CURRICULUM VITAE

William W. Hsieh

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Citizenship: Canadian

Education:

1972-1976: University of British Columbia
B.Sc. in Combined Honours Mathematics and Physics

1976-1978: University of British Columbia
M.Sc. in Physics
Thesis (supervised by J.M. McMillan): "A new Hamiltonian for systems of nucleons and pions."

1978-1981: University of British Columbia
Ph.D. in Physics and Oceanography
Thesis (supervised by L.A. Mysak): "Resonant interactions between continental shelf waves."

Professional Positions:

1981-1982: University of Cambridge
Postdoctoral Fellow in the Department of Applied Mathematics and Theoretical Physics (under A.E. Gill)

1983-1985: University of New South Wales
1983: ARGS Research Associate in the School of Mathematics (under V.T. Buchwald).
1984-85: Queen's Fellow in Marine Science.

1985-present: University of British Columbia
1985-86: Research Associate
1986-1990: Assistant Professor of Oceanography
1990-93: Assistant Professor of Oceanography and Physics
1993-96: Associate professor of Oceanography and Physics
1996-2001: Associate Professor of Earth & Ocean Sciences, and Physics & Astronomy

2001-2010: Professor of Earth & Ocean Sciences, and Physics & Astronomy
2002-2007, 2008-2010: Chair of the Atmospheric Science Programme
2010-: Professor emeritus of Earth, Ocean & Atmospheric Sciences

2016-present: Visiting scientist, School of Earth and Ocean Sciences, University of Victoria, BC, Canada

1992: Visiting Fellow, Program in Atmospheric and Oceanic Sciences, Princeton University.

Awards:

Canadian Meteorological and Oceanographic Society Graduate Student Prize for 1981. Citation: "for outstanding contributions to dynamic oceanography" in my Ph.D. thesis work.

NSERC Postdoctoral Fellowship, held at the University of Cambridge, 1981-82.

Australian Queen's Fellowship in Marine Science, held at the University of New South Wales, 1984-85.

UBC Killam Faculty Research Fellowship 1992-93.

Canadian Meteorological and Oceanographic Society President's Prize for 1999. Citation: "for his outstanding contribution to global climate research through the development and application of neural network techniques for the analysis and forecasting of climate variability".

Peter Wall Inst. for Advanced Studies: Distinguished UBC Scholar in Residence, 2000

Fellow of the Canadian Meteorological and Oceanographic Society, 2010. Citation: "for his internationally recognized leadership in the application of artificial neural networks to the advancement of our understanding of meteorological, oceanographic and climate variability"

John Patterson medal (2013), Meteorological Service of Canada.

Fellow of the American Meteorological Society, 2020.

Membership in professional societies:

1. Canadian Meteorological and Oceanographic Society
2. American Meteorological Society
3. American Geophysical Union
4. International Neural Network Society
5. European Geosciences Union

Committees & Miscellaneous Services (outside UBC):

Member of the Scientific Committee, Canadian Meteorological & Oceanography Society (1988 - 91), Secretary (1990 - 91)

Member of the Prizes and Awards Committee, Canadian Meteorological and Oceanographic Society (1991-94)

Chair of the Scientific Program Committee of the Canadian Meteorological and Oceanographic Society 1995 Congress (1994-95)

CMOS/CICS 1997 Tour Speaker: "Neural Networks for Short-term Climate Prediction", Halifax (97/10/17), Montreal (97/10/20), Ottawa (97/10/22), Toronto (97/10/23), Vancouver (97/11/27), Sidney (97/12/4), Victoria (97/12/5), Edmonton (97/12/9), Saskatoon (97/12/10), Winnipeg (97/12/11).

Member of the Committee on Artificial Intelligence applications to Environmental Science, American Meteorological Society (1999-2002, 2005-2011).

Member of the Scientific Program Committee of the Canadian Meteorological and Oceanographic Society (1999-2000, 2007-2008, 2014-)

Canadian Meteorological and Oceanographic Society BC Lower Mainland Centre: Treasurer (2000-2010) and Chair (2010-).

Member of the Prizes and Awards Committee, Canadian Meteorological and Oceanographic Society (2004-2006)

Treasurer, Canadian Meteorological and Oceanographic Society 2005 Congress (2004-2005).

Chair of the Prizes and Awards Committee, Canadian Meteorological and Oceanographic Society (2006-2007)

Co-editor: Neural Networks: Special issue on "Computational Intelligence in Earth and Environmental Sciences" (2006-07).

Member of the University and Professional Education Committee, Canadian Meteorological and Oceanographic Society (2006-2010)

Member of Technical Committee, IEEE World Congress on Computational Intelligence, 2008

Member of the Editorial Board of the International Journal of Oceanography (2008-2011)

Editor of Nonlinear Processes in Geophysics (2010-2015)

Editor-in-chief of Atmosphere-Ocean (2010-2013). Associate editor (2013-2019)

Member of Editorial Advisory Board of the Atmospheric and Oceanographic Sciences Library, Springer (2011-)

Associate editor of Advances in Statistical Climatology, Meteorology and Oceanography (2019-)

Invited Symposia Lectures (since 1999):

"Nonlinear principal component analysis by neural network models". European Geophysical Society XXIV General Assembly. 19-23 April 1999, The Hague, Netherlands.

"Forecasting the equatorial Pacific sea surface temperatures by neural network models". European Geophysical Society XXIV General Assembly. 19-23 April 1999, The Hague, Netherlands.

"Neural networks for nonlinear multivariate data analysis", and "Neural networks for nonlinear time series analysis". Amer. Meteorol. Soc. Short Course on Neural Network Applications to Environmental Sciences, 12-13 Jan. 2002. Orlando, Florida.

"From principal component analysis (PCA), to nonlinear PCA" and "Nonlinear principal component analysis and extensions". Amer. Meteorol. Soc. Short Course on Artificial Intelligence Methods in Atmospheric and Oceanic Sciences: Neural Networks, Fuzzy Logic, and Genetic Algorithms, 10-11 Jan., 2004, Seattle, WA.

"Non-linear modes of climate variability via neural network methods". European Geophysical Society Congress. 25-29 April, 2005, Vienna, Austria.

"Nonlinear principal component analysis of noisy data", Amer. Meteorol. Soc. Annual Meeting, 14-18 Jan., 2007, San Antonio, Texas.

"Nonlinear principal component analysis of noisy data". European Geophysical Society Congress. 16-20 April, 2007, Vienna, Austria.

"Modes of climate variability, their changes, and their detection by machine learning methods", keynote speaker at the 5th Annual Northern High Performance Computing Spring Conference, Univ. Northern British Columbia, 14 May, 2007, Prince George, B.C.

"Downscaling by kernel methods", National Workshop on "Climate Scenarios of Extremes for Impact and Adaptation studies", 6-8 May, 2008, Montreal, Quebec.

"Machine learning methods in climate and weather research". IEEE International Conference on Data Mining, Workshop on "Knowledge discovery from climate data: prediction, extremes, and impacts" keynote speaker, 11 Dec 2011, Vancouver, BC

"Online learning with extreme learning machines, with applications to environmental sciences" Big Data and the Earth Sciences: Grand Challenges Workshop, 31 May - 2 June, 2017, La Jolla, CA.

"Machine learning and statistics: the yin and yang of data science". 17th Conference on Artificial and Computational Intelligence and its Applications to the Environment Sciences. 98th Annual Meeting of the American Meteorological Society, Core Science Keynote Speaker. 7-11 Jan 2018, Austin, TX

"Applying machine learning to the environmental sciences". Solicited speaker in Joint Session JM07, 27th IUGG General Assembly, 8-18 July 2019, Montreal, QC.

