

Biographical Sketch – Dr. Dale Melvyn Barker

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a. Education:

1984-1987: B.Sc. (Single Hons.) in Astronomy and Astrophysics, University Of Newcastle, UK.

1987-1990: PhD in Numerical Magnetohydrodynamics, Astronomy Centre, Sussex University, UK. Thesis titled “Studies in the Magnetohydrodynamics of Star Formation and of Stellar Coronae”.

1991-1993: Postdoctoral researcher in Numerical Magnetohydrodynamics, Mathematics Dept., Manchester University, UK.

b. Appointments:

2006-Present: NCAR Program Manager. Roles include: a) Lead scientist for NCAR’s Air Force Data Assimilation Program, b) Director of NCAR’s Data Assimilation Testbed Center (DATC), and c) Lead scientist for WRF’s variational data assimilation system (WRF-Var). Research interests include: a) Advanced data assimilation techniques (Four-Dimensional Variational Data Assimilation, Ensemble Filters, hybrids), b) Polar data assimilation, and c) Forecast error covariance estimation.

1999-2006: Project Scientist in Mesoscale and Meteorology Division of NCAR, focussing on data assimilation research and development associated with the MM5 and WRF models.

1993-1999: Higher/Senior Scientist Officer in NWP Division of the UK Meteorological Office. Experience includes: a) Research/development leading to the operational implementation of 3D-Var for the Met. Office's "Unified Model", b) The use of neural networks for diagnosing the origins of forecast error, c) Observation impact via Observation System Experiments (OSEs), d) Ensemble prediction systems, e) The imposition of balance and flow-dependent error covariances in variational data assimilation.

c. Education/Outreach/Community Service:

- Member of WMO/WWRP’s Mesoscale Weather Forecasting Research Working Group.
- Advisor for MSc and PhD students (Leicester, Colorado Universities).
- Director Of International Summer School for the Atmospheric and Oceanic Sciences (ISSAOS) in Atmospheric Data Assimilation, L’Aquila University, Italy, Summer 2004,
- Invited lecture series on “Atmospheric Data Assimilation” at Seoul National University, Republic of Korea, July 2006.
- Coordinator of WRF-Var component of NCAR’s WRF model tutorial (held twice yearly).

- Regular reviewer of articles (e.g. *MWR*, *Geo Res. Lets.*, *QJRMS*) and proposals (e.g. NSF, NASA).

d. Memberships and Awards:

- Fellow of the Royal Meteorological Society (FRMS) since 1995.
- Fellow of the Royal Astronomical Society (FRAS) since 1989.
- Joint winner of the 2002 NCAR “Outstanding Scientific and Technical Achievement” award.

e. Current Collaborators:

David Bromwich (Byrd Polar Research Center, Ohio State University), Prof. Dong-Kyou Lee (Seoul National University), Sang-Won Joo (Korean Meteorological Administration), Tomislava Vukicevic (Colorado University), Andrew Lorenc (NWP Division, the Met. Office), Chris Snyder, Xiang-Yu Huang, Bill Kuo, and Jordan Powers (MMM Division, NCAR).

Doctoral Advisor: Prof. Leon Mestel, Astronomy Centre, Sussex University, UK.

Postdoctoral advisor: Dr. David Moss, Mathematics Dept., Manchester University, UK.

f. Refereed Publications:

Xiao, Q., Y.-H. Kuo, J. Sun, W.-C. Lee, **D. M. Barker**, and E. Lim, 2007: An approach of Doppler reflectivity data assimilation and its assessment with the inland QPF of Typhoon Rusa (2002) at landfall. *J. Appl. Meteor.*, **46(1)**, 14-22.

Lee, M. -S., Y. -H. Kuo, and **D. M. Barker**, 2006: Incremental Analysis Updates Initialization Technique Applied to 10-km MM5 and MM5 3DVAR. *Mon. Wea. Rev.*, **134**, 1389-1404.

