

*(Updated Feb 2020)*

## Summary

Ángel G. Muñoz is an Associate Research Scientist at the International Research Institute for Climate and Society (IRI) at the Earth Institute of Columbia University, and Country Lead for Colombia and Guatemala in the Columbia World Project [ACToday](#). His present research interests are associated with how cross-timescale interferences of climate modes impact predictability and predictive skill of extreme events at subseasonal-to-decadal scales; how these interferences can be used to diagnose comprehensive circulation models; and the development of climate services in developing countries. He holds a PhD in Earth and Environmental Sciences from Columbia University's Department of Earth and Environmental Sciences (DEES). Dr. Muñoz also holds a MA and a MPhil from Columbia, along with a BSc in Physics from Universidad del Zulia (Venezuela). Before arriving in the US in 2011, he was Associate Professor in the Department of Physics of Universidad del Zulia for 6 years, and acted as founder (2007) and deputy director of the Venezuela's Center for Scientific Modeling (CMC). At CMC he helped create (2008-2010) the [Latin American Observatory](#), a regional partnership aimed at improving regional capacities and networking to provide better climate services for decision-makers in Latin American countries. The Observatory has offered him the opportunity to work directly with decision-makers on different projects for the Inter-American Development Bank; the United Nations; the World Bank; Central American Regional Committee for Hydrological Resources (CRRH); Comunidad Andina de Naciones; the Environmental Ministry of Ecuador; and the National Met Services of Ecuador, Peru, Colombia, Bolivia, Chile, Paraguay, Uruguay, Panama and Venezuela.

## Research Interests

- cross-timescale interference
- subseasonal-to-decadal (s2d) predictability and prediction
- regional climate variability and change
- lightning (especially in North Western South America, and the Catatumbo Lightning)
- computational modeling, and climate downscaling methodologies
- forecast methodologies
- climate services

## EDUCATION

**2002** – B.Sc. in Physics (with honors). La Universidad del Zulia. Venezuela.

**2013** – M.A. Earth and Environmental Sciences (DEES). Columbia University.

**2015** – M.Phil. Earth and Environmental Sciences (DEES). Columbia University.

**2016** – PhD. Earth and Environmental Sciences. Columbia University.

## LANGUAGES

**3.- French:** medium fluency speaking and writing

**2.- English:** fluent

**1.- Spanish:** native speaker

## GENERAL PROFESSIONAL EXPERIENCE

- 19.- ACToday Country Lead for Colombia and Guatemala**, at the International Research Institute for Climate and Society (IRI). Columbia University. Jan 2018 - present.
- 18.- Associate Research Scientist (ARS)** at the International Research Institute for Climate and Society (IRI). Columbia University. Jan 2018 - present.
- 17.- Member** of NOAA's Modeling, Analysis, Prediction and Projections (MAPP) Sub-seasonal-to-Seasonal (S2S) Task Force. Oct 2016 – present.
- 16.- Member** of the Verification and Products Sub-Project of the WWRP/WCRP S2S Prediction Project. Feb 2016 – present.
- 15.- Postdoctoral Fellow (part time)** at the International Research Institute for Climate and Society, Earth Institute of Columbia University. Jun 2016 – Jan 2018.
- 14.- Postdoctoral Research Associate** at the Atmospheric and Oceanic Sciences (AOS) Program, Princeton University. Feb 2016 – present (working first at NOAA's Geophysical Fluid Dynamic Laboratory, Princeton University under the supervision of Dr. Gabriel A. Vecchi from Feb 2016 – June 2017; and later at AOS/Geosciences under the supervision of Dr. Vecchi from July 2017 – Jan 2018).
- 13.- Graduate Research Fellow (Climate Division)** at the International Research Institute for Climate and Society (IRI). Earth Institute of Columbia University. Sep 2011 – Jan 2016.
- 12.- Faculty fellow** at the Department of Earth and Environmental Sciences (DEES) of Columbia University, under the supervision of Dr. Lisa Goddard. Sep 2011-Jan 2016.
- 11.- Associate (Agregado) Professor** at Department of Physics in the Faculty of Sciences of La Universidad del Zulia. 2010 – 2015.
- 10.- Scientific Coordinator of the Latin American Observatory.** <http://mediawiki.cmc.org.ve> May 2008 – Sep 2012, Sep 2012-today.
- 9.- Coordinator of the Geosciences Area** at Center for Scientific Modeling (Centro de Modelado Científico –CMC) of Universidad del Zulia. Mar 2009 – Sep 2011.
- 8.- Grid Technologies Advisor** for Universidad del Zulia. Feb 2007 – Jan 2009.
- 7.- Scientific Director of the Simón Bolívar Planetarium** (Maracaibo, Venezuela). Jan 2007 – Dec 2008.
- 6.- Deputy Director** of Center for Scientific Modeling (Centro de Modelado Científico –CMC) of Universidad del Zulia. Apr 2007 – Mar 2009.
- 5.- Research Scientist** at Center for Scientific Modeling (Centro de Modelado Científico –CMC) of Universidad del Zulia. Jan 2007 – today.
- 4.- Assistant Professor** at Department of Physics in the Faculty of Sciences of La Universidad del Zulia. Mar 2006 – Oct 2010.
- 3.- Coordinator of the Theoretical Physics and Astronomy Laboratory**, in the Faculty of Sciences of La Universidad del Zulia. Jun 2005 – Jan 2008