Research contributions

My research interests have evolved over the years: I started in low-frequency wave dynamics over the continental shelf, then broadened into ocean circulation and climate variability. Through climate, I became interested in atmospheric sciences, hydrology, fisheries and agricultural science. Interests in modelling and predicting climate variability, especially the El Niño phenomenon, led me to machine learning (a major branch of artificial intelligence) in the early 1990s – this was a lucky switch since within a few years, the spectacular rise of the internet spurred the wide use of machine learning to extract information from the massive internet data.

My most important research accomplishment has been in the development and application of machine learning methods (esp. neural networks) in climate and meteorological research. My group has been able to show that neural networks offer a nonlinear generalization of the current multivariate data analysis methods (e.g. principal component analysis, canonical correlation analysis and multichannel singular spectrum analysis) used in the environmental sciences. More specifically, my student Alex Cannon and I invented a new neural network architecture for nonlinear canonical correlation analysis. With my research associate Aiming Wu, we invented nonlinear multichannel singular spectrum analysis, and discovered nonlinear atmospheric teleconnections. Together with my student Adam Monahan, we popularized the use of autoencoders in environmental sciences through nonlinear principal component analysis. With my student Youmin Tang, we studied how neural networks can be combined with dynamical models to form hybrid models. With my student Aranildo R. Lima, we developed extremely fast and updatable randomized neural network models (a.k.a. extreme learning machines). With other students and post-docs, machine learning methods were used as nonlinear regression and classification models for post-processing and downscaling numerical model output for climate (esp. extreme climate) and weather, and for data analysis and prediction.

My nonlinear principal component analysis and nonlinear canonical correlation analysis programs (in MATLAB), downloadable from our web site (http://www.ocgy.ubc.ca/projects/clim.pred/download.html) since Jan., 2001, have registered users from about 80 countries.

As existing data analysis books in atmospheric and related sciences were entirely based on statistics instead of the newer field of machine learning, I wrote a graduate level text "Machine Learning Methods in the Environmental Sciences", Cambridge Univ. Press, 2009 (http://www.cambridge.org/catalogue/catalogue.asp?isbn=9780521791922). A new textbook,"Introduction to Environmental Data Science", for senior undergraduate and graduate students, is in press (Cambridge Univ. Press).

Our group produced the first El Niño/La Niña forecast model in Canada using neural networks, with the forecasts posted monthly on our web site (www.ocgy.ubc.ca/projects/clim.pred) since 1997. Our forecasts were displayed in the Summary of ENSO Model Forecasts issued monthly by the International Research Institute for Climate Prediction (http://iri.columbia.edu/climate/ENSO/currentinfo/SST_table.html).

Career publication list: (Web of Science researcher ID G-8380-2011, *h*-index = 29; Google Scholar *h*-index = 39)

In multi-authored journal publications, the student or post-doc who does most of the hands-on work is the first author. Students are listed in **bold** font.

1. REFEREED PUBLICATIONS

(a) Journals

106. Haupt, S. E., Gagne, D. J., Hsieh, W. W., Krasnopolsky, V., McGovern, A., Marzban, C., Moninger, W., Lakshmanan, V., Tissot, P., & Williams, J. K., 2021. The history and practice of AI in the environmental sciences, Bulletin of the American Meteorological Society (published online ahead of print 2021). https://journals.ametsoc.org/view/journals/bams/aop/BAMS-D-20-0234.1/BAMS-D-20-0234.1.xml.

105. Hsieh, W. W., 2022. Evolution of machine learning in environmental science -- A perspective. Environmental Data Science, 1:1-8. https://doi.org/10.1017/eds.2022.2

104* Hsieh, W.W. Improving predictions by nonlinear regression models from outlying input data. Journal of Environmental Informatics. (accepted 2019-08-10). [Preprint in arXiv:2003.07926, http://arxiv.org/abs/2003.07926]

103. **Snauffer, A.M.**, W.W. Hsieh, A.J. Cannon and M. Schnorbus, 2018. Improving gridded snow water equivalent products in British Columbia, Canada: multi-source data fusion by neural network models. Cryosphere, 12: 891-905. https://www.the-cryosphere.net/12/891/2018.

102* **Lima, A.R.**, W.W. Hsieh and A.J. Cannon, 2017. Variable complexity online sequential extreme learning machine, with applications to streamflow prediction. J. Hydrology, 555:983-994. https://doi.org/10.1016/j.jhydrol.2017.10.037

101. **Snauffer, A.M.**, W.W. Hsieh and A.J. Cannon, 2016. Comparison of gridded snow water equivalent products with in situ measurements in British Columbia, Canada. J. Hydrology, 541:714-726. http://dx.doi.org/10.1016/j.jhydrol.2016.07.027

100. **Peng, H.**, **A.R. Lima**, A. Teakles, J. Jin, A.J. Cannon and W.W. Hsieh, 2016. Evaluating hourly air quality forecasting in Canada with nonlinear updatable machine learning methods. Air Quality, Atmosphere and Health. http://link.springer.com/article/10.1007/s11869-016-0414-3

99* **Lima, A.R.**, A.J. Cannon and W.W. Hsieh, 2016. Forecasting daily streamflow using online sequential extreme learning machines. J. Hydrology, 537:431-443.

98. **Johnson, M.D.**, W.W. Hsieh, A.J. Cannon, A. Davidson, F. Bédard, 2016. Crop yield forecasting on the Canadian Prairies by remotely sensed vegetation indices and machine learning methods. Agricultural and Forest Meteorology, 218-219:74-84.

97. **Lima, A.R.**, A.J. Cannon and W.W. Hsieh, 2015. Nonlinear regression in environmental sciences using extreme learning machines: A comparative evaluation. Environmental Modelling & Software machines. Environmental Modelling & Software 73:175-188.

96. Matsumura, K., **C.F. Gaitan**, K. Sugimoto, A.J. Cannon and W.W. Hsieh, 2015. Maize yield forecasting by linear regression and artificial neural networks in Jilin, China. The Journal of Agricultural Science, Cambridge, 153:399-410.

95. **Gaitan, C.F.,** W.W. Hsieh and A.J. Cannon, 2014. Comparison of statistically downscaled precipitation in terms of future climate indices and daily variability for southern Ontario and Quebec, Canada. Climate Dynamics 43:3201-3217.

94. **Gaitan, C.F.**, W.W. Hsieh, A.J. Cannon and P. Gachon, 2013. Evaluation of linear and non-linear downscaling methods in terms of daily variability and climate indices: surface temperature in Ontario and Quebec, Canada. Atmosphere-Ocean 52:211-221, doi: 10.1080/07055900.2013.857639

93. **Lima, A.R.**, A.J. Cannon and W.W. Hsieh, 2013. Nonlinear regression in environmental sciences by support vector machines combined with evolutionary strategy. Computers & Geosciences, 50:136-144. http://dx.doi.org/10.1016/j.cageo.2012.06.023.

92. Finnis, J., W.W. Hsieh, H. Lin and W. Merryfield, 2012. Nonlinear post-processing of numerical seasonal climate forecasts. Atmos.-Ocean, 50:207-218. DOI:10.1080/07055900.2012.667388.

91* **Rasouli, K.,** W.W. Hsieh and A.J. Cannon, 2012. Daily streamflow forecasting by machine learning methods with weather and climate inputs. J. Hydrology, 414-415: 284-293. doi:10.1016/j.jhydrol.2011.10.039.

90. Jenkner, J., W.W. Hsieh and A.J. Cannon, 2011. Nonlinear seasonal modulations of the active MJO cycle. Mon. Wea. Rev., 139:2259-2275. doi: 10.1175/2010MWR3562.1

89. Zeng, Z., W.W. Hsieh, W.R. Burrows, A. Giles and A. Shabbar, 2011. Surface wind speed prediction in the Canadian Arctic using nonlinear machine learning methods. Atmos.-Ocean, 49(1): 22-31, DOI:10.1080/07055900.2010.549102.

