

CURRICULUM VITAE OF JOHANNES (JOS) LELIEVELD

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Education

- B.Sc. in Biology, University of Leiden, the Netherlands, 1980
- Doctoral Degree from Mathematics and Natural Sciences Faculty, University of Leiden, 1984, including one year Mathematics at the Free University of Amsterdam
- Ph.D. in Atmospheric Physics and Chemistry (supervisor Paul J. Crutzen), Physics and Astronomy Faculty, University of Utrecht, 1990

Professional career

- 1984-1987: Research scientist
Geosens B.V., Atmospheric Research Department, Rotterdam, the Netherlands
- 1987-1993: Research scientist
Max Planck Institute for Chemistry, Atmospheric Chemistry Department, Mainz
- 1993-1995: Professor in Air Quality, Chair Air Quality Department
University of Wageningen
- 1996-2000: Professor in Atmospheric Physics and Chemistry
University of Utrecht
- 2000-present: Director of Atmospheric Chemistry Department
Max Planck Institute for Chemistry, Mainz
- 2004-2007, 2010-2013, 2020-present: Managing director of the MPI for Chemistry
- 2008-present: Part-time professor at the Cyprus Institute, Nicosia

Extended visits

- August 1991-January 1992:
International Meteorological Institute, University of Stockholm
- June 1992-September 1992:
Center for Clouds, Chemistry and Climate, University of California, San Diego

Research interests

- Ozone photochemistry and self-cleaning mechanism of the atmosphere
- Role of reactive gases and aerosols in biogeochemical cycles and climate
- Air quality, climate change and planetary health

Teaching experience

- Introduction air quality (lectures University of Wageningen, 1993-1995)
- Atmospheric chemistry (lectures Universities of Wageningen and Utrecht, 1994-2000)
- Climate processes and global change (lectures University of Wageningen 1994-1995)
- Planetary atmospheres (lectures University of Utrecht 1997-2000)
- Atmospheric chemistry introduction (lectures University of Mainz, 2002-2005)
- Atmospheric chemistry methods (lectures University of Mainz, 2003-2005)
- Organization and contributions to summer schools, lecture series and Capita Selecta
- Supervisor of 61 PhD student dissertations (since 1995)

Awards and honors

- J.W. van Oostrom Meyjes prize, Royal Netherlands Society for Gas Production, 1994
- Editor's citation for excellence in refereeing, Journal of Geophysical Research, 2000
- Professor of the year, University of Utrecht, 2000
- Highly cited researcher, Web of Science, 2001–2014, 2021; Google Scholar, 2021
- Professor in atmospheric physics, Johannes Gutenberg University Mainz, 2002
- Harold Schiff lecturer, York University, Toronto, 2002
- Distinguished lecturer, Weizmann Institute, Israel, 2005
- Academy of Athens, Greece, Citation for achievements in ozone research, 2007
- Hubert Curien lecturer at the Cyprus Institute, 2008
- European Research Council advanced research grant, 2008
- Institute professor at the Cyprus Institute, 2010
- Distinguished scientist, professor in geophysics, King Saud University, Riyadh, 2010
- Yuval Ne'eman distinguished lecturer in geophysics, Tel Aviv University, 2010
- Presidential plaque for the advancement of science in the Republic of Cyprus, 2013
- German National Academy of Sciences – Leopoldina, 2015
- Doctor Honoris Causa, School of Science and Engineering, University of Crete, 2016
- International Silk Road Academy of Sciences, China, 2016
- Fellow of the Royal Society of Chemistry, UK, 2017
- Fellow of the American Geophysical Union, 2018
- Vilhelm Bjerknes Medal of the European Geosciences Union, 2019
- Cardiovascular research high impact award, European Society of Cardiology, 2021

Service and memberships

- American Geophysical Union (since 1987)

