

ANNALISA MOLINI

CURRICULUM VITÆ

(LAST UPDATED: MAY 1, 2012)

MASDAR INSTITUTE OF SCIENCE AND TECHNOLOGY
WATER AND ENVIRONMENTAL ENGINEERING PROGRAM

PO BOX 54224, ABU DHABI,
UNITED ARAB EMIRATES

&

RALPH M. PARSONS LABORATORY
DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Room 48-309, 15 Vassar Street
Cambridge, MA, 02139

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RESEARCH INTERESTS

- Climate change, hydro-statistics and water resources availability
- Stochastic modeling in hydrology and eco-hydrology
- Climatology and modeling of extreme hydrological and biological events
- Hydro-meteorology and impacts of land-atmosphere interactions on the onset of convective precipitation
- Analysis of the linkages between meteorological (essentially deterministic) and hydrological (stochastic) models
- Non-linear time series analysis and wavelet-based spectral methods
- Remote-sensing of the rainfall field, reliability analysis of rainfall intensity measurements and error/measure theory

PROFESSIONAL EXPERIENCE

CURRENT POSITION

- | | |
|------------------------|---|
| Sep 2011 to
present | Assistant Professor , <i>Masdar Institute of Science and Technology, Water and Environmental Engineering</i> , Abu Dhabi, United Arab Emirates. |
| Sep 2011 to
present | Visiting Scholar , <i>Ralph M. Parsons Laboratory, Dept. of Civil and Environmental Engineering, Massachusetts Institute of Technology</i> , Cambridge, MA, USA. |

PREVIOUS APPOINTMENTS

ACADEMIC

- | | |
|-------------------------|---|
| Nov 2007 to
Aug 2011 | Research Associate , <i>Pratt School of Engineering & Nicholas School of the Environment, Duke University</i> , Durham, NC, USA. |
| 2006–2007 | Research Fellow , <i>University of Genova, Department of Construction, Environmental and Territorial Engineering (DICAT)</i> , Genoa, Italy. |

2001–2005 **Research Fellow**, *University of Genova, Department of Environmental Engineering (DIAM)*, Genova, Italy.

OTHER PROFESSIONAL EXPERIENCES

2007 **Data Manager**, *World Meteorological Organization (WMO), Observing and Information Systems Department*, Geneva, Switzerland – Vigna di Valle, Italy.

Data Manager and Analyst of the [WMO Field Intercomparison of Rainfall Intensity Gauges](#), at the Italian Air-force Meteorological Center of Vigna di Valle (Rome, Italy). See Subsection [Technical Reports](#) for further details.

2006–2007 **Grant Consultant for the Department of Environmental Policies**, *Municipality of Genoa*, Genova, Italy.

EDUCATION

Feb 2002 PhD in Methods for Environmental Monitoring – Civil and Environmental Engineering, *University of Genova*, Genova, Italy.

Dissertation title *Analysis of the non-linear characteristics of the rainfall process, with particular regard to its intermittent structure (Analisi delle caratteristiche non lineari del processo di precipitazione con particolare riguardo alla struttura di intermittenza)* – In Italian

Downloadable at <http://www.dicat.unige.it/molini/DOCUMENTAZIONE/MoliniPhD02LR.pdf>

Supervisor Paolo La Barbera, Dept. of Construction, Environmental and Territorial Engineering (DICAT), University of Genova, Italy

Major Hydrological Sciences and Water Resources Management

Research Area Environmental Monitoring, Data Analysis and Assimilation, Stochastic Modelling

Apr 1998 M.S. in Marine Environmental Sciences, *University of Genova*, Genova, Italy, 110/110 *Magna Cum Laudæ distinction*.

