

CURRICULUM VITAE

Personal Details			
Name	Dr Gregory Elton Bodeker		
Present position	Director		
Organisation/Employer	Bodeker Scientific		
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Academic Qualifications

1994	PhD	Physics	University of Natal, South Africa
1992	MSc	Physics	University of Natal, South Africa
1988	BSc (Hons, 1 st class)	Physics	University of Natal, South Africa
1987	BSc (cum laude)	Physics and Applied Maths,	University of Natal

Professional Positions Held

Oct 2009 to present	Director	Bodeker Scientific
2006-Sep 2009	Principal Scientist	NIWA
2002-2005	Programme co-ordinator	NIWA
1998-2001	Project leader	NIWA
1997	JSPS research fellow	NIES, Japan
1994-1996	Scientist	NIWA
1994	Lecturer	University of Natal, South Africa
1989-1992	Scientist	Department of Environmental Affairs, South Africa

Total Years Research Experience	21 years
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Present Research / Professional Speciality

- Detection and attribution of long-term changes in stratospheric composition and dynamics; statistical analysis of trends in stratospheric trace species and in particular ozone trends; long-term changes in ozone levels over Antarctica and New Zealand; global analyses of trends in ozone measured by satellite; trends in lower stratospheric temperatures.
- Development of climate pattern scaling methods to generate fields of surface climate variables from simple climate model simulations.
- Investigation of feedbacks between ozone and temperature changes to better understand the connections between stratospheric change and climate change; coupled chemistry-climate modelling; development and applications of simple climate models.
- Analysis of the dynamical attributes of the polar vortices and the interaction between midlatitude planetary wave activity, the structure of the polar vortices and the resultant interannual difference in the severity of polar ozone depletion.

Selected current and previous research projects

A semi-empirical model of the stratosphere in the Antarctic Climate system

- *Principal outcome:* Improved capability for modelling future Antarctic ozone levels.
- *Principal end user(s):* New Zealand Antarctic Research Institute; global atmospheric chemistry modelling community; Antarctica New Zealand.

Climate Changes Impacts & Implications

- *Principal outcome:* Resilient and functioning natural environments; maintain and enhance the knowledge base & inform actions; support growth in business dependent on the environment.
- *Principal end user(s):* DairyNZ; DoC; Fonterra; Hort NZ; Local Government; Maori whanau, hapu, iwi, Rununga and Trust Boards; Mighty River Power; Ministry for Primary Industries; Ministry for the Environment; Primary Sector research organisations; Zespri

Antarctic ozone recovery – a NZ contribution to the 2007 international polar year (IPY)

- *Principal outcome:* Improved 21st century projections of the Antarctic ozone layer
- *Principal end user(s):* Antarctica New Zealand; MFaT; Ministry of Fisheries; IPY partner organisations; MfE; NOAA; UNEP; UNFCCC; WCRP; WMO.

Drivers and Mitigation of Global Change

- *Principal outcome:* Maintaining New Zealand's contribution to the global effort to monitor changes in the composition of the atmosphere; improving projections of global and regional changes in climate; provision of tools to support decision making by international and national policymakers.
- *Principal end user(s):* MfE; MFaT; Ministry of Fisheries; NOAA; UNEP; UNFCCC; WCRP; WMO; International and national policymakers (through WMO/UNEP ozone assessments and IPCC assessments); international ozone and climate research communities; epidemiologists; materials scientists.

Ozone Profiles over New Zealand: Processes and Trends

- *Principal outcome:* Improved monitoring of changes in the vertical distribution of ozone over New Zealand.
- *Principal end user(s):* International Ozone Commission; MfE.

Commercial, Social, or Environmental Impact of Previous Research Work

Commercial

1. *Bodeker Scientific (BS):* BS was established 1 September 2009 as a research organisation and has conducted contract work for a number of international organisations (NOAA, Deutscher Wetterdienst, WMO, ESA) and national organisations (NIWA, NZAGRC, NZARI).

Social

2. *UV radiation exposure of NZ children:* Through my work on UV radiation I was involved in this project with the department of social and preventative medicine at the University of Otago. This included the co-supervision of a PhD student. The outcome of this research was improved guidelines for mitigating UV exposure in NZ school children.