- American Meteorological Society (since 1991)
- Center for Clouds, Chemistry and Climate, Scripps Institution of Oceanography, University of California, San Diego (since 1992)
- Committee on Atmospheric Chemistry and Global Pollution of the International Association of Meteorology and Atmospheric Sciences (1994-2002)
- Editorial Board of Water, Air and Soil Pollution (1995-2005)
- Advisory Board of Tellus B (since 1996)
- Editorial Board of Journal of Atmospheric Chemistry (since 1996)
- Advisory Board Institute for Tropospheric Research (IFT), Leipzig (1996-2003)
- Associate Editor of Journal of Geophysical Research, Atmospheres (1997-2001)
- Director of the international research school COACH (Cooperation on Oceanic, Atmospheric and climate Change studies) (1997-2000)
- Science Panel on Stratospheric Ozone Research of the European Union (1997-2003)
- Professor in Atmospheric Physics, Johannes Gutenberg University, Mainz (since 2002)
- Spokesperson of the International Max Planck Research School for Atmospheric Physics and Chemistry – currently Paul Crutzen Graduate School (since 2002)
- Chairman Science Panel on Atmospheric Research of the EU Commission (2003-2005)
- Program Committee Earth Observations of the DLR Space Agency (2003-2008)
- Scientific Steering Committee of the HALO research aircraft (2003-2017)
- Deputy Spokesperson of the Excellence Cluster “Geocycles: time and space in the Earth sciences”, Johannes Gutenberg University, Mainz (2005-2008)
- Scientific-Technical Committee of the Executive Board, Karlsruhe Institute of Technology, Chair Advisory Board of the Atmosphere and Climate Program (2006-2019)
- Board COSMOS network (Community Earth System Models) (2007-2012)
- Board of the Netherlands Institute for Space Research, SRON (2008-2012)
- Steering Committee Max Planck Graduate Center Mainz (since 2008)
- Editorial Board of Earth System Dynamics (since 2010)
- Selection and Evaluation Committee, Institute for Basic Science, South Korea (since 2013)
- German National Academy of Sciences – Leopoldina (since 2015)
- European Geosciences Union, life member (since 2015)
- International Silk Road Academy of Sciences and kick-off committee, China (since 2016)
- Royal Society of Chemistry, UK (since 2017)
- Guest editor of the Proceedings of the National Academy of Sciences, USA (since 2018)
- Scientific Council of the National Observatory Athens (since 2019)
- Advisory Board of the Ruisdael Observatory, the Netherlands (since 2019)
- Advisory Board of the Panhellenic infrastructure for atmospheric composition and climate change (since 2019)

Publications

1. Lelieveld, J., F.W. Jansen and J.R.D. Stoute (1986) Radioactivity measurements in the Netherlands by aircraft after the Chernobyl accident. Geosens/ECN, Rotterdam.
2. Beilke, S., R. Berg, A.H. Blommers, W. Grosch, F.W. Jansen and J. Lelieveld (1986) Air sampling flights at low altitudes along the border between the Federal Republic of Germany and its neighbours. Procs. COST 611, Stresa, Italy, pp. 685-703, D. Reidel Publ. Co., Dordrecht.
3. Lelieveld, J., F.W. Jansen and J.F. den Tonkelaar (1987) Assessment of transboundary mass fluxes of air pollutants by aircraft measurements: A preliminary survey with reference to a case study. *Atmos. Environ.* 21, 2133-2143.
4. Lelieveld, J. and G. Helas (1987) Luchtverontreiniging in de troposfeer. Meulenhoff, Amsterdam.
5. de Boer, R.J. and J. Lelieveld (1987) Aircraft measurements in ozone research. In: R. Guicherit, J. van Ham and A.C. Posthumus (eds.) *Ozon: fysische en chemische veranderingen in de atmosfeer en de gevolgen*, pp. 45-48, Kluwer, Deventer.
6. Lelieveld, J. (1988) The calculation of transboundary and deposition fluxes of SO₂ and sulfate by means of aircraft measurements. *Water, Air, Soil Pollut.* 38, 199-209.
7. Lelieveld, J. and F.W. Jansen (1988) Het schatten van transporten van luchtverontreinigingen met behulp van meetvliegtuigen. *Lucht en Omgeving* 5, 50-54.
8. Beilke, S., W. Fricke, J. Lelieveld and F.W. Jansen (1988) Air sampling flights at low altitudes along the border between the Federal Republic of Germany and its neighbours: An assessment of transboundary mass fluxes of air pollutants. In: S. Beilke, J. Morelli and G. Angeletti (eds.) *Field measurements and their interpretation*. Air Pollution Research Report 14, pp. 245-254, CEC, Brussels.
9. Lelieveld, J. (1989) Die Bestimmung grenzüberschreitenden Transports von Luftverunreinigungen bei Smogwetterlagen mit Hilfe von Messflugzeugen. In: VDI (ed.) *Fluggestützte Messungen von Luftverunreinigungen*. VDI-RdL Band 9, pp. 45-56, Düsseldorf.
10. Lelieveld, J. (1989) The role of clouds in the photochemistry of the background troposphere. In: A. Ebel, F.M. Neubauer, E. Raschke and P. Speth (eds.) *Mitteilungen aus dem Institut für Geophysik und Meteorologie der Universität zu Köln*. Heft 61, pp. 117-121, Universität zu Köln.
11. Lelieveld, J., P.J. Crutzen and H. Rodhe (1989) Zonal average cloud characteristics for global atmospheric chemistry modeling. Report CM-76. International Meteorological Institute Stockholm.
12. Lelieveld, J., F.W. Jansen and H. van Dop (1989) Assessment of pollutant fluxes across the frontiers of the Federal Republic of Germany on the basis of aircraft measurements. *Atmos. Environ.* 23, 939-951.
13. Lelieveld, J. (1989) Transboundary air pollution: several years of measurements. In: L.J. Brassler and W.C. Mulder (eds.) *Man and his ecosystem*, pp. 37-42, Elsevier Science Publishers, Amsterdam.
14. Lelieveld, J. and P.J. Crutzen (1990) Influences of cloud photochemical processes on tropospheric ozone. *Nature* 343, 227-233.
15. Lelieveld, J. (1990) The role of clouds in tropospheric photochemistry. Ph.D. Thesis, University of Utrecht, The Netherlands.

