Dr Keith Graham McNaughton

Curriculum Vitae

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Academic Qualifications

Ph.D.	1974	Soil Science, University of British Columbia, Canada
B.A.	1968	Economics, Monash University, Australia
B.Sc (Hons)	1965	Physics, Monash University, Australia

Employment

2007—	Private Researcher. Research on turbulence in convective boundary layers.
2006-2007	AI on Marsden contract, with Johannes Laubach of Landcare Research Institute of New Zealand. Fundamental research into turbulent transport processes in boundary layers.
2000-2006	Research Associate, Institute for Atmospheric and Environmental Sciences, University of Edinburgh, Scotland. Fundamental research into turbulent transport processes in convective boundary layers.
1992-1998	Scientist. Horticulture and Food Research Institute of New Zealand Ltd. Research into scalar transport processes in the atmospheric surface layer and plant-atmosphere interactions.

1974 - 92	Scientist. DSIR Crop Research/Plant Physiology/Fruit & Trees Divisions, New Zealand. Research into effects of windbreaks on microclimate, water use by vegetation and interactions between the land surface and the atmospheric boundary layer.
1970 - 74	Research Assistant and Teaching Assistant, University of British Columbia, Vancouver, Canada. Writing laboratory exercises, laboratory demonstrator, occasional lecturer.
1967 – 69	Technician/Senior Technician. Geography Department, Monash University, Australia. Field assistant and data processing.
1966 - 67	Secondary school teacher in general science and physics.

Visiting Positions

2007 fall	Visiting Professor, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland. Lectures and research on turbulent structure of the atmospheric boundary layer.
1999/2000	Chercheur Étranger, INRA Laboratoire de Bioclimatologie, Bordeaux, France. Research into turbulent structure and transport processes in the atmospheric surface layer.
1992	Visiting Scientist at Department of Meteorology, Agricultural University, Wageningen, The Netherlands. Research into scalar transport processes in variable wind conditions and on the energy balance of sparse vegetation.
1980 - 81	Visiting Scientist at CSIRO Division of Environmental Mechanics, Canberra, Australia. Research on local advection and turbulence processes over a paddy field.

Honorary Positions

2010-12	Honorary Research Associate, Department of Physics, University of Auckland
2007 -12	Honorary Professor, School of GeoSciences, The University of Edinburgh
1994, 96, 98	Assessor for the World Meteorological Organization Norbert Gerbier-MUMM International prize.

1992 - 2000	Editorial Adviser Climate Research (Inter-Research)
1985 - 91	Regional Editor for Asia, Australasia and South America Agricultural and Forest Meteorology (Elsevier)
1984 - 2008	Editorial Board member Agricultural and Forest Meteorology (Elsevier)
1982 - 95	Honorary Lecturer, Department of Soil Science, Massey University
1982 - 95	Honorary Professor, School of Geosciences, University of Edinburgh

Invited Participation in Meetings and Workshops

	[Sponsor in brackets]
Keynote Paper	Annual Conference of the Korean Meteorological Society, Jeju Island, 13-15 October, 2014. [Korean Meteorological Administration]
Keynote Paper	Sixth International Study Conference on GEWEX in Asia and GAME. Kyoto 3-5 December 2004. [GEWEX/GAME]
Paper	Exploratory Workshop on "Terrestrial Carbon Balance", Strasbourg, 11-12 September, 2000. [European Science Foundation]
Keynote Paper	Symposium on "Transfer processes in the Natural Environment: State of the Science" Canberra 25-27 August, 1998. CSIRO Division of Land and Water. [CSIRO Div. Land & Water]
Paper	Workshop on "Remote Sensing and Scaling for Heterogeneous Areas". Wallingford, UK. June 10-12, 1996. [IGBP/BAHC]
Participant	IPCC (Working Group 1) Workshop on Chapter 7 of the 1995 assessment "Interactions of Terrestrial Ecosystem C and H2O Fluxes". Woods Hole, MA. 22-24 February, 1995. [Electric Power Research Institute, USA]
Paper	Workshop on "Modelling Stomatal Resistance". College Park, PA, USA. 10-13 April, 1989. [National Science Foundation, USA].
Paper	Royal Society Discussion Meeting on "Forests, Weather and Climate". London, U.K. 2-3 June, 1989. [Royal Society of London]

