



## Francisco Zambrano

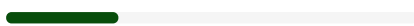
- Providencia, Santiago, Chile
- Chilean-Italian

## Skills

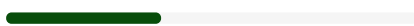
R 10+ yrs.



Python 2 yrs.



Matlab 3 yrs.



GIS 10 yrs.



Rmarkdown 6 yrs.



Quarto 1 yr.



Spatial Data Analysis 10 yrs.



Desarrollo web 5 yrs.



## Software

- Git
- RStudio - Positron
- VS Code
- Terminal
- QGIS
- SAGA
- SNAP - ESA

## Summary

Spatial data scientist and researcher with over ten years of experience. My work focuses on understanding climate variability, drought monitoring, and water resource management through remote sensing and geospatial and climate data analysis. I hold a PhD in agricultural engineering—which does not define me—and have published on vegetation dynamics, long-term droughts, land-use change, and water efficiency. My research seeks to contribute to both academic knowledge and practical decision-making to address the water crisis and strengthen climate resilience by integrating science, data, and public policy into sustainable solutions.

## Experience

### Associate Professor

Earth observation center  
Hemera - Universidad Mayor

02/2018 - 08/2025

I was awarded and led projects funded by ANID for more than 600 million euros, including a Fondecyt Initiation Grant, a FONDEF IDeA Grant, and a drought fund. I coordinated the development of the ODES-Chile and SatOri platforms, focused on climate change adaptation through Earth observation and spatial analysis. In the academic field, I taught undergraduate and graduate courses in GIS (QGIS) and spatial data science with R, training students in technologies applied to environmental and territorial management.

### Visiting Scholar

International Institute for Geo-Information Science and  
Earth Observation (ITC)  
University of Twente, Enschede, The Netherlands

09/2016 - 12/2016

I led a study to predict drought-induced agricultural productivity declines in Chile, integrating time series satellite data (MODIS, CHIRPS) and advanced spatial analysis techniques. The results of this research were published in the journal Remote Sensing of Environment.

### Visiting Scholar

Center for Advanced Land Management Information  
Technologies (CALMIT)  
National Drought Mitigation Center (NDMC)  
University of Nebraska, Lincoln, Nebraska, United  
States

01/2016 - 06/2016

I led a study on the evaluation of satellite products for estimating precipitation in Chile and their applicability for drought monitoring. The results were published in the journal Atmospheric Research.

### Assistant Researcher

Quilamapu Regional Research Center  
National Institute of Agricultural Research (INIA)

14/2012 - 03/2015

I processed and analyzed data from weather stations and satellites for drought studies and monitoring in Chile. I also automated the generation of monthly drought and agroclimate reports, which are incorporated into the regional agro-climate reports.

## Spatial data

- ▶ MODIS
- ▶ ERA5/ERA5-Land
- ▶ CHIRPS
- ▶ Sentinel-1/2/5p
- ▶ Landsat 7/8/9
- ▶ SoilGrid
- ▶ CMIP6

## Educación

**03/2014 - 09/2017**

**PhD. in Agricultural Engineering, mention in Water Resources**

Universidad de Concepción

Thesis: Agricultural drought in Chile: from assessment to prediction using satellite data

**03/2000 - 09/2007**

**Agricultural Civil Engineer**

Universidad de Concepción

## Contact

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🌐 frzambra

## Other professional experiences

Public services in Chile  
CNR | DGA | INDAP

I have worked as an engineer in public services such as the General Directorate of Water (DGA), the National Irrigation Commission (CNR), and the Agricultural Development Institute (INDAP) in different regions of Chile on issues related to water resources, agriculture, and water user organizations (WOUs).

**09/2007 - 12/2012**

## Funded projects

I have directed and participated in eight projects awarded by the National Agency for Research and Development (ANID).

### Crea Ciencia 2030

Leading director

**01/2025 - 10/2025**

Title: Impact of climate change on avocado phenology and native sclerophyllous forest according to access to potential groundwater in the Aconcagua River basin

### ODES-Chile (FSEQ210022)

Leading director

**03/2022 - 10/2023**

We created ODES-Chile, a multi-scale drought observatory for Chile, an early warning system to mitigate agricultural and ecological impacts. (<https://odes-chile.org>).

### SatOri (ID21I10297)

Leading director

**03/2022 - 12/2024**

We created SatOri, a satellite system for optimizing irrigation in cherry orchards (<https://s4tori.cl>).

### Fondecyt Iniciación 11190360

Principal researcher

**03/2020 - 03/2022**

I led research that evaluated biomass prediction in wheat and corn using satellite data and machine learning techniques.

### Fondecyt Postdoctorado

Sponsoring researcher

**03/2023 - 03/2025**

I sponsored the project titled: Assessing Current and Future Water Availability for Agriculture and Terrestrial Ecosystems Under Different Land-Use Scenarios in the Aconcagua Basin: Toward Adaptation to Drought.

### Fondecyt Regular (1210526)

Co-researcher

**03/2021 - 12/2024**

Title: Multivariate drought monitoring system: biophysical modeling, remote sensing, and hydroclimatic information for drought analysis and prediction in agriculture.

## Projects submitted (on evaluation)

In 2025, I presented three projects that are currently under evaluation by the National Research and Development Agency (ANID).

**Fondecyt Regular 2026****01/2026**

Principal Researcher

Title: From Drought to Resilience: A New Framework for Climate-Adaptive Agriculture Through Water-Efficient Crops and Landscape Optimization in Aridified Regions

**Fondef Tecnologías Avanzadas 2025****08/2025**

Lead director

Title: ODES-Adapta: information platform for agricultural adaptation to climate change in the Aconcagua River basin

**Anillos de Investigación en Áreas Temáticas 2025****10/2025**

Lead director

Title: Towards sustainable agricultural adaptation amid water scarcity and declining biodiversity in the Aconcagua Basin.

## Publications

Since 2016, I have had over 500 citations, of which ~90% are articles published as first or corresponding author, with an h-index of 7.

**Zambrano, F.**, Herrera, A., Olguín, M., Miranda, M., Garrido, J., & Almeida, A. M. (2025). Prediction of the daily spatial variation of stem water potential in cherry orchards using weather and Sentinel-2 data. *Agricultural Water Management*, 318, 109721. <https://doi.org/10.1016/j.agwat.2025.109721>

Duran-Llacer, I., Salazar, A. A., Mondaca, P., Rodríguez-López, L., Martínez-Retureta, R., **Zambrano, F.**, Llanos, F., & Frappart, F. (2025). Influence of Avocado Plantations as Driver