88. Zeng, Z., W.W. Hsieh, A. Shabbar and W.R. Burrows, 2011. Seasonal prediction of winter extreme precipitation over Canada by support vector regression. Hydrol. Earth Syst. Sci., 15:65-74, doi:10.5194/hess-15-65-2011

87. **Choi, J.,** S.-I. An, B. Dewitte and W.W. Hsieh, 2009. Interactive feedback between the tropical Pacific Decadel Oscillation and ENSO in a coupled general circulation model. J. Climate 22:6597-6611.

86. **Aguilar-Martinez, S**. and W.W. Hsieh, 2009. Forecasts of tropical Pacific sea surface temperatures by neural networks and support vector regression. Int. J. Oceanography, vol. 2009, Article ID 167239, 13 pages. doi:10.1155/2009/167239.

85. **Ye, Z**. and W.W. Hsieh, 2008. Enhancing predictability by increasing nonlinearity in ENSO and Lorenz systems. Nonlin. Processes in Geophys. 15:793-801.

84. **Ye, Z**. and W.W. Hsieh, 2008. ENSO and associated overturning circulations from enhanced greenhouse gases. J. Climate, 21:5745-5763.

83* **Cannon, A.J.** and W.W. Hsieh, 2008. Robust nonlinear canonical correlation analysis: application to seasonal climate forecasting. Nonlin. Processes in Geophys. 15: 221-232.

82. Wong, C.S., L. Xie, W.W. Hsieh, 2007. Variations in nutrients, carbon and other hydrographic parameters related to the 1976-77 and 1988-89 regime shifts in the sub-arctic northeast Pacific. Prog. Oceanogr. 75: 326-342. doi:10.1016/j.pocean.2007.08.002

81* Hsieh, W.W., 2007. Nonlinear principal component analysis of noisy data. Neural Networks 20: 434-443. DOI 10.1016/j.neunet.2007.04.018.

80. Wu, A., W.W. Hsieh, G.J. Boer and F.W. Zwiers, 2007. Changes in the Arctic Oscillation under increased atmospheric greenhouse gases. Geophys. Res. Lett. 34, L12701, doi:10.1029/2007GL029344.

79. An, S.-I., **Z. Ye** and W.W. Hsieh, 2006. Changes in the leading ENSO modes associated with the late 1970s climate shift: Role of surface zonal current. Geophys. Res. Lett. 33, L14609, doi:10.1029/2006GL026604.

78. **Laîné, A.,** W.W. Hsieh and H.J. Freeland, 2006. Forcing mechanisms controlling surface and subsurface temperature anomalies along Line-P, northeast Pacific Ocean. Atmos.-Ocean, 44: 163-176.

77. Hsieh, W.W., A. Wu and A. Shabbar, 2006. Nonlinear atmospheric teleconnections. Geophys. Res. Lett. 33, L07714, doi:10.1029/2005GL025471.

76. Wu, A., W.W. Hsieh and B. Tang, 2006. Neural network forecasts of the tropical Pacific sea surface temperatures. Neural Networks, 19: 145-154.

75. Wu, A., W.W. Hsieh, A. Shabbar, G.J. Boer and F.W. Zwiers, 2006. The nonlinear association between the Arctic Oscillation and North American winter climate. Clim. Dynam. 26:856-879. DOI: 10.1007/s00382-006-0118-8.

74. **Ye, Z.** and W.W. Hsieh, 2006. The influence of climate regime shift on ENSO. Clim. Dynam., 26:823-833. DOI: 10.1007/s00382-005-0105-5.

73. An, S.-I., W.W. Hsieh and F.-F. Jin, 2005. A nonlinear analysis of the ENSO cycle and its interdecadal changes. J. Climate, 18: 3229-3239.

72. Li, S., W.W. Hsieh and A. Wu, 2005. Hybrid coupled modeling of the tropical Pacific using neural networks. J. Geophys. Res. 110, C09024, 10.1029/2004JC002595.

71. Jamet, C. and W.W. Hsieh, 2005. The nonlinear atmospheric variability in the winter northeast Pacific associated with the Madden-Julian Oscillation. Geophys. Res. Lett. 32(13), L13820, DOI: 10.1029/2005GL023533.

70. **Rattan, S.S.P.,** B.G. Ruessink and W.W. Hsieh, 2005. Nonlinear complex principal component analysis of nearshore bathymetry. Nonlin. Processes in Geophys. 12: 661-670.

69. Wu, A., W.W. Hsieh and A. Shabbar, 2005. The nonlinear patterns of North American winter temperature and precipitation associated with ENSO. J. Climate 18: 1736-1752. doi: 10.1175/JCLI3372.1

68. **Rattan, S.S.P.** and W.W. Hsieh, 2005. Complex-valued neural networks for nonlinear complex principal component analysis. Neural Networks, 18: 61-69, doi:10.1016/j.neunet.2004.08.002.

67. **Rattan, S.S.P.** and W.W. Hsieh, 2004. Nonlinear complex principal component analyis of the tropical Pacific interannual wind variability. Geophys. Res. Lett. 31, no. 21, L21201, DOI:10.1029/2004GL020446.

66. Wu, A. and W.W. Hsieh, 2004. The nonlinear association between ENSO and the Euro-Atlantic winter sea level pressure. Clim. Dynam. 23: 859-868. DOI: 10.1007/s00382-004-0470-5.

65* Hsieh, W.W., 2004. Nonlinear multivariate and time series analysis by neural network methods. Reviews of Geophysics, 42, RG1003, doi:10.1029/2002RG000112.

64. Wu, A. and W.W. Hsieh, 2004. The nonlinear Northern Hemisphere atmospheric response to ENSO. Geophys. Res. Lett. 31, L02203, doi:10.1029/2003GL018885

63. Wu, A. and W.W. Hsieh, 2003. Nonlinear interdecadal changes of the El Nino-Southern Oscillation. Clim. Dynam. 21: 719-730. DOI 10.1007/s00382-003-0361-1.

62. **Newbigging, S.C.,** L.A. Mysak and W.W. Hsieh, 2003. Improvements to the Nonlinear Principal Component Analysis method, with applications to ENSO and QBO. Atmos.-Ocean, 41(4): 291-299.

61. Hsieh, W.W. and K. Hamilton, 2003. Nonlinear singular spectrum analysis of the tropical stratospheric wind. Q. J. R. Meteorol. Soc. 129: 2367-2382.

60. Wu, A., W.W. Hsieh, and F.W. Zwiers, 2003. Nonlinear modes of North American winter climate variability detected from a general circulation model. J. Climate 16(14): 2325-2339

59. **Yuval,** and W.W. Hsieh, 2003. An adaptive nonlinear MOS scheme for precipitation forecasts using neural networks. Weather and Forecasting, 18(2): 303-310.

58. **Tang, Y.** and W.W. Hsieh, 2003. Nonlinear modes of decadal and interannual variability of the subsurface thermal structure in the Pacific Ocean. J. Geophys. Res. 108(C3), DOI: 10.1029/2001JC001236.