**2.- Instructor Professor** at Department of Physics in the Faculty of Sciences of La Universidad del Zulia. Oct 2004 - Mar 2006.

**1.- Associate (Agregado) Professor** at Faculty of Engineering of Universidad Rafael Urdaneta Oct 2004- Mar 2006.

## REFEREED PUBLICATIONS (h-index: 14)

(details: <https://scholar.google.com/citations?user=Q2Gh20AAAAJ&hl=en>)

**53.-** “Can we predict ‘climate migrations’? The 2018 Guatemalan case.” Á.G. Muñoz, D. Pons-Gandini, D. Giraldo-Mendez, S. Adamo, A. de Sherbinin, L. Goddard. *PNAS*. **(to be submitted)**

**52.-** “Shifting climate connections enhanced malaria resurgence in East African Highlands. Will it happen again?” Á.G. Muñoz, S.J. Mason, A.M. Tompkins, L. Goddard, R. Snow, M.C. Thomson. **(to be submitted)**

**51.-** “The Madden-Julian Oscillation affects crop yields around the world”, Anderson, W., E. Han, W. Baethgen, L. Goddard, Á.G. Muñoz, A.W. Robertson. *GRL*. **(sub-judice)**

**50.-** “AeDES: A Next-Generation Monitoring and Forecasting System for Environmental Suitability of Aedes-borne Disease Transmission”, Muñoz, Á.G., X. Chourio, A. Riviere-Cinammond, M. Diuk-Wasser, P. Kache, E. Mordecai, L. Harrington, M.C. Thomson. *Nature Scientific Reports* **(sub-judice)**

**49.-** “On the link between the Madden-Julian Oscillation, Euro-Mediterranean weather regimes, and Morocco winter precipitation”. Gadouali, F., N. Semane, Á.G. Muñoz, M. Messouli. *GRL*. **(sub-judice)**

**48.-** “Targeted model evaluations for climate services: a case study on heat waves in Bangladesh”, Nissan, H., Á.G. Muñoz, S.J. Mason. *Clim Risk Man.* <https://doi.org/10.1016/j.crm.2020.100213> **2020**

**47.-** “MJO teleconnections to crop growing seasons”. Anderson, W., Á.G. Muñoz, L. Goddard, W. Baethgen, X. Chourio. *Clim Dyn.* <https://doi.org/10.1007/s00382-019-05109-0> **2020**.

**46.-** “Improving seasonal precipitation forecast for agriculture in the Orinoquía Region of Colombia”. Fernandes, K., Á.G. Muñoz, J. Ramirez-Villegas, D. Agudelo, L. Llanos-Herrera, A. Esquivel, J. Rodríguez-Espinoza, S. Prager. *Weather and Forecasting.* <https://doi.org/10.1175/WAF-D-19-0122.1> **2020**

**45.-** “Multimodel Subseasonal Forecasts of Spring Cold Spells: Potential Value for the Hazelnut Agribusiness” S. Materia, Á.G. Muñoz, S.J. Mason, M.C. Álvarez-Castro, F. Vitart, S. Gualdi. *Weather and Forecasting.* <https://doi.org/10.1175/WAF-D-19-0086.1> **2020**.