Environmental

3. *Montreal Protocol*: Through my research on stratospheric ozone and my subsequent participation as a coordinating lead author on the past two WMO/UNEP assessments of stratospheric ozone depletion, I have shaped international policy for the protection of the ozone layer. I have also given many public lectures on my ozone related research.
4. *International climate protection*: Through my research on interactions between ozone depletion and climate change, my co-authorship of a chapter in the IPCC/TEAP Special Report on Safeguarding the Ozone Layer and the Global Climate System, and my contribution to various IPCC reports, I have shaped international policy for the protection of the climate system. I was one of a few New Zealanders named as a contributor to the co-award of the Nobel Peace Prize to the IPCC.
5. *Development of climate change adaptation and mitigation strategies in New Zealand*: Through my involvement in the MBIE funded 'Climate Changes, Impacts and Implications' research programme I have developed methods for creating large ensembles of future climate scenarios for New Zealand. These can then be used to provide probabilistic projections of regional climate change. I have given public talks on this work, and engaged in the national public debate around New Zealand's response to climate change.

Relationships with the International Community

1. *Global Climate Observing System (GCOS)*: I am co-chair of the GCOS Reference Upper Air Network (GRUAN). In this role I interact with a wide range of GCOS and WMO panels and groups. From 2009 to 2010 I was also the New Zealand national GCOS coordinator.
2. *World Climate Research Programme (WCRP)*: I was co-chair of SPARC (Stratosphere-troposphere Processes And their Role in Climate), one of the four core projects of the WCRP, from 1 January 2012 to 31 January 2014. I had to resign from this role due to lack of funding. In this role I also interacted extensively with the other core projects of WCRP and associated WCRP working groups.
3. *International Ozone Commission (IO₃C)*: In this role I worked to maintain and expand the global ground-based network for monitoring long-term changes in the ozone layer and to validate satellite based measurements of ozone.
4. *Stratospheric ozone, Halogen Impacts in a Varying Atmosphere (SHIVA)*: I am one of 3 members of the international advisory board for this FP7 funded programme.
5. *WMO/UNEP ozone research managers' meetings*: I was the New Zealand delegate to these meetings in 1999, 2005 and 2008. I was also asked to attend this meeting as an independent consultant in 2011 and 2014.

Supervision of PhD students

1. **Renske Timmermans:** Technische Universiteit Eindhoven, The Netherlands, 2003-2005. Informal co-supervision and external examiner on her PhD. Thesis topic: Space-based measurements of stratospheric dynamical processes.
2. **Caradee Wright:** Department of Preventive and Social Medicine, University of Otago, 2004-2006. Formal co-supervisor together with Dr Tony Reeder. Thesis topic: Factors affecting excess UV radiation exposure in New Zealand school children.
3. **Petra Huck:** Physics Department, University of Canterbury, 2004-2007. Formal co-supervisor together with Dr Adrian McDonald. Thesis topic: Development of a medium term predictor of the severity of Antarctic ozone depletion.
4. **Kate Monahan:** Physics Department, University of Canterbury, 2005-2008. Formal co-supervisor together with Adrian McDonald. Thesis topic: Observations of stratosphere-troposphere exchange in the southern hemisphere.
5. **Birgit Hassler:** Department of Physics, University of Munich, 2006-2009. Formal co-supervisor together with Martin Dameris. Thesis topic: Using the longitudinal and altitudinal structure in ozone changes to differentiate between chemical and dynamical forcings of those changes - comparison of measurements and model.
6. **Hella Garny:** German Aerospace Center, Munich, Germany, 2007-2010. Formal co-supervision together with Prof Martin Dameris. Thesis topic: Validation of stratospheric mixing processes in chemistry-climate models.
7. **Stefanie Kremser:** Institute for Meteorology, Free University of Berlin, 2008-2011. Formal co-supervision together with Prof Ulrike Langematz. Thesis topic: Projections of future changes in the Antarctic ozone hole based on improved understanding of polar stratospheric chlorine chemistry.
8. **Laura Revell:** University of Canterbury Chemistry Department, 2009-2011. Co-supervision together Dr Petra Huck (NIWA) and Prof Bryce Williamson (UoC). Thesis topic: Diagnosing the interplay between chemistry and dynamics in coupled chemistry-climate models.
9. **Helena Södergren:** University of Canterbury Physics Department, 2014-present. Co-supervision together Dr Adrian McDonald (UoC). Thesis topic: Using simple models to improve understanding of the interactions between components of the climate system.
10. **Jordis Tradowsky:** Free University of Berlin, 2015-present. Thesis topic: Improving the utility of ground-based measurements for space-based sensor calibration and validation
11. **Chris Cameron:** University of Victoria, Wellington, 2015-present. Thesis topic: The permeability of the Antarctic vortex

