Raúl A. Valenzuela

Assistant Professor
Engineering Sciences Institute
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Adjoint Researcher
Center for Climate and Resilience Research (CR2)
University of Chile, Santiago, Chile

Education

2016 Doctor of Philosophy (PhD) in Atmospheric and Oceanic Science, University of Colorado Boulder, Colorado, United States. Thesis: "Terrain-trapped Airflows and Orographic Precipitation along the Coast of Northern California". Advisor: Dr. David Kingsmill.

2008 Renewable Natural Resources Engineer, University of Chile. Thesis: "Agroclimatology Zoning Method for Olive Crop in Central Chile". Advisor: Dr. Luis Morales.

Employment History

2020-present Assistant Professor, Institute of Engineering Sciences, Universidad de O'Higgins, Rancagua, Chile. Role: teach two courses per semester, perform scientific research, disseminate sciences for broad audiences, create links with regional stakeholders, obtain competitive grants for research.

2010 Meteorological data analyst for air quality assessment. Ambimet Ltda., Chile. Role: analyze meteorological data collected for mining companies, create monthly reports of meteorological conditions, support air quality measurements and equipment maintenance.

2009 Water rights auditor. General Directorate of Water, Atacama Region. Ministry of Public Works, Chile. Role: audit water rights in Atacama Region according to the given point and amount of extraction, elaborate technical reports of auditions, planning weekly inspections, drafting the administrative resolution to issue corresponding fines.

Research Project Experience

2023-2025 *Principal investigator*: "Atmospheric Water Vapor and Precipitation Processes in Central and Southern Chile", FONDECYT INICIACION, Chile.

2022-2024 *Co-investigator*: "Compound and Cascading Climate Extremes in Chile", ANID ANILLO, Chile.

2022-2024 *Co-investigator*: "Articulated Research System in Climate Change and Coastal Zones Sustainability", Ministry of Education, Chile.

2017-2019 *Principal investigator*: "Atmospheric Rivers in the Southeastern Pacific and Their Impact on Extreme Orographic Precipitation", Postdoctoral scholarship, FONDECYT, Chile. Sponsor: Dr. Rene Garreaud.

2012-2016 *Research assistant*: "Coastal orographic precipitation process studies", National Science Foundation-NOAA. Research supervisor: Dr. David Kingsmill.

2011 NCAR Summer visitor. May 23 to August 19. Host: Thomas Warner.

2008 *Research assistant*: "Agroclimatological Zoning of Wheat by Yield and Quality between Metropolitan and Bío-Bío Region", Department of Environmental Science and Natural Resources, University of Chile.

2007 *Research assistant*: "Agrothermic Zoning in Punilla Territory, Bío-Bío Region", Department of Soil and Renewal Resources, University of Concepción.

Scholarships and Awards

2009 Fulbright Doctoral Scholarship "Equal Opportunity" to start a doctoral degree in 2011, Fulbright Foundation Chile.

2009 Doctoral Scholarship "Becas Chile" to start a doctoral degree in 2011, CONICYT, Chile.

2001-2004 Economic Assistance Program Scholarship, University of Chile.

2001 Bicentenario Scholarship, Ministry of Education, Chile.

Peer Reviewed Publications

2024 Feron, S., R. Cordero, A. Damiani, S. MacDonell, J. Pizarro, K. Goubanova, **R. Valenzuela**, C. Wang, L. Rester, A. Beaulieu. South America is becoming warmer, drier, and more flammable. *Communications Earth & Environment* (In Press).

2024 Mudiar, D., R. Rondanelli, **R. Valenzuela**, R. Garreaud. Unraveling the Dynamics of Moisture Transport during Atmospheric Rivers Producing Rainfall in the Southern Andes. *Geophysical Research Letters,* 51, e2024GL108664. https://doi.org/10.1029/2024GL108664

