simplifying approximations in radiative transfer modelling. *J. Quant. Spectrosc. Radiat. Transfer*, **72**, 249-280, doi:10.1016/S0022-4073(01)00123-6.

Stiller, G. P., *et al.*, 2007: Global distributions of HO_2NO_2 as observed by the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS). J. *Geophys. Res.*, **112**, D09314, doi:10.1029/2006JD007212.

Stiller, G. P., *et al.*, 2008: Global distribution of mean age of stratospheric air from MIPAS SF_6 measurements. *Atmos. Chem. Phys.*, **8**, 677-695, doi:10.5194/acp-8-677-2008.

Stiller G. P., *et al.*, 2012: Validation of MIPAS IMK/IAA temperature, water vapour, and ozone profiles with MOHAVE-2009 campaign measurements. *Atmos. Meas. Tech.*, **5**, 289-320, doi:10.5194/amt-5-289-2012.

Stolarski, R. S., *et al.*, 2014: Seasonal variation of ozone in the tropical lower stratosphere: Southern tropics are different from northern tropics. *J. Geophys. Res. Atmos.*, **119**, 6196-6206, doi:10.1002/2013JD021294.

Strong, K., *et al.*, 2008: Validation of ACE-FTS N2O measurements. *Atmos. Chem. Phys.*, **8**, 4759-4786, doi:10.5194/acp-8-4759-2008.

Taha, G., *et al.*, 2004: Comparison of Stratospheric Aerosol and Gas Experiment (SAGE) II version 6.2 water vapor with ballon-born and space-based instruments. *J. Geophys. Res.*, **109**, D18313, doi:10/1029/2004/2004JD004859.

Tamminen, J., *et al.*, 2010: GOMOS data characterisation and error estimation. *Atmos. Chem. Phys.*, **10**, 9505-9519, doi:10.5194/acp-10-9505-2010.

Taylor, F. W., 1987: Infrared remote sensing of the middle atmosphere from satellites: The stratospheric and mesospheric sounder experiment 1978-1983. *Surveys in Geophysics*, **9**, 123-148, doi:10.1007/BF01904119.

Taylor, F. W., *et al.*, 1993: Remote sensing of atmospheric structure and composition by pressure modulator radiometry from space: The ISAMS experiment on UARS. *J. Geophys. Res.*, **98**, 10799-10814, doi:10.1029/92JD03029.

Taylor, K. E., 2001: Summarizing multiple aspects of model performance in a single diagram. *J. Geophys. Res.*, **106**, 7183-7192, doi:10.1029/2000JD900719.

Tegtmeier, S., *et al.*, 2013: SPARC Data Initiative: A comparison of ozone climatologies from international satellite limb sounders. *J. Geophys. Res. Atmos.*, **118**, 12229-12247, doi:10.1002/2013JD019877.

Tikhonov, A. N., 1963: О решении некорректно поставленных задач и методе регуляризации. *Doklady Akademii Nauk SSSR*, **151**, 501-504. Translated in "Solution of incorrectly formulated problems and the regularization method". *Soviet Mathematics*, **4**, 1035-1038.

Thomason, L. W., and G. Taha, 2003: SAGE III aerosol extinction measurements: Initial results. *Geophys. Res. Lett.*, **30**, 1631, doi:10.1029/ 2003GL017317.

Thomason, L. W., *et al.*, 2004: A revised water vapor product for the Stratospheric Aerosol and Gas Experiment (SAGE) II version 6.2 data set. *J. Geophys. Res.*, **109**, D06312, doi:10.1029/2003JD004465.

Thomason, L. W., *et al.*, 2010: An evaluation of the SAGE III version 4 aerosol extinction coefficient and water vapour data products. *Atmos. Chem. Phys.*, **10**, 2159-2173, doi:10.5194/acp-10-2159-2010.

Thompson, A. M., *et al.*, 2003: Southern Hemisphere Additional Ozonesondes (SHADOZ) 1998-2000 tropical ozone climatology 1. Comparison with Total Ozone Mapping Spectrometer (TOMS) and ground-based measurements. *J. Geophys. Res.*, **108**, 8238, doi:10.1029/2001JD000967.

Toohey, M., *et al.*, 2010: Validating the reported random errors of ACE-FTS measurements. *J. Geophys. Res.*, **115**, D20304, doi:10.1029/2010JD014185.

Toohey, M., and von Clarmann,T., 2013: Climatologies from satellite measurements: The impact of orbital sampling on the standard error of the mean. *Atmos. Meas. Tech.*, **6**, 937-948, doi:10/5194/amt-6-937-2013.

Toohey, M., *et al.*, 2013: Characterizing sampling biases in the trace gas climatologies of the SPARC Data Initiative. *J. Geophys. Res.*, **118**, 11847-11862, doi:10.1002/jgrd.50874.