16. Lelieveld, J. and P.J. Crutzen (1991) Climate discussion and fossil fuels. *Eur. Mag. Oil and Gas* 4, 11-15.
17. Lelieveld, J. and P.J. Crutzen (1991) The role of clouds in tropospheric photochemistry. *J. Atmos. Chem.* 12, 229-267.
18. Ramaswamy, V., K. Shine, C. Leovy, W.-C. Wang, H. Rodhe, D. Wuebbles, M. Ding, J. Lelieveld, J.A. Edmonds, M.P. McCormick, P. Frazer, A. Oort, K. Grant, M.D. Schwarzkopf, C. Johnson, A. Sutera, D. Lashof, D.A. Warrilow, J. Leggett and T. Wigley (1991) Radiative forcing of climate. In: D.L. Albritton and R.T. Watson (eds.) Scientific assessment of ozone depletion: 1991, pp. 7.1-7.28. World Meteorological Organization, Global ozone research and monitoring project, Report no. 25, WMO, Geneva.
19. Lelieveld, J. and P.J. Crutzen (1992) Indirect chemical effects of methane on climate warming. *Nature* 355, 339-342.
20. Galloway, J.N., J.E. Penner, C.S. Atherton, J.M. Prospero, H. Rodhe, R.S. Artz, Y.J. Balkanski, H.G. Bingemer, R.A. Brost, S. Bürgermeister, G.R. Carmichael, J.S.Chang, R.J. Charlson, S. Cober, W.G. Ellis, C.J. Fischer, J.M. Hales, D.R. Hastie, T. Iversen, D.J. Jacob, K. John, J.E. Johnson, P.S. Kasibhatla, J. Langner, J. Lelieveld, H. Levy, F. Lipschultz, J.T. Merrill, J.L. Moody, J. Pinto, A.A.P. Pszenny, P.A. Spiro, L. Tarrason, S.M. Turner and D.M. Whelpdale (1992) Sulfur and nitrogen levels in the North Atlantic Ocean's atmosphere: A synthesis of field and modeling results. *Global Biogeochem. Cycles* 6, 77-100.
21. Lelieveld, J. and J. Heintzenberg (1992) Sulfate cooling effect on climate through in-cloud oxidation of SO₂. *Science* 258, 117-120.
22. Isaksen, I.S.A., V. Ramaswamy, H. Rodhe, T.M.L. Wigley, R. Charlson, I. Karol, J. Lelieveld, C.B. Leovy, S.E. Schwartz, K.P. Shine, R.T. Watson, D.J. Wuebbles and B.A. Callander (1992) Radiative forcing of climate. In: J.T. Houghton, B.A. Callander and S.K. Varney (eds) Climate Change 1992. The supplementary report to the IPCC scientific assessment, pp. 47-67. Cambridge University Press, New York, USA.
23. Isaksen, I.S.A., J.A. Fuglestvedt Y.-P. Lee, C. Johnson, R. Atkinson, J. Lelieveld, H. Sidebottom, A. Thompson, W. Brune, M. Oppenheimer, J. Kaye, T. Berntsen (1992) Scientific Assessment of Ozone Depletion: 1991. Chapter 5. Tropospheric Processes: Observations and Interpretation. In: D.L. Albritton and R.T. Watson (eds.) World Meteorological Organization Global Ozone Research and Monitoring Project – Report Nr. 25, WMO, Geneva, Switzerland.
24. Sander, R., J. Lelieveld and P.J. Crutzen (1992) Model calculations of the nighttime aqueous phase oxidation of S(IV) in an orographic cloud. In: J. Peeters (ed.) Chemical mechanisms describing tropospheric processes. Air pollution Research Report 45, pp. 285-290, CEC, Brussels.
25. Ramaswamy, V., K. Shine, C. Leovy, W.-C. Wang, H. Rodhe, D. Wuebbles, M. Ding, J. Lelieveld, J.A. Edmonds, M.P. McCormick, P. Fraser, A. Oort, K. Grant, M.D. Schwarzkopf, C. Johnson, A. Sutera, D. Lashof, D.A. Warrilow, J. Leggett and T. Wigley (1992) Scientific Assessment of Ozone Depletion: 1991. Chapter 7. Radiative forcing of climate. In: D.L. Albritton and R.T. Watson (eds.) World Meteorological Organization Global Ozone Research and Monitoring Project – Report Nr. 25, WMO, Geneva, Switzerland.