Professional Distinctions and Memberships

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| 2010-2015 | Associate editor for Journal of Geophysical Research. |
| 2009-2015 | Associate editor for Journal of Climate. |
| 2011-2015 | Co-chair of GRUAN (GCOS Reference Upper Air Network) |
| 2012-2015 | Honorary research associate at University of Melbourne |
| 2009-2015 | Adjunct professor at New Zealand Climate Change Research Institute in the School of Geography, Environment and Earth Sciences, Victoria University |
| 2012-2014 | Co-chair of SPARC (Stratosphere-troposphere Processes And their Role in Climate). |

- 2014 Recipient of the 2014 Kidston Medal
- 2009-2012 Member of international advisory board for EU FP7 funded programme SHIVA (Stratospheric ozone: Halogen Impacts in a Varying Atmosphere).
- 2007-2011 Scientific Steering Group for SPARC
- 2004-2011 Member of International Ozone Commission (IO₃C).
- 2003-2011 Member of International Commission on the Middle Atmosphere (ICMA).
- 2009-2010 Co-ordinating lead author on WMO/UNEP “Scientific Assessment of Ozone Depletion: 2010”.
- 2009-2010 New Zealand national Global Climate Observing System (GCOS) coordinator.
- 2007-2009 Programme leader for FRST funded programme “Reducing uncertainty in projections of Antarctic ozone through the 21st century using IPY measurements” (\$285k/year).
- 1999-2008 New Zealand delegate to WMO/UNEP ozone research managers meetings in 1999, 2005 and 2008.
- 2007 Named New Zealand contributor to the award of the 2007 Nobel Peace Prize to Al Gore and the IPCC.
- 2005-2006 Co-lead author on WMO/UNEP “Scientific Assessment of Ozone Depletion: 2006”.
- 2003-2005 Lead author on IPCC/TEAP special report: “Safeguarding the ozone layer and the global climate system: issues related to hydrofluorocarbons and perfluorocarbons”.
- 2002-2009 Honorary Research Fellow: University of Natal.
- 2002-2005 Programme leader for FRST funded programme “Drivers and Mitigation of Global Change” (~\$5.3M/year).
- 2002 Invited reviewer of 2003 EU report on ozone-climate interactions.
- 2001-2002 Co-author on WMO/UNEP “Scientific Assessment of Ozone Depletion: 2002”.
- 1999 World Meteorological Organisation Research Award for Young Scientists.
- 1996 Japan Society for the Promotion of Science fellowship.
- 1992-1993 University of Natal Graduate Research Assistant Scholarship.
- 1992-1993 Foundation for Research Development PhD bursary, South Africa.
- 1992 Henry Dyer award for top postgraduate student at the University of Natal.
- 1988 Foundation for Research Development Honours bursary, South Africa.
- 1986-1987 Council for Scientific and Industrial Research bursary, South Africa.

Total number of peer reviewed publications and patents	Journal articles	Books, book chapters, books edited	Conference proceedings	Patents
	120	5	5	0

Research Publications and Dissemination

- Ajtic, J.; Connor, B.J.; Lawrence, B.N.; Bodeker, G.E.; Hoppel, K.W.; Rosenfield, J.E. and Heuff, D.N., Dilution of the Antarctic Ozone Hole into Southern Midlatitudes, 1998–2000, *J. Geophys. Res.*, 109, D17107, doi:17110.11029/12003JD004500, 2004.
- Ajtic, J.; Connor, B.J.; Randall, C.E.; Lawrence, B.N.; Bodeker, G.E.; Rosenfield, J.E. and Heuff, D.N., Antarctic air over New Zealand following vortex breakdown in 1998, *Ann. Geophys.*, 21, 2175–2183, 2003.