57. Hsieh, W.W., **Yuval**, J. Li, A. Shabbar and S. Smith, 2003. Seasonal prediction with error estimation of Columbia River streamflow in British Columbia. J. Water Resour. Plng. and Mgmt. 129(2): 146-149.
56. **Tang, Y.** and W.W. Hsieh, 2003. ENSO simulation and prediction in a hybrid coupled model with data assimilation. J. Meteorol. Soc. Japan, 81:1-19.
55. Wu, A., W.W. Hsieh and A. Shabbar, 2002. Nonlinear characteristics of the surface air temperature over Canada. J. Geophys. Res. 107(D21), DOI: 10.1029/2001JD001090
54. **Yuval**, and W.W. Hsieh, 2002. The impact of time-averaging on the detectability of nonlinear empirical relations. Quart. J. Roy. Met. Soc. 128: 1609-1622.
53. Hamilton, K. and W.W. Hsieh, 2002. Representation of the QBO in the tropical stratospheric wind by nonlinear principal component analysis. J. Geophys. Res. 107(D15), DOI: 10.1029/2001JD001250
52. Wu, A. and W.W. Hsieh, 2002. Nonlinear canonical correlation analysis of the tropical Pacific wind stress and sea surface temperature. Clim. Dynam. 19: 713-722. DOI 10.1007/s00382-002-0262-8.
51* Hsieh, W.W. and A. Wu, 2002. Nonlinear multichannel singular spectrum analysis of the tropical Pacific climate variability using a neural network approach. J. Geophys. Res. 107(C7), DOI: 10.1029/2001JC000957.
50. **Tang, Y.** and W.W. Hsieh, 2002. Hybrid coupled models of the tropical Pacific -- ENSO prediction. Clim. Dynam. 19: 343-353.
49* Hsieh, W.W., 2001. Nonlinear principal component analysis by neural networks. Tellus 53A: 599-615.
48. Hsieh, W.W. and B. Tang, 2001. Interannual variability of accumulated snow in the Columbia basin, British Columbia. Water Resources Res. 37: 1753-1759.
47* Hsieh, W.W., 2001. Nonlinear canonical correlation analysis of the tropical Pacific climate variability using a neural network approach. J. Climate 14: 2528-2539.
46. Haigh, S.P., K.L. Denman and W.W. Hsieh, 2001. Simulation of the plankton ecosystem response to pre- and post-1976 forcing in an isopycnic model of the North Pacific. Can. J. Fish. Aquat. Sci. 58: 703-722.
45. **Tang, Y.** and W.W. Hsieh, 2001. Coupling neural networks to incomplete dynamical systems via variational data assimilation. Mon. Wea. Rev. 129: 818-834.
44. **Tang, Y.,** W.W. Hsieh, B. Tang and K. Haines, 2001. A neural network atmospheric model for hybrid coupled modelling. Climate Dynamics 17: 445-455.
43* Hsieh, W.W., 2000. Nonlinear canonical correlation analysis by neural networks. Neural Networks 13: 1095-1105.
42. Tang, B., W.W. Hsieh, A.H. Monahan, F.T. Tangang, 2000. Skill comparisons between neural networks and canonical correlation analysis in predicting the equatorial Pacific sea surface temperatures. J. Climate. 13: 287-293.
41. **Wu, J.Q.** and W.W. Hsieh, 1999. A modelling study of the 1976 climate regime shift in the North Pacific Ocean. Can. J. Fish. Aquat. Sci. 56: 2450-2462.
40. Hsieh, W.W., B. Tang, and E.R. Garnett, 1999. Teleconnections between Pacific sea surface temperatures and Canadian prairie wheat yield. Agricul. Forest Meterol. 96: 209-217.
39. **Monahan, A.H., F.T. Tangang** and W.W. Hsieh, 1999. A potential problem with extended EOF analysis of standing wave fields. Atmos.-Ocean. 37:241-254.
38. **Lu, J**. and W.W. Hsieh, 1998b. On determining initial conditions and parameters in a simple coupled atmosphere-ocean model by adjoint data assimilation. Tellus. 50A: 534-544.
37. **Lu, J**. and W.W. Hsieh, 1998a. Adjoint data assimilation in coupled atmosphere-ocean models: Determining initial conditions in a simple equatorial model. J. Met. Soc. Japan. 76: 737-748.
36. Hsieh, W.W. and B. Tang, 1998. Applying neural network models to prediction and data analysis in meteorology and oceanography. Bull. Amer. Met. Soc. 79:1855-1870.
35. **Tangang, F.T.,** B. Tang, **A.H. Monahan** and W.W. Hsieh, 1998. Forecasting ENSO events: a neural network-extended EOF approach. J. Climate. 11: 29-41.
34. **Tangang, F.T.,** W.W. Hsieh and B. Tang, 1998. Forecasting regional sea surface temperatures in the tropical Pacific by neural network models, with wind stress and sea level pressure as predictors. J. Geophys. Res. 103: 7511-7522.
33. Allen, S.E. and W.W. Hsieh, 1997. How does the El Niño generated coastal current propagate past the Mendocino escarpment? J. Geophys. Res. 102: 24,977-24,985
32. **Lu, J.** and W.W. Hsieh, 1997. Adjoint data assimilation in coupled atmosphere-ocean models-- Determining model parameters in a simple equatorial model. Q. J. R. Meteorol. Soc. 123: 2115-2139.

31. **Tangang, F.T.,** W.W. Hsieh and B. Tang, 1997. Forecasting the equatorial Pacific sea surface temperatures by neural network models. Clim. Dynam. 13: 135-147.
30. Hsieh, W.W. and K. Bryan, 1996. Redistribution of sea level rise associated with enhanced greenhouse warming: A simple model study. Clim. Dynam. 12: 535-544.
29. **Zou, J.,** W.W. Hsieh and I.M. Navon, 1995. Sequential open boundary control by data assimilation in a limited-area model. Mon. Wea. Rev. 123: 2899-2909.
28. Hsieh, W.W., D. Ware and R.E. Thomson, 1995. Wind-induced upwelling along the west coast of North America, 1899-1988. Can. J. Fish. Aquat. Sci. 52: 325-334..
27. Xie, L. and W.W. Hsieh, 1995. The global distribution of wind-induced upwelling. Fish. Oceanogr., 4: 52-67.
26. **Ng, M.K.F.** and W.W. Hsieh, 1994. The equatorial Kelvin wave in finite-difference models, J. Geophys. Res. 99 (C7). 14,173-14,185
25. **Fang. W.** and W.W. Hsieh, 1993. Summer sea surface temperature variability off Vancouver Island from satellite data. J. Geophys. Res. 98 (C8): 14391-14400.
24. Hsieh, W.W. and G.J. Boer, 1992. Global climate change and ocean upwelling. Fish. Oceanogr., 1: 333-338.
23. Lee, W.G., G. Holloway and W.W. Hsieh, 1992. Importance of bottom topography in the seasonal cycle of the North Pacific Subarctic Gyre. Atmos.-Ocean, 30: 140-145.
22. Hsieh, W.W. and B.V. Hamon, 1991. The El Niño-Southern Oscillation in south-eastern Australian waters. Aust. J. Mar. Freshw. Res., 42: 263-75.
21. Hsieh, W.W., W.G. Lee and L.A. Mysak, 1991. Using a numerical model of the Northeast Pacific Ocean to Study the interannual variability of the Fraser River sockeye salmon (Oncorhynchus nerka). Can. J. Fish. Aquat. Sci. 48: 623-630.
20. Xie, L., W.W. Hsieh and J.A. Helbig, 1990. A tidal model of Bohai. Cont. Shelf Res. 10: 707-721.
19. **Burgert, R.** and W.W. Hsieh, 1989. Spectral analysis of the AVHRR sea surface temperature variability off the west coast of Vancouver Island. Atmos.-Ocean, 27: 577-587.
18. Xie, L. and W.W. Hsieh, 1989. Predicting the return migration routes of the Fraser River sockeye salmon (Oncorhynchus nerka). Can. J. Fish. Aqua. Sci., 8: 1287-1292.
17. Buchwald, V.T. and W.W. Hsieh, 1988. Reply. J. Phys. Oceanogr., 18: 394-396.
16. Hsieh, W.W. 1987. A numerical study of the seasonal cycle in the northeast Pacific Ocean as driven by the windstress and surface heatflux. Atmosphere-Ocean, 25: 375-386.
15. **Weaver, A.J.** and W.W. Hsieh, 1987. The influence of buoyancy flux from estuaries on continental shelf circulation. J. Phys. Oceanogr., 17: 2127-2140.
14. Middleton, J.H., **M.L. Cahill** and W.W. Hsieh, 1987. Edge waves on the Sydney coast. J. Geophys. Res., 92(C9):9487-9493.
13. Hsieh, W.W. 1986. Comments on "Rotary empirical orthogonal function analysis of currents near the Oregon coast". J. Phys. Oceanogr. 16: 791-792.
12. Hsieh, W.W. and V.T. Buchwald, 1985. The scattering of a continental shelf wave by a long thin barrier lying parallel to the coast. J. Phys. Oceanogr., 15: 524-532.
11. Hsieh, W.W. 1985. Modal bias in sea level and sea surface temperature, with applications to remote-sensing. J. Phys. Oceanogr., 15: 351-356.
10. Hsieh, W.W. and V.T. Buchwald, 1984. The scattering of a continental shelf wave by a semi-infinite barrier located along the outer edge of a step shelf. Geophys. and Astrophys. Fluid Dyn. 28: 257-276.
9. Hsieh, W.W. and A.E. Gill, 1984. The Rossby adjustment problem in a rotating stratified channel, with and without topography. J. Phys. Oceanogr., 14: 424-437.
8. Davey, M.K., W.W. Hsieh and **R.C. Wajsowicz**, 1983. The free Kelvin with lateral and vertical viscosity. J. Phys. Oceanogr., 13: 2182-2191.
7* Hsieh, W.W., M.K. Davey and **R.C. Wajsowicz**, 1983. The free Kelvin wave in finite-difference numerical models. J. Phys. Oceanogr., 13: 1383-1397.
6. Parsons, T.R., R.I. Perry, E.D. Brown, W. Hsieh and C.M. Lalli, 1983. Frontal zone analysis at the mouth of Saanich Inlet, British Columbia Canada. Marine Biol., 73: 1-5.
5. Mysak, L.A., W.W. Hsieh and T.R. Parsons, 1982. On the relationship between interannual baroclinic waves and fish populations in the Northeast Pacific. Biol. Oceanogr., 2: 63-102.
4. Hsieh, W.W. 1982. Observations of continental shelf waves off Oregon and Washington. J. Phys. Oceanogr., 12: 887-896.
3. Hsieh, W.W. 1982. On the detection of continental shelf waves. J. Phys. Oceanogr., 12: 414-427.