2024 Salio, P., H. Bechis, B. Z. Ribeiro, E. Nascimento, V. Galligani, F. Garcia, L. Alvarenga, M. Benedicto, C. Casanovas, M. Cancelada, D. D'AFmen, R. D'Elia, A. D. Páez, S. González, V. Goede, J. Goñi, A. Granato, M. M. Lopes, M. Mederos, M. Menalled, R. Mezher, E. Mingo, R. Rondanelli, J. J. Ruiz, N. Santayana, L. Santos, G. Schild, I. Simone, **R.Valenzuela**, L. Vidal. Towards a South American High Impact Weather Reports Database. *Bulletin of the American Meteorological Society*, 105, E1204–E1217, https://doi.org/10.1175/BAMS-D-23-0063.1

2022 **Valenzuela, R.**, R. Garreaud, I. Vergara, D. Campos, M. Viale, and R. Rondanelli. An Extraordinary Dry Season Precipitation Event in the Subtropical Andes: Drivers, impacts, and predictability. *Weather and Climate Extremes*, **37**, 100472, https://doi.org/10.1016/j.wace.2022.100472

2022 Garreaud, R., M. Ralph, A. Wilson, A. Ramos, J. Eiras-Barca, H. Steen-Larsen, J. Rutz, C. Albano, N. Tilinina, M. Warner, M. Viale, R. Rondanelli, J. McPhee, **R.Valenzuela,** and I. Gorodetskaya. Running a Scientific Conference during Pandemic Times. *Bulletin of the American Meteorological Society, E1650–E1657*, https://doi.org/10.1175/BAMS-D-22-0023.1

2021 Vicencio, J., R. Rondanelli, D. Campos, **R. Valenzuela,** R. Garreaud, A. Reyes, R. Padilla, R. Abarca, C. Barahona, R. Delgado and G. Nicora. The Chilean Tornado Outbreak of May 2019: Synoptic, mesoscale, and historical context. *Bulletin of the American Meteorological Society, E611–E634*, https://doi.org/10.1175/BAMS-D-19-0218.1

2019 **Valenzuela, R.** and R. Garreaud. Extreme Daily Rainfall in Central-Southern Chile and its Relationship with Low-Level Horizontal Water Vapor Fluxes. *Journal of Hydrometeorology, **20**, 1829–1850*, https://doi.org/10.1175/JHM-D-19-0036.1

2018 Viale, M., **R. Valenzuela**, R. Garreaud and M. Ralph. Precipitation Impacts of Atmospheric Rivers in South America. *Journal of Hydrometeorology,* **19***,* 1671-1687, https://doi.org/10.1175/JHM-D-18-0006.1

2018 **Valenzuela, R**. and D. Kingsmill. Terrain-trapped Airflows and Orographic Rainfall along the Coast of Northern California. Part II: Horizontal and vertical structures observed by a scanning Doppler radar. *Monthly Weather Review,* **146**, 2381-2402, https://doi.org/10.1175/MWR-D-17-0227.1

2017 **Valenzuela, R**. and D. Kingsmill. Terrain-trapped Airflows and Orographic Rainfall along the Coast of Northern California. Part I: Kinematic characterization using a wind profiling radar. *Monthly Weather Review*, **145**, 2993-3008, https://doi.org/10.1175/MWR-D-16-0484.1

2017 Massmann, A., J. Minder, R. Garreaud, D. Kingsmill, **R. Valenzuela**, A. Montecinos, S. L. Fults, and J. Snider. The Chilean Coastal Orographic Precipitation Experiment: Observing the influence of microphysical rain regime on coastal orographic precipitation. *Journal of Hydrometeorology*, **18**, 2723-2743, https://doi.org/10.1175/JHM-D-17-0005.1

2015 **Valenzuela, R**. and D. Kingsmill. Orographic Precipitation Forcing along the Coast of Northern California during a Landfalling Winter Storm. *Monthly Weather Review*, **143**, 3570-3590, https://doi.org/10.1175/MWR-D-14-00365.1

Scientific Meetings

2023 **Valenzuela, R.,** G. Contador, C. Quiñinao, J. Jara, and I. Gonzalez. Filling missing data of long-term GNSS zenith total delay observations over a wide range of climates along the Andes. American Geophysical Union (AGU) Annual Meeting, 11-15 December, San Francisco, California. Poster presenter.

2023 Garreaud, R., D. Bozkurt, D. Campos, R. Rondanelli, S. Krogh, L. Scaff, and **R. Valenzuela**. Return of the Giants: The extreme Atmospheric River of late June 2023 in central Chile. American Geophysical Union (AGU) Annual Meeting, 11-15 December, San Francisco, California.