Dissertation title *A simple model for the Oceanic Now-casting (Un semplice modello per il Now-casting Oceanico)* – In Italian

Downloadable at <http://www.dicat.unige.it/molini/DOCUMENTAZIONE/MoliniTL98.pdf>

Supervisor Roberto Festa, Dept. of Physics, University of Genova, Italy

Major Physics of Atmosphere and Oceanography

Research Area Meteorological Models at the Synoptic Scale

PUBLICATIONS

REFEREED JOURNAL PUBLICATIONS

2012 [1](#)) Detto M., Molini A., Katul G. G., Stoy P., Palmroth S., Baldocchi D. (2012) Causality and Persistence in Ecological Systems: A Nonparametric Spectral Granger Causality Approach. *American Naturalist*, 179(4), 52435.

[2](#)) Cava D., Katul G. G., Molini A., Elefante C. (2012) The role of surface characteristics on intermittency and zero-crossing properties of atmospheric turbulence. *Journal of Geophysical Research-Atmospheres*, 117, D01104.

[3](#)) Konings A. G., Feng X., Molini A., Manzoni S., Vico G., Porporato A. (2012) Thermodynamics of an idealized hydrologic cycle. *Water Resources Research*, 48, W05527.

2011 [4](#)) Manzoni, S., Molini, A., Porporato, A., (2011) Stochastic modelling of phytoremediation, *Proc. R. Soc. A*, rspa.2011.0209v1-rspa20110209.

- 5) Molini A., Talkner, P., Katul, G., Porporato, A., (2011) First passage time statistics of Brownian motion with purely time dependent drift and diffusion, *Physica A*, 390(11), 1841-1852, doi:10.1016/j.physa.2011.01.024.
- 6) Molini A., Katul, G., Porporato, A. (2011) Maximum Discharge from Snowmelt in a Changing Climate, *Geophys. Res. Lett.*, 38, L05402, doi:10.1029/2010GL046477.
- 7) Ramirez-Cobo, P., Lee, K.S., Molini, A., Porporato, A., Katul G.G. and B. Vidakovic, (2011) Wavelet-based spectral methods for extracting self-similarity measures in time-varying two-dimensional geophysical fields, *Journal of Time Series Analysis*, DOI: 10.1111/j.1467-9892.2011.0073.
- 2010 8) Molini A., Katul, G., Porporato, A., (2010) Fingerprint of Convective and Frontal Systems in the Scale-wise Evolution of Rainfall Probability Density Functions, *Geophys. Res. Lett.*, 37, L07403, doi:10.1029/2010GL042634.
- 9) Molini, A., Katul, G., Porporato, A., (2010) Causality Across Rainfall Time Scales: A Wavelet Approach, *J. Geophys. Res. Atmos.*, 115, D14123, doi:10.1029/2009JD013016.
- 2009 10) Molini, A., Katul, G., Porporato, A., (2009) Revisiting rainfall clustering and intermittency across different climatic regimes, *Water Resource Res.*, 45, W11403, doi:10.1029/2008WR007352.
- 2006 11) Molini, A., La Barbera, P., Lanza, L. G., (2006) Correlation Patterns and information flows in rainfall field, *J. of Hydrology*, 322(1-4), 89-104.
- 2005 12) Molini, A., Lanza, L.G., La Barbera, P., (2005) Improving the accuracy of tipping-bucket rain records using disaggregation techniques, *J. of Atmos. Res.*, 77(1-4), 203-217.
- 2004 13) Molini, A., La Barbera, P., Lanza, L. G., (2004) The impact of TBRs measurement errors on design rainfall for urban-scale applications, *Hydrological Processes*, 19(5), 1073-1088.
- 2002 14) Molini, A., La Barbera, P., Lanza, L. G., (2002) On the properties of stochastic intermittency in rainfall processes, *Water Science and Technology*, 45(2), 35-40.
- 2001 15) Molini, A., La Barbera, P., Lanza, L. G., Stagi, L., (2001) Rainfall intermittency and the sampling error of tipping-bucket rain gauges, *Phys. Chem. Earth (C)*, 26(10-12), 737-742.