2. Mysak, L.A., E.R. Johnson and W.W. Hsieh, 1981. Baroclinic and barotropic instabilities of coastal currents. J. Phys. Oceanogr., 11: 209-230.
1. Hsieh, W.W. and L.A. Mysak, 1980 Resonant interactions between shelf waves, with applications to the Oregon shelf. J. Phys. Oceanogr., 10: 1729-1741.

(b) Conference Proceedings

8. **Zhu, L.**, J. Jin, A.J. Cannon, W.W. Hsieh, 2016. Bayesian neural networks based bootstrap aggregating for tropical cyclone tracks prediction in South China Sea. 23rd International Conference on Neural Information Processing. Kyoto. 8 pp.
7. **Cai, S.,** W.W. Hsieh and A.J. Cannon, 2008. A comparison of Bayesian and conditional density models in probabilistic ozone forecasting. IEEE International Joint Conference on Neural Networks (IJCNN), Hong Kong. pp. 2310-2314, DOI: 10.1109/IJCNN.2008.4634117.
6. Hsieh, W.W., 2006. Nonlinear principal component analysis of noisy data. IEEE International Joint Conference on Neural Networks (IJCNN), Vancouver, B.C., pp. 4582-4586, DOI: 10.1109/IJCNN.2006.1716735.
5. **Rattan, S.S.P.,** W.W. Hsieh, and B.G. Ruessink, 2005. Nonlinear complex principal component analysis and its applications. International Joint Conference on Neural Networks (IJCNN), Montreal. pp. 1626-1629.
4. **Lu, B.** and W. W. Hsieh, 2003 Simplified nonlinear principal component analysis. Int. Joint Conf. Neural Networks, 20-24 July, 2003, Portland, Oregon.
3. Hsieh, W. W. and A. Wu, 2002. Nonlinear singular spectrum analysis. Int. Joint Conf. Neural Networks, 12-17 May, 2002, Honolulu, Hawaii.
2. Tang, B., W. Hsieh and **F. Tangang,** 1996. "Clearning" neural networks with continuity constraint for prediction of noisy time series. Proceedings of International Conference on Neural Information Processing 1996, Hong Kong. 2: 722-725.
1. Hsieh, W.W. and W.G. Lee, 1989. A numerical model for the variability of the northeast Pacific Ocean, p.247-254. In R.J. Beamish and G.A. McFarlane (ed.). Effects of ocean variability on recruitment and an evaluation of parameters used in stock assessment models. Can. Spec. Publ. Fish. Aquat. Sci. 108.

2. NON-REFEREED PUBLICATIONS

(a) Journals

(b) Conference Proceedings

13. **Rasouli, K.,** W.W. Hsieh, and A.J. Cannon, 2010. Short lead-time streamflow forecasting by machine learning methods, with climate variability incorporated. ASCE Conf. Proc. 371, 468, doi: 10.1061/41114(371)468. (World Environmental and Water Resources Congress, Providence, Rhode Is., 16-20 May, 2010).
12. **Lu, B**. and W.W. Hsieh, 2003 Simplified nonlinear principal component analysis. 83rd Amer.Met.Soc. annual meeting. Long Beach, California.
11. Wu, A. and W.W. Hsieh, 2003. The nonlinear ENSO mode and its interdecadal changes. 83rd Amer.Met.Soc. annual meeting. Long Beach, California.
10. **Monahan, A.H.,** W.W. Hsieh and B.Tang, 1999. Nonlinear principal component analysis and ENSO. Second Hayes Symp. on seasonal to interannual climate variability. 79th Amer.Met.Soc. annual meeting. Dallas, Texas, 103-104.
9. Hsieh, W.W., B.Tang and **A.H. Monahan**, 1999. Neural network prediction of the tropical pacific sea surface temperatures. Second Hayes Symp. on seasonal to interannual climate variability. 79th Amer.Met.Soc. annual meeting. Dallas, Texas, 101-102.
8. Tang, B. and W.W. Hsieh, 1998. Teleconnection between Pacific SST and the climate of Vancouver, B.C. Proc. 23rd Annual Climate Diagnostics and Prediction Workshop. Miami, Florida. NOAA, 147-150.

7. Hsieh, W.W., **A.H. Monahan** and B. Tang, 1998. Neural networks for data analysis and prediction. Proc. 23rd Annual Climate Diagnostics and Prediction Workshop. Miami, Florida. NOAA, 139-142.
6. Hsieh, W.W. and B. Tang, 1998. Neural networks for short-term climate prediciton. First Conf. on Artificial Intelligence. 78th Amer.Met.Soc. annual meeting. Phoenix, Arizona. 64-65.
5. Tang, B., W.W. Hsieh and **F.T. Tangang**, 1998. Bagging neural networks for time series predictions. First Conf. on Artificial Intelligence. 78th Amer.Met.Soc. annual meeting. Phoenix, Arizona. 59-60.
4. **Lu, J.** and W.W. Hsieh, 1998. Adjoint data assimilation in coupled atmosphere-ocean models--determining model initial conditions in a simple equatorial model. Ninth Conf. on Interaction of the Sea and Atmosphere. 78th Amer.Met.Soc. annual meeting. Phoenix, Arizona. 103-104.
3. **Tangang, F.T., A.H. Monahan**, B. Tang, W.W. Hsieh, 1998. Forecasting the tropical Pacific sea surface temperature field by neural network models. Ninth Conf. on Interaction of the Sea and Atmosphere. 78th Amer.Met.Soc. annual meeting. Phoenix, Arizona. 81-84.
2. Hsieh, W.W., 1997. Neural networks for short-term climate prediction. Proc. of the Long-range Weather and Crop Forecasting Work Group Meeting III. Dorval, Quebec. 5-9.
1. **Zou, J.** and W.W. Hsieh, 1991 Persistence of non-modal disturbances and supercritical bifurcation. 8th Conference on Atmospheric and Oceanic Waves and Instability, Oct. 14-18, 1991. Denver, Colorado, pp.233-236.