26. Lelieveld, J. (1992) Cloud modelling in the study of global tropospheric photochemistry. Procs. WMO workshop on cloud microphysics and applications to global change. WMP Report No. 19, WMO/TD - No. 537, pp. 19-24, Geneva.
27. Langner, J., T.S. Bates, R.J. Charlson, A.D. Clarke, P.A. Durkee, J. Gras, J. Heintzenberg, D.J. Hofmann, B. Huebert, C. Leck, J. Lelieveld, J.A. Ogren, J. Prospero, P.K. Quinn, H. Rodhe and A.G. Ryaboshapko (1993) The global atmospheric sulfur cycle: An evaluation of model predictions and observations. Report CM-81, International Meteorological Institute Stockholm.
28. Lelieveld, J. and P.J. Crutzen (1993) Methane emissions into the atmosphere: An overview. In: A.R. van Amstel (ed.) Methane and nitrous oxide: methods in national emissions inventories and options for control, pp. 17-25, IPCC/RIVM, Bilthoven.
29. Crutzen, P.J., F.J. Dentener, M. Kanakidou, J. Lelieveld and P.H. Zimmermann (1993) A global three-dimensional study of the fate of HCFCs and HFC-134a in the troposphere. SPA-AFEAS, Washington, DC.
30. Lelieveld, J. (1993) Modelling of heterogeneous chemistry in the global troposphere. In: J.T. Kiehl (ed.) Clouds and climate, pp. 423-446, National Center for Atmospheric Research, Boulder.
31. Lelieveld, J. (1993) Multiphase processes in the atmospheric sulfur cycle. In: R. Wollast, F.T. Mackenzie and L. Chou (eds.) Interactions of C, N, P and S biogeochemical cycles and global change. NATO ASI Series I4, pp. 305-331, Springer-Verlag, Berlin.
32. Lelieveld, J., P.J. Crutzen and C. Brühl (1993) Climate effects of atmospheric methane. *Chemosphere* 26, 739-768.
33. Charlson, R.J. and J. Lelieveld (1993) Multiphase atmospheric chemistry: Implications for climate. In: R.G. Prinn (ed.) Global Atmospheric-Biospheric Chemistry, pp. 57-69, Plenum Press, New York.
34. Crutzen, P.J., J. Lelieveld and C. Brühl (1994) Oxidation processes in the atmosphere and the role of human activities: Observations and model results. *Adv. Environ. Sci. Technol.* 28, 63-93.
35. Lelieveld, J. (1994) Modeling of heterogeneous chemistry in the global troposphere. In: G. Bidoglio and W. Stumm (eds.) Chemistry of aquatic systems: local and global perspectives, pp. 73-95, Kluwer Academic Publ., Dordrecht.
36. Lelieveld, J. and P.J. Crutzen (1994) Role of deep cloud convection in the ozone budget of the troposphere. *Science* 264, 1759-1761.
37. Volz-Thomas A., M.O. Andreae, W.L. Chameides, R.G. Derwent, I.E. Galbally, J. Lelieveld, S.A. Penkett, B.A. Ridley, M.O. Rodgers, M. Trainer, G. Vaughan, X. Zhou (1994) WMO/UNEP Scientific Assessment of Ozone Depletion: Tropospheric Ozone, pp. 5.1-5.29, World Meteorological Organization, Geneva.
38. Lelieveld, J. (1994) Klimaateffecten door gebruik van verschillende fossiele brandstoffen. *Tijdschrift voor Gas, KVG*, 22-29.
39. Lelieveld, J. and P.J. Crutzen (1994) Emissionen klimawirksamer Spurengase durch die Nutzung von Öl und Erdgas. *Energiewirtschaftliche Tagesfragen* 7, 435-440.
40. Dentener, F.J., P.J. Crutzen and J. Lelieveld (1994) Chemical reactions in clouds: consequences for the global budget of O₃. In: G. Angeletti and G. Restelli (eds.) Physicochemical behaviour of atmospheric pollutants, pp. 14-17, Reidel Publ. Co., Dordrecht.