3. Austin, J.; Struthers, H.; Scinocca, J.; Plummer, D.A.; Akiyoshi, H.; Baumgaertner, A.J.G.; Bekki, S.; Bodeker, G.E.; Braesicke, P.; Brühl, C.; Butchart, N.; Chipperfield, M.P.; Cugnet, D.; Dameris, M.; Dhomse, S.; Frith, S.; Garny, H.; Gettelman, A.; Hardiman, S.C.; Jöckel, P.; Kinnison, D.; Kubin, A.; Lamarque, J.F.; Langematz, U.; Mancini, E.; Marchand, M.; Michou, M.; Morgenstern, O.; Nakamura, T.; Nielsen, J.E.; Pitari, G.; Pyle, J.; Rozanov, E.; Shepherd, T.G.; Shibata, K.; Smale, D.; Teyssèdre, H. and Yamashita, Y., Chemistry-climate model simulations of spring Antarctic ozone, *J. Geophys. Res.*, 115, D00M11, doi:10.1029/2009JD013577, 2010.
4. Austin, J.; Tourpali, K.; Rozanov, E.; Akiyoshi, H.; Bekki, S.; Bodeker, G.E.; Brühl, C.; Butchart, N.; Chipperfield, M.; Deushi, M.; Fomichev, V.I.; Giorgetta, M.A.; Gray, L.; Kodera, K.; Lott, F.; Manzini, E.; Marsh, D.; Matthes, K.; Nagashima, T.; Shibata, K.; Stolarski, R.S.; Struthers, H. and Tian, W., Coupled chemistry climate model simulations of the solar cycle in ozone and temperature, *J. Geophys. Res.*, 113, D11306, doi:11310.11029/12007JD009391, 2008.
5. Bekki, S.; Bodeker, G.E., (lead authors); Bais, A.; Butchart, N.; Eyring, V.; Fahey, D.W.; Kinnison, D.E.; Langematz, U.; Mayer, B.; Portmann, R.W.; Rozanov, E.; Braesicke, P.; Charlton-Perez, A.J.; Chubarova, N.E.; Cionni, I.; Diaz, S.B.; Gillett, N.P.; Giorgetta, M.A.; Komala, N.; Lefèvre, F.; McLandress, C.; Perlwitz, J.; Peter, T. and Shibata, K., Future Ozone and Its Impact on Surface UV, *Chapter 3 in "Scientific Assessment of Ozone Depletion: 2010", Global Ozone Research and Monitoring Project-Report No. 52, World Meteorological Organization, Geneva, 2011.*
6. Bodeker, G.E., Trends in total column ozone over Australia and New Zealand and its influence on clear-sky surface erythemal irradiance, *Radiation Protection in Australia*, 13, 39-49, 1995.
7. Bodeker, G.E.; Bojinski, S.; Cimini, D.; Dirksen, R.J.; Haeffelin, M., et al., Reference upper-air observations for climate: From concept to reality, *Bull. Amer. Meteor. Soc.*, 2015.
8. Bodeker, G.E.; Boyd, I.S. and Matthews, W.A., Trends and variability in vertical ozone and temperature profiles measured by ozonesondes at Lauder, New Zealand: 1986 to 1996, *J. Geophys. Res.*, 103, 28661-28681, 1998.
9. Bodeker, G.E.; Connor, B.J.; Liley, J.B. and Matthews, W.A., The global mass of ozone: 1978-1998, *Geophys. Res. Lett.*, 28, 2819-2822, 2001.
10. Bodeker, G.E.; Garny, H.; Smale, D.; Dameris, M. and Deckert, R., The 1985 Southern Hemisphere mid-latitude total column ozone anomaly, *Atmos. Chem. Phys.*, 7, 5625–5637, 2007.
11. Bodeker, G.E.; Hassler, B.; Young, P.J. and Portmann, R.W., A vertically resolved, global, gap-free ozone database for assessing or constraining global climate model simulations, *Earth System Science Data*, 5, 31-43, 2013.
12. Bodeker, G.E. and Kremser, S., Techniques for analyses of trends in GRUAN data, *Atmos. Meas. Tech.*, 8, 1673–1684, 2015.
13. Bodeker, G.E. and McKenzie, R.L., Erythemal UV at 45°S: longitudinal and secular variability, *Weather and Climate*, 13, 17-21, 1994.
14. Bodeker, G.E. and McKenzie, R.L., An algorithm for inferring surface UV irradiance including cloud effects, *J. Appl. Meteorol.*, 35, 1860-1877, 1996.