**44.-** "On the potential impact of a half-degree warming on cold and warm temperature extremes in mid-latitude North America" M. Barcikowska, Á.G. Muñoz, W. Scott, S. Russo, M. Wehner. *European Env. Lett.* **2019**.

- 43.-** “Climate Impacts from Large Volcanic Eruptions in a High-resolution Climate Model: the importance of Forcing Structure”. W. Yang, G.A. Vecchi, S. Fueglistaler, L. W. Horowitz, D.J. Luet, Á.G. Muñoz, D. Paynter, S. Underwood. *Geo. Res. Letters*.  
46. <https://doi.org/10.1029/2019GL082367> **2019**.
- 42.-** "Climate information for adaptation: from years to decades.", H. Nissan, M. C. Thomson, S. J. Mason, Á.G. Muñoz In *Climate Information for Public Health Action*, pp. 227-246. Routledge, **2018**.
- 41.-** “Zika in the Americas”. Á.G. Muñoz, R. Lowe, A.M. Stewart, J. Shumake-Guillemot, M.C. Thomson. In “WMO Statement on the state of the Global Climate in 2017”. World Meteorological Organization. Geneva. March **2018**.
- 40.-** “Climate drivers of vector-borne diseases in Africa and their relevance to control programmes”. M.C. Thomson; Á.G. Muñoz; R. Cousin; J. Shumake-Guillemot. *Infectious Diseases of Poverty*. **7**:81 **2018**
- 39.-** “Heavy rainfall in Paraguay during the 2015-2016 austral summer: causes and subseasonal-to-seasonal predictive skill”. Doss-Gollin, J., Á.G. Muñoz, S.J. Mason, M. Pastén. *J. Clim.* **31**, 6669–6685. <https://doi.org/10.1175/JCLI-D-17-0805.1> **2018**
- 38.-** “An asymmetric rainfall response to ENSO in East Asia”. Ng, J., G.A. Vecchi, Á.G. Muñoz, H. Murakami. *Clim.Dyn.* <https://doi.org/10.1007/s00382-018-4253-9> **2018**
- 37.-** “The social and spatial ecology of dengue presence and burden during an outbreak in Guayaquil, Ecuador, 2012”. C. Lippi, A.M. Stewart-Ibarra, Á.G. Muñoz, M. Borbor-Córdova, R. Mejía, K. Rivero, W. Cárdenas, K. Castillo, S.J. Ryan. *Int. J. Environ. Res. Public Health* **15**(4), 827 **2018**
- 36.-** “Assessment of summer rainfall forecast skill in the Intra-Americas in GFDL high- and low-resolution models”. Krishnamurthy, L., Á.G. Muñoz, G.A. Vecchi, R. Msadek, A. Wittenberg, W. Stern, R. Gudgel, F. Zeng. *Clim Dyn.* <https://doi.org/10.1007/s00382-018-4234-z> **2018**
- 35.-** “Improved seasonal prediction skill of rainfall for the Primera season in Central America”. Alfaro, E., X. Chourio, Á.G., Muñoz, S.J. Mason. *Int. J. of Clim.* DOI: 10.1002/joc.5366 **2017**
- 34.-** “A menace wrapped in a protein: Zika and the Global Health Security Agenda”. Epstein, H., W. James, Á.G. Muñoz, L. Stanberry, M.C. Thomson. Columbia GHS&D Working Group Papers 2017-01. Technical Report. Global Health Security Agenda. 60 pp. **2017**.
- 33.-** “A Weather-type-based Cross-timescale Diagnostic Framework for Coupled Circulation Models”. Á.G. Muñoz, X. Yang, G. Vecchi, A.W. Robertson, W.F. Cooke. *J. Clim.* **30**:8951-8972. <https://doi.org/10.1175/JCLI-D-17-0115.1> **2017**
- 32.-** “Could the recent zika epidemic have been predicted?” Á.G. Muñoz, M.C. Thomson, A.M. Stewart-Ibarra, G. Vecchi, X. Chourio, P. Nájera, Z. Moran, X. Yang. *Frontiers Microbiol – Infectious Diseases* 12 July 2017. <https://doi.org/10.3389/fmicb.2017.01291> **2017**
- 31.-** “Vector-virus microclimate surveillance system for dengue control in Machala, Ecuador”. M. Borbor-Córdova, F. Beltrán, W. Cárdenas, T. Endy, J. Findelstein, C. King, R. León, Á.G. Muñoz, R. Mejía, M. Polhemus, C. Recalde-Coronel, S.J. Ryan, A.M. Stewart-Ibarra. In *Climate Services for Health*. Chapter 5c, Shumake-Guillemot, J (Editor). Publisher: WHO-WMO. **2016**

