OSCAR MARTÍNEZ-ALVARADO, D. Phil.

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RESEARCH INTERESTS

Weather-climate interaction, mid-latitude and tropical atmospheric dynamics, mesoscale processes, dynamics and thermodynamics of mid-latitude cyclones, nonlinear dynamics, wind energy

EDUCATION

2003 – 2007 **D.Phil. Applied Mathematics** University of Oxford

Thesis: "A POD–Galerkin approach to the Martian atmospheric dynamics"

Supervisors: Dr Irene M Moroz and Prof Peter L Read

2001 - 2003 **M.Sc. Physical Sciences** National University of Mexico

Thesis: "Dynamics of a dripping faucet with variable supply" (Spanish)

Supervisor: Dr Eduardo Ramos

1995 - 2001 **B.Sc. Mechanical Engineering** National University of Mexico

Thesis: "Two-fluid turbulence model with application to the hydrodynamics of shallow lakes" (Spanish)

Supervisor: Dr Alejandro Rodríguez Valdés

EXPERIENCE

Research Experience

2014 – Present **National Centre for Atmospheric Science – Atmospheric Physics**
Department of Meteorology, University of Reading

- *Senior Research Scientist*
  - Dynamical processes and predictability in high-impact weather systems
    - Fundamental dynamical processes and on interactions across scales with the aim of improving forecasts of high-impact weather events (e.g. extratropical cyclones, atmospheric blocking, tropical weather patterns).
    - Applications of Numerical Weather Prediction (e.g. renewable energy)

2008 – 2014 **Department of Meteorology, University of Reading**

- *Post-doctoral researcher*.
  - FRANC (Forecasting Rainfall exploiting new data Assimilation techniques and Novel observations of Convection)
    - Development of **new moisture control variables** suitable for data assimilation of moisture (vapour and cloud condensate) at convective scales
  - DIAMET (DIAbatic influences on Mesoscale structures in ExTratropical storms)
    - Development and use of advanced techniques to trace the **impact of diabatic** (heat-generating) **processes in extratropical cyclones**
  - Sting jets in severe Northern European windstorms
    - Construction of the **first regional climatology of sting jets** (strong descending winds near the centre of extratropical cyclones)

2000 – 2001 **Institute of Engineering, National University of Mexico (UNAM)**

- *Scholarship holder*. Turbulence models for shallow lakes and ponds.

2000 **University Programme for the Environment, UNAM**

- *Analyst*. Energy expenses in different urban environments to implement solar heating.

Teaching Experience

2020 **National Centre for Atmospheric Science**

- Introduction to Atmospheric Dynamics, within: Introduction to Atmospheric Science

2010 – 2020 Department of Meteorology, University of Reading

- Delivery of a 10-week lecture and tutorials on Physics of the Natural World
- Class tutor to Linear Algebra (2015), Calculus (2014) and Atmospheric Physics (2013)
- Three PhD students supervised and co-supervised
- Eight MSc dissertations supervised and co-supervised
- Two undergraduate dissertations supervised or co-supervised

2004 – 2007 Mathematical Institute and St Hilda's College, University of Oxford

- *Class tutor and teaching assistant*. (Techniques of Applied Mathematics, Nonlinear Systems, Classical mechanics, differential equations, and fluid dynamics)
- *Laboratory demonstrator*.
    - Numerical methods to first year mathematics students.

OTHER QUALIFICATIONS AND SKILLS

Science meeting organisation

- **2nd International Workshop on Meteorological Models in Wind Power Applications.** University of Reading, UK, December 2019.
- **4th Summer School in Atmospheric Sciences/1st Forum on Numerical Weather Prediction in Wind Energy,** National University of Mexico, Mexico, June 2019.
- **COST Meeting on Thermodynamics**. University of Reading, UK, January 2013.

OTHER PROFESSIONAL ACTIVITIES

Member of Doctoral Monitoring Committees

- University of Reading (two students)
- National University of Mexico (one student)

External Examiner (MSc)

- National University of Mexico (four students)
- Botswana International University of Science and Technology (one student)

Associate Editor of Atmospheric Science Letters

Journal Peer Review

- The Quarterly Journal of the Royal Meteorological Society
- Weather
- Atmospheric Science Letters
- Journal of Climate
- Monthly Weather Review
- Weather and Forecasting
- Geophysical Research Letters
- Journal of Atmospheric Sciences
- Nonlinear Processes in Geophysics
- Weather and Climate Dynamics

Professional Membership

- Associate fellow of the Royal Meteorological Society

GRANTS AND PRIZES

2020 "Weather Regimes for Southeast Asia". **Principal Investigator**. Newton Fund Weather and Climate Science for Service Partnership (WCSSP) – Southeast Asia

2020 "Arctic Summer-time Cyclones". **Co-Investigator**. NERC

2019 "Atmospheric blocking dynamics: Persistence, re-intensification and interaction with other weather systems". **Academic supervisor**. Met Office CASE studentship award.