Animateur	International Symposium on "Flow and Transport in the Natural Environment". Canberra, Australia. September 1987. [CSIRO Division of Environmental Mechanics]
Paper	International Association of Hydrologic Sciences "Workshop on Estimation of Areal Evapotranspiration". Vancouver, B.C., Canada. 9-22 August 1987. [British Columbia Ministry of Forests]
Plenary Paper	"International Symposium on Windbreak Technology". Lincoln, Nebraska, USA. June 23-27, 1986. [U.S. Department of Agriculture]
Paper	Society for Experimental Biology, Easter meeting on "Plant Canopies: their Growth, Form and Function". Nottingham, U.K. March 1986. [British Council and AFRC Woodward Fellowship]
Paper	Workshop on "Climate-Vegetation Interactions". Greenbelt, MA, USA Jan 27-29, 1986. NASA/Goddard Institute for Space Studies. [NASA/GISS]
Assessor	Workshop on "Forests, Climate and Hydrology: Regional Impacts". Oxford. March, 1984. United Nations University. [United Nations University]
Paper	Workshop on "Evapotranspiration from Plant Communities". Bunbury, Western Australia. May 1982. [University of West Australia]

Papers in Refereed Scientific Journals

McNaughton, K.G. and Chowdhuri, S., 2020. Temperature profiles, plumes and spectra in the surface layer of convective boundary layers. *AIP Advances*, 10:105306.

Chowdhuri, S. And McNaughton, K.G., 2019. An empirical scaling analysis of heat and momentum cospectra above the surface friction layer in a convective boundary layer. *Boundary Layer Meteorology* 170:257-284.

K.G. McNaughton, 2012. The flow of mechanical energy in convective boundary layers. *Boundary Layer Meteorology* 145:145-163.

J. Laubach & K.G. McNaughton, 2009. Scaling properties of temperature spectra and heat flux cospectra in the surface friction layer beneath an unstable outer layer. *Boundary Layer Meteorology* 133:219-252.

K.G. McNaughton, R.J. Clement & J.B. Moncrieff, 2007. Scaling properties of velocity and temperature spectra above the surface friction layer in a convective atmospheric boundary layer. *Nonlinear Processes in Geophysics* 14: 257-271.

K. G. McNaughton, 2006. On the kinetic energy budget of the unstable atmospheric surface layer. *Boundary-Layer Meteorology* 118: 103-127.

K. G. McNaughton, 2004. Turbulence structure of the unstable atmospheric surface layer and transition to the outer layer. *Boundary-Layer Meteorology* 112: 199-221.

K.G. McNaughton, 2004. Attached eddies and production spectra in the atmospheric logarithmic layer. *Boundary-Layer Meteorology* 111:1-18.

S.R. Green, K.G. McNaughton, J.N. Wünsche & B.E. Clothier, 2003. Modeling light interception and transpiration of apple tree canopies. *Agronomy Journal* 95: 1380-1387.

K.G. McNaughton & Y. Brunet, 2002. Townsend's hypothesis, coherent structures and Monin-Obukhov similarity. *Boundary-Layer Meteorology* 102: 161-175.

C.C. Daamen & K.G.McNaughton, 2000. Modelling energy fluxes from sparse canopies and understoreys. *Agronomy Journal* 92: 837-847.

K.G. McNaughton & J. Laubach, 2000. Power spectra and cospectra for wind and scalars in a disturbed surface layer at the base of an advective inversion. *Boundary-Layer Meteorology* 96: 143-185.

J. Laubach, K.G. McNaughton & J.D. Wilson, 2000. Heat and water vapour diffusivities near the base of a disturbed stable internal boundary layer. *Boundary-Layer Meteorology* 94: 23-63.

C.C. Daamen, W.A. Dugas, P.T. Prendergast, M.J.Judd & K.G. McNaughton, 1999. Energy flux measurements in a sheltered lemon orchard. *Agricultural and Forest Meteorology* 93: 171-183.

J. Laubach & K.G. McNaughton, 1998. A spectrum-independent procedure for correcting eddy fluxes measured with separated sensors. *Boundary-Layer Meteorology* 89: 445-467

K.G. McNaughton & J. Laubach, 1998. Unsteadiness as cause of non-equality of eddy diffusivities for heat and vapour at the base of an advective inversion. *Boundary-Layer Meteorology* 88: 479-504.