- 30.-** “Analyzing climate variations on multiple timescales can guide Zika virus response measures”. Á.G. Muñoz, M.C. Thomson, L. Goddard, S. Aldighieri. *GigaScience* **5**:41. Doi: 10.1186/s13742-016-0146-1. **2016**.
- 29.-** “Cross-timescale interactions and rainfall extreme events in South East South America for the austral summer. Part II: Predictive skill”. Á.G. Muñoz, L. Goddard, S. Mason, A. Robertson. *J. Clim.* **29**:16, 5915-5934. doi: 10.1175/JCLI-D-15-0699.1. **2016**
- 28.-** “Predicting monthly rainfall along Coastal Ecuador: ENSO and Transfer Function Models”. L. Bravo-deGuenni, Á.G. Muñoz, M. García, J.L. Santos, C. Perugachi, A. Cedeño, J. Castillo. *Theoretical and Applied Climatology*. doi:10.1007/s00704-016-1828-4. **2016**.
- 27.-** “Seasonal Prediction of Lightning Activity in North Western Venezuela: Large-Scale versus Local Drivers”. Á.G. Muñoz, J. Díaz-Lobaton, X. Chourio, M.J. Stock. *Atmos. Res.* doi:10.1016/j.atmosres.2015.12.018. **2016**.
- 26.-** “Impact of vehicular emissions on the formation of fine particles in the Sao Paulo Metropolitan Area: a numerical study using the WRF-Chem model”. A. Vara-Vela, M.F. Andrade, P. Kumar, R.Y. Ynoue, Á.G. Muñoz. *Atmos. Chem. Phys.*, **15**, 14171-14219. **2016**.
- 25.-** “Urban Waters in Costa Rica”. Book chapter, in *Urban Water Challenges in the Americas*. H. Hidalgo, C. Herrero, E. Alfaro, Á.G. Muñoz, N. Mora, D. Mora, V. Chacón, V. *Interamerican Network of Academies of Sciences (IANAS) and UNESCO*. 202-226. **2015**.
- 24.-** “Cross-timescale interactions and rainfall extreme events in South East South America for the austral summer. Part I: Potential predictors”. Á.G. Muñoz, A. Robertson, L. Goddard, Y. Kushnir, W. Baethgen. *J. Clim.*, **28**, 7894–7913, doi:10.1175/JCLI-D-14-00693.1. **2015**.
- 23.-** “Spatiotemporal clustering, climate periodicity, and social-ecological risk factors for dengue during an outbreak in Machala, Ecuador, in 2010”. A.M. Stewart., Á.G. Muñoz, S. Ryan, M.J. Borbor, E.B. Ayala, J.L. Finkelstein, R. Mejía, T. Ordóñez, G.C. Recalde, K. Rivero. *BMC Infectious Diseases* **16**:610. **2014**.
- 22.-** “Investigating ENSO and Society Relationships”. Zebiak, S., B. Orlove, C. Vaughan, Á.G. Muñoz, J. Hansen, T. Troy, M. Thomson, A. Lustig., S. Garvin. *WIREs Climate Change*. doi: 10.1002/wcc.294 . **2014**.
- 21.-** “Predictability of December-April Rainfall in Ecuador” Recalde-Cornel, G.C., A. Barnston, Á.G. Muñoz. *J. Appl. Met. Clim.*, **53**, 1471-1493. doi: <http://dx.doi.org/10.1175/JAMC-D-13-0133.1> . **2014**.
- 20.-** “Dengue Vector Dynamics (*Aedes aegypti*) Influenced by Climate and Social Factors in Ecuador: Implications for Targeted Control” Stewart-Ibarra, A., S. Ryan, E. Beltrán, R. Mejía, M. Silva, Á.G. Muñoz. *PLOS ONE*, **8**:11, e78263. **2013**.
- 19.-** “Risk Management at the Latin American Observatory” Á.G. Muñoz, D. Ruiz-Carrascal, P. Ramírez, G. León, J. Quintana, W. Torres, M. Pastén, O. Sánchez. In *Risk Management: Current Issues and Challenges*, Chapter 22. ISBN 979-953-307-789-4. 24 pp. **2012**.
- 18.-** “Characterizando las elecciones venezolanas a través de Twitter. Caso: #26s” D. Artigas, Á.G. Muñoz, F. Luengo, X. Chourio, A. Fernández. Anuario Electrónico de Estudios en Comunicación Social *Disertaciones*. **5**, (1), 4. **2012**.
- 17.-** “Climate System Simulations: An Integrated, Multi-Scale Approach for Research and Decision-Making” Á.G. Muñoz, A. Núñez, R. Cova In *Computational Simulations and Applications*, Jianping Zhu (Ed.), ISBN: 978-953-307-430-6, InTech Publishing. doi: 10.5772/24229. **2011**.

