



Paul Muñoz

PhD. candidate in Water Resources

FLASH-FLOOD FORECAST MODELING WITH MACHINE LEARNING TECHNIQUES. USE OF INFORMATION RETRIEVED FROM GROUND AND REMOTE SENSING PRODUCTS.

Education

Dec 2019- present, Ph.D candidate in Water Resources.

University Of Cuenca (Ecuador) and University of Marburg (Germany).

<https://www.ucuenca.edu.ec/doctorado-rh/programa/>

Sep 2016 - Sep 2018, MSc. in Water Resources Engineering.

KU Leuven and Vrije Universiteit Brussel, Belgium.

<http://iupware.be/>

Sep 2009 - Jul 2015, Civil Engineering.

Universidad de Cuenca, Cuenca (Ecuador).

<http://www.ucuenca.edu.ec/>

Experience

Oct 2018 - present, Researcher at the Department of Water Resources and Environmental Sciences at Universidad de Cuenca, Cuenca (Ecuador).

- Ongoing project: Design and implementation of an Hydrological Warning System for the MINAS – SAN FRANCISCO Hydroelectric dam in Ecuador.
- Ongoing project: Development of Machine Learning models for hydrological forecasting with data coming from a weather radar in mountain catchments.
- Hydrometeorology of Andean páramo headwater catchments.
- Flash-flood forecasting.
- Storm analysis based on radar information.
- Machine learning applied to water resources.

Jul 2013 - Aug 2016, Assistant researcher at the Department of Water Resources and Environmental Sciences at Universidad de Cuenca, Cuenca (Ecuador).

- Hydrometeorology of Andean páramo headwater catchments.
- Installation, operation and maintenance of rain gauges.
- Installation, operation and maintenance of laser disdrometers.
- Data quality control.
- Analysis of precipitation.

Contact:

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Skills

Operating systems

- Windows, Linux, Mac

Programming

- MATLAB[®], R[®], Python[®]

Modelling

- Surface water modelling on SWAT[®]
- River and Flood modelling on MIKE[®]
- GIS: QGIS[®], ArcGIS[®]

Languages

- Spanish, mother tongue
- English, TOEFL iBT test score 112/120. Test Date: 24 Aug 2019

Publications

- **Muñoz, P.**, Orellana-Alvear, J., Bendix, J., Feyen, J., Célleri, R. (2021). Flood Early Warning Systems Using Machine Learning Techniques: The Case of the Tomebamba Catchment at the Southern Andes of Ecuador. *Hydrology*, 8(4), 183.
- Muñoz, D. F., **Muñoz, P.**, Moftakhari, H., Moradkhani, H. (2021). From local to regional compound flood mapping with deep learning and data fusion techniques. *Science of The Total Environment*, 782, 146927.
- **Muñoz, P.**, Orellana-Alvear, J., Célleri, R. (2021). Application of a Machine Learning Technique for Developing Short-Term Flood and Drought Forecasting Models in Tropical Mountainous Catchments. In *Integrated Research on Disaster Risks* (pp. 11-35). Springer, Cham.
- Muñoz, D. F., **Muñoz, P.**, Alipour, A., Moftakhari, H., Moradkhani, H., Mortazavi, B. (2021). Fusing multi-source data to estimate the effects of urbanization, sea level rise and hurricane impacts on long-term wetland change dynamics. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*.
- Contreras P, Orellana-Alvear J, **Muñoz P**, Bendix J, Célleri R. Influence of Random Forest Hyperparameterization on Short-Term Runoff Forecasting in an Andean Mountain Catchment. *Atmosphere*. 2021; 12(2):238.
- Orellana-Alvear, J., Célleri, R., Rollenbeck, R., **Muñoz, P.**, Contreras, P., Bendix, J. (2020). Assessment of Native Radar Reflectivity and Radar Rainfall Estimates for Discharge Forecasting in Mountain Catchments with a Random Forest Model. *Remote Sensing*, 12(12), 1986.
- **Muñoz, P.**; Orellana-Alvear, J.; Willems, P.; Célleri, R. Flash-Flood Forecasting in an Andean Mountain Catchment—Development of a Step-Wise Methodology Based on the Random Forest Algorithm. *Water* 2018, 10, 1519.
- **Muñoz, P.**; Célleri, R.; Feyen, J. Effect of the Resolution of Tipping-Bucket Rain Gauge and Calculation Method on Rainfall Intensities in an Andean Mountain Gradient. *Water* 2016, 8, 534.

Honours and awards

- Research Grants - Bi-nationally Supervised Doctoral Degrees/Cotutelle, 2020/21, German Academic Exchange Service, 2020.
- Instructor in the summer course "Hydrology of Andean ecosystems: Introduction to ecohydrology and environmental tracers", University of Cuenca, July 2019
- Selected member of the Young Scientists Programme 2018-2020. Integrated Research on Disaster Risk (IRDR), China, 2018. www.irdrinternational.org
- VLIR-UOS award scholarship to study in Belgium. Interuniversity Programme in Water Resources Engineering, 2015.
- Selected participant in the third competition "Recognition to the university student research, awards 2015". Area: Engineering. October 2015, National Secretariat of High Education, Science, Technology and Innovation (SENESCYT), Ecuador.

International conferences

- Oral : Long Short-Term Memory Networks for Real-Time Runoff Forecasting using Remotely Sensed Data P Muñoz, DF Muñoz, J Orellana-Alvear, H Moftakhari, H Moradkhani, ... EGU General Assembly Conference Abstracts, EGU21-13900
- Oral : Remote Sensing and Machine Learning for Real-Time Runoff Forecasting in Large Complex Mountainous Basins – Application to Hydropower Optimization", Water Security and Climate Change International Conference (WSCC), Vietnam, 2021
- Oral: Comparison of Machine Learning Techniques Powering Flood Early Warning Systems. Application to a catchment located in the Tropical Andes of Ecuador. P Munoz, J Orellana-Alvear, J Bendix, R Célleri EGU General Assembly Conference Abstracts, 4243
- Poster : Short-term Extreme Flow Forecasting in an Tropical Andean Mountain Catchment—Development of a Step-Wise Methodology Based on the Random Forest Algorithm. P Muñoz, J Orellana-Alvear, P Willems, R Célleri Geophysical Research Abstracts 21

Courses

- Deep Learning Explained, On-line Microsoft course. June 2020. Verified edx certificate: c0d683f47e094607aeb2ad65f6bbd073.
- Seasonal Water Resources Management, Regionalized Global Data and Transfer to Practice, Universidad Técnica Particular de Loja, Ecuador, 2019
- Course on scientific writing, October 2020, Dirección de Investigación, Universidad de Cuenca, Ecuador.
- Prediction of hydrological and meteorological variables: Models based on decision trees with R®, Ecuador, 2019
- AGU Chapman Conference: Tropical Ecohydrology, Ecuador, 2016
- International meeting on Environmental Law, March 2015, Spanish cooperation in Ecuador, Cuenca, Ecuador.
- International Workshop "Data quality control and preprocessing of precipitation and runoff data", Universidad de Cuenca, Ecuador, 2014.