41. Lelieveld, J. and L. Bengtsson (1995) Study of the indirect and direct climate influences of anthropogenic trace gas emissions. In: I. Troen (ed.) Global change: Climate change and climate change impacts Symposium in Kopenhagen, pp. 87-99, CEC, Brussels.
42. Hov, Ø., J. Lelieveld, G. Brasseur, J. Fuglestedt, D. Hauglustaine, J.E. Johnson, I. Karol, A. Ravishankara, F. Stordal (1995) Chemical modeling. In: W.C. Wang and I.S.A. Isaksen (eds.) Atmospheric ozone as a climate gas. NATO ASI Series, pp. 19-38, Springer-Verlag, Berlin.
43. Meijer, E.W., J.P. Beck en J. Lelieveld (1995) Milieueffecten van vliegverkeer in de troposfeer en stratosfeer. *Lucht 12*, 134-138.
44. Sander, R., J. Lelieveld and P.J. Crutzen (1995) Modelling of the nighttime nitrogen and sulfur chemistry in size resolved droplets of an orographical cloud. *J. Atmos. Chem.* **20**, 89-116.
45. Lelieveld, J. and R. van Dorland (1995) Model simulations of ozone chemistry changes in the troposphere and consequent radiative forcings of climate during industrialization. In: W.C. Wang and I.S.A. Isaksen (eds.) Atmospheric ozone as a climate gas. NATO ASI Series, pp. 227-258, Springer-Verlag, Berlin.
46. Bregman, A., P.F.J. van Velthoven, F.G. Wienhold, H. Fischer, T. Zenker, A. Waibel, A. Frenzel, F. Arnold, G.W. Harris, M.J.A. Bolder and J. Lelieveld (1995) Aircraft measurements of O₃, HNO₃, and N₂O in the winter Arctic lower stratosphere during STREAM-I. *J. Geophys. Res.* **100**, 11245-11260.
47. Lelieveld, J., P.J. Crutzen, H. Graßl, J. Heintzenberg, R. Jaenicke, Y.J. Kaufman, J.T. Kiehl, J.E. Penner, H. Rodhe, I. Schult and I. Tegen (1995) Magnitudes, geographical variations and uncertainties of properties of tropospheric and stratospheric aerosols and their forcing. In: R.J. Charlson and J. Heintzenberg (eds.) Aerosol forcing of climate, pp. 335-348, Wiley-Interscience, Chichester
48. Roelofs, G.-J. and J. Lelieveld (1995) Distribution and budget of O₃ in the troposphere calculated with a chemistry-general circulation model. *J. Geophys. Res.* **100**, 20983-20998.
49. Ganzeveld, L.N. and J. Lelieveld (1995) Dry deposition parameterization in a chemistry-general circulation model and its influence on the distribution of chemically reactive trace gases. *J. Geophys. Res.* **100**, 20999-21012.
50. Feichter, J., E. Kjellström, H. Rodhe, F. Dentener, J. Lelieveld and G.-J. Roelofs (1996) Simulation of the tropospheric sulfur cycle in a global climate model. *Atmos. Environ.* **30**, 1693-1707.
51. Waibel, A.E., M. Welling, H. Fischer, A. Bregman, B. Scheeren, M.J.A. Bolder and J. Lelieveld (1996) Correlations of N₂O, CO, O₃, and NO_y in the winter Arctic lower stratosphere during the STREAM-II campaign, February 1995. In: J.A. Pyle, N.R.P. Harris and G.T. Amanatidis (eds.) *Polar Stratospheric ozone*, Proc. Third Europeansymposium on solar stratospheric ozone, Schliersee, Germany.
52. Lelieveld, J. (1996) Der antropogene Treibhauseffekt - Was ist das eigentlich? *Gas, Wasser, Wärme 96*, 273-278.
53. Holton, J.R. and J. Lelieveld (1996) The dynamics of stratosphere-troposphere mass exchange and the control of tropospheric ozone. In: P.J. Crutzen and V. Ramanathan(eds.) *Clouds, Chemistry and Climate*, pp. 173-190, NATO ASI Series. Springer Verlag, Berlin.