A. Verhoef, K.G. McNaughton & A.F.G. Jacobs, 1997. A parameterization of momentum roughness length and displacement height for a wide range of canopy densities. *Hydrology and Earth System Sciences* 1: 81-91.

S.R. Green & K.G. McNaughton, 1997. Modelling effective stomatal resistance for calculating transpiration from an apple tree. *Agricultural and Forest Meteorology* 83: 1-26.

S.R. Green, K.G. McNaughton, D.H. Greer & D.J. McLeod, 1995. Measurement of the increased PAR and net all-wave radiation absorption by an apple tree caused by applying a reflective ground covering. *Agricultural and Forest Meteorology* 76: 163-183.

K.G. McNaughton & B.J.J.M. Van den Hurk, 1995. A 'Lagrangian' revision of the resistors in the two-layer model for calculating the energy budget of a plant canopy. *Boundary-Layer Meteorology* 74: 261-288

B.J.J.M.Van den Hurk & K.G. McNaughton, 1995. Implementation of near-field dispersion in a simple two-layer surface resistance model. *Journal of Hydrology.* 166: 293-311.

S.J. Bradley, D.M. Suckling, K.G. McNaughton, C.H. Wearing, & G. Karg, 1995. A temperature-dependent predictive model for polyethylene tubing pheremone dispenser release rates. *Journal of Chemical Ecology* 21: 745-760.

K.G. McNaughton, 1994. Effective stomatal and boundary-layer resistances of heterogeneous surfaces. *Plant, Cell and Environment* 17: 1061-1068.

A.F.G. Jacobs & K.G. McNaughton, 1994. The excess temperature of a rigid, fast-response thermometer and it s effects on the measured heat flux. *Journal of Atmospheric and Oceanic Technology* 11: 680-686.

K.G. McNaughton, S.R. Green, T.A. Black, B.R. Tynan & W.R.N. Edwards, 1992. Direct measurement of net radiation and PAR absorbed by a single tree. *Agricultural and Forest Meteorology* 62: 87-107.

K.G. McNaughton & P.G. Jarvis, 1991. Effects of scale on stomatal control of transpiration. *Agricultural and Forest Meteorology* . 54: 279-301.

E.R. Morgan & K.G. McNaughton, 1991. Architecture of a kiwifruit canopy. *New Zealand Journal of Crop and Horticultural Research* 19: 237-246

S.R. Green, K.G. McNaughton & B.E. Clothier, 1989. Nocturnal water use by apple trees and Kiwifruit vines. *Agricultural and Forest Meteorology* 48: 251-261.

K.G. McNaughton, 1989. Micrometeorology of shelterbelts and forest edges. *Philosophical Transactions of the Royal Society: Series B* 324: 351 - 368.

K.G. McNaughton, 1988. Effects of windbreaks on turbulent transport and microclimate. *Agriculture, Ecosystems and Environment* 22/23 : 17 - 39.

P.G. Jarvis & K.G. McNaughton, 1986. Stomatal control of transpiration: scaling up from leaf to region. *Advances in Ecological Research* 15 : 1 - 49.

K.G. McNaughton, 1986. The effect of wind on plant water use. *New Zealand Agricultural Science* 20 : 38 - 42.

K.G. McNaughton & T.W. Spriggs, 1986. A mixed-layer model for regional evaporation. *Boundary-Layer Meteorology* 6 : 243 - 262.

K.G. McNaughton, P.W. Gandar & H.G. McPherson, 1986. Estimating the effects of varying temperature on the rate of development of plants. *Annals of Botany* 56 : 579 - 595.

K.G. McNaughton & P.G. Jarvis, 1984. Using the Penman-Monteith equation predictively. *Agricultural Water Management* 8 : 263 - 278.

K.G. McNaughton, 1983. The direct effect of shelter on evaporation rates: theory and an experimental test. *Agricultural Meteorology* 29 : 125 - 136.

A.R.G. Lang, K.G. McNaughton, Chen Fazu, E.F. Bradley & Eiji Ohtaki, 1983. An experimental appraisal of the terms in the heat and moisture flux equations for local advection. *Boundary-Layer meteorology* 25 : 89 - 102.