2019 "A prototype real-time sting jet precursor tool for forecasters". **Co-Investigator**. NERC

2018 "Application of numerical weather prediction for wind power resource assessment in Mexico". **Principal Investigator**. Newton Fund Institutional Links Grant

2015 "Mechanisms leading to the downstream control of blocking and Rossby-wave breaking by extratropical cyclones". **Academic co-supervisor**. NERC Industrial CASE studentship in collaboration with the Met Office

LIST OF PUBLICATIONS BY OSCAR MARTÍNEZ-ALVARADO

PEER-REVIEWED JOURNAL PAPERS

1. Thomas, S., **O. Martínez-Alvarado**, D. R. Drew and H. Bloomfield (2020): Drivers of extreme wind events in Mexico for wind power applications. *Int. J. Climatol.* In Press.
2. Morales-Ruvalcaba, C. F., O. Rodríguez-Hernández, **O. Martínez-Alvarado**, D. R. Drew and E. Ramos (2020): Estimating wind speed and capacity factors in Mexico using reanalysis data. *Energy Sustain. Dev.* **58**, 158–166. DOI: 10.1016/j.esd.2020.08.006
3. **Martínez-Alvarado, O.** and C. Sanchez (2020): Examining model error in potential temperature and potential vorticity via weather forecasts at different lead times. *Q. J. R. Meteorol. Soc.* **146**, 1264–1280. DOI: 10.1002/qj.3736
4. Maddison, J. W., S. L. Gray, **O. Martínez-Alvarado** and K. D. Williams (2020): Impact of model upgrades on diabatic processes in extratropical cyclones and downstream forecast evolution. *Q. J. R. Meteorol. Soc.* **146**, 1322–1350. DOI: 10.1002/qj.3739
5. Bannister, R. N., H. Chipilski and **O. Martínez-Alvarado** (2020): Techniques and challenges in the assimilation of atmospheric water observations for numerical weather prediction towards convective scales. *Q. J. R. Meteorol. Soc.* **146**, 1–48. DOI: 10.1002/qj.3652
6. Dacre, H. F., **O. Martínez-Alvarado** and C. O. Mbengue (2019)**:** Linking atmospheric rivers and warm conveyor belt airflows. *J. Hydrometeorol.* **20**, 1183–1196. DOI: 10.1175/JHM-D-18-0175.1
7. Maddison, J. W., S. L. Gray, **O. Martínez-Alvarado** and K. D. Williams (2019): Upstream cyclone influence on the predictability of block onsets over the Euro-Atlantic region. *Mon. Weather Rev.* **147**, 1277–1296. DOI: 10.1175/MWR-D-18-0226.1
8. **Martínez-Alvarado, O.**, J. Maddison, S. L. Gray and K. D. Williams (2018): Atmospheric blocking and upper-level Rossby wave forecast skill dependence on model configuration. *Q. J. R. Meteorol. Soc.* **144**, 2165–2181. DOI: 10.1002/qj.3326
9. **Martínez-Alvarado, O.**, S. L. Gray, N. Hart and P. A. Clark (2018): Increased wind risk from sting-jet windstorms with climate change. *Environ. Res. Lett.* **13**, 044002. DOI: 10.1088/1748-9326/aaae3a
10. **Martínez-Alvarado, O.**, S. L. Gray and J. Methven (2016): Diabatic processes and the evolution of two contrasting summer extratropical cyclones. *Mon. Weather Rev.* **144**, 3251–3276. DOI: 10.1175/MWR-D-15-0395.1
11. **Martínez-Alvarado, O.**, E. Madonna, S. L. Gray and H. Joos (2016): A route to systematic error in forecasts of Rossby waves. *Q. J. R. Meteorol. Soc.* **142**, 196–210. DOI: 10.1002/qj.2645
12. Dacre, H., P. Clark, D. Lavers, **O. Martínez-Alvarado** and M. Stringer (2015): How do atmospheric rivers form? *B. Am. Meteorol. Soc.* **96**, 1243–1255. DOI: 10.1175/BAMS-D-14-00031.1
13. Vaughan, G., J. Methven, D. Anderson, B. Antonescu, L. Baker, T. Baker, S. Ballard, K. Bower, P. Brown, J. Chagnon, T. Choularton, J. Chylik, P. Connolly, P. Cook, R. Cotton, J. Crosier, C. Dearden, J. Dorsey, T. Frame, M. Gallagher, M. Goodliff, S. Gray, B. Harvey, P. Knippertz, H. Lean, D. Li, G. Lloyd, **O. Martínez-Alvarado**, J. Nicol, J. Norris, E. Ostrom, J. Owen, D. Parker, R. Plant, I. Renfrew, N. Roberts, P. Rosenberg, A. Rudd, D. Schultz, J. Taylor, T. Trzeciak, R. Tubbs, A. Vance, P. van Leeuwen, A. Wellpott and A. Woolley (2015): Cloud Banding and Winds in Intense European Cyclones: Results from the DIAMET Project. *B. Am. Meteorol. Soc.* 96, 249–265. DOI: 10.1175/BAMS-D-13-00238.1
14. **Martínez-Alvarado, O.**, L. H. Baker, S. L. Gray, J. Methven and R. S. Plant (2014a): Distinguishing the cold conveyor belt and sting jet air streams in an intense extratropical cyclone. *Mon. Weather Rev*. **142**, 2571–2591. DOI: 10.1175/MWR-D-13-00348.1
15. **Martínez-Alvarado, O.**, H. Joos, J. Chagnon, M. Böttcher, S. L. Gray, R. S. Plant, J. Methven and H. Wernli (2014b): The dichotomous structure of the warm conveyor belt. *Q. J. R. Meteorol. Soc.* **140**, 1809–1024. DOI: 10.1002/qj.2276