- 16.- “*The Catatumbo Lightnings: A Review*” Á.G. Muñoz, J. Díaz-Lobatón Proceedings of the XIV International Conference on Atmospheric Electricity (ICAE 2011). **2011.**
- 15.- “*ANDESGRID: A Grid Infrastructure for Geosciences in the Andes*”. Á. G. Muñoz, X. Chourio, S. Reverol, A. Urdaneta, C. Díaz Proc. Latin-American Conf. on High Performance Computing, Gramado, Brazil, Bull, Hewlett-Packard, Intel Corporation, Microsoft, Silicon Graphics International, 9–14, **2010**
- 14.- “*An Environmental Watch system for the Andean countries: El Observatorio Andino*” Á.G. Muñoz, P. López, R. Velásquez, L. Monterrey, G. León, F. Ruiz, C. Recalde, J. Cadena, R. Mejía, M. Paredes, J. Bazo, C. Reyes, G. Carrasco, Y. Castellón, C. Villarroel, J. Quintana, A. Urdaneta, *Bulletin of the American Meteorological Society-BAMS*, doi: 10.1175/2010BAMS2958.1, **2010.**
- 13.- “*Characterising the Venezuelan Troposphere for Radioastronomy Studies*” R. Pacheco, Á. G. Muñoz, A. Brito, N. Cubillán *RevMexAA*, **35**, p. 317, **2009**
- 12.- “*Automatization Project for the Carl-Zeiss-Jena Coudé Telescope of the Simón Bolívar Planetarium II. The Grid Infrastructure*”. Á. G. Muñoz, F. Luengo, S. Reverol, *RevMexAA*, **35**, p. 316, **2009**
- 11.- “*Automatization Project for the Carl-Zeiss-Jena Coudé Telescope of the Simón Bolívar Planetarium I. The Electro-Mechanic System*” Á. G. Muñoz, A. Núñez, A. Maharaj, *RevMexAA*, **35**, p. 316-317, **2009**
- 10.- “*Optical properties of Cu(In<sub>1-x</sub>Gax)Se<sub>8</sub> from ellipsometric measurements*” L Durán, J. Castro, E. Hernández, Á.G. Muñoz, J. Naranjo, C.A. Durante Rincón. *CIENCIA*, **15**:2, **2007.**
- 9.- “*Effective Potential for Non-Coupled Stochastic Partial Differential Equations*” P. Franceschini, L. A. González, Ángel G. Muñoz S., D. Sierra P., T. Soldovieri. *CIENCIA*, **15**:4. **2007**
- 8.- “*Modelling Tropospheric Radio-Attenuation Parameters for Venezuela*”. Á.G. Muñoz, R. Pacheco, N. Cubillán, L. Durán, C. A. Durante, J. Fermín. *CIENCIA*, **14**:4 **2006**
- 7.- “*Variational and Potential Formulation for Stochastic Partial Differential Equations*” Á.G. Muñoz, J. Ojeda, D. Sierra P., T. Soldovieri. *J. Phys. A, Math. Gen.* **39**:L93-L98. **2006**
- 6.- “*Soluciones Conformemente Planas con Ecuación de Estado No Local*” Á.G. Muñoz & L.A. Núñez *Rev. Mex. Física.*, S Vol **52**:3, 112-115, **2006**
- 5.- “*Verhulst's Lagrangean and Self-Regulated Systems*” Á.G. Muñoz, D. Sierra P., T. Soldovieri, D. Montiel, R. Rodríguez, J. Toro-Mendoza, L. Rivero. *Rev. Mex. Física.*, S Vol 52, **3**, 116-118. **2006**
- 4.- “*Diseño de un Arreglo Radio-interferométrico de Antenas Yagi-Uda con Centro de Ventana Espectral en 400 MHz*” Ángel G. Muñoz & Leonardo Hernández *Rev. Téc. Ing. Univ. Zulia*, **26**:1, 10-19, **2003.**
- 3.- “*Obtaining the Gravitational Force for Arbitrary Space-Times. The Schwarzschild Case*” Terenzio Soldovieri & Á.G. Muñoz, *Revista Mexicana de Física*, **49**:3, 271-275, **2003.**
- 2.- “*Microfísica del Relámpago del Catatumbo*” Nelson Falcón, Williams Prieto, Á.G. Muñoz, Día Nader. *Ingeniería UC*. Año **7**:1, 47-53, **2000.**
- 1.- “*Modelo Electroatmosférico del Relámpago sobre el Río Catatumbo*” N. Falcón, W. Prieto, Á.G. Muñoz, T. Barros, Á. Vilorio, D. Nader. *CIENCIA*, **8**:2, 155-167, **2000.**