REFEREED CONFERENCE PROCEEDINGS

- 2008 1) Berretta, C., Gnecco, I., Molini, A., Palla, A., Lanza, L.G., La Barbera, P., (2008) On the efficiency of catch basin inserts for storm water runoff treatment, *Proceedings of the 11th International Conference on Urban Drainage*, 11ICUD, Edinburgh, 31 August – 5 September 2008.
- 2007 2) Molini, A., Berretta, C., Cattaneo, C., Furfaro, M., Gnecco, I., La Barbera, P., Lanza, L.G., Rovatti, M., (2007) A laboratory intercomparison of distributed stormwater treatment device, *NOVATECH 2007*, 6th international conference on sustainable techniques and strategies in urban water management, Lyon (France), June 25-28, Vol.2 pp. 719-726.
- 3) Berretta, C., Molini, A., Gnecco, I., Lanza, L.G., La Barbera, P., (2007). Sull'efficienza dei sistemi distribuiti per il trattamento delle acque meteoriche in cadoioa. *Atti di "Acqua e Citta", Il Convegno Nazionale Idraulica Urbana*", Chia (Italy), September 25-28 2007, (in Italian).

- 2006 4) Molini, A., La Barbera, P., Lanza, L. G., (2006) Information measures and the intermittent behavior of rainfall patterns in time and space, Proceedings of the 7th International Workshop on Precipitation in Urban Areas, Sant Moritz (Switzerland), pp. 203-207.
- 2005 5) Molini, A., Cassini, G., Lanza, L.G., Stagi, L., (2005) Dealing with uncertainty in rainfall gauges calibration: the QM-RIM metrological validation, Proceedings of TECO2005, 20 pp.
- 6) Molini, P. La Barbera, L.G. Lanza, (2005) Affidabilità dell'Informazione Pluviometrica nella Stima delle Piogge di Progetto dei Sistemi di Drenaggio Urbano, I Convegno Nazionale di Idraulica Urbana, Sant'Agnello (Italy), September 28-30 2005, CD-Rom, 16 pp. (in Italian).
- 2003 7) Molini, A., La Barbera, P., Lanza, L. G., (2003) Improving the Accuracy of Rain Intensity Records by Disaggregation Techniques, Proceedings of the 6th International Workshop on Precipitation in Urban Areas, Pontresina (Switzerland), December 4-7, 2003, 146-152.
- 2002 8) Molini, A., La Barbera, P., Lanza, L. G., (2002) Intermittenza e flussi d'informazione complessi all'interno del processo di precipitazione spazio temporale, Atti del XXVIII Convegno Nazionale di Idraulica e Costruzioni Idrauliche, Potenza (Italy) , Vol. 2, pp. 337-348 (in Italian).
- 9) Molini, A., La Barbera, P., Lanza, L. G., Stagi, L., (2002) L'errore sistematico meccanico dei pluviometri a vaschette basculanti: ricostruzione e correzione delle serie storiche, Atti del XXVIII Convegno Nazionale di Idraulica e Costruzioni Idrauliche, Potenza (Italy), Vol. 1, pp. 139-148 (in Italian).
- 10) Coniglio, D., Molini, A., La Barbera, P., Lanza, L. G., (2002) Real time control and management of the urban drainage system in the town of Genova, Proceedings of the 2nd International Conference - New trends in water and environmental engineering for safety and life: Eco-compatible solutions for aquatic Environments, Capri (Italy), June 24-28 2002, 12 pp.
- 11) Molini, A., La Barbera, P., Lanza, L. G., (2002), Linear And Non-Linear Information Flows In Space-Time Rainfall, Proceedings of the Second International Symposium on Flood Defence (ISFD'2002), Beijing (China), September 10-13 2002, Vol. I, 545-553.
- 12) Coniglio, D., Molini, A., La Barbera, P., Lanza, L. G., (2002) Non Invasive Defence Structures In The Urban Environment: A Case Study, Proceedings of The Second International Symposium on Flood Defence (ISFD'2002), Beijing (China), September 10-13 2002, Vol. II, 1347-1356.
- 2001 13) Molini, A., La Barbera, P., Lanza, L. G., (2001) A few stochastic properties of rainfall intermittency in space and time, Proceeding of Plinius Conference on "Mediterranean Storms", Siena (Italy), October 16-18 2000, 337-348.
- 2000 14) Molini, A., Festa, R., (2000) A simplified model for meteorological now-casting, Proceeding of Plinius Conference on "Mediterranean Storms", Maratea (Italy) October 14-16 1999, pp. 157-168.
- 15) Molini, A., (2000) Analisi della struttura probabilistica di eventi pluviometrici osservati ad elevata risoluzione temporale, con particolare riguardo alla struttura dell'intermittenza, Atti del XXVII Convegno Nazionale di Idraulica e Costruzioni Idrauliche, Genova (Italy), Vol. II, pp 251-258 (in Italian).
- 16) Stagi, L., Molini, A., (2000) Risposta di strumenti pluviometrici ad eventi sintetici di pioggia, Atti del XXVII Convegno Nazionale di Idraulica e Costruzioni Idrauliche, Genova (Italy), Vol. II , pp 417-422 (in Italian).

