

## Curriculum Vitae

### Juan Pedro Mellado González

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#### EDUCATION

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- 2001 **Doctor of Philosophy** in Engineering Sciences (Aerospace Engineering).  
– 2004 Department of Mechanical and Aerospace Engineering, University of California, San Diego.
- 1999 **Master of Science** in Engineering Sciences (Aerospace Engineering).  
– 2001 Department of Mechanical and Aerospace Engineering, University of California, San Diego.
- 1993 **Bachelor and Master of Science** in Aeronautical Engineering.  
– 1999 School of Aeronautical Engineering, Polytechnic University of Madrid.

#### PROFESSIONAL EXPERIENCE

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- 10.2021 **Professor (W3)**, Department of Earth System Sciences, University of Hamburg.  
– today Research on cloud microphysics, planetary boundary layers, turbulence, surface phenomena, microscale-mesoscale interactions, for climate, weather and environmental applications.
- 04.2019 **Full Professor**, Department of Physics, Universitat Politècnica de Catalunya, Barcelona.  
–09.2021 Research on cloud microphysics, planetary boundary layers, turbulence, surface phenomena, microscale-mesoscale interactions, for climate, weather and environmental applications.
- 08.2010 **Max Planck Research Group Leader**, Max Plank Institute for Meteorology, Hamburg.  
–03.2019 Group *Turbulent Mixing Processes in the Earth System*, theory and high-resolution simulations to study small-scale boundary-layer processes and their coupling to large-scale properties.
- 04.2007 **Scientific Researcher**, Institute for Combustion Technology, RWTH Aachen University.  
– 07.2010 Research on shear- and buoyancy driven turbulent flows, external intermittency, density effects in turbulent jets, and moist convection in stratocumulus.
- 04.2006 **Project Engineer**, European Space Operations Center, ESA, Darmstadt.  
– 03.2007 Contractor for GMV in the OPS/GFA Division. Work on launch vehicle optimization and mission analysis (transfer trajectories to libration equilibrium points, and orbits around them).
- 03.2005 **Assistant Professor**, Department of Aerospace Engineering, University of Sevilla.  
– 01.2006
- 05.2004 **Post-doctoral Fellow**, Turbulence Simulation Group, Technical University of Munich.  
– 12.2004 Research on non-premixed turbulent combustion and subgrid-scale modeling using direct numerical simulation.
- 10.1999 **Research Assistant**, Department of Mechanical and Aerospace Engineering, University of California, San Diego.  
– 04.2004 Doctoral research on direct numerical simulation and large-eddy simulation of variable density flows (jets, Rayleigh-Taylor turbulence, and nonpremixed combustion).
- 10.1998 **Internship**, Department of Motopropulsion and Thermofluidmechanics of the School of Aeronautical Engineering, Polytechnic University of Madrid.  
– 06.1999 Simulation of the thermodynamic cycle in reciprocating engines and unstructure mesh generation for supersonic flows.

#### TEACHING EXPERIENCE

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- 2023 **Atmospheric Physics**, Universität Hamburg  
– today An introduction to STEM master students without a background in atmospheric science to basic concepts of atmospheric thermodynamics, fluid mechanics, and cloud microphysics.

- 2021 – today **Turbulence and Boundary Layers**, Universität Hamburg  
Mathematical models and conservation laws in atmospheric sciences, theory and modeling of turbulence and boundary layers, for master students.
- 2021 – today **Thermodynamics**, Universität Hamburg  
Fundamental concepts of classical thermodynamics and applications to atmospheric systems, for undergraduates.
- 2021 – 2021 **Meteorology**, Universitat Politècnica de Catalunya  
An introduction to fundamental concepts of meteorology and its relevance for aerospace engineering, for undergraduates.
- 2020 – 2021 **Turbulence**, Universitat Politècnica de Catalunya  
An introduction to fundamental concepts and analysis of turbulence, for undergraduates.
- 2020 – 2021 **Aerospace Technology**, Universitat Politècnica de Catalunya  
An introduction to flight dynamics, propulsion and space systems, for undergraduates.
- 2019 – 2021 **Numerical Methods**, Universitat Politècnica de Catalunya  
An introduction for applications in aerospace engineering, for master students.
- 2012 – 2018 **Turbulence**, Max Planck Institute for Meteorology  
An introduction to fundamental concepts and analysis of turbulence, for PhD students.
- 2008 – 2009 **Combustion**, RWTH Aachen University  
An introduction to premixed and non-premixed combustion, for master students.
- 2005 **Propulsion**, University of Sevilla  
An introduction to air-breathing and rocket engines, for undergraduate students.
- 2002 **C/C++ Programming**, University of California, San Diego  
An introduction to general programming skills and C language, for undergraduate students.

## DOCTORAL SUPERVISION

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Kenneth Chan. *Radiation effects in stratocumulus*, started on 06.2023.

Raphael Pistor. *Microphysical effects in stratocumulus and their dependence on the structure and dynamics of the subtropical highs*, started on 02.2022.

Katherine Fodor. *The influence of large coherent structures on near-surface and entrainment zone properties in convective boundary layers*, PhD thesis, University of Hamburg, Hamburg, Reports on Earth System Science, 227, 2020.

Armin Haghshenas. *On entrainment in sheared convective boundary layers*, PhD thesis, University of Hamburg, Hamburg, Reports on Earth System Science, 218, 2019.

Bernhard Schulz. *On the role of wind shear and cloud droplet sedimentation on entrainment in stratocumulus*, PhD thesis, University of Hamburg, Hamburg, Reports on Earth System Science, 215, 2019.

Cedrick Ansorge. *Analyses of turbulence in the neutrally and stably stratified planetary boundary layer*, PhD thesis, University of Hamburg, Hamburg, Springer Theses, Springer, 2017.

Awarded the Otto-Hahn Medal from the Max Planck Society.

Thomas Keitzl. *Turbulent enhancement of the melt rate at an ice-ocean interface*, PhD thesis, University of Hamburg, Hamburg, Reports on Earth System Science, 176, 2015.

Jade Rachele Garcia. *Analysis of the surface layer and entrainment zone of a convective boundary layer using direct numerical simulation*, PhD thesis, University of Hamburg, Hamburg, Reports on Earth System Science, 159, 2014.