Xiao, Q., Y.-H. Kuo, Y. Zhang, **D. M. Barker**, and D.-J. Won, 2006: A tropical cyclone bogus data assimilation scheme in the MM5 3D-Var system and numerical experiments with Typhoon Rusa (2002) near landfall. *J. Meteor. Soc. Japan*, **84(4)**, 671-689.

Cucurull, L., Y. H. Kuo, **D. M. Barker**, and S. R. H. Rizvi, 2006: Assessing the impact of COSMIC GPS radio occultation data on weather analysis and short-term forecasts over the Antarctic. *Mon. Wea. Rev.*, **134**, 3283-3296.

Barker, D. M., 2005: High Southern-Latitude Ensemble Data Assimilation in the Antarctic Mesoscale Prediction System. *Mon. Wea. Rev.*, **133**, 3431-3449.

Lee, M. -S., and **D. M. Barker**, 2005: Preliminary Tests of First Guess at Appropriate Time (FGAT) with WRF 3DVAR and WRF Model. *Journ. Korean Met. Soc.*, **41**, 495-505.

Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, **D. M. Barker**, W. Wang, and J. G. Powers, 2005: A Description Of The Advanced Research WRF Version. *NCAR Tech Note*, NCAR/TN-

468+STR, 88 pp. [Available from UCAR Communications, P.O. Box 3000, Boulder, CO, 80307.]

- Gu, J., Q. -N. Xiao, Y. -H. Kuo, **D. M. Barker**, J. Xue, and X. Ma, 2005: A Case Study Of Typhoon Rusa (2002) On Its Analysis And Simulation Using WRF 3DVAR And The WRF Modeling System. *Adv. In Atmos, Sci.*, **22**, 415-425.
- Guo, Y. -R., H. Kusaka, **D. M. Barker**, Y. -H. Kuo, and A. Crook, 2005: Impact of Ground-Based GPS PW and MM5-3DVar Background Error Statistics on Forecast of a Convective Case. *SOLA*, **1**, 73-76.
- Xiao, Q. N., Y. H. Kuo, J. Sun, W. C. Lee, E. Lim, Y. R. Guo, and **D. M. Barker**, 2004: Assimilation of Doppler Radar Observations with a Regional 3D-Var System: Impact of Doppler Velocities on Forecasts of a Heavy Rainfall Case. *J. Appl. Met.* **44(6)**, 768-788.
- Barker, D. M.**, W. Huang, Y.-R. Guo, and Q. N. Xiao, 2004: A Three-Dimensional (3DVAR) Data Assimilation System For Use With MM5: Implementation and Initial Results. *Mon. Wea. Rev.*, **132**, 897-914.
- Cucurull, L., F. Vandenberghe, **D. Barker**, E. Vilaclara, and A. Rius, 2004: 3DVAR assimilation of GPS and meteorological observations in MM5 during the December 14th 2001 storm event over the western Mediterranean sea. *Mon. Wea. Rev.*, **132**, 749-763.
- Faccani, C., R. Ferretti, R. Pacione, F. Vespe, L. Cucurull, and **D. M. Barker**, 2003: Near real-time data assimilation of GPS ZTD and PW into a non-hydrostatic model. *Atmospheric Remote Sensing using Satellite Navigation Systems*.
- Barker, D. M.**, W. Huang, Y.-R. Guo, and A. Bourgeois, 2003: A Three-Dimensional Variational (3DVAR) Data Assimilation System For Use With MM5. *NCAR Tech Note*, NCAR/TN-453+STR, 68 pp. [Available from UCAR Communications, P.O. Box 3000, Boulder, CO, 80307.]
- Lorenc, A.C., S.P. Ballard, R.S. Bell, N.B. Ingleby, P.L.F. Andrews, **D. M. Barker**, J.R. Bray, A.C. Clayton, T. Dalby, D. Li, T.J. Payne, and F.W. Saunders, 2000: The Met. Office Global 3-Dimensional Variational Data Assimilation Scheme. *Quart. J. Roy. Meteor. Soc.*, **126**, 2991-3012.
- Lorenc, A. C., **D. Barker**, R.S. Bell, B. MacPherson, and A.J. Maycock, 1995: On the Use of Radiosonde Humidity Observations in Mid-Latitude NWP. *Met. and Atmos. Physics*, **60**, 3-20.
- Barker, D. M.**, and L. Mestel, 1996: Self-Gravitating Disc-Like Magnetic Gas Clouds. *Mon. Not. R. astr. Soc.*, **282**, 317-326.
- Moss, D., **D. M. Barker**, A. Brandenburg, and I. Tuominen, 1995: Nonaxisymmetric Dynamo Solutions and Extended Starspots on Late-Type Stars. *Astr. Astrophys.*, **294**, 155-164.