17) Molini, A., La Barbera, P., Lanza, L. G., (2000) On the properties of stochastic intermittency in rainfall processes, Proceedings of the Fifth International Workshop on Rainfall in Urban Areas, December 2000, Pontresina (Switzerland).

ABSTRACTS, PRESENTATIONS & WORKSHOPS

- 2011 1) Molini, A., Hassan, A. S., Katul, G. and A. Porporato (2011) ENSO and Indian Ocean Dipole signatures in the history of Indian-Pakistani severe floods, AGU Fall Meet. Suppl. 2011, Abstract H24C-04.
- 2) Porporato, A., Molini, A., Hassan, A. S., (2011) Impact of complex climatic interactions on Pakistan flood risk, 2011 World Environmental & Water Resources Congress, Palm Springs, California, May 22-26, 2011.
- 2010 3) Molini, A., Porporato, A., Katul, G., (2010) A Stochastic-Dynamical Approach to Snow Accumulation-Melting in a Changing Climate, AGU Fall Meet. Suppl. 2010, Abstract 961457.
- 2010 4) Porporato, A., Manzoni, S., Molini, A., Rigby, JR, and Vico, G., (2010) Biologically-defined extremes: survival and ecosystem changes under climate change, Geophysical Research Abstracts Vol. 12, 2010, EGU General Assembly 2010.
- 5) Molini, A., Katul, G., Porporato, A., (2010) Scale-wise evolution of rainfall probability density functions fingerprints the rainfall generation mechanism, Geophysical Research Abstracts Vol. 12, EGU2010-13785-2, 2010, EGU General Assembly 2010.
- 6) Katul, G., Molini, A., Porporato, A., (2010) Causal signatures in rainfall cascade: a wavelet approach, Geophysical Research Abstracts Vol. 12, EGU2010-13712-2, 2010, EGU General Assembly 2010.
- 2009 7) Molini, A., Katul, G., Porporato, A., (2009) Causality in Rainfall Cascades , AGU Fall Meet. Suppl. 2009, Abstract H31D-0816.
- 2008 8) Porporato, A., Daly, E., Molini, A., Rigby, J.R., Katul, G., (2008) Scaling and intermittency in rainfall models with state dependent noise, (Abstract), Geophysical Research Abstracts, Vol. 10, EGU2008-A-10242, 2008, Invited Contribution at the EGU General Assembly 2008.
- 9) Molini, A., Katul, G., Porporato, A., (2008) Causality, Scale Dependence and Intermittency Build-up Across Rainfall Time Scales: a Wavelet Approach, AEos Trans. AGU, 89(53), Fall Meet. Suppl., Abstract H51B-0799.
- 2007 10) Molini, A., La Barbera, P., Lanza, L. G., (2007) The role of uncertainty and accuracy of measured data in the assessment of climatological patterns from rainfall time series, (Abstract), Geophysical Research Abstracts, Vol. 9, 06651.
- 11) Molini, A., La Barbera, P., Lanza, L. G., (2007) Binary signal characteristics as a tool for the interpretation of the intermittent structure of rainfall in space and time, (Abstract), Geophysical Research Abstracts, Vol. 9, 06726.
- 12) Molini, A., La Barbera, P., Lanza, L. G., (2007) the key role of intermittency in rainfall disaggregation schemes, (Abstract), IUGG 2007 Perugia - XXIV IUGG General Assembly, Perugia (Italy), July 2-13 2007.
- 13) Vuerich E., Malaspina F., Foti F., Daddario G., Molini A., Stagi L., Lanza L., (2007) Intercalibrazione mondiale degli strumenti per la misura dell' intensita di precipitazione: un laboratorio a cielo aperto, (Abstract), Italian Society of Physics National Assembly, Pisa (Italy), September 24-29 2007, (in Italian).