## POST-DOCTORAL SUPERVISION

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Kay Schäfer, 10.2023 –

Raphaela Vogel, 04.2022 –

Ian Dragaud, 04.2022 –

Mona Karimi, 11.2016 – 10.2018.

Chiel van Heerwaarden, 09.2011 – 10.2015, currently at U. Wageningen

Alberto de Lozar, 02.2011 – 10.2016, currently at the German Weather Service

## FUNDING

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- 03.2023 **Bundesministerium für Bildung und Forschung, 243.0 k EUR**  
– 02.2027 WarmWorld-Better, PI in the project *Development and validation of the turbulence parametrization in ICON*.
- 09.2021 **European Climate, Infrastructure and Environment Executive Agency, 272.5 k EUR**  
– 08.2025 nextGEMS (Next Generation Earth Modelling Systems), PI in the project *Validation and development of boundary layer schemes*.
- 06.2020 **Spanish Ministry of Science, Innovation and University, 170.6 k EUR**  
– 05.2023 State R&D Program Oriented to the Challenges of the Society, coordinating PI of the project *Turbulence and large coherent structures in the atmospheric boundary layer: Fundamental aspects for parametrizations of cloud formation and for wind-energy applications*.
- 11.2010 **Max Plank Society for the Advancement of Science, 2.9 M EUR**  
– 10.2019 Max Planck Research Groups, group leader of the group *Turbulent Mixing Processes in the Earth System*.
- 11.2016 **German Research Foundation, 193 k EUR**  
– 10.2019 First phase of the DFG priority programme 1881 Turbulent Superstructures, PI of the project *Convection Cells in the Planetary Boundary Layer: Origin and Reduced Modeling*.
- 07.2011 **German Research Foundation, 11.4 k EUR**  
– 06.2014 Third phase of the DFG priority programme 1276 Metström, co-PI of the project *Analysis and Numerical Simulation of Stratocumulus Clouds*.

## Supercomputing

- 11.2022 **Gauss Centre for Supercomputing Large-Scale Project, 67 million core-hours**  
– 10.2023 Computational time at Leibniz Supercomputing Centre, PI of the project pn49de *Convection in the Planetary Boundary Layer*.
- 11.2010 **John von Neumann Institute for Computing, 250 million core-hours**  
– 10.2021 Computational time at Jülich Supercomputing Centre, PI of the project HHH07 *Direct Numerical Simulation of Turbulent Mixing in the Planetary Boundary Layer*.
- 07.2009 **German Federal Ministry of Education and Research, 6.9 million core-hours**  
– 12.2013 Computational time at German Climate Computing Center, PI of the project 573 *Direct Numerical Simulation of Climate Relevant Cloud Mixing Processes*.

## INSTITUTIONAL RESPONSABILITIES

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- 05.2022 **Scientific steering committee**, German Climate Computing Center  
– today
- 11.2019 **Academic evaluation committee of the Department of Physics**, Universitat Politècnica de Catalunya  
– 09.2021
- 11.2019 **Academic committee of the Master's degree** in Aerospace Science and Technology, Universitat Politècnica de Catalunya  
– 09.2021
- 04.2019 **Academic committee of the doctoral programme** Aerospace Science and Technology, Universitat Politècnica de Catalunya  
– 09.2021
- 11.2010 **Graduate student advisor**, Max Planck Institute for Meteorology, Hamburg  
– 03.2019

## SELECTED PUBLICATIONS

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- J. P. Mellado, 2017: *Cloud-top entrainment in stratocumulus clouds*, Annu. Rev. Fluid Mech., 49, 145-169.
- J. P. Mellado, C. S. Bretherton, B. Stevens and M. C. Wyant, 2018: *DNS and LES for simulating stratocumulus: Better together*, J. Adv. Model. Earth Syst., 10, 1421-1438.
- J. P. Mellado, M. Puche and C. C. van Heerwaarden, 2017: *Moisture statistics in free convective boundary layers growing into linearly stratified atmospheres*, Q. J. R. Meteorol. Soc., 143, 2403–2419.
- C. Ansorge and J. P. Mellado, 2016: *Analyses of external and global intermittency in the logarithmic layer of Ekman flow*, J. Fluid Mech., 805, 611-635.
- J. P. Mellado, C. C. van Heerwaarden and J. R. Garcia, 2016: *Near-surface effects of free atmosphere stratification in free convection*, Boundary-Layer Meteorol., 159, 69-95.

## FELLOWSHIPS, HONORS AND AWARDS

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- Mercator Fellowship, German Research Foundation, 2019-2022.
- Invitation to contribute a review article to the Annual Review of Fluid Mechanics on the topic of cloud-top entrainment, 2016.
- John von Neumann Exzellenz-Projekt 2013, Jülich Supercomputing Centre, project *Direct Numerical Simulation of Turbulent Mixing in the Planetary Boundary Layer*.
- Student Employee Graduate Research Fellowship, Lawrence Livermore National Laboratory, 2002–2004.
- Academic award (Graduate Research), Department of Mechanical and Aerospace Engineering, University of California, San Diego, June 2004.
- Academic award (Graduate Research), Department of Mechanical and Aerospace Engineering, University of California, San Diego, June 2002.
- National Outstanding End-of-Studies Award (1st prize) in Aeronautical Engineering, Ministry of Education of Spain, July 2000.
- Francisco Arranz Outstanding Award (1st prize), Aeronautical Engineering Association of Spain, December 1999.
- Fellowship at the Department of Motopropulsion and Thermofluidmechanics of the School of Aeronautical Engineering, Polytechnic University of Madrid, academic year 1998-1999.
- Fellowship at the Von Karman Institute for Fluid Dynamics, summer 1998.
- Fellowship at the Astrophysics Institute of the Canary Islands, summer 1997.
- University Outstanding Midterm-Studies Award (1st prize) in Aeronautical Engineering, Polytechnic University of Madrid, January 1997.

## ORGANIZATION ACTIVITIES

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- Organizer of the programme *Ten Lectures on Tropical Clouds Dynamics* at the ITN-ETN COMPLETE 2th Summer School on *Microphysics and Dynamics of Clouds*, Zugspitze Environmental Research Station Schneefernerhaus (UFS), Germany, July 9-14 2018.
- Co-convenor of the symposium *Fluid Mechanics of Clouds* at the 11th European Fluid Mechanics Conference in Sevilla, 2016.