Toon, O. B., 1986: Condensation of HNO_3 and HCl in winter polar stratospheres. *Geophys. Res. Lett.*, **13**, 1284-1287, doi:10.1029/GL013i012p01284.

Toon, G. C., 1991: The JPL MkIV Interferometer. *Opt. Photonics News*, **2**, 19-21, https://doi.org/10.1364/OPN.2.10.000019.

Twomey, S., 1975: Comparison of constrained linear iversion and an iterative non-linear algorithm applied to the indirect estimation of particle size distribution. *J. Comput. Phys.*, **18**, 188-198, doi:10.1016/0021-9991(75)90028-5.

Urban, J., *et al.*, 2004: MOLIERE (v5): A versatile forward- and inversion model for the millimeter and sub-millimeter wavelength range. *J. Quant. Spectrosc. Rad. Transf.*, **83**, 529-554, http://dx.doi.org/10.1016/S0022-4073(03)00104-3.

Urban, J., *et al.*, 2005a: Odin/SMR limb observations of stratospheric trace gases: Level 2 Processing of ClO, N_2O, O_3, and HNO_3. *J. Geophys. Res.*, **110**, D14307, doi:10.1029/2004JD005741.

Urban, J., *et al.*, 2005b: Odin/SMR limb observations of stratospheric trace gases: Validation of N_2O. *J. Geophys. Res.*, **110**, D09301, doi:10.1029/2004JD005394.

Urban, J., *et al.*, 2006: Odin/SMR Limb Observations of Trace Gases in the Polar Lower Stratosphere during 2004-2005. In: Proc. ESA First Atmospheric Science Conference, 8-12 May 2006, Frascati, Italy. Lacoste, H. (ed.), ESA-SP-628 Noordwijk: European Space Agency. ISBN-92-9092-939-1.

Urban, J., *et al.*, 2007: Global observations of middle atmospheric water vapour by the Odin satellite: An overview. *Planet. Space Sci.*, **55**, 1093-1102, http://dx.doi.org/10.1016/j.pss.2006.11.021.

Urban, J., 2008: Tropical ascent of lower stratospheric air analysed using measurements of the Odin Sub-Millimetre Radiometer. Proc. Reunion Island Int. Symp. Tropical Stratosphere – Upper Troposphere, 5-9 November 2007, St. Gilles, Reunion Island, France. Bencherif, H. (ed.), publisher: Université de la Réunion, pp29-34.

Urban, J., *et al.*, 2009: Nitric acid in the stratosphere based on Odin observations from 2001 to 2009 – Part 1: A global climatology. *Atmos. Chem. Phys.*, **9**, 7031-7044, doi:10.5194/acp-9-7031-2009.

Urban, J., *et al.*, 2012: Evolution and variability of water vapour in the tropical tropopause and lower stratosphere region derived from satellite measurements. In: Proc. ATMOS 2012, Advances in Atmospheric Science and Applications, ESA SP-708 (CD-ROM), ESA Communications, European Space Agency, Noordwijk, The Netherlands.

Vanhellemont, F., *et al.*, 2010: Optical extinction by upper tropospheric/stratospheric aerosols and clouds: GOMOS observations for the period 2002-2008. *Atmos. Chem. Phys.*, **10**, 7997-8009, doi:10.5194/acp-10-7997-2010.

Vanhellemont, F., *et al.*, 2016: AerGOM, an improved algorithm for stratospheric aerosol extinction retrieval from GOMOS observations – Part 1: Algorithm description. *Atmos. Meas. Tech.*, **9**, 4687-4700, doi:10.5194/amt-9-4687-2016.

Vernier, J.-P., *et al.*, 2011: Major influence of tropical volcanic eruptions on the stratospheric aerosol layer during the last decade. *Geophys. Res. Lett.*, **38**, L12807, doi:10.1029/2011GL047563.

Verronen, P. T., *et al.*, 2005: A comparison of night-time GOMOS and MIPAS ozone profiles in the stratosphere and mesosphere. *Adv. Space Res.,* **36**, 958-966, doi:10.1016/j.asr.2005.04.073.

Verstraeten, W. W., *et al.*, 2013: Validation of six years of TES tropospheric ozone retrievals with ozonesonde measurements: implications for spatial patterns and temporal stability in the bias. *Atmos. Meas. Tech.*, **6**, 1413-1423, doi:10.5194/amt-6-1413-2013.

Voemel, H., *et al.*, 2007: Validation of Aura Microwave Limb Sounder water vapour by balloon-borne Cryogenic Frost Point Hygrometer measurements. *J. Geophys. Res.*, **112**, D24S37, doi:10.1029/2007JD008698.