54. Dentener, F.J., G.R. Carmichael, Y. Zhang, J. Lelieveld and P.J. Crutzen (1996) The role of mineral aerosol as a reactive surface in the global troposphere. *J. Geophys. Res.* **101**, 22869-22889.
55. Lelieveld, J. (1997) Hoe veranderlijk is "global change"? *Meteorologica* **6**, 4-9.
56. Lelieveld, J., P.J. Crutzen, D.J. Jacob and A.M. Thompson (1997) Modeling of biomassburning influences on tropospheric ozone. In: B.W. van Wilgen, M.O. Andreae, J. Goldammer and J.A. Lindsay (eds.) *Fire in southern African savannas: Ecological and atmospheric perspectives*, pp. 217-238, Witwatersrand University Press, Johannesburg.
57. Lelieveld, J., F. Arnold, B. Bregman, V. Bürger, P. Crutzen, H. Fischer, P. Siegmund, P. van Velthoven, and A. Waibel (1997) Chemical perturbation of the lowermost stratosphere through exchange with the troposphere. *Geophys. Res. Lett.* **24**, 603-606.
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61. Bregman, A., M. van den Broek, K.S. Carslaw, R. Müller, Th. Peter, R. Scheele and J. Lelieveld (1997) Ozone depletion in the late winter lower Arctic stratosphere: observations and model results. *J. Geophys. Res.* **102**, 10815-10828.
62. Lelieveld, J., G.-J. Roelofs, L. Ganzeveld, J. Feichter and H. Rodhe (1997) Terrestrial sources and distribution of atmospheric sulphur. *Phil. Trans. R. Soc. Lond. B* **352**, 149-158.
63. Crutzen, P., R. Brost, F. Dentener, J. Feichter, R. Hein, M. Kanakidou, J. Lelieveld and P. Zimmermann (1997) Development of a time-dependent global tropospheric air chemistry model "GLOMAC" based on the weather forecast model of the "ECMWF". In: A. Ebel, R. Friedrich and H. Rodhe (eds.) *Tropospheric modelling and emission estimation*, pp. 380-391, Springer Verlag, Berlin.
64. Fischer, H., A.E. Waibel, M. Welling, F.G. Wienhold, T. Zenker, P.J. Crutzen, F. Arnold, V. Bürger, J. Schneider, A. Bregman, J. Lelieveld and P.C. Siegmund (1997) Observations of high concentrations of total reactive nitrogen (NO_y) and nitric acid (HNO₃) in the lower Arctic stratosphere during the STREAM II campaign in February 1995. *J. Geophys. Res.* **102**, 23559-23571.
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66. van Dorland, R., F.J. Dentener and J. Lelieveld (1997) Radiative forcing due to tropospheric ozone and sulfate aerosols. *J. Geophys. Res.* **102**, 28079-28100.
67. Lelieveld, J., P.J. Crutzen and F.J. Dentener (1998) Changing concentration, lifetime and climate forcing of atmospheric methane. *Tellus* **50B**, 128-150.

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69. Brasseur, G.P., R.A. Cox, D. Hauglustaine, I. Isaksen, J. Lelieveld, D. Lister, R. Sausen, U. Schumann, A. Wahner and P. Wiesen (1998) European scientific assessment of the atmospheric effects of aircraft emissions. *Atmos. Environ.* **32**, 2329-2416.
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72. Vilà-Guerau de Arellano, J. and J. Lelieveld (1998) Chemistry in the atmospheric boundary layer. In: P.G. Duynkerke and A.A.M. Holtslag (eds.) Clear and cloudy boundary layers, pp. 267-286, Royal Netherlands Academy for Arts and Sciences, Amsterdam.
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