## REVIEWING AND EVALUATION ACTIVITIES

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- EVALUATION COMMITTEES OF PROFESSORSHIPS: 01.2020, 3 tenure-track positions for the Division of Aerospace Engineering of the Universitat Politècnica de Catalunya (secretary). 07.2021, 2 associate professorships for the Division of Aerospace Engineering of the Universitat Politècnica de Catalunya (president). 10.2022, 2 tenure-track positions for the Division of Aerospace Engineering of the Universitat Politècnica de Catalunya.

EVALUATION COMMITTEES OF RESEARCH PROGRAMS: 2016, Atmospheric System Research (U. S. Department of Energy). 2015, Max Planck Research Group Leader (Max Planck Society).

EVALUATION COMMITTEES OF PH.D. THESES: Guillem Borrell (student of J. Jiménez, Polytechnic University Madrid, 09.2015), Vincent Perrin (student of H. Jonker, TU Delft, 06.2015), Bart van Stratum (student of B. Stevens, MPI Meteorology, 07.2016), Joel S. Schröter (student of A. F. Moene, Wageningen University, 06.2018), Paul Götzfried (student of J. Schumacher, TU Ilmenau, 04.2019), Ruben Garcia (student of M. Gonçalves, UPC, 07.2020), Kay Schäfer (student of B. Frohnäpfel, KIT, 02.2023).

PROPOSAL REVIEWS: German Research Foundation, Alexander von Humboldt Foundation, Institute for Advanced Simulation (Jülich Supercomputing Centre), Polish National Science Centre, U. S. National Science Foundation, U. S. Department of Energy, Swiss National Science Foundation, Spanish Research Agency.

JOURNAL PAPER REVIEWS: Journal of Atmospheric Sciences, Quarterly Journal of the Royal Meteorological Society, Journal of Advances in Modeling Earth Systems, Geophysical Research Letters, Journal of Geophysical Research, Boundary-Layer Meteorology, Dynamics of Atmospheres and Oceans, Geoscientific Model Development, Journal of Fluid Mechanics, Physics of Fluids, New Journal of Physics, Physical Review Fluids, Journal of Turbulence, Theoretical and Computational Fluid Mechanics, Physica D, Applied Mechanics Reviews.

## PUBLIC OUTREACH

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*The atmospheric boundary layer: Arbiter of weather and climate*, Fenomen, Newsletter of the Department of Physics, Universitat Politècnica de Catalunya, no. 20, Summer 2019.

Front cover of the Journal of Advances in Modeling Earth Systems, volume 10 issue 7 (July 2018).

*Direct Numerical Simulation of Turbulent Mixing in the Planetary Boundary Layer*, website of the Gauss Centre for Supercomputing, Projects Environment and Energy, published 12.2017.

*Turbulence in the Planetary Boundary Layer*, inSiDE: Innovatives Supercomputing in Deutschland, vol. 3, no. 1, Spring 2015.

*Understanding the influence of small-scale turbulence in stratocumulus clouds*, 2014 yearly report of the Max Planck Society.

*Im Bilde: Chaos in der Atmosphäre*, Forschen in Jülich, issue 01|2014.

*Turbulence: Chaos in the Sky*, Exascale Newsletter of Forschungszentrum Jülich on Supercomputing, issue 01/2014.

*Höchstleistungsrechner: Erforschung von Turbulenzen*, Aachener Zeitung, 22.01.2014.

*Erforschung nächtlicher Turbulenzen*, innovations report, 16.01.2014.

Front cover of the Journal of Fluid Mechanics, volume 712, December 2012.

*Simulation: Die Zukunft aus dem Computer*, GEO Magazin, issue 05/2012.

*Images from Science: Turbulence in the sky*, 2011 calendar of the Max Planck Society.

Front cover of the Journal of Fluid Mechanics, volume 660, October 2010.

Front cover of the Journal of Fluid Mechanics, volume 626, May 2009.