## ROLE IN RESEARCH

**14.- Principal Investigator.** Columbia University President Global Innovation Fund (PGIF) “The Chilean NextGeneration (#NextGen) of Climate Forecasts”. Seed award. 2019.

**13.- Principal Investigator.** NOAA's International Research and Application Project (IRAP2) "The development of climate-informed decision-support tools for the prevention and control of Aedes-borne diseases in the US and transboundary regions", award NA18OAR4310339. (Jul 2018-Jun 2021)

**12.- Principal Investigator.** NOAA's Modeling, Analysis, Predictions and Projections (MAPP) project "Weather-Type Based Cross-Timescale Diagnostics of CMIP6-Era Models", award NA18OAR4310275. (Sep 2018- Aug 2020)

**11.- Postdoctoral Research Associate** at the Atmospheric and Oceanic Sciences (AOS) Program, Princeton University. Feb 2016 – present (working first at NOAA's Geophysical Fluid Dynamic Laboratory, Princeton University under the supervision of Dr. Gabriel A. Vecchi from Feb 2016 – June 2017; and later at AOS/Geosciences under the supervision of Dr. Vecchi from July 2017 – December 2017).

**10.- Graduate Research Fellow** in NOAA-USAID Project "Integrating Climate Information and Decision Processes for Regional Climate Resilience". Jan 2014-today. PI (Columbia U.): Lisa Goddard. IRI- Columbia University.

**9.- Graduate Research Fellow** in National Science Foundation Project No. AGS1049066 "Multi-Scale Climate Information for Agricultural Planning in Southeastern South America for Coming Decades". Jan 2011-Feb 2014. PI: Lisa Goddard. IRI- Columbia University.

**8.- Principal Investigator.** Project "Latin American Observatory for Climate Events". Jan 2010 – today. Funding: Center for Scientific Modeling (CMC), Zulia University.