A.R.G. Lang, K.G. McNaughton, Chen Fazu, E.F. Bradley & Eiji Ohtaki, 1983. Inequality of eddy transfer coefficients for vertical transport of sensible and latent heats during advection inversions. *Boundary-Layer meteorology* 25 : 25 - 41.

K.G. McNaughton, 1981. Net interception losses during sprinkler irrigation. *Agricultural Meteorology 24* : 11 - 27.

L.J. Davies & K.G. McNaughton, 1980. The effect of herbage cover on the survival and spring growth of tropical grasses in a temperate environment. *New Zealand Journal of Agricultural Research* 23 : 331 - 337.

P.A. Tang, K.G. McNaughton & T.A. Black, 1976. Precision integrator for environmental measurement. *Transactions of the American Society of Agricultural Engineers* 19 : 550 - 552.

K.G. McNaughton, 1976. Evaporation and advection II: Evaporation downwind of a boundary separating regions having different surface resistances and available energies. *Quarterly Journal of the Royal Meteorological Society* 102 : 193 - 202.

K.G. McNaughton, 1976. Evaporation and advection I: Evaporation from extensive homogeneous surfaces. *Quarterly Journal of the Royal Meteorological Society* 102 : 181 - 191.

P.A. Tang, K.G. McNaughton & T.A. Black, 1974. Inexpensive diode thermometry using integrated circuit components. *Canadian Journal of Forest Research* 4 : 250 - 254.

K.G. McNaughton & T.A. Black, 1973. A study of evapotranspiration from a Douglas-fir forest using the energy balance approach. *Water Resources Research* 9 : 1579 - 1589.

T.A. Black & K.G. McNaughton, 1972. Average Bowen-ratio methods of calculating evapotranspiration applied to a Douglas-fir forest. *Boundary-Layer Meteorology* 2 : 466 - 475.

T.A. Black & K.G. McNaughton, 1972. Psychrometric apparatus for Bowen ratio determination over forests. *Boundary-Layer Meteorology* 2 : 246 - 254.

Chapters in Books

Y. Malhi, K.G.McNaughton & C. von Randow, 2004. Low Frequency Atmospheric Transport and Surface Flux Measurements. In: *Handbook of micrometeorology: a guide for surface flux measurements.* Xuhui Lee, William Massman and Beverly Law (eds) Kluwer, Boston. Pp 101-118.

K.G. McNaughton & M.R. Raupach, 1996. Responses of the convective boundary layer and the surface energy balance to large-scale heterogeneity. In: *Scaling Up in Hydrology Using Remote Sensing*. J.B. Stewart, E.T. Engman, R.A. Feddes & J.Y. Kerr (eds.) Wiley, Chichester. Pp 170 - 182.

J.R. Garratt, M.R. Raupach & K.G. McNaughton, 1996. Climate and the Terrestrial Biosphere. In: *Greenhouse: Coping With Climate Change* W.J. Bouma, G.I. Pearman & M.R. Manning (eds.) CSIRO, Melbourne. Pp 42-55.

K.G. McNaughton & T.W. Spriggs, 1989. An evaluation of the Priestley & Taylor equation and the Complementary Relationship using results from a mixed-layer model of the convective boundary layer. In *Estimation of Areal Evapotranspiration*. T.A. Black, D.L. Spittlehouse, M.D. Novak & D.T. Price (eds.). Publication number 177. IAHS Press, Wallingford. Pp 89 - 104.

K.G. McNaughton, 1989. Regional Interactions between canopies and the atmosphere. In *Plant Canopies: their Growth, Form and Function*. G. Russell, B. Marshall and P.G. Jarvis (eds.). Society for Experimental Biology Seminar Series 31. Cambridge University Press, Cambridge. Pp 63 - 81.

K.G. McNaughton & P.G. Jarvis, 1983. Predicting the effects of vegetation changes on transpiration and evaporation. In *Water Deficits and Plant Growth*, Vol. VII. T.T. Kozlowski (ed.) Academic Press, New York. Pp 1 - 47.

K.G. McNaughton, B.E. Clothier & J.P. Kerr, 1979. Evaporation from land surfaces. In *Physical Hydrology. New Zealand Experience*. D.L. Murray and P. Ackroyd (eds.). New Zealand Hydrological Society, Wellington. Pp97 - 119.