(c) Other

54. Hsieh, W.W., 2015. El Niño is back! CMOS Bulletin SCMO, Vol.43, No.5, October 2015, pp.161-162.
53. Hsieh, W.W., 2014. Teaching via online video lectures -- a new paradigm? CMOS Bulletin SCMO, Vol.42, No.2, April 2014, pp.60-61.
52. Hsieh, W.W. 2012. Ocean and Climate Dynamics—a Tribute to Professor Lawrence A. Mysak. Atmosphere-Ocean, 50: 123-126. http://dx.doi.org/10.1080/07055900.2012.676753
51. Hsieh, W.W., A. Wu and B. Tang, 2006. Did the current El Niño arrive as a surprise? CMOS Bulletin, 34(6): 201-202.
50. Hsieh, W.W. 2004. Review of: The Sea's Enthrall: Memoirs of an Oceanographer. CMOS Bulletin 32(5): 151.
49. Tang, Y., W.W. Hsieh, 2004. Neural-dynamical hybrid coupled model forecasts of the tropical Pacific sea surface temperatures. Experimental Long-lead Forecast Bulletin. 13(2): 4.
48. Wu, A. and W.W. Hsieh, 2003. Forecasting the tropical Pacific sea surface temperatures by nonlinear canonical correlation analysis. Experimental Long-lead Forecast Bulletin. 12(1-2): 94-96.
47. Tang, Y., W.W. Hsieh, 2003. Neural-dynamical hybrid coupled model forecasts of the tropical Pacific sea surface temperatures. Experimental Long-lead Forecast Bulletin. 12(1-2): 85-86.
46. Wu, A. and W.W. Hsieh, 2003. Forecasting the tropical Pacific sea surface temperatures by nonlinear canonical correlation analysis. Experimental Long-lead Forecast Bulletin. 12(1-2): 28-30.
45. Tang, Y., W.W. Hsieh, 2003. Neural-dynamical hybrid coupled model forecasts of the tropical Pacific sea surface temperatures. Experimental Long-lead Forecast Bulletin. 12(1-2): 8-9.
44. Tang, B., W. Hsieh and F. Tangang, 2002. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 11(3-4): 108.
43. Wu, A. and W.W. Hsieh, 2002. Forecasting the tropical Pacific sea surface temperatures by nonlinear canonical correlation analysis. Experimental Long-lead Forecast Bulletin. 11(3-4): 106-107.
42. Tang, Y., W.W. Hsieh, 2002. Neural-dynamical hybrid coupled model forecasts of the tropical Pacific sea surface temperatures. Experimental Long-lead Forecast Bulletin. 11(3-4): 86-87.
41. Wu, A. and W.W. Hsieh, 2002. Forecasting the tropical Pacific sea surface temperatures by nonlinear canonical correlation analysis. Experimental Long-lead Forecast Bulletin. 11(3-4):34-36.
40. Tang, B., W. Hsieh and F. Tangang, 2002. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 11(3-4): 25.
39. Tang, Y., W.W. Hsieh, 2002. Neural-dynamical hybrid coupled model forecasts of the tropical Pacific sea surface temperatures. Experimental Long-lead Forecast Bulletin. 11(3-4): 17-18.
38. Wu, A. and W.W. Hsieh, 2002. Forecasting the tropical Pacific sea surface temperatures by nonlinear canonical correlation analysis. Experimental Long-lead Forecast Bulletin. 11(2):43-44.
37. Tang, B., W. Hsieh and F. Tangang, 2002. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 11(2): 42.

36. Tang, Y., W.W. Hsieh, 2002. Neural-dynamical hybrid coupled model forecasts of the tropical Pacific sea surface temperatures. Experimental Long-lead Forecast Bulletin. 11(2): 10.
35. Tang, B., W. Hsieh and F. Tangang, 2002. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 11(1): 36.
34. Wu, A. and W.W. Hsieh, 2002. Forecasting the tropical Pacific sea surface temperatures by nonlinear canonical correlation analysis. Experimental Long-lead Forecast Bulletin. 11(1):30-31.
33. Tang, Y., W.W. Hsieh, 2002. Neural-dynamical hybrid coupled model forecasts of the tropical Pacific sea surface temperatures. Experimental Long-lead Forecast Bulletin. 11(1): 21-23.
32. Tang, B., W. Hsieh and F. Tangang, 2001. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 10(4): 26.
31. Wu, A. and W.W. Hsieh, 2001. Forecasting the tropical Pacific sea surface temperatures by nonlinear canonical correlation analysis. Experimental Long-lead Forecast Bulletin. 10(4): 20-22.
30. Tang, Y., W.W. Hsieh, 2001. Neural-dynamical hybrid coupled model forecasts of the tropical Pacific sea surface temperatures. Experimental Long-lead Forecast Bulletin. 10(4): 4-6.
29. Tang, B., W. Hsieh and F. Tangang, 2001. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 10(3): 39.
28. Wu, A. and W.W. Hsieh, 2001. Forecasting the tropical Pacific sea surface temperatures by nonlinear canonical correlation analysis. Experimental Long-lead Forecast Bulletin. 10(3): 23-25.
27. Tang, B., W. Hsieh and F. Tangang, 2001. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 10(2): 39.
26. Tang, Y., W.W. Hsieh, 2001. Neural-dynamical hybrid coupled model forecasts of the tropical Pacific sea surface temperatures. Experimental Long-lead Forecast Bulletin. 10(2): 10-12.
25. Tang, B., W. Hsieh and F. Tangang, 2001. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 10(1): 42.
24. Tang, Y., W.W. Hsieh, 2001. Neural-dynamical hybrid coupled model forecasts of the tropical Pacific sea surface temperatures. Experimental Long-lead Forecast Bulletin. 10(1): 1-4.
23. Tang, B., W. Hsieh and F. Tangang, 2000. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 9(4): 51.
22. Tang, B., W. Hsieh and F. Tangang, 2000. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 9(3): 30.
21. Tang, B., W. Hsieh and F. Tangang, 2000. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 9(2): 30.
20. Tang, B., W. Hsieh and F. Tangang, 2000. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 9(1): 35.
19. Tang, B., W. Hsieh and F. Tangang, 1999. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 8(4): 37.
18. Tang, B., W. Hsieh and F. Tangang, 1999. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 8(3): 39-40.
17. Tang, B., W. Hsieh and F. Tangang, 1999. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 8(2): 37.
16. Tang, B., W. Hsieh and F. Tangang, 1999. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 8(1): 45.
15. Tang, B., W. Hsieh and F. Tangang, 1998. Neural network model forecasts of the NINO 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 7(4): 44-46.
14. Tang, B., W. Hsieh and F. Tangang, 1998. Neural network model forecasts of the Nino 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 7(3): 50-52.
13. Tang, B., W. Hsieh and F. Tangang, 1998. Neural network model forecasts of the Nino 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 7(2): 47-49.
12. Tang, B., W. Hsieh and F. Tangang, 1998. Neural network model forecasts of the Nino 3.4 sea surface temperature. Experimental Long-lead Forecast Bulletin. 7(1): 49-51.
11. Tang, B., W. Hsieh and F. Tangang, 1997. Forecasts of Niño 3.4 SST using neural network models. Experimental Long-lead Forecast Bulletin. 6(2): 61-62.
10. Tang, B., W. Hsieh and F. Tangang, 1997. Forecasts of Niño 3.4 SST using neural network models. Experimental Long-lead Forecast Bulletin. 6(1): 47-49.
9. Tang, B., W. Hsieh and F. Tangang, 1996. Forecasts of Niño 3.5 SST using a pruned data assimilating neural network model. Experimental Long-lead Forecast Bulletin. 5(4): 44-46.