1. J. Yeom, K.-E. Szodry, H. Siebert, A. Ehrlich, **J. P. Mellado**, R. Shaw, S. S. Yum, 2023: *High-resolution measurements of microphysics and entrainment in marine stratocumulus clouds*, Q. J. R. Meteorol. Soc., doi: 10.1002/qj.4586
2. F. Hayder, **J. P. Mellado** and J. Schumacher, 2022: *Generalizability of reservoir computing for flux-driven two-dimensional convection*, Phys. Rev. E, 106, 055303, doi: 10.1103/PhysRevE.106.055303
3. A. Naseem, **J. P. Mellado** and M. Wilczek, 2022: *A wavenumber–frequency spectrum model for sheared convective atmospheric boundary layer flows*, J. Atmos. Sci., doi: 10.1175/JAS-D-22-0079.1
4. K. Schäfer, B. Frohnepfel, **J. P. Mellado**, 2022: *The effect of spanwise heterogeneous surfaces on mixed convection in turbulent channels*, J. Fluid Mech., 950, A22, doi: 10.1017/jfm.2022.773
5. K. Fodor, **J. P. Mellado** and A. Haghshenas, 2022: *On the non-monotonic variation of the entrainment buoyancy flux with wind shear*, Boundary-Layer Meteorol., 184, 463–477, doi: 10.1007/s10546-022-00712-x.
6. C. W. Y. Li, G. P. Brasseur, H. Schmidt, **J. P. Mellado**, 2021: *Error induced by neglecting subgrid chemical segregation due to inefficient turbulent mixing in regional chemical-transport models in urban environments*, Atmos. Chem. Phys., 21, 483–503, doi: 10.5194/acp-2020-545
7. H. Siebert, K. Szodry, U. Egerer, B. Wehner, S. Henning, K. Chevalier, J. Lückerrath, O. Welz, K. Weinhold, F. Lauermann, M. Gottschalk, A. Ehrlich, M. Wendisch, P. Fialho, G. Roberts, N. Allwayin, S. Schum, R. A. Shaw, C. Mazzoleni, L. Mazzoleni, J. Nowak, S. Malinowski, K. Karpinska, W. Kumala, D. Czyżewska, E. Luke, P. Kollias, R. Wood and **J. P. Mellado**, 2021: *Observations of aerosol, cloud, turbulence and radiation properties at the top of the marine boundary layer over the Eastern North Atlantic Ocean: The ACORES campaign*, Bull. Am. Meteorol. Soc., doi: 10.1175/BAMS-D-19-0191.1.
8. K. Fodor and **J. P. Mellado**, 2020: *New insights into wind shear effects on entrainment in convective boundary layers using conditional analysis*, J. Atmos. Sci., 77, 3227–3248, doi: 10.1175/JAS-D-19-0345.1
9. R. A. Shaw, W. Cantrell, S. Chen, P. Chuang, N. Donahue, G. Feingold, P. Kollias, A. Korolev, S. Kreidenweis, S. Krueger, **J. P. Mellado**, D. Niedermeier, and L. Xue, 2020: *Cloud-aerosol-turbulence interactions: Science priorities and concepts for a large-scale laboratory facility*, Bull. Amer. Meteor. Soc., 101, E1026–E1035, doi: 10.1175/BAMS-D-20-0009.1.
10. H. Omidvar, E. Bou-Zeid, Q. Li, **J. P. Mellado** and P. Klein, 2020: *Plume or bubble? Mixed-convection flow regimes and city-scale circulations*, J. Fluid Mech., 897, A5, 1–27, doi: 10.1017/jfm.2020.360
11. G. Green, D. G. Vlaykov, **J. P. Mellado** and M. Wilczek, 2020: *Resolved energy budget of superstructures in Rayleigh–Bénard convection*, J. Fluid Mech., 887, A21.
12. A. Haghshenas, **J. P. Mellado** and M. Hartmann, 2019: *Non-singular zero-order bulk models of sheared convective boundary layers*, J. Atmos. Sci., 76, 3697–3715, doi: 10.1175/JAS-D-19-0022.1
13. B. Schulz and **J. P. Mellado**, 2019: *Competing effects of wind shear and droplet sedimentation at stratocumulus tops*, J. Adv. Model. Earth Syst., 11, 1830–1846.
14. E. O. Akinlabi, M. Waclawczyk, S. Malinowski and **J. P. Mellado**, 2019: *Fractal reconstruction of sub-grid scales for large eddy simulation*, Flow Turbulence Combust., 103, 293–322.
15. K. Fodor, **J. P. Mellado** and M. Wilczek, 2019: *On the role of large-scale updrafts and downdrafts in deviations from Monin–Obukhov similarity theory in free convection*, Boundary-Layer Meteorol., 172, 371–396.
16. E. O. Akinlabi, M. Waclawczyk, **J. P. Mellado** and S. Malinowski, 2019: *Estimating turbulence kinetic energy dissipation rate in numerically simulated stratocumulus cloud-top mixing layers*, J. Atmos. Sci., 76, 1471–1488.
17. A. Haghshenas and **J. P. Mellado**, 2019: *Characterization of wind-shear effects on entrainment in a convective boundary layer*, J. Fluid Mech., 858, 145–183.
18. **J. P. Mellado**, C. S. Bretherton, B. Stevens and M. C. Wyant, 2018: *DNS and LES for simulating stratocumulus: Better together*, J. Adv. Model. Earth Syst., 10, 1421–1438.



19. Q. Li, P. Gentine, **J. P. Mellado** and K. A. McColl, 2018: *Implications of non-local transport and conditionally-averaged statistics on Monin-Obukhov Similarity Theory and Townsend's attached eddy hypothesis*, J. Atmos. Sci., 75, 3403-3431.
20. B. Schulz and **J. P. Mellado**, 2018: *Wind-shear effects on radiatively and evaporatively driven stratocumulus tops*, J. Atmos. Sci., 75, 3245-3263.
21. **J. P. Mellado**, M. Puche and C. C. van Heerwaarden, 2017: *Moisture statistics in free convective boundary layers growing into linearly stratified atmospheres*, Q. J. R. Meteorol. Soc., 143, 2403-2419.
22. A. K. Naumann, B. Stevens, C. Hohenegger and **J. P. Mellado**, 2017: *A conceptual model of a shallow circulation induced by prescribed low-level radiative cooling*, J. Atmos. Sci., 74, 3129-3143.
23. C. C. van Heerwaarden, B. J. H. van Stratum, T. Heus, J. A. Gibbs, E. Fedorovich and **J. P. Mellado**, 2017: *MicroHH 1.0: a computational fluid dynamics code for direct numerical simulation and large-eddy simulation of atmospheric boundary layer flows*, Geosci. Model Dev., 10, 3145-3165.
24. **J. P. Mellado**, 2017: *Cloud-top entrainment in stratocumulus clouds*, Annu. Rev. Fluid Mech., 49, 145-169.
25. A. de Lozar and **J. P. Mellado**, 2017: *Reduction of the entrainment velocity by sedimentation in stratocumulus*, J. Atmos. Sci., 74, 751-765.
26. T. Keitzl, **J. P. Mellado** and D. Notz, 2016: *Reconciling estimates of the ratio of heat and salt fluxes at the ice-ocean interface*, J. Geophys. Res.-Oceans, 121, 8419-8433.
27. C. Ansorge and **J. P. Mellado**, 2016: *Analyses of external and global intermittency in the logarithmic layer of Ekman flow*, J. Fluid Mech., 805, 611-635.
28. C. C. van Heerwaarden and **J. P. Mellado**, 2016: *Growth and decay of a convective boundary layer over a surface with a constant temperature*, J. Atmos. Sci., 73, 2165-2177.
29. T. Keitzl, **J. P. Mellado** and D. Notz, 2016: *Impact of thermally driven ocean turbulence on the melting of ice*, J. Phys. Oceanogr., 46, 1171-1187.
30. **J. P. Mellado**, C. C. van Heerwaarden and J. R. Garcia, 2016: *Near-surface effects of free atmosphere stratification in free convection*, Boundary-Layer Meteorol., 159, 69-95.
31. A. de Lozar and **J. P. Mellado**, 2015: *Evaporative-cooling amplification of the entrainment velocity in radiatively-driven stratocumulus*, Geophys. Res. Lett., 42, 7223-7229.
32. A. de Lozar and **J. P. Mellado**, 2015: *Mixing driven by radiative and evaporative cooling at the stratocumulus top*, J. Atmos. Sci., 72, 4681-4700.
33. E. Dietze, H. Schmidt, B. Stevens and **J. P. Mellado**, 2014: *Controlling entrainment in the smoke cloud using level set-based front tracking*, Meteorol. Z., 23, 661-674.
34. C. C. van Heerwaarden, **J. P. Mellado** and A. de Lozar, 2014: *Scaling laws for the heterogeneously heated free convective boundary layer*, J. Atmos. Sci., 71, 3975-4000.
35. C. Ansorge and **J. P. Mellado**, 2014: *Global intermittency and collapsing turbulence in a stratified planetary boundary layer*, Boundary-Layer Meteorol., 153, 89-116.
36. J. R. Garcia and **J. P. Mellado**, 2014: *The two-layer structure of the entrainment zone in the convective boundary layer*, J. Atmos. Sci., 71, 1935-1955.
37. **J. P. Mellado**, B. Stevens and H. Schmidt, 2014: *Wind shear and buoyancy reversal at the top of stratocumulus*, J. Atmos. Sci., 71, 1040-1057.
38. A. de Lozar and **J. P. Mellado**, 2014: *Cloud droplets in a bulk formulation and its application for the buoyancy reversal instability*, Q. J. R. Meteorol. Soc., 140, 1493-1504.
39. A. K. Naumann, A. Seifert and **J. P. Mellado**, 2013: *A refined statistical cloud closure using double-Gaussian probability density functions*, Geosci. Model Dev., 6, 1641-1657.
40. A. de Lozar and **J. P. Mellado**, 2013: *Direct numerical simulations of a smoke cloud-top mixing layer as a model for stratocumuli*, J. Atmos. Sci., 70, 2356-2375.