- 14) Molini, A., Lanza, L. G., La Barbera, P., (2007) Hydrologic implications of rain intensity measurement errors from presently operational gauges, (Abstract), 11th International Conference on Urban Drainage, 11ICUD, Edinburgh, August 31 – September 5 2008.
- 2006 15) Molini A., La Barbera, P., Lanza, L. G., (2006) Independent components analysis: an application to the study of rainfall field in space and time, (Abstract), Geophysical Research Abstracts, Vol. 8, 09227, 2006.
- 16) Lanza, L.G. , Molini, A., Stagi, L., Malaspina, F., Foti, F., Vuerich, E., Casu, G., Beltrano, C., (2006) The influence of rainfall intensity measurement errors on the climatological interpretation of historic rain series, (Abstract), Geophysical Research Abstracts, Vol. 8, 09111, 2006.
- 17) Lanza, L.G., Molini, A., Stagi, L., Cassini, G., (2006) Correction techniques for tipping-bucket rain gauges and their influence on the accuracy of rain intensity measurements, (Abstract), Geophysical Research Abstracts, Vol. 8, 08938, 2006.
- 18) Molini, A., La Barbera, P., Lanza, L. G., (2006) Climatological patterns from rainfall time series: the role of uncertainty and accuracy of measured data, 7th International Workshop on Precipitation in Urban Areas.
- 2005 19) De Bartolo, S. G., Dàcamp, N., De Michele, C., Molini, A., Primavera, L., (2005) Multifractal analysis of rainfall time series: uncertainty assessment and drawbacks through different fixed-size techniques, (Abstract), Geophysical Research Abstracts 2005.
- 2003 20) Molini, A., La Barbera, P., Lanza, L. G., (2003) Design rainfall and accuracy of rain intensity records, (Abstract), Geophysical Research Abstracts 2003, Vol. 5, 12832.
- 21) Molini, A., La Barbera, P., Lanza, L. G., (2003) Patterns and prediction in rainfall field: an information theory approach, (Abstract) Hydrofractals 2003, Fractals in Hydrosiences, Ascona (Switzerland), August 24-29 2003, Book of Abstracts 38-39.
- 2002 22) Molini, A., La Barbera, P., Lanza, L. G., Stagi, L., (2002) The influence of measurement errors on rainfall disaggregation, (Abstract), Geophysical Research Abstracts 2002. (Young Scientist's Award for Europeans - YSTA).
- 23) Molini, A., La Barbera, P., Lanza, L. G., (2002) Linear and non-linear information flows in rainfall field, (Abstract), Geophysical Research Abstracts 2002.
- 24) Beretta, C., Gnecco, I., La Barbera, P., Lanza, L.G., Molini, A.,(2002) An experimental catchment for first flush flows in the town of Genova, (Abstract), TIES 2002: Annual Conference of The International Environmetrics Society, Genova (Italy), June 18 - 22 2002.
- 25) Cerisola, D., Vallebona, A., La Barbera, P., Lanza, L.G., Molini, A., Stagi, L.,(2002) An automatic device for dynamic calibration of tipping bucket rain gauges, (Abstract), TIES 2002: Annual Conference of The International Environmetrics Society, Genova (Italy), June 18 - 22 2002.
- 2001 26) Molini, A., Lanza, L. G., Stagi, L., (2001) The influence of intermittency on tipping bucket rain gauge measurements, (Abstract), EGS General Conference, Geophysical Research Abstracts 2001.
- 27) Molini, A., La Barbera, P., Lanza, L. G., (2001) A stochastic approach to the analysis of intermittency in high resolution rain signals, (Abstract), EGS General Conference, Geophysical Research Abstracts 2001.
- 28) Molini, A., La Barbera, P., Lanza, L. G.,(2001) Entropy and correlation in temporal rainfall process, (Abstract), Seventh International Conference on Precipitation - Observations, Estimation, and Prediction of Precipitation Variability at All Scales, Rockport, Maine (USA).