8. Tang, B., W. Hsieh and F. Tangang, 1996. Forecasts of Niño 3 SST using a data assimilating neural network model. Experimental Long-lead Forecast Bulletin. 5(3): 32-33.
7. Tang, B., W. Hsieh and F. Tangang, 1996. Forecasts of Niño 3 SST using a data assimilating neural network model. Experimental Long-lead Forecast Bulletin. 5(2): 47-48.
6. Tang, B., W. Hsieh and F. Tangang, 1996. Forecasts of tropical Pacific SST using a data assimilating neural network model. Experimental Long-lead Forecast Bulletin. 5(1): 24-26.
5. Zou, J. and W. W. Hsieh, 1994. Sequential open boundary control by data assimilation in a limited-area model. Tech. Rep. No. 94-11, Inst. of Applied Math., Univ. British Columbia, 31 pp.
4. Zou, J. and W. W. Hsieh, 1994. On finite amplitude nonmodal disturbances. Part I: Relative intensity of modal to nonmodal disturbance growth. Tech. Rep. No. 94-2, Inst. of Applied Math., Univ. British Columbia, 55 pp.
3. Xie, L. and W.W. Hsieh, 1991. Upwelling winds along the west coast of North America, 1899-1988. Manuscript Rep. No. 58, Dept. of Oceanography, Univ. of Brit. Columbia.
2. Hsieh, W.W. and W.G. Lee, 1990. A numerical hindcast of the interannual variability in the northeast Pacific Ocean, 1955-1979. Tech. Rep. 90-6, Inst. of Applied Math., Univ. Brit. Col. 42 pp.
1. Hsieh, W.W. and B.V. Hamon, 1985. Manifestations of the El Nino Southern Oscillation in southeastern Australian waters. Tropical Ocean-Atmosphere Newsletter, no. 30: 7.

3. BOOKS

(a) Authored

1* Hsieh, W. W., 2009. Machine Learning Methods in the Environmental Sciences: Neural Networks and Kernels. Cambridge University Press, Cambridge. 349 pp.

(b) Chapters

2. Hsieh, W. W., 2009. Nonlinear principal component analysis. In S.E. Haupt, A. Pasini and C. Marzban, (eds.). Artificial Intelligence Methods in the Environmental Sciences, pp. 173-190. Springer.
1. Hsieh, W. W. and A. J. Cannon, 2008. Towards robust nonlinear multivariate analysis by neural network methods. In Donner, R. and Barbosa, S. (eds.), Nonlinear Time Series Analysis in the Geosciences -- Applications in Climatology, Geodynamics, and Solar-Terrestrial Physics, pp.97-124. Springer.

4. WORK SUBMITTED

THESES SUPERVISED:

28. Snauffer, A.M. 2017. Machine Learning Estimation of Snow Water Equivalent over British Columbia. Ph.D. thesis, Univ. of British Columbia, 113 pp. (co-supervisor: Alex Cannon).
27. Lima, A.R. 2016. Short-term hydro-meteorological forecasting with extreme learning machines. Ph.D. thesis, Univ. of British Columbia, 160 pp. (co-supervisor: Alex Cannon)
26. Peng, H. 2015. Air Quality Prediction by Machine Learning Methods. M.Sc. thesis, Univ. of British Columbia, 95 pp. (co-supervisor: Alex Cannon)
25. Johnson, M.J. 2013. Crop yield forecasting on the Canadian Prairies by satellite data and machine learning methods. M.Sc. thesis, Univ. of British Columbia, 61 pp. (co-supervisor: Alex Cannon)
24. Gaitan Ospina, C.F. 2013. Comparison of linearly and nonlinearly statistically downscaled atmospheric variables in terms of future climate indices and daily variability. Ph.D. thesis, Univ. of British Columbia, 177 pp. (co-supervisor: Alex Cannon)
23. Rasouli, K., 2010. Short lead-time streamflow forecasting by machine learning methods, with climate variability incorporated. M.Sc. thesis, Univ. of British Columbia, 63 pp. (co-supervisor: Alex Cannon)

22. Aguilar-Martinez, Silvestre, 2008. Forecasts of tropical Pacific sea surface temperatures by neural networks and support vector regression. M.Sc. thesis, Univ. of British Columbia, 82 pp.
21. Cannon, Alex J., 2008. Multivariate statistical models for seasonal climate prediction and climate downscaling. Ph.D. thesis, Univ. of British Columbia, 141 pp.
20. Wang, Qiang, 2007. Seasonality in the response of sea ice and upwelling to wind forcing in the southern Beaufort Sea. M.Sc. thesis, Univ. of British Columbia, 90 pp. (co-supervisor: Grant Ingram)
19. Ye, Zhengqing, 2007. Changes in the El Niño-Southern Oscillation under climate regime shift and increased greenhouse gases. Ph.D. thesis, Univ. of British Columbia, 155 pp.
18. Laine, Alexandre, 2004. Forcing mechanisms controlling surface and subsurface temperature anomalies along line-P, northeast Pacific Ocean. M.Sc. thesis, Univ. of British Columbia, 80 pp.
17. Rattan, Sanjay, 2004. Nonlinear complex principal component analysis: Applications to tropical Pacific wind velocity anomalies. M.Sc. thesis, Univ. of British Columbia, 58 pp.
16. Tang, Youmin, 2001. ENSO simulation and prediction using hybrid coupled models with data assimilation. Ph.D. thesis, Univ. of British Columbia, 193 pp.
15. Zudman, Yuval, 2001. Strategies for implementing neural networks in ocean and atmosphere studies. Ph.D. thesis, Univ. of British Columbia, 171 pp.
14. Monahan, A.H., 2000. Nonlinear principal component analysis of climate data . Ph.D. thesis, Univ. of British Columbia, 159 pp. (co-supervisor: Lionel Pandolfo)
13. Wu, Q., 1998. A modelling study of the 1976 climate regime shift in the North Pacific Ocean. M.Sc. thesis, Univ. of British Columbia, 92 pp.
12. Lu, J., 1997. Adjoint data assimilation in an equatorial coupled atmosphere-ocean model. Ph.D. thesis, Univ. British Columbia, 134 pp.
11. Tangang, F.T., 1997. Forecasting El Niño-Southern Oscillation (ENSO) events: a neural network approach. Ph.D. thesis, Univ. British Columbia, 154 pp.
10. Hoey, J., 1994. Use of a vessel-mounted acoustic Doppler current profiler to study currents and zooplankton biomass distribution over the Vancouver Island continental margin. M.Sc. thesis, Univ. British Columbia, 203 pp. (co-supervisor: R.E. Thomson)
9. Bailey, D.A., 1993. Adjoint data assimilation in an open ocean barotropic quasi-geostrophic model. M.Sc. thesis, Univ. British Columbia, 51 pp.
8. Fang, W., 1993. Summer sea surface temperature variability off Vancouver Island from satellite data, 1984-91. M.Sc. thesis, Univ. British Columbia, 72 pp.
7. Matear, R. J., 1993. Understanding the CO_2 cycle in the North Pacific Ocean using inverse box models. Ph.D. thesis, Univ. Brit. Columbia, 204 pp. (co-supervisor: C.S. Wong)
6. Staples, G., 1993. Satellite AVHRR Observations of the Intensification of the Shelf Break Current during an Upwelling Event off Vancouver Island. M.Sc. thesis, Univ. British Columbia, 120 pp.
5. Weaver, A.T., 1990. On assimilating sea surface temperature data into an ocean general circulation model. M.Sc. thesis. Univ. of British Columbia., 95 pp.
4. Zou, J., 1991. Nonlinear stability and statistical equilibrium of forced and dissipated flow. Ph.D. thesis. Univ. of Brit. Col., 180 pp.
3. Bermejo, R., 1990. Analysis of a Galerkin-characteristic algorithm for the potential vorticity-stream function equations. Ph.D. thesis. Univ. of British Columbia, 137 pp.
2. terHart, B.A., 1990. The physical oceanography of British Columbia's Inside Passage with respect to the return migration of Oncorhynchus nerka. M.Sc. thesis. Univ. of British Columbia, 151 pp.
1. Matear, R.J., 1989. Circulation of the northeast Pacific Ocean inferred from temperature and salinity data. M.Sc. thesis. Univ. of British Columbia. 121 pp. (co-supervisor: G.A.McBean)

Refereed journal publications by my students from their thesis research:

13. Cannon, A.J., 2009. Negative ridge regression parameters for improving the covariance structure of multivariate linear downscaling models. International Journal of Climatology, 29:761-769, doi:10.1002/joc.1737.
12. Cannon, A.J., 2008. Probabilistic multi-site precipitation downscaling by an expanded Bernoulli-gamma density network. Journal of Hydrometeorology, 9(6):1284-1300, doi:10.1175%2F2008JHM960.1
11. Cannon, A.J., 2007. Nonlinear analog predictor analysis: a coupled neural network/analog model for climate downscaling. Neural Networks, 20(4): 444-453.