41. D. Abma, T. Heus and **J. P. Mellado**, 2013: *Direct numerical simulation of evaporative cooling at the lateral boundary of shallow cumulus clouds*, J. Atmos. Sci., 70, 2088-2102.
42. E. Dietze, **J. P. Mellado**, B. Stevens and H. Schmidt, 2013: *Study of low-order numerical effects in the two-dimensional cloud-top mixing layer*, Theor. Comput. Fluid Dynamics, 27, 239-251.
43. **J. P. Mellado**, 2012: *Direct numerical simulation of free convection over a heated plate*, J. Fluid Mech., 712, 418-450.
44. **J. P. Mellado** and C. Ansorge, 2012: *Factorization of the Fourier transform of the pressure-Poisson equation using finite differences in colocated grids*, Z. Angew. Math. Mech., 92, 380-392.
45. **J. P. Mellado**, B. Stevens, H. Schmidt and N. Peters, 2010: *Probability density functions in the cloud-top mixing layer*, New J. Phys., 12, 085010.
46. **J. P. Mellado**, 2010: *The evaporatively driven cloud-top mixing layer*, J. Fluid Mech., 660, 5-36.
47. **J. P. Mellado**, B. Stevens, H. Schmidt and N. Peters, 2010: *Two-fluid formulation of the cloud-top mixing layer for direct numerical simulation*, Theor. Comput. Fluid Dynamics, 24, 511-536.
48. H. Foyi, **J. P. Mellado**, S. Sarkar, 2010: *Large-eddy simulation of variable-density round and plane jets*, Intl. J. Heat and Fluid Flow, 31, 307-314.
49. **J. P. Mellado**, B. Stevens, H. Schmidt and N. Peters, 2009: *Buoyancy reversal in cloud-top mixing layers*, Q. J. R. Meteorol. Soc., 135, 963-978.
50. **J. P. Mellado**, L. Wang and N. Peters, 2009: *Gradient trajectory analysis of a scalar field with external intermittency*, J. Fluid Mech., 626, 333-365.
51. **J. P. Mellado**, R. Friedrich and S. Sarkar, 2007: *Modeling of filtered heat release for large eddy simulation of compressible infinitely-fast reacting flows*, Proc. Combust. Inst., 31, 1691-1699.
52. **J. P. Mellado**, S. Sarkar and Y. Zhou, 2005: *Large-eddy simulation of Rayleigh-Taylor turbulence with compressible miscible fluids*, Phys. Fluids, 17, 076101.
53. **J. P. Mellado**, S. Sarkar and C. Pantano, 2003: *Reconstruction subgrid models for nonpremixed combustion*, Phys. Fluids, 15, 3280-3307.
54. S. A. Stanley, S. Sarkar and **J. P. Mellado**, 2002: *A study of the flow-field evolution and mixing in a planar turbulent jet using direct numerical simulation*, J. Fluid Mech., 450, 377-407.
55. D. V. Abeele, P. Barbante, G. Degrez and **J. P. Mellado**, 1999: *Numerical simulation of multicomponent inductive plasma flows under chemical non-equilibrium*, Ann. N. Y. Acad. Sci., 891, 340-347.

#### REFEREED CONFERENCE PROCEEDINGS (ONLY FIRST AUTHOR)

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- J. P. Mellado, 2020: *Using numerical simulations to study the atmospheric boundary layer* In: M. García-Villalba, H. Kuerten, M. Salvetti (eds) Direct and Large Eddy Simulation XII. DLES 2019. ERCOFTAC Series, vol 27, pp 1-10. Springer, Cham
- J. P. Mellado, C. van Heerwaarden and J. R. Garcia, 2015: *Buoyancy profiles inside the inner region of a convective boundary layer*, Proceedings of the Ninth International Symposium on Turbulence and Shear Flow Phenomena, pp 1-5.
- J. P. Mellado, 2014: *Turbulent entrainment in the atmospheric boundary layer*, Proceedings in Applied Mathematics and Mechanics (PAMM), vol 14, pp 651-652.
- J. P. Mellado, H. Schmidt, B. Stevens and N. Peters, 2009: *Analysis of the cloud-top mixing layer using DNS*, Proceedings of the Sixth International Symposium on Turbulence and Shear Flow Phenomena, pp 1154-1159.
- J. P. Mellado, H. Schmidt, B. Stevens, N. Peters, 2009: *DNS of the turbulent cloud-top mixing layer*, In: Eckhardt B. (eds) Advances in Turbulence XII. Springer Proceedings in Physics, vol 132, pp 401-404. Springer, Berlin, Heidelberg



J. P. Mellado J.P., L. Wang, N. Peters, 2009: *Investigation of the Conditional Scalar Dissipation Rate Across a Shear Layer Using Gradient Trajectories* In: J. Peinke, M. Oberlack, A. Talamelli (eds) *Progress in Turbulence III*. Springer Proceedings in Physics (Third iTi Conference in Turbulence 2008), vol 131, pp 21-24. Springer, Berlin, Heidelberg

J. P. Mellado, S. Sarkar and Y. Zhou, 2004: *Compressibility effects on Rayleigh-Taylor turbulence*, In: S. Dalziel (eds) *Proceedings of the 9th International Workshop on the Physics of Compressible Turbulent Mixing*, pp 1-4.