16. **Martínez-Alvarado, O.** and R. S. Plant (2014): Parametrized diabatic processes in numerical simulations of an extratropical cyclone. *Q. J. R. Meteorol. Soc.* **140**, 1742–1755. DOI: 10.1002/qj.2254
17. **Martínez-Alvarado, O.**, S. L. Gray, P. A. Clark, and L. H. Baker (2013): Objective detection of sting jets in low-resolution datasets. *Meteorol. Appl.* **20**, 41–55. DOI: 10.1002/met.297
18. Baker, L., **O. Martínez-Alvarado**, J. Methven, and P. Knippertz (2013): Flying through extratropical cyclone Friedhelm. *Weather* **68**, 9–13. DOI: 10.1002/wea.2047
19. **Martínez-Alvarado, O.**, S. L. Gray, J. L. Catto, and P. A. Clark (2012): Sting jets in intense winter North-Atlantic storms. *Environ. Res. Lett.* **7**, 024014. DOI:10.1088/1748-9326/7/2/024014
20. Gray, S. L.**, O. Martínez-Alvarado**, L. H. Baker, and P. A. Clark (2011): Conditional symmetric instability in sting jet storms. *Q. J. R. Meteorol. Soc.* **137**, 1482–1500. DOI: 10.1002/qj.859
21. **Martínez-Alvarado, O.**, F. Weidle, and S. L. Gray (2010): Sting jets in simulations of a real cyclone by two mesoscale models. *Mon. Weather Rev.* **138**, 4054–4075. DOI: 10.1175/2010MWR3290.1
22. **Martínez-Alvarado, O.**, L. Montabone, S. R. Lewis, I. M. Moroz, and P. L. Read (2009a): Transient teleconnection event at the onset of a planet-encircling dust storm on Mars. *Ann. Geophys.,* **27**, 3663–3676. DOI: 10.5194/angeo-27-3663-2009
23. **Martínez-Alvarado, O.**, I. M. Moroz, P. L. Read, S. R. Lewis, and L. Montabone (2009b): Low-order dynamical behaviour in the Martian atmosphere: Diagnosis of general circulation model results. *Icarus,* **204**, 48–62. DOI:10.1016/j.icarus.2009.06.010
24. Juarez, L.H., H. Kantz, **O. Martínez**, E. Ramos, and R. Rechtman (2004): Complex dynamics in simple systems with periodic parameter oscillations, *Phys. Rev. E* **70**, 056202. DOI:10.1103/PhysRevE.70.056202

DISCUSSION PAPERS

Martínez-Alvarado, O. (2014): Implications of model error for numerical climate prediction. *Nonlin. Processes Geophys. Discuss.* **1**, 131–153. DOI:10.5194/npgd-1-131-2014

PEER-REVIEWED CONFERENCE PAPERS

Martínez-Alvarado, O., I. M. Moroz, P .L. Read, and S. R. Lewis (2005): *Reduced-order models of the Martian atmospheric dynamics*, Proceedings of the Fifth EUROMECH Nonlinear Dynamics Conference, Eindhoven, The Netherlands.

BOOK CHAPTERS

Plant, R. S. and **O. Martínez-Alvarado** (2015): Spectral and bulk mass flux representations. In R. S. Plant and J.-I. Yano (editors) *Parameterization of Atmospheric Convection. Volume 1: Theoretical Background and Formulation*, pages 249–272. Imperial College Press (in press).

INVITED TALKS AND SEMINARS

Martínez-Alvarado, O. (2018): High-impact weather at mid-latitudes: Drivers, effects and future changes. During the Workshop *Multiscale meteorological models in wind power resource assessment*. Temixco, Mor. Mexico. 2018

Martínez-Alvarado, O. (2017): *Atmospheric dynamics and predictability (a lecture in four sessions)*. 2nd Summer School in Atmospheric Sciences (II-EVCA). Juriquilla, Mexico. 2017

Martínez-Alvarado, O. (2016): *Sensitivity of European forecast errors to time-lagged forecast errors upstream*. RMetS/NCAS Conference. Session P11: Prediction of high-impact weather and climate – the role of model error. Manchester, UK. 2016

Martínez-Alvarado, O. (2015): *Errores en pronósticos del tiempo a escala sinóptica en latitudes medias: Caos, ciclones y procesos no-adiabáticos.* Multidisciplinary Unit for Teaching and Research campus Juriquilla, National University of Mexico. Querétaro, Mexico. 2015.