- Barker, D. M.**, and D. Moss, 1994: The Nonlinear Limitation of Nonaxisymmetric Mean Field Dynamos by the Large-Scale Lorentz Force. *Astr. Astrophys.*, **283**, 1009-1017.
- Barker, D. M.**, 1993: The Onset of Dynamo Action in Alpha-Lambda Dynamos. In: *Theory of Solar and Planetary Dynamos, NATO ASI*, eds. P.C. Matthews and A.M. Rucklidge, Cambridge University Press, 27-34.
- Barker, D. M.**, and L. Mestel, 1990: Disc-like Magneto-Gravitational Equilibria-II. *Mon. Not. R. astr. Soc.*, **245**, 147-153.

Non-Refereed Publications:

Barker, D. M., J. R. Bray, Y. -R. Guo, H. Huang, S. Rizvi, Q. Xiao, Z. Liu, H. -C. Shin, and M. - S. Lee, 2006: Status Report on WRF's Variational Data Assimilation System (WRF-Var). Preprint of the 7th WRF user's workshop, Boulder, Colorado, 19-22 June 2006.

Lee, M. -S, H. -C. Shin, K. -H. Youn, **D. M. Barker**, S. Rizvi, W. Huang, and Y. -R. Guo, 2006: Development of Unified 3D-Var for Global and Regional Applications in KMA. Preprint of the 7th WRF user's workshop, Boulder, Colorado, 19-22 June 2006.

Liu, Z., and **D. M. Barker**, 2006: Radiance Assimilation in WRF-Var: Implementation and Initial Results. Preprint of the 7th WRF user's workshop, Boulder, Colorado, 19-22 June 2006.

Huang, X. -Y., Q. Xiao, W. Huang, **D. M. Barker**, J. Michalakes, J. Bray, Z. Ma, Y. -R. Guo, H. - C. Lin, and Y. -H. Kuo, 2006: Preliminary Results With WRF 4D-Var. Preprint of the 7th WRF user's workshop, Boulder, Colorado, 19-22 June 2006.

Huang, X.-Y., Q. Xiao, W. Huang, **D. M. Barker**, J. Michalakes, J. Bray, Y.-R. Guo, H.-C. Lin, and Y.-H. Kuo, 2006: Preliminary results of WRF 4D-Var. The Seventh International Workshop on Adjoint Applications in Dynamic Meteorology, Obergurgl, Tyrol, Austria, 8-13 October 2006.

Xiao, Q., Z. Ma, Wei Huang, X.-Y. Huang, **D. M. Barker**, Y.-H. Kuo, and J. Mickalakes, 2006: Development of the WRF adjoint modeling system and its applications to the investigation of the May 2004 McMurdo Antarctica severe wind event. Antarctic Meteorological Observation, Modeling, and Forecasting Workshop, Boulder, CO, 13-15 June 2006.

Xiao, Q., J. Sun, W. -C. Lee, E. Lim, S. Sugimoto, J. Gu, Z. Zhang, Y. -R. Guo, **D. M. Barker**, X. -Y. Huang, and Y. -H. Kuo, 2006: Doppler Radar Data Assimilation With WRF-Var: Current Status and Future Plans. Preprint of the 7th WRF user's workshop, Boulder, Colorado, 19-22 June 2006.