J. P. Mellado, S. Sarkar and C. Pantano, 2002: *Evaluation of a subgrid model for the Arrhenius reaction rate in a jet*, 40th AIAA Aerospace Sciences Meeting and Exhibit, 2002-0165, pp 1-10.

## GRAY LITERATURE

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J. P. Mellado, 2018: *The challenge of small-scale turbulence in the planetary boundary layer*, In: K. Binder, M. Müller and A. Trautmann (eds) *Proceedings of the NIC Symposium 2018*, pp 341-348.

J. P. Mellado, C. Ansorge, A. de Lozar, J. R. Garcia, T. Keitzl and C. van Heerwaarden, 2014: *Direct numerical simulation of turbulent mixing in the planetary boundary layer*, In: K. Binder, G. Münster and M. Kremer (eds) *Proceedings of the NIC Symposium 2014*, pp 325-332.

J. P. Mellado and C. Ansorge, 2012: *Direct numerical simulation of turbulent mixing in the planetary boundary layer*, In: K. Binder, G. Münster and M. Kremer (eds) *Proceedings of the NIC Symposium 2012*, pp 295-302.

J. P. Mellado, B. Stevens, H. Schmidt and N. Peters, 2010: *Investigation of latent heat effects at the stratocumulus top using direct numerical simulations*, Report No 34/2010 of the Workshop on Mathematical Theory and Modelling in Atmosphere-Ocean Science, Oberwolfach Mathematical Institute, pp 36-37.

## INVITED TALKS

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*Laboratory Studies of Boundary-Layer Clouds*, Workshop to Explore Science Opportunities and Concepts for a Large-Scale Aerosol-Cloud-Turbulence Research Facility, National Center for Atmospheric Research, Boulder, November 21-22 2019.

*Small-Scale Turbulence in the Atmospheric Boundary Layer: Challenges and Recent Advances*, 12th ERCOFTAC Workshop on Direct and Large Eddy Simulation, Universidad Carlos III de Madrid, June 5-7 2019.

*The Challenge of Small-Scale Turbulence in Planetary Boundary Layers*, 9th John von Neumann Institute for Computing (NIC) Symposium, Jülich Research Centre, February 23 2018.

*Entrainment in Convective Boundary Layers*, Workshop *Convection in Nature*, Princeton University, February 10 2018.

*The Challenge of Small-Scale Turbulence in Planetary Boundary Layers*, Symposium *Perspectives on Turbulence and Wind Energy Research*, Carl von Ossietzky University Oldenburg, December 1 2017.

*On the Relevance of Droplet Sedimentation in Stratocumulus-Top Mixing*, Mini-Symposium on the Fluid Dynamics of Atmospheric Clouds, 70th Annual Meeting of the APS Division of Fluid Dynamics, November 19-21 2017.

*Resolving Submeter-Scale Processes at the Top of Stratocumulus Clouds*, 2nd International Workshop on Cloud Turbulence, Nagoya Institute of Technology, March 8-10 2017.

*Cloud Boundaries in Entrainment Zones*, International Workshop on Cloud Microphysics – Turbulence Interaction, Leibniz Institute for Tropospheric Research, Leipzig, February 28 – March 1 2017.

*Resolving Turbulence in Planetary Boundary Layers*, Turbulence and the Climate System: Jim McWilliams Symposium, National Center for Atmospheric Research, Boulder, August 24-26 2016.

*Using Direct Numerical Simulation to Understand Cloud and Boundary Layer Dynamics*, Workshop Cloud and Boundary Layer Dynamics: The Next Decade, ETH Zürich, June 13-15 2016.

*New Insights into Atmospheric Turbulence Gained from Direct Numerical Simulations*, Meeting of the Scientific Advisory Board, John von Neumann Institute for Computing (NIC), Jülich, April 15 2016.

*Understanding and Representing Atmospheric Turbulence with Direct Numerical Simulation*, Assessing the Climate via Models–Prediction, Understanding, and Computer Simulation, Center for Interdisciplinary Research, U Bielefeld, June 8 2015.

*Wind Shear and Buoyancy Reversal at the Stratocumulus Top*, 47th AGU Fall Meeting of the American Geophysical Union, San Francisco, December 15-19 2014.

*Turbulent Entrainment in the Atmospheric Boundary Layer*, 85th Annual Meeting of the International Association of Applied Mathematics and Mechanics, Erlangen, March 10-14 2014.

*Mean Shear Effects at the Cloud-Top Boundary*, 23rd International Congress on Theoretical and Applied Mechanics, Beijing, August 19-24 2012.

*Stratocumulus-top moist convection*, Solving the riddle of turbulence: What, Why, and How?, Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany, May 6-9 2009.

#### INVITED LECTURES AT SUMMER AND WINTER SCHOOLS

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*Atmospheric Turbulence*, Summer School *200 Years of Navier-Stokes Equations and Turbulences*, Les Houches School of Physics, Session CXXII, Les Houches, July 31-August 25 2023.

*Introduction to Atmospheric Flows*, Summer School *Fluid Mechanics of Planets and Stars*, International Centre for Mechanical Sciences (CISM), Course C2301, Udine April 17-21 2023.

*Atmospheric Turbulence*, Winter School *New Challenges in Turbulence Research VI*, École de Physique des Houches, France, February 7-12 2021.

*Introduction to Tropical Convection, Governing Equations for Tropical Convection, Stratocumulus Clouds, and Entrainment*, ITN-ETN COMPLETE 2th Summer School on *Microphysics and Dynamics of Clouds*, Zugspitze Environmental Research Station Schneesfernerhaus (UFS), Germany, July 9-14 2018.