- 2000 29) Molini, A., (2000) Intermittence statistical structure in pluviometric time series observed at high resolution (Abstract), EGS General Conference, Geophysical Research Abstracts 2000.
- 30) Molini, A., Stagi, L., (2000) Rain gauges response to synthetic rainfall events (Abstract), EGS General Conference, Geophysical Research Abstracts 2000.

TECHNICAL REPORTS

- 2007 1) Molini, A., (2007) WMO Field Intercomparison of Rainfall Intensity Gauges, Vigna di Valle, Italy, Mid 2007 – Mid 2008, Data Manager Technical Report, No. 1, July–August 2007
- 2) Molini, A., (2007) WMO Field Intercomparison of Rainfall Intensity Gauges, Vigna di valle, Italy, Mid 2007 – Mid 2008, Data Manager Technical Report, No. 2, September 2007, downloadable at: <http://www.wmo.ch/pages/prog/www/IMOP/reports/2003-2007/>

TEACHING EXPERIENCE

- Spring 2011 **Guest Lecturer**, *Duke University, Department of Civil and Environmental Engineering, Durham, NC USA.*
Fluid Mechanics (undergraduate)
- Fall 2010 **Instructor**, *Duke University, Department of Civil and Environmental Engineering, Durham, NC USA.*
Environmental Thermodynamics (graduate)
- Spring 2010 **Guest Lecturer**, *Duke University, Department of Civil and Environmental Engineering, Durham, NC USA.*
Fluid Mechanics (undergraduate)
- 2001–2007 **Teaching Assistant**, *University of Genova, Department of Construction, Environmental and Territorial Engineering (DICAT), Genoa, Italy.*
Water Resources Management (graduate and undergraduate)
- **Teaching Assistant**, *University of Genova, Department of Construction, Environmental and Territorial Engineering (DICAT), Genoa, Italy.*
Hydraulic Infra-structures (undergraduate)
- **Teaching Assistant**, *University of Genova, Department of Construction, Environmental and Territorial Engineering (DICAT), Genoa, Italy.*
Introductory classes of "Statistic and Stochastic Methods in Hydrology and Civil Engineering (graduate and undergraduate)
- **Laboratory Assistant**, *University of Genova, Department of Construction, Environmental and Territorial Engineering (DICAT), Genoa, Italy.*
Working on Measure & Sampling theory, Metrological Validation of hydraulic/hydrological measurements and Instrumental Calibration (see [Publications](#)). In this context, I also collaborated to the development, and to the following metrological validation, of a the Calibration module for the laboratory qualification of rainfall intensity measurements (QM-RIM), used by the university of Genova during the [WMO Laboratory Intercomparison of Rainfall Intensity Gauges](#)

I also advised students during the preparation of their Master thesis and graduate students in the development of their PhD research programs.

INVITED TALKS

April, 9th 2010 **"Intermittency, Asymmetry and Causality Signatures in the Rainfall Generation"**, *School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Atlanta, GA -Joint seminar with BESTA (Bioengineering Statistic Center at Tech).*

PEER REVIEW REFEREE FOR:

Water Resources Research.
Journal of Geophysical Research.
Journal of Hydrology.
Journal of Hydrometeorology.
Water, Air & Soil Pollution.
Advances in Water Resources.
Environmental Science & Technology.

SCIENTIFIC AFFILIATIONS

2000 to present **Member of the European Geophysical Union (EGU).**
2007 to present **Member of the American Geophysical Union (AGU).**