Xiao, Q., J. Sun, W. C. Lee, E. Lim, J. Gu, S. Sugimoto, X. Zhang, Y. R. Guo, **D. M. Barker**, X. Y. Huang, and Y. H. Kuo, 2007: Variational Doppler Radar Data Assimilation for the Weather Research and Forecasting Model. 11th Symposium on Integrated Observing and Assimilation Systems for the Atmosphere, Oceans, and Land Surface, San Antonio, 14-18 January 2007.

Barker, D. M., Y.-H. Kuo, J. Bresch, Y.-R. Guo, Z. Liu, S. R. Rizvi, and Q. Xiao, 2005: Development of A Unified Three-Dimensional Variational (3D-Var) Data Assimilation System. Tech. Report for KMA, 46pp. December 2005.

Wang, W., **D. M. Barker**, C. Bruyere, J. Dudhia, D. O. Gill, and J. Michalakes, 2005: Users' Guide For The Advanced Research WRF (ARW) Modeling System Version 2.1. Available from <http://www.wrf-model.org/>.

- Sugimoto, S., A. Crook, J. Sun, **D. M. Barker**, and Q. Xiao, 2005: Assimilation of multiple-Doppler radar data with WRF-3DVAR system: Preliminary results in observing system simulation experiments. Proceedings of the 11th Conference on Mesoscale Processes, Albuquerque, NM, 22-28 October 2005.
- Xiao, Q., Y.-H. Kuo, J. Sun, J. Gu, Eunha Lim, **D. M. Barker**, and Wen-Chau Lee, 2005: Assimilation of Doppler radar observations using WRF/MM5 3D-Var system and its impact on short-range QPF. Proceedings of the World Weather Research Program Symposium on Now-casting and Very Short Range Forecasting, Toulouse, France, 5-9 September 2005.
- Sugimoto, S., A. Crook, J. Sun, **D. M. Barker**, and Q. Xiao, 2005: Potential benefits of multiple-Doppler radar data to quantitative precipitation forecasting: assimilation of simulated data using the WRF 3D-Var system. Proceedings of the World Weather Research Program Symposium on Now-casting and Very Short Range Forecasting, Toulouse, France, 5-9 September 2005.
- Xiao, Q., Z. Ma, W. Huang, X.-Y. Huang, **D. M. Barker**, Y.-H. Kuo and J. Michalakes, 2005: Development of the WRF tangent linear and adjoint models: Nonlinear and linear evolution of initial perturbations and adjoint sensitivity analysis at high-southern latitudes. Preprint of the 6th WRF user's workshop, Boulder, Colorado, 27-30 June 2005.
- Huang, X.-Y., Q. Xiao, W. Huang, **D. M. Barker**, Y.-H. Kuo, J. Michalakes, and Z. Ma, 2005: The weather research and forecasting model based 4-dimensional variational data assimilation system. Preprint of the 6th WRF user's workshop, Boulder, Colorado, 27-30 June 2005.
- Barker, D. M.**, Y. -R. Guo, W. Huang, S. R. H. Rizvi, Q. -N. Xiao, Y.- H. Kuo, J. Gu, X. -Y. Huang, and M. -S. Lee, 2005: WRF-Var - A Unified Variational Data Assimilation System For WRF. WRF Workshop, June 2005.
- Barker, D. M.**, Y. -H. Kuo, Q. -N. Xiao, S. R. H. Rizvi, and W. Huang, 2004: Development Of A Unified Three-Dimensional Variational (3D-Var) Data Assimilation Scheme. KMA Final Report. December 2004.
- Xiao, Q., Y.-H. Kuo, J. Sun. W.-C. Lee, **D. M. Barker**, and Eunha Lim, 2004: Assimilation of Doppler radar observations and its impacts on forecasting of the landfalling typhoon Rusa (2002), *Proceedings of the Third European Conference on Radar in Meteorology and Hydrology (ERAD)*, Vol. 2, 178-182.
- Xiao, Q., Y.-H. Kuo, Y. Zhang, **D. M. Barker**, and D.-J. Won, 2004: Experiments of a typhoon bogussing scheme in the MM5 3D-Var cycling system, *Proceedings of the 26th Conference on Hurricanes and Tropical Meteorology*, 598-599.
- Xiao, Q., J. Gu, **D. M. Barker**, and Y.-H. Kuo: 2004: Tropical cyclone initialization with Doppler radar data using a regional 3D-Var system and its application to Typhoon Ruisa (2002) case, *Preprint of the 5th WRF and 14th MM5 User's Workshop*, 124-127.