*On the Relevance of Small-Scale Turbulence in Planetary Boundary Layers*, The 6th Bremen Winter School and Symposium *Dynamical Systems and Turbulence*, U Bremen, March 12-16 2018.

*Entrainment in the Atmospheric Boundary Layer*, Summer School *Turbulent Flows*, Imperial College London, July 24-27 2017.

#### INVITED SEMINARS

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*Sketches of High-Resolution Microscale Modeling*, Department of Meteorology, University of Reading, UK, February 20 2023.

*New Results about Wind Shear Effects on Entrainment in Convective Boundary Layers*, National Center for Atmospheric Research, Boulder, November 25 2019.

*Small-Scale Turbulence in Planetary Boundary Layers: Recent Advances and Standing Challenges*, Kolloquium für Mechanik, Karlsruhe Institute of Technology, January 17 2019.

*The Challenge of Small-Scale Turbulence in Planetary Boundary Layers*, Niels Bohr Institute, Copenhagen, November 9 2018.

*Entrainment in Stratocumulus Clouds*, Department of Civil and Environmental Engineering, Princeton University, February 7 2018.

*The Challenge of Small-Scale Turbulence in Planetary Boundary Layers*, MPIDS Advances, Max Planck Institute for Dynamics and Self-Organization, Göttingen, September 6 2017.

*On the Relevance of Small-Scale Turbulence in Planetary Boundary Layers*, Geophysical Fluid Dynamics Seminar, Free University of Berlin, June 28 2017.

*On the Relevance of Small-Scale Turbulence in Planetary Boundary Layers*, Center of Applied Space Technology and Microgravity, University of Bremen, June 14 2017.

*Resolving Turbulence in Planetary Boundary Layers*, Institute of Geophysics, University of Warsaw, February 3 2017.

*New Insights into Boundary-Layer Turbulence Gained from High-Resolution Simulations*, Polytechnic University of Catalonia, Barcelona, September 30 2015.

*Small-Scale Turbulent Mixing at the Top of the Planetary Boundary Layer*, Technical University of Berlin, February 3 2015.

*New Insights into Boundary-Layer Turbulence Gained from High-Resolution Simulations*, Meteorological Colloquium, Goethe University Frankfurt, January 29 2015.

*Turbulent Entrainment at the Stratocumulus Top*, Meteorological Colloquium, Leibniz University Hannover, January 15 2015.

*Small-Scale Turbulent Mixing at the Top of the Planetary Boundary Layer*, National Weather Center Colloquium, University of Oklahoma, Norman, December 9 2014.

*Small-Scale Turbulent Mixing at the Top of the Planetary Boundary Layer*, MMM Seminar, National Center for Atmospheric Research, Boulder, December 4 2014.

*Turbulent Entrainment in the Atmospheric Boundary Layer*, Insitute for Atmospheric Sciences and Climate, Lecce, November 18 2018.

*Turbulent Mixing at the Stratocumulus Top*, Johannes Gutenberg University, Mainz, January 13 2014.

*Turbulent Entrainment in the Atmospheric Boundary Layer*, Universidad Carlos III de Madrid, Spain, December 20 2013.

*Small Scale Turbulent Mixing at the Stratocumulus Top*, Meteorological Colloquium, Karlsruhe Institute of Technology, October 22 2013.

*The Role of Evaporative Cooling in Cloud-Top Turbulence*, Technical University of Munich, October 30 2012.

*The Role of Evaporative Cooling at the Cloud Boundary*, University of Siegen, April 26 2012.

*New Results on the Cloud-Top Entrainment Instability*, University of California San Diego, May 23 2011.

*Latent heat effects in the cloud-top mixing layer*, Ilmenau University of Technology, Germany, April 6 2010.

*LES of variable density flows*, Technical University of Munich, Germany, May 19 2004

*LES de flujos de densidad variable*, Universidad Carlos III de Madrid, Spain, May 7 2004

#### CONTRIBUTED TALKS (ONLY FIRST AUTHOR)

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J. P. Mellado, C. S. Bretherton, B. Stevens, M. C. Wyant, *"DNS and LES for simulating stratocumulus: Better together"*, 2<sup>th</sup> Workshop on Eulerian vs. Lagrangian Methods for Cloud Microphysics, Jagiellonian University Cracow, April 15-17x 2019

J. P. Mellado, K. Fodor, M. Wilczek, *"Large-scale effects near the surface in convective boundary layers"*, 55<sup>th</sup> Annual Technical Meeting of the Society of Engineering Sciences, Madrid, October 9-12 2018.

J. P. Mellado, M. Puche, C. van Heerwaarden, *"Moisture statistics in free convective boundary layers"*, 23<sup>rd</sup> Symposium on Boundary Layers and Turbulence, Oklahoma City, June 11-15 2018.

J. P. Mellado, *"The turbulent/non-turbulent interface at the top of stratocumulus clouds"*, Euromech Colloquium 590: Turbulent/non-turbulent interfaces: From laboratory to geophysical flows, Imperial College London, July 2-5 2017.

J. P. Mellado, B. Schulz, A de Lozar, *"Wind shear in stratocumulus-top entrainment"*, 11<sup>th</sup> European Fluid Mechanics Conference, Sevilla, September 12-16 2016.

J. P. Mellado, C. van Heerwaarden, *"Near-surface effects of free atmosphere stratification in free convection"*, 22<sup>nd</sup> Symposium on Boundary Layers and Turbulence, Salt Lake City, June 20-24 2016.

J. P. Mellado, C. van Heerwaarden and J. R. Garcia, *Buoyancy Profiles inside the Inner Region of a Convective Boundary Layer*, 9<sup>th</sup> International Symposium on Turbulence and Shear Flow Phenomena, University of Melbourne, June 30-July 3 2015.

J. P. Mellado, C. van Heerwaarden, *"On the relation between large-scale circulations and near-surface properties"*, International Conference on Rayleigh-Bénard Turbulence, Göttingen, June 1-5 2015.

J. P. Mellado, C. van Heerwaarden and J. R. Garcia, *Effect of Outer Stratification inside the Inner Region of a Convective Boundary Layer*, 86th Annual Meeting of the International Association of Applied Mathematics and Mechanics, Lecce, March 23-27 2015.

J. P. Mellado, B. Stevens and H. Schmidt, *Wind shear and evaporative cooling at the stratocumulus top*, 7<sup>th</sup> International Scientific Conference on the Global Water and Energy Cycle, The Hague, July 14-17 2014.