**7.- Principal Investigator.** Project "Climate Variability in the Andean countries". Dec 2010 – Dec 2011. Funding: Center for Scientific Modeling (CMC), Zulia University.

**6.- Co-researcher of** the Project "Lightning Activity in Northwestern South America". Jan 2010 – Mar 2011. Funding: Center for Scientific Modeling (CMC), Zulia University.

**5.- Principal Investigator.** Project "Andean Observatory for Climate Events". Dec 2007 – Dec 2009. Funding: Center for Scientific Modeling (CMC), Zulia University.

**4.- Principal Investigator.** Project "Causal Agents of the Catatumbo Lightning". Jul 2007 – Mar 2009. Funding: Center for Scientific Modeling (CMC), Zulia University.

**3.- Principal Investigator.** Project "Theoretical-Experimental study of Tropospheric Radio-attenuation Parameters for Venezuela". Approved Dec 2007. Funding: Science and Technology Ministry of the Venezuelan Bolivarian Republic.

**2.- Co-researcher** in the Project "Schwarzschild's Newtonian-equivalent Force". Sep 2002 – Feb 2003. Funding: Faculty of Sciences, Zulia University.

**1.- Co-researcher** in the Project "Verhulst's Lagrangean". Jul 2002 – Mar 2003. Funding: Faculty of Sciences, Zulia University.

## TEACHING EXPERIENCE

As a TA at Columbia University (2012-2014)  
Regional Climates and Impacts (2012,2015); Dynamics of Climate (2013)

As Instructor and then Associate Professor at Universidad del Zulia (2004-2011):

Statistical Physics, Mathematical Methods 1, Mathematical Methods 2, Optics, Calculus 4, Gravitation, Numerical Analysis, Hydrodynamics, Statistics and Numerical Methods, Physical Climatology.

As Instructor Professor at Universidad Rafael Urdaneta (2004-2006):  
Physics 1, Physics Laboratory 1, Statistics.

## COMPUTATIONAL EXPERIENCE

Muñoz possesses advanced skills in Linux/UNIX/Mac operating systems (administrator level) and Beowulf clusters (NPACI Rocks). He uses scientific packages like Maple, Matlab, Scilab.

He prefers to program in Fortran95 (Intel and Portland Group compilers), both serial and parallel. Other (interpreted) programming languages/environments he uses are CSH, BASH, PERL, Python, GrADS Scripting Language (GS), NCAR Command Language (NCL), Matlab and Ingrid (IRI Data Library coding language)

Muñoz has been designing and running experiments and/or operational forecasts (for the Latin American Observatory partnership, [www.ole2.org](http://www.ole2.org)) with the following comprehensive numerical models/systems since 2007: MM5, WRF, ETA, RSM, GSM, CAM, CESM, SPEEDY, AM2.1/2.5, CM2.1, LOAR, FLOR and HiFLOR. He has also experience running and modifying intermediate-complexity models using GFDL's Flexible Model System (FMS).

He has an advanced knowledge of (and minor contributions to) IRI's Climate Predictability Tool (CPT), as well as an advanced knowledge and manipulation of the S2S Database at ECMWF, CMA and IRI.

## AWARDS

**8.- Orden de la Zulianidad 2016.** Gobernación del Estado Zulia, Venezuela. (Given by Zulia State to outstanding Venezuelan citizens).

**7.- Faculty Fellow 2011.** Department of Earth and Environmental Sciences (DEES), Columbia University.

**6.- Level II PPI 2007 (level 2. Maximum level = 3).** Programa Promoción a la Investigación – PPI. Ministerio de Ciencia y Tecnología de la República de Venezuela. (Venezuelan Research Award)

**5.- Level I PPI 2004 (level 1. Maximum level = 3).** Programa Promoción a la Investigación – PPI. Ministerio de Ciencia y Tecnología de la República de Venezuela. (Venezuelan Research Award)

**4.- Candidate Level PPI 2003 (level 0. Maximum level = 3).** Programa Promoción a la Investigación – PPI. Ministerio de Ciencia y Tecnología de la República de Venezuela. (Venezuelan Research Award)