2023 Mudiar, D., R. Rondanelli., **R. Valenzuela**, and R. Garreaud. Water Vapor Budget Evaluation in Atmospheric Rivers Associated with Heavy Rainfall Events in Chile. American Geophysical Union (AGU) Annual Meeting, 11-15 December, San Francisco, California.

2022 **Valenzuela, R.**, R. Garreaud, and R. Rondanelli. Quantitative Precipitation Forecast Performance Along Central-Southern Chile. International Atmospheric River Conference (IARC), 10-14 October, Santiago, Chile.

2019 **Valenzuela, R**. and R. Garreaud. Extreme daily rainfall in central-southern Chile and its relationship with low-level horizontal water vapor fluxes. 35th International Conference on Alpine Meteorology (ICAM), 2-6 September, Rive del Garda, Italy.

2018 **Valenzuela, R.**, R. Garreaud, M. Viale. Extreme rainfall characteristics in central-southern Chile and its relationship with Atmospheric Rivers. AMOS-ICSHMO, 5-9 February, Sydney, Australia.

2017 **Valenzuela, R.**, R. Garreaud, M. Viale. Precipitación extrema en Chile centro-sur y su relación con ríos atmosféricos. V Congreso de Ocenografia Fisica, Meteorología y Clima del Pacífico Sur Oriental, 6-10 November, Concepción, Chile.

2017 **Valenzuela, R**. and D. Kingsmill. Terrain-trapped airflows and orographic rainfall along the coast of northern California: Horizontal and vertical structures of kinematics and precipitation. 34th International Conference on Alpine Meteorology, 18-23 June, Reykjavík, Iceland.

2016 Viale, M. and **R. Valenzuela**. The impacts of atmospheric rivers on precipitation over the west coast of southern South America. International Atmospheric Rivers Conference, 8-11 August, San Diego, CA.

2015 Minder, J., A. Massmann, D. Kingsmill, S. Fults, J. Snider, R. Garreaud, **R. Valenzuela**, A. Montecinos. The Chilean coastal orographic precipitation experiment pilot project (CCOPE-2015): Overview and preliminary results. AGU Fall Meeting, San Francisco, CA.

2014 **Valenzuela, R**. and D. Kingsmill. Terrain-blocked airflow and orographic precipitation along the coast of northern California. 16th Conference on Mountain Meteorology, 18-22 August, San Diego, CA.

2013 **Valenzuela, R.** and D. Kingsmill. Forzamiento de la precipitacion orografica costera debido al bloqueo orografico: analisis de un caso de estudio en el norte de California observado con radar Doppler durante PACJET. 3er Congreso de Oceanografia Fisica, Meteorologia y Clima del Pacifico Sur Oriental, 16-18 October, Santiago, Chile.

2013 **Valenzuela, R.** and D. Kingsmill. Scanning Doppler radar observations of a coastal orographic precipitation event in northern California during PACJET. 36th Conference on Radar Meteorology, 16-20 September, Breckenridge, CO.

2013 **Valenzuela, R.** and D. Kingsmill. Kinematic and thermodynamic structure of a coastal orographic precipitation event in northern California. CIRES Rendezvous Annual Symposium, May 2nd, University of Colorado, Boulder, CO.

Books Chapters

2019 J. J. Rutz, B. Guan, D. Bozkurt, I. Gorodetskaya, A. Gurshunov, D. A. Lavers, K. M. Mahoney, B. J. Moore, W. Neff, P. J. Neiman, F. M. Ralph, A. M. Ramos, H. C. Steen–Larsen, M. Tsukernik, **R. Valenzuela**, M. Viale, Chapter 4: Global and regional perspectives. In: *Atmospheric Rivers*. Ralph, F. M., M.D. Dettinger, J.J. Rutz, and D. E. Walliser (Eds). Springer (366 pages).

2009 Román, C., K. Vázquez, **R. Valenzuela**, G. Martínez, G. Lillo, L. Morales, R. Fuster, A. de la Fuente, J. Uribe, L. Faúndez, M. Paneque. 2009. *Energy Crops, a future bet*. University of Chile (224 pages).