15. Bodeker, G.E.; Scott, J.C.; Kreher, K. and McKenzie, R.L., Global ozone trends in potential vorticity coordinates using TOMS and GOME intercompared against the Dobson network: 1978-1998, *J. Geophys. Res.*, 106, 23029-23042, 2001.
16. Bodeker, G.E. and Scourfield, M.W.J., SANAE total column ozone: 1980 to 1990, *S. Afr. J. Antarct. Res.*, 21, 220-221, 1991.
17. Bodeker, G.E. and Scourfield, M.W.J., Planetary waves in total ozone and their relation to Antarctic ozone depletion, *Geophys. Res. Lett.*, 22, 2949-2952, 1995.
18. Bodeker, G.E. and Scourfield, M.W.J., Estimated past and future variability in UV radiation in South Africa based on trends in total column ozone, *S. Afr. J. Sci.*, 94, 24-32, 1998.
19. Bodeker, G.E.; Scourfield, M.W.J. and Barker, M.D., Total column ozone above South Africa: 1987 to 1990, *S. Afr. J. Sci.*, 88, 222-224, 1992.
20. Bodeker, G.E.; Shiona, H. and Eskes, H., Indicators of Antarctic ozone depletion, *Atmos. Chem. Phys.*, 5, 2603-2615, 2005.
21. Bodeker, G.E.; Struthers, H. and Connor, B.J., Dynamical containment of Antarctic ozone depletion, *Geophys. Res. Lett.*, 29, 10.1029/2001GL014206, 2002.
22. Bodeker, G.E.; Waugh (Lead Authors), D.W.; Akiyoshi, H.; Braesicke, P.; Eyring, V.; Fahey, D.W.; Manzini, E.; Newchurch, M.J.; Portmann, R.W.; Robock, A.; Shine, K.P.; Steinbrecht, W. and Weatherhead, E.C., The Ozone Layer in the 21st Century, Chapter 6 in, *Scientific Assessment of Ozone Depletion: 2006*, 2007.
23. Boyd, I.S.; Bodeker, G.E.; Connor, B.J.; Swart, D.P.J. and Brinksma, E.J., An assessment of ECC ozonesondes operated using 1% and 0.5% KI cathode solutions at Lauder, New Zealand, *Geophys. Res. Lett.*, 25, 2409-2412, 1998.
24. Brinksma, E.J.; Ajtic, J.; Bergwerff, J.B.; Bodeker, G.E.; Boyd, I.S.; de Haan, J.F.; Hogervorst, W.; Hovenier, J.W. and Swart, D.P.J., Five years of observations of ozone profiles over Lauder, New Zealand, *J. Geophys. Res.*, 107, 10.1029/2001JD000737, 2002.
25. Brinksma, E.J.; Bergwerff, J.B.; Bodeker, G.E.; Boersma, K.F.; Boyd, I.S.; Connor, B.J.; de Haan, J.F.; Hogervorst, W.; Hovenier, J.W.; Parrish, A.; Tsou, J.J.; Zawodny, J.M. and Swart, D.P.J., Validation of 3 years of ozone measurements over Network for the Detection of Stratospheric Change station Lauder, New Zealand, *J. Geophys. Res.*, 105, 17291-17306, 2000.
26. Brinksma, E.J.; Meijer, Y.J.; Connor, B.J.; Manney, G.L.; Bergwerff, J.B.; Bodeker, G.E.; Boyd, I.S.; Liley, J.B.; Hogervorst, W.; Hovenier, J.W.; Livesey, N.J. and Swart, D.P.J., Analysis of record-low ozone values during the 1997 winter over Lauder, New Zealand, *Geophys. Res. Lett.*, 25, 2785-2788, 1998.
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28. Brunner, D.; Staehelin, J.; Künsch, H.-R. and Bodeker, G.E., A Kalman filter reconstruction of the vertical ozone distribution in an equivalent latitude-potential temperature framework from TOMS/GOME/SBUV total ozone observations, *J. Geophys. Res.*, 111, D12308, doi:10.1029/2005JD006279, 2006.

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34. Cunningham, P.F. and Bodeker, G.E., Ground-based measurements of UVB in Namibia, *S. Afr. J. Sci.*, 96, 547-549, 2000.
35. Deshler, T.; Liley, J.B.; Bodeker, G.E.; Matthews, W.A. and Hofmann, D.J., Stratospheric aerosol following Pinatubo, comparison of the north and south mid latitudes using in situ measurements, *Adv. Space Res.*, 20, 2089-2095, 1997.
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