**3.- Publication Award 2002** (for BSc. Thesis on conformally-flat Einstein solutions with a non-local equation of state). La Universidad del Zulia, Venezuela

**2.- Unisys Honour Award 2001.** (for building a radiotelescope with Uda-Yagi antennas). Eureka Group. Caracas. Venezuela

**1.- Simón Rodríguez Award 1996** (for highest grades in the Faculty of Sciences) La Universidad del Zulia, Venezuela



## REVIEWER

(details: <https://publons.com/author/420315/angel-g-munoz#profile>)

- 13.- **Science**. Since 2020.
- 12.- **Geophysical Research Letters**. Since 2017.
- 11.- **PLOS One**. Since 2017.
- 10.- **Climate Dynamics**. Since 2016.
- 9.- **Journal of Applied Meteorology and Climatology**. Since 2015.
- 8.- **Journal of Hydrometeorology**. Since 2015.
- 7.- **International Journal of Climatology**. Since 2015.
- 6.- **Revista de Climatología**. Since 2014.
- 5.- **Weather and Forecasting**. American Meteorological Society. Since 2014
- 4.- **BMC Infectious Diseases**. **BioMed**. Since 2014.
- 3.- **CLEI electronic journal**. Centro Latinoamericano de Estudios en Informática (CLEI). Since 2011.
- 2.- **Meteorología Colombiana**. Universidad Nacional de Colombia. Since 2011
- 1.- **Journal of Climate**. American Meteorological Society. Since 2010

## CONSULTING EXPERIENCE

Each contract involves both *research/implementation* activities and human resources *training* on the consulting topic.

- 11.- **Climate Variability, Climate Change and Seasonal Forecast Consultant** for Comunidad Andina de Naciones and the World Bank, Project “Adaptation to the Impact of the Accelerated Glacier Retreat in the Tropical Andes” (Bolivia). N° 121-2011-SGCA. June 2011.
- 10.- **Climate Variability and Change Advisor** for Comunidad Andina de Naciones, the World Bank, NewVI Solutions and FONAG, under the Project “Adaptation to the Impact of the Accelerated Glacier Retreat in the Tropical Andes” (Ecuador). Apr 2011-Dec 2011.
- 9.- **Climate Variability and Climate Change Consultant** for the Environmental Ministry of Ecuador, under contract CDC-UCP-071A-2010. Dec 2010 – Jan 2011.
- 8.- **Seasonal Downscaling Consultant** for the Colombian National Weather Service (IDEAM), Project CC-INAP-123-09. Oct 2009- Apr 2010.
- 7.- **Data Analysis and Climate Change Modeling Consultant** for Comunidad Andina de Naciones and the World Bank, Project “Adaptation to the Impact of the Accelerated Glacier Retreat in the Tropical Andes” (Ecuador). Dec 2009 – Sep 2010.
- 6.- **Climate Variability and Climate Change Consultant** for the United Nations Development Program (UNDP) and the Environmental Ministry of Ecuador, Project P/00058409. Jan 2010 – Sep 2010.

# Ángel G. Muñoz

International Research Institute for Climate and Society (IRI)  
The Earth Institute, Columbia University, New York, NY, USA  
Phone: +1 (845) 680-4453 • E-Mail: [agmunoz@iri.columbia.edu](mailto:agmunoz@iri.columbia.edu)

**5.- Numerical Modeling Consultant** for the Peruvian National Weather Service (SENAMHI), under contract 0003-2009-SENAMHI. Oct 2009.

**4.- Numerical Modeling Consultant** for the Ecuadorian National Weather Service (INAMHI), under contract INAMHI-CDCC-004-2009. Aug 2009 – Jan 2010.

**3.- Air Quality Modeling Consultant** for Universidad Mayor de San Andrés (UMSA) in Bolivia, Project UMSA IDH 2009-2010. Mar 2009.

**2.- Hydrological Modeling Consultant** for United Nations Development Program (UNDP) Project P/00058543. Jul 2008 – Nov 2008.

**1.- Dynamical Modeling Consultant** for the Inter-American Development Bank Project ATN/OC 10064-RG (CIIFEN) Dec 2007 – Jul 2008.