J. P. Mellado, B. Stevens and H. Schmidt, *Wind shear and evaporative cooling at the stratocumulus top*, 21<sup>st</sup> Symposium on Boundary Layers and Turbulence, Leeds, June 9-13 2014.

J. P. Mellado, *Shear Effects in the Evaporatively Driven Cloud-Top Mixing Layer*, 66<sup>th</sup> Annual Meeting of the APS Division of Fluid Dynamics, Pittsburgh, November 24-26 2013.

J. P. Mellado, B. Stevens and H. Schmidt, *Small Scale Turbulent Mixing at the Stratocumulus Top*, 1<sup>st</sup> International Conference on Frontiers of Computational Physics: Modelling the Earth System, Boulder, December 16-20 2012.

J. P. Mellado, *Turbulent Free Convection Over a Heated Plate*, 65<sup>th</sup> Annual Meeting of the APS Division of Fluid Dynamics, San Diego, November 18-20 2012.

J. P. Mellado, *Gradient Trajectory Analysis of the Scalar T/NT Interface*, First Multiflow Conference on the Turbulent-Nonturbulent Interface, Polytechnic University of Madrid, October 25-26 2012.

J. P. Mellado, B. Stevens, H. Schmidt and N. Peters, *New Results about the Cloud-Top Entrainment Instability*, International MetStröm Conference, Free University of Berlin, June 6-10 2011.

J. P. Mellado, *Buoyancy Reversal at Cloud Boundaries*, Kavli Institute for Theoretical Physics, UC Santa Barbara, April 4 2011.

J. P. Mellado, *The evaporatively driven cloud-top mixing layer*, 63<sup>rd</sup> Annual Meeting of the APS Division of Fluid Dynamics, Long Beach, November 21-23 2010.

J. P. Mellado, H. Schmidt, B. Stevens and N. Peters, *The cloud-top mixing layer*, Below the Rossby radius: Workshop on small-scale variability in the general circulation of the atmosphere and oceans, Tremsbüttel, Germany, September 15-17 2010.

J. P. Mellado, H. Schmidt, B. Stevens and N. Peters, *Investigation of latent heat effects at the Stratocumulus top using direct numerical simulations*, Mathematical Theory and Modelling in Atmosphere-Ocean Sciences, Mathematisches Forschungsinstitut Oberwolfach, Germany, August 8-14 2010.

J. P. Mellado, *Moist turbulence at the cloud boundary*, Aachen Workshop on Conditional Statistics in Turbulence, Institute for Combustion Technology, Aachen, Germany, May 31 - June 2 2010.

J. P. Mellado, H. Schmidt, B. Stevens and N. Peters, *DNS of the cloud-top mixing layer*, 12<sup>th</sup> EUROMECH European Turbulence Conference, Philipps University, Marburg Germany, September 7-10 2009.

J. P. Mellado, B. Stevens, H. Schmidt and N. Peters, *Analysis of the cloud-top mixing layer using DNS*, 6<sup>th</sup> International Symposium on Turbulence and Shear Flow Phenomena, Seoul National University, Seoul, Korea, June 22-24 2009.

J. P. Mellado, B. Stevens, H. Schmidt and N. Peters, *Small-domain DNS analysis of Stratocumulus tops: evaporative cooling effects*, Workshop on Advanced Concepts for Boundary Layer Parameterizations, Deutscher Wetterdienst (DWD), Offenbach, Germany, May 25-27 2009.

J. P. Mellado, B. Stevens, H. Schmidt and N. Peters, *Buoyancy reversal in the cloud-top mixing layer*, 4<sup>th</sup> IMS Turbulence Workshop, Imperial College, London, England, March 23-25 2009.

J. P. Mellado, L. Wang and N. Peters, *Investigation of the conditional scalar dissipation rate across a shear layer using gradient trajectories*, 3<sup>rd</sup> iTi Conference on Turbulence, Bertinoro, Italy, October 12-15 2008.

J. P. Mellado, L. Wang, N. Peters and J. H. Göbbert, *Variation of the conditional dissipation rate across a shear layer*, 2<sup>nd</sup> Meeting of the Spanish Section of the Combustion Institute, Valencia, Spain, May 8-9 2008.

- J. P. Mellado, *Conditional scalar dissipation in free turbulent shear flows*, Aachen Workshop on Scalar Dissipation Lengths, Institute for Combustion Technology, Aachen, Germany, July 25-27 2007.
- J. P. Mellado, R. Friedrich and S. Sarkar, *Modeling of filtered heat release for large eddy simulation of compressible infinitely-fast reacting flows*, 31<sup>st</sup> International Symposium on Combustion, Heidelberg, Germany, August 6-11 2006.
- J. P. Mellado, S. Sarkar and Y. Zhou, *Compressibility effects on Rayleigh-Taylor turbulence*, 9<sup>th</sup> International Workshop on the Physics of Compressible Turbulent Mixing, Cambridge, UK, July 19-23 2004.
- J. P. Mellado and S. Sarkar, *Large-eddy simulation of jets with density variation*, LES-SGS Modeling for Turbulent Mixing and Reactive Flows Workshop, Pasadena, December 8-9 2003.
- J. P. Mellado and S. Sarkar, *Subfilter models for nonpremixed combustion: ARM and assumed PDF approaches*, 55<sup>th</sup> Annual Meeting of the APS Division of Fluid Dynamics, Dallas, November 24-26 2002.
- J. P. Mellado, S. Sarkar and C. Pantano, *On modeling the reaction rate in a LES of a jet*, Spring Meeting of the Western States Section of the Combustion Institute, paper WSSCI 02S-89, La Jolla, March 25-26 2002.
- J. P. Mellado, S. Sarkar and C. Pantano, *Evaluation of a subgrid model for the Arrhenius Reaction Rate in a Jet*, 40<sup>th</sup> AIAA Aerospace Sciences Meeting & Exhibits, paper AIAA 2002-0165, Reno, January 14-17 2002.
- J. P. Mellado and S. Sarkar, *Modeling of the Arrhenius-type reaction rate for LES*, 54<sup>th</sup> Annual Meeting of the APS Division of Fluid Dynamics, San Diego, November 18-20 2001.