- Caya, A., **D. M. Barker**, and C. Snyder, 2004: An Ensemble Kalman Filter For WRF And A Comparison With The WRF Three-Dimensional Variational Assimilation Scheme. First THORPEX International Science Symposium, Montreal, Canada, 6-10th December 2004.
- Barker, D. M.**, M.S. Lee, Y. -R. Guo, W. Huang, Q. -N. Xiao, and S. R. H. Rizvi, 2004: WRF Variational Data Assimilation Development at NCAR. WRF Workshop, June 2004.
- Barker, D. M.**, S. R. H. Rizvi, and M. Duda, 2004: Recent Developments For The AMPS-3DVAR Assimilation Scheme. AMPS Workshop, Charleston, SC, June 2004.
- S. Weygandt, T. Schlatter, S. Koch, S. Benjamin, A. Marroquin, J. Smart, M. Hardesty, B. Rye, A. Belmonte, **D. M. Barker**, Q. Zhang, D. Devenyi, 2004: Results From the Regional Lidar OSSE Experiment. AMS Conference, Seattle, Washington, January 2004.
- Barker, D. M.**, S. R. H. Rizvi, and M. Duda, 2003: Data Assimilation in the Antarctic Mesoscale Prediction System (AMPS). Polar NWP Workshop, Fairbanks, Alaska. October 8-10th 2003.
- Barker, D. M.**, W. Huang, and M. Duda, 2003: Three-Dimensional Variational Data Assimilation in AMPS. AMPS Workshop, University of Wisconsin/Madison. June 2003.
- Barker, D. M.**, Y.-R. Guo, W. Huang, Q.-N. Xiao, and R. Rizvi, 2003: The MM5 implementation of 3DVAR. 13th PSU/NCAR Mesoscale Model User's Workshop, Boulder, CO. June 2003.
- Barker, D. M.**, and Q. H. Zhang, 2003: Calibration of the MM5 Regional Nature Run Trajectory. Space-based lidar project workshop, NOAA, Silver Springs, Maryland. March 2003.
- Barker, D. M.**, and A. Bourgeois, 2002: General Development of the MM5 3DVAR system in 2001/2002. CAMS/NCAR Workshop, April 2002, NCAR.
- Barker, D. M.**, A. J. Bourgeois, Y.-R. Guo, W. Huang, and Q. Xiao, 2002: Initial Results Using WRF 3DVAR in MM5 Applications. Preprints of the Twelfth PSU/NCAR Mesoscale Model Users' Workshop, June 24 - 25, 2002.
- Guo, Y.-R, D.-H. Shin, J.-H. Lee, Q. Xiao, **D. M. Barker**, and Y.-H. Kuo, 2002: Application of MM5 3DVAR System for Heavy Rain Case over Korea Peninsula. Preprints of the Twelfth PSU/NCAR Mesoscale Model Users' Workshop, June 24 - 25, 2002
- Barker, D. M.**, Y. -R. Guo, W. Huang and Q. -N. Xiao, 2002: The Development Of A 3DVAR Assimilation Capability For The WRF Model." February 2002 US-Korea Workshop Proceedings.
- Barker, D. M.**, Y. R. Guo, W. Huang and F. C. Vandenberghe, 2001: "Initial Verification Of The MM5 3DVAR Data Assimilation System". In preprint volume of Ninth Conference on Mesoscale Processes, Ft. Lauderdale, August 2001.