10. Cannon, A.J., 2006. Nonlinear principal predictor analysis: application to the Lorenz system. Journal of Climate 19(4): 579-589.
9. Tang, Y., 2002 Hybrid coupled models of the tropical Pacific -- Interannual variability. Clim. Dynam. 19: 331-342.
8. Yuval, 2001. Enhancement and error estimation of neural network prediction of Nino 3.4 SST anomalies. J. Climate. 14: 2150-2163.
7. Monahan, A.H., 2001. Nonlinear principal component analysis by neural networks: Tropical Indo-Pacific sea surface temperature and sea level pressure. J. Climate 14: 219-233..
6. Yuval, 2000. Neural network training for prediction of climatological time series; regularized by minimization of the Generalized Cross Validation function. Mon.Wea.Rev. 128: 1456-1473.
5. Monahan, A.H., 2000. Nonlinear principal component analysis by neural networks: Theory and application to the Lorenz system. J. Climate. 13: 821-835, 2000.
4. Matear, R.J., 1993. Circulation of the Ocean Storms area, located in the northeast Pacific Ocean, determined by inverse methods. J. Phys. Oceanogr., 23:648-658.
3. Bermejo, R., 1991. Analysis of an algorithm for Galerkin characteristic method. Numerisch Mathematik. 60: 163-194.
2. Bermejo, R., 1990. On the equivalence of semi-Lagrangian schemes and particle-in-cell finite-element methods. Mon. Wea. Rev. 118: 978-987.
1. Bermejo, R., 1990. A finite element model of a two-layer ocean. Int. J. Numer. Meth. Eng. 29: 665-678.

Teaching:

Postgraduate and undergraduate courses in Physical Oceanography and Atmospheric Science (dynamic oceanography, satellite oceanography, dynamic meteorology, geophysical fluid dynamics, climate system, natural disasters)

Postgraduate course in statistical/machine learning methods, including an online version: http://www.ocgy.ubc.ca/~william/EOSC510/index.html

Undergraduate courses in Physics.

Session	Course Number	Scheduled Hours/wk	Class Size	Hours Taught Lectures	Tutorials	Labs	Other (Office Hrs)
1985-86	PHYS 421	2	64	26			
1986-87	PHYS 421	2	32	26			
1986-87	OCGY 514	2	5	48			
1986-87	OCGY 516	2	4	24			
1987-88	PHYS 421	3	28	39			
1987-88	OCGY 514	2	4	48			
1987-88	OCGY 510		3		18		
1987-88	OCGY 449		1				12
1988-89	OCGY 514	2	7	48			
1988-89	ATSC/OCGY 414	3	9	39			

1988-89	OCGY 516	2	7	24			
1988-89	OCGY 505A		1				12
1989S	OCGY 448		1				
1989-90	OCGY 514	2	4	48			
1989-90	ATSC/OCGY 414	3	18	39			
1989-90	OCGY 526	3	9	18			
1990-91	ATSC/OCGY 414	3	14	39			
1990-91	OCGY 516	2	5	24			
1990-91	PHYS 312	3	29	39			
1990-91	PHYS 153	1	48		12		
1991-92	ATSC/OCGY 414	3	14	39			
1991-92	OCGY 526	3	9	18			
1991-92	PHYS 312	3	34	39			
1991-92	PHYS 153	1 (2 sect.)	48		24		
1993-94	ATSC/OCGY 414	3	21	39			
1993-94	OCGY 308	3	177	35			
1993-94	OCGY 526	3	11	18			
1993-94	PHYS 306	3	20	39			
1993-94	PHYS 349B		1				12
1993-94	PHYS 449		1				12

1994-95	ATSC/OCGY 414	3	10	39			
1994-95	OCGY 308	3	268	35			
1994-95	PHYS 306	3	17	39			
1995-96	OCGY 308	3	254	35			
1995-96	OCGY 449		1				12
1995-96	OCGY 526	3	9	18			
1995-96	PHYS 153	3 (2 sect.)	46, 48			72	
1995-96	PHYS 102	1 (4 sect.)	40,40,40,40		48		
1996-97	OCGY 308	3	244	35			
1996-97	OCGY 405	3	16	39			
1996-97	PHYS 314	3	18	39			
1996-97	PHYS 102	1 (3 sect.)	40, 54, 51		36		
1996-97	PHYS 449		1				12

1997-98	OCGY 308	3	225	35			
1997-98	PHYS 314	3	10	39			
1997-98	OCGY 526	3	6	18			
1997-98	PHYS 102	1 (3 sect.)	40, 40, 40		36		
1997-98	PHYS 449		1				12
1998-99	OCGY 308	3	268	33			
1998-99	PHYS 314	3	24	39			
1998-99	OCGY 505A	2	8	24			
1998-99	PHYS 170	1 (2 sect.)	40, 40		24		
1998-99	PHYS 449		1				12
1998-99	OCGY 449		1				3
1999-00	OCGY 308	3	281	33			
1999-00	PHYS 314	3	27	39			
1999-00	EOSC 502	3	8	35			
1999-00	OCGY 449		1				12
2001-02	EOSC 510	3	13	36			
2001-02	EOSC 114	3 (3 sect.)	132,244,63	15			
2001-02	EOSC 112	3	80	5			
2001-02	EOSC 314	3	289	9			
2001-02	PHYS 314	3	21	36			
2002-03	EOSC 510	3	6	36			
2002-03	EOSC 114	3 (3 sect.)	149,177,244	16			
2002-03	EOSC 112	3	133	17			
2002-03	PHYS 314	3	20	36			
2003-04	ATSC 404	3	17	27			
2003-04	EOSC 112	3 (2 sect.)	75, 82	19, 20			
2003-04	PHYS 314	3	32	39			
2004-05	EOSC 112	3	80	19			
2004-05	EOSC 114	3	211	5			
2004-05	EOSC 510	3	6	36			
2004-05	PHYS 100	1 (2 sect.)	44, 44		24		
2004-05	PHYS 314	3	35	37			
2004-05	PHYS 349		1				6

2005-06	ATSC 404	3	22	37			
2005-06	EOSC 112	3	109	19			
2005-06	PHYS 170	1	53		11		
2005-06	PHYS 314	3	28	36			
2005-06	PHYS 449		1				6
2006-07	PHYS 170	2	~53x2		22		
2006-07	PHYS 314	3	19	36			
2006-07	EOSC 510	3	8	39			
2006-07	ATSC 414/EOSC 477	3	12	26			
2008-09	PHYS 314	3	27	37			
2008-09	EOSC 510	3	9	36			
2008-09	EOSC 112	3	155	20			
2009-10	PHYS 314	3	21	36			
2009-10	ATSC 404	3	17	39			
2009-10	EOSC 112	3	171	19			
2010-11	EOSC 510	1.5	5	20			
2011-12	EOSC 510	3	6	36			
2013-14	EOSC 510	3	12	38 (online)			