Vogel, B., *et al.*, 2008: Model simulations of stratospheric ozone loss caused by enhanced mesospheric NO_x during Arctic Winter 2003/2004. *Atmos. Chem. Phys.*, **8**, 5279-5293, doi:10.5194/acp-8-5279-2008.

von Clarmann, T., *et al.*, 2002: Intercomparison of radiative transfer codes under nonlocal thermodynamic equilibrium conditions. *J. Geophys. Res.*, **107**, 4631, doi:10.1029/2001JD001551.

von Clarmann, T., *et al.*, 2003a: A blind test retrieval experiment for infrared limb emission spectrometry. *J. Geophys. Res.*, **108**, 4746, doi:10.1029/2003JD003835.

von Clarmann, T., *et al.*, 2003b: Retrieval of temperature and tangent altitude pointing from limb emission spectra recorded from space by the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS). *J. Geophys. Res.*, **108**, 4736, doi:10.1029/2003JD003602.

von Clarmann, T., *et al.*, 2003c: Modelling of atmospheric mid-infrared radiative transfer: the AMIL2DA algorithm intercomparison experiment. *J. Quant. Spectrosc. Radiat. Transfer*, **78**, 381-407, doi:10.1016/S0022-4073(02)00262-5.

von Clarmann, T., *et al.*, 2005: Experimantal evidence of perturbed odd hydrogen and chlorine chemistry after the October 2003 solar proton events. *J. Geophys. Res.*, **110**, A09S45, doi:10.1029/2005JA011053.

von Clarmann, T., *et al.*, 2006: Global stratospheric HOCl distributions retrieved from infrared limb emission spectra recorded by the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS). *J. Geophys. Res.*, **111**, D05311, doi:10.1029/2005JD005939.

von Clarmann, T., *et al.*, 2009a: Retrieval of temperature, H_2O, O_3, HNO_3, CH_4, N_2O, $ClONO_2$ and ClO from MIPAS reduced resolution nominal mode limb emission measurements. *Atmos. Meas. Tech.*, **2**, 159-175, doi:10.5194/amt-2-159-2009.

von Clarmann, T., *et al.*, 2009b: HOCl chemistry in the Antarctic Stratospheric Vortex 2002, as observed with the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS). *Atmos. Chem. Phys.*, **9**, 1817-1829, doi:10.5194/acp-9-1817-2009.

von Clarmann, T., *et al.*, 2010: Technical Note: Trend estimation from irregularly sampled, correlated data. *Atmos. Chem. Phys.*, **10**, 6737-6747, doi:10.5194/acp-10-6737-2010.

von Clarmann, T., *et al.*, 2012: The MIPAS HOCl climatology. *Atmos. Chem. Phys.*, **12**, 1965-1977, doi:10.5194/acp-12-1965-2012.

von Clarmann, T., 2014: Smoothing error pitfalls. *Atmos. Meas. Tech.*, **7,** 3023-3034, doi:10.5194/amt-7-3023-2014.

von Savigny, C., *et al.*, 2015: Improved stratospheric aerosol extinction profiles from SCIAMACHY: Validation and Sample results. *Atmos. Meas. Tech.*, **8**, 5223-5235, doi:10.5194/amt-8-5223-2015.

Wang, H. J., *et al.*, 1996: A critical analysis of SAGE ozone trends. *J. Geophys. Res.*, **101**, 12495-12514, Paper No. 96JD00581.

Wang, H. J., *et al.*, 2002: Assessment of SAGE version 6.1 ozone data quality. *J. Geophys. Res.*, **107**, 4691, doi:10.1029/2002JD002418.

Wang, D.-Y., *et al.*, 2004: Cross-validation of MIPAS/ENVISAT and GPS-RO/CHAMP temperature profiles. *J. Geophys. Res.,* **109**, D19311, doi:10.1029/2004JD004963.

Wang, D.-Y., *et al.*, 2005a: Comparisons of MIPAS/ENVISAT ozone profiles with SMR/ODIN and HALOE/UARS observations. *Adv. Space Res.*, **36**, 927-931, doi:10.1016/j.asr.2005.03.015.

Wang, D. Y., *et al.*, 2005b: Validation of stratospheric temperatures measured by Michelson Interferometer for Passive Atmospheric Sounding MIPAS on Envisat. *J. Geophys. Res.*, **110**, D08301, doi:10.1029/2004JD005342.

Wang, H.-J., *et al.*, 2006: SAGE III solar ozone measurements: Initial results. *Geophys. Res. Lett.*, **33**, L03805, doi:10.1029/2005GL025099.

Wang, D. Y., *et al.*, 2007: Validation of nitric acid retrieved by the IMK/IAA processor from MIPAS/ENVISAT measurements. *Atmos. Chem. Phys.*, **7**, 721-738, doi:10.5194/acp-7-721-2007.