Teaching Experience

- **Courses taught at Universidad de O'Higgins**

2024 *Data Analysis for Environmental and Earth Sciences*. Master's in Environmental and Earth Sciences. 6 students. Co-taught.

Introduction to Programming (spring). School of Engineering Sciences. 54 students.

Introduction to Programming (fall). School of Engineering Sciences. 25 students.

Data Exploration, Visualization and Maintenance. School of Engineering Sciences. 16 students.

2023 *Data Analysis for Environmental and Earth Sciences*. Master's in Environmental and Earth Sciences. 3 students. Co-taught.

Topics in Environmental and Earth Sciences. Master's in Environmental and Earth Sciences. 3 students. Co-taught.

Climate and Modeling. School of Engineering Sciences. 17 students.

Introduction to Programming. School of Engineering Sciences. 50 students.

Data Exploration, Visualization and Maintenance. School of Engineering Sciences. 18 students.

2022 *Visualization of Multidimensional Scientific Data*. School of Engineering Sciences. 2 students.

Data Exploration, Visualization and Maintenance. School of Engineering Sciences. 31 students.

Introduction to Programming. School of Engineering Sciences. 61 students. Coordinate 3 sections.

Introduction to Geosciences. School of Engineering Sciences. 46 students.

2021 *Climatology*. School of Agricultural and Environmental Sciences. 38 students.

Data Exploration, Visualization and Maintenance. School of Engineering Sciences. 31 students.

Introduction to Programming. School of Engineering Sciences. 80 students. Coordinate 2 sections.

2020 *Climatology*. School of Agricultural and Environmental Sciences. 27 students.

Data Exploration, Visualization and Maintenance. School of Engineering Sciences. 2 students.

Hydrology. School of Engineering Sciences. 17 students. Co-taught.

Introduction to Programming. School of Engineering Sciences. 66 students.

Introduction to Geosciences. School of Engineering Sciences. 62 students. Co-taught.

- **Invited lecturer at Universidad de Chile**

2017-2019 *Atmospheric Observing Systems*. Master's in Meteorology and Climatology program, Department of Geophysics, University of Chile.

2017-2019 *Natural Resources Management*, Renewable Natural Resources Engineering program, Department of Environmental Science and Natural Resources, University of Chile.

- **Undergraduate teaching assistant**

2004 - 2007 Teaching assistant: Numerical Calculus, Ecology, Systems Theory and Environmental Modeling, Environmental Physics. Department of Environmental Science and Natural Resources, University of Chile.

Undergraduate advising

2024 Gonzalez, Samara: Assessment of the particulate matter mineralogic composition in Rancagua and its possible source. Civil Geological Engineer program. Universidad de O'Higgins (co-adviser).

2023 Bulnes, Andrea: Model for verifying and analyzing anthropogenic emissions inventories. Civil Industrial Engineer program. Universidad de O'Higgins.

2022 Gonzalez, Valentina and Cristobal Aguilera: Forecast verification of extreme precipitation events using Model Evaluation Tool (MET) Software. Meteorology program. Aeronautic Technical School.

2021 Cerda, Anibal: Design, Construction and implementation of a low-cost weather station using an Arduino platform. Civil Electrical Engineering program. Universidad de O'Higgins.

Undergraduate committee

2024 Pablo Jorquera

2023 Ignacio González, Matías López, Paulina Tapia, Alfonso Valenzuela

2022 Benjamín Acuña, Hernán Reyes, Kevin Cortez, Patricio Fernández

2021 Rubén Quijón

Doctorate committee (outside Universidad de O'Higgins)

2022 Alvarez, Milagros: Study of the impact of WRF model configuration on deterministic and probabilistic forecasts for a case of convection initiation in the Sierras de Córdoba, Argentina. Doctorate in Atmospheric and Oceanic Sciences, Universidad de Buenos Aires. Advisor: Dra. Paola Salio.