Other Publications

Keith McNaughton, 2009. The rise and fall of Monin-Obukhov theory. AsiaFlux Newsletter No. 30, September 2009. Pp 1-4.

D.M. Suckling and K.G. McNaughton, 1997. Response to second letter by Leslie M. McDonough. *Journal of Chemical Ecology* 23: 1222-1223.

D.M. Suckling, K.G. McNaughton, S.J. Bradley, G. Karg, C.H. Wearing and T. Bellas, 1997. Response to letter by Leslie M. McDonough. *Journal of Chemical Ecology* 23: 1216-1220.

I.J. Warrington, E.A. Halligan, L.C. Ruby & K.G. McNaughton, 1994. Heat dissipation in controlled environment enclosures through the application of water screens. *In*: Lighting in Controlled Environments, Proceedings of an International Workshop, Madison, Wisconsin, 27-30 March 1994. NASA Technical Series. 367-377.

W.E. Reifsnyder, K.G. McNaughton & J.R. Milford, 1991. Symbols, units notation. A statement of journal policy. [Technical Note] *Agricultural and Forest Meteorology* 54: 389-397.

K.G. McNaughton, 1988. Surface temperature and the surface energy balance: commentary. *In* Flow and Transport in the Natural Environment: Advances and Applications. W. Steffan & O.T. Denmead (eds.), Springer, Berlin. Pp154 - 159.

K.G. McNaughton, 1987. Comments on "Modelling effects of vegetation on climate". *In* The Geophysiology of Amazonia: Vegetation and Climate Interactions. R.E. Dickenson (ed.), Wiley, New York. Pp 339 - 342.

Ron McGann & Keith McNaughton, 1987. Better information for choosing frost protection methods. The Orchardist of New Zealand, April 1987. Pp. 89 - 90.

K.G. McNaughton, 1986. Regional evaporation models. *In* Climate-Vegetation Interactions. C Rosenzweig & R.E. Dickenson (eds.). Proceedings of a workshop held at and sponsored by NASA/Godard Space Flight Centre, Greenbelt, Maryland, 27-29 January 1986. Report OIES 2. NCAR, Boulder. Pp. 103 - 105.

K.G. McNaughton, 1985. Notes on water use by orchards. *In* Proceedings of the Workshop on Crop Water Requirements, 19-21 August 1985. Tech. Publ. No. 32, Auckland Regional Water Board. Pp 51 - 54.

K.G. McNaughton, A.K.H. Jackson & I.J. Warrington, 1981. Greenhouse covering materials - optical and thermal properties of some materials available in New Zealand. Technical Report No. 9, DSIR Plant Physiology Division, Palmerston North.

T.M. Ballard, T,A. Black & K.G. McNaughton, 1977. Summer energy balance and temperatures in a forest clearcut in Southwestern British Columbia. *In* British Columbia Soil Science Workshop Report 1977. B.C. Ministry of Agriculture, Victoria. Pp 74 - 86.

K.G. McNaughton, 1977. Evaporation: potential, equilibrium and actual. Proceedings of the Soil and Plant Water Symposium, Palmerston North, 1976. DSIR Information Series No. 126.

K.G. McNaughton, 1976. Comment on 'The evaporation of intercepted rainfall from a forest stand' by Charles E. Murphy, Jr. and Kenneth R. Knoerr. *Water Resources Research* 12: 1081 - 1082.

Contributions to Publications

Keith McNaughton and John Grace, Foreword in '*Forests at the Land-Atmosphere Interface*' M. Mencuccini, J. Grace, J.B. Moncrieff & K.G. McNaughton (eds). CABI Press, 2004.

Contributed entry 'Planetary Boundary Layer'. *In*: Encyclopedia of Ecology and Environmental Management. P. Callow (ed.), Blackwell Science, Oxford. pp 557-559, 1998.

Contributor to Chapters 4 and 9 of "Climate Change 1995: The Science of Climate Change" (J.T. Houghton et al eds..) Contribution of WG1 to the Second Assessment report of the Intergovernmental Panel on Climate Change. CUP 1996

Edited Volumes

M. Mencuccini, J. Grace, J.B. Moncrieff & K.G. McNaughton, 2004. *Forests at the Land-Atmosphere Interface.* CABI Press.