Wang, S., *et al.*, 2008: Validation of Aura Microwave Limb Sounder OH measurements with Fourier Transform Ultra-Violet Spectrometer total OH column measurements at Table Mountain, California. *J. Geophys. Res.*, **113**, D22301, doi:10.1029/2008JD009883.

Wang, S., *et al.*, 2013: Midlatitude atmospheric OH response to the most recent 11-y solar cycle. *Proc. Nat. Acad. Sci.*, **110**, 2023-2028, doi:10.1073/pnas.1117790110.

Waters, J. W., *et al.*, 1993: Stratospheric ClO and ozone from the Microwave Limb Sounder on the Upper Atmosphere Research Satellite. *Nature*, **362**, 597-602, doi:10.1038/362597a0.

Waters, J. W., *et al.*, 1999: The UARS and EOS Microwave Limb Sounder (MLS) Experiments. *J. Atmos. Sci.*, **56**, 194-218, http://dx.doi.org/10.1175/1520-0469(1999)056<0194:TUAEML>2.0.CO;2.

Waters, J. W., *et al.*, 2006: The Earth Observing System Microwave Limb Sounder (EOS MLS) on the Aura satellite. *IEEE Trans. Geosci. Remote Sens.,* **44**, 1075-1092, doi:10.1109/TGRS.2006.873771.

Waugh, D. W., and V. Eyring, 2008: Quantitative performance metrics for stratospheric-resolving chemistry-climate models. *Atmos. Chem. Phys.*, **8**, 5699-5713, doi:10.5194/acp-8-5699-2008.

Waugh, D. W., *et al.*, 2009: Impacts of climate change on stratospheric ozone recovery. *Geophys. Res. Lett.*, **36**, L03805, doi:10.1029/2008GL036223.

Weinstock, E. M., *et al.*, 2009: Validation of the Harvard Lyman-a in situ water vapour instrument: Implications for the mechanisms that control stratospheric water vapour. *J. Geophys. Res.*, **114**, D23301, doi:10.1029/2009JD012427.

Wennberg, P. O., *et al.*, 1994: Removal of stratospheric O_3 by radicals: In situ measurements, of OH, HO_2, NO, NO_2, ClO, and BrO. *Science*, **266**, 398-404, doi:10.1126/science.266.5184.398.

Winker, D. M., *et al.*, 2003: The CALIPSO mission: Spaceborne lidar for observation of aerosols and clouds. *Proc. SPIE Int. Soc. Opt. Eng.*, **4893**, 1-11, doi:10.1117/12.466539.

WMO, 2011: World Meteorological Organization Scientific Assessment of Ozone Depletion: 2010. Report 52, Global Ozone Research and Monitoring Project.

WMO, 2014: World Meteorological Organization Scientific Ozone Assessment of Ozone Depletion: 2014, Report 55, Global Ozone Research and Monitoring Project..

Wolff, M. A., *et al.*, 2008: Validation of HNO_3, $ClONO_2$ and N_2O_5 from the Atmospheric Chemistry Experiment Fourier Transform Spectrometer (ACE-FTS). *Atmos. Chem. Phys.*, **8**, 3529-3562, doi:10.5194/acp-8-3529-2008.

Worden, J. S., *et al.*, 2004: Predicted errors of Tropospheric Emission Spectrometer nadir retrievals from spectral window selection. *J. Geophys. Res.*, **109**, D09308, doi:10.1029/2004JD004522.

Worden, H. M., *et al.*, 2007: Comparisons of Tropospheric Emission Spectrometer (TES) ozone profiles to ozonesodes: methods and initial results. *J. Geophys. Res.*, **112**, D03309, doi:10.1029/2006JD007258.

Worden, H. M., *et al.*, 2008: Satellite measurements of the clear-sky greenhouse effect from tropospheric ozone. *Nature Geosci.*, **1**, 305-308, doi:10.1038/ngeo182.

Worden, H. M., *et al.*, 2011: Sensitivity of outgoing longwave radiative flux to the global vertical distribution of ozone characterized by instantaneous radiative kernels from Aura TES. *J. Geophys. Res.*, **116**, D14115, doi:10.1029/2010JD015101.

Worden, H. M., *et al.*, 2013: Decadal record of satellite carbon monoxide observations. *Atmos. Chem. Phys.*, **13**, 837-850, doi:10.5194/acp-13-837-2013.

Yoon, J., *et al.*, 2013: Technical Note: Temporal change in averaging kernels as a source of uncertainty in trend estimates of carbon monoxide retrieved from MOPITT. *Atmos. Chem. Phys.*, **13**, 11307-11316, doi:10.5194/acp-13-11307-2013.

Zawodny, J. M., and M. P. McCormick, 1991: Stratospheric aerosol and gas experiment II measurements of the quasi-biennial oscillation of ozone and nitrogen dioxide. *J. Geophys. Res.*, **96**, 9371-9377.