Review for Journals, Proposals, and Reports

2024 Monthly Weather Review, Journal of Applied Meteorology and Climatology

2023 Monthly Weather Review

2019 Remote Sensing, Monthly Weather Review, NSF Proposal, Adaptation to Climate Change Risks in Ibero-American Countries (RIOCCADAPT) Report. Chapter 9 Storms and Hurricanes, Natural Hazards and Earth System Sciences

Outreach

2023 "Weather events, how do we observe these phenomena in Chile?" Interview in CNN Chile. Link: https://www.youtube.com/watch?v=Z3yA2Q5ONFs

2023 "How does a rain profiler radar work?" Interview in CNN Chile. Link: https://www.youtube.com/watch?v=9Ci-ZS1iiBs

2023 "Launch of a balloon sounding". Activity in the *National Sciences Festival*, 6 October, San Vicente de Tagua-Tagua.

2023 "What's wrong with this El Niño? Its behavior and relationship to precipitation in 2023" keynote speaker at 8th Redagricola Seminar, San Francisco de Mostazal, Chile (https://conferencias.redagricola.com/speakers-chile-2023/)

2023 "Chile needs a new hydroclimatic policy". Opinion column published in Le Monde Diplomatique Chile. Link: https://www.lemondediplomatique.cl/es-tiempo-de-una-nueva-politica-hidro-climatica-por-raul-valenzuela.html

2022	"Flying through Weather", Public Science project funded by the *Ministry of Science*. The project aims to disseminate meteorological and climatological phenomena to children of 3-6 years old by telling the story of a parrot and ladybug flying along different places along Chile. The story is distributed in a wall-calendar format (www.volandoeneltiempo.cl).
2022	"Understanding Climate Change from the O'Higgins Region". Talk in the *National Sciences Festival*, 10 October.
2022	"Launch of a balloon sounding". Activity in the *National Sciences Festival*, 10 October. Rancagua.
2022	"The Air Pollution Observatory". Talk in seminar *Air Quality: Cleaning the air in the Central Valley of Chile*, 30 September.
2021	"A story of hacking, atmospheric rivers, and GPS". Invited talk to webinar Extreme Weather in the Tropics and Southern South America, organized by Stanford University and University of Santiago de Chile.
2021	"Hydrometeorological extreme events in Chile, how could meteorological radars help?. Invited speaker to the webinar Monitoring Extreme Hydrometeorological Events organized by the Argentinian Embassy in Chile.
2020	"Waterspouts and tornadoes, Chile cannot predict them". Interview in T13 channel. Link: https://www.youtube.com/watch?v=VZyDbqeERbM
2019	"COP25 and the need for instrumentation for understanding our climate". Opinion column in *La Tercera* newspaper. 29 April. Link: https://uchile.cl/noticias/153328/cop25-y-la-falta-de-instrumentos-para-entender-nuestro-clima-cambiante
2018	"Changes in the Earth Climate", Talk in *Congreso Futuro Lo Prado,* 12 November.
2018	"Extreme hydrometeorological events " Interview in *Emol TV* , 13 November.

Participation in Workshops, Symposiums, and Tutorials

2018	Climate and Weather Extremes Tutorial. 1-3 August 2018, NCAR, Boulder, Colorado.
2016	Weather Research and Forecast (WRF) model Tutorial. 25-29 July 2016, NCAR, Boulder, Colorado.
2015	RMACC High Performance Computing Symposium, 11-13 August, Boulder, Colorado.
2012	Orographic Precipitation and Climate Change Workshop, 13-15 March, NCAR, Boulder, CO.
2012	Community Earth System Modeling (CESM) tutorial, 30 July-03 August, NCAR, Boulder, CO.

Technical and Specialized Skills

Programming languages – experienced: Python
Programming languages – familiar with: C++, Fortran
Python libraries: Xarray, Pandas, Matplotlib, Numpy
Radar software: SoloII, Cedric, Reorder
GIS software: QGIS
Favorite operative systems: MacOS and Linux
Version control: Git

Language Skills

Spanish: native
English: fluent

Research Interests

Terrain-induced and mesoscale forcings in meteorology
Atmospheric observations
Atmospheric rivers
Precipitation processes
Meteorological forecast and verification
GPS meteorology

Social Media

ResearchGate: https://www.researchgate.net/profile/Raul_Valenzuela
Github: https://github.com/rvalenzuelar
Twitter: @raulrainfall
Personal site: http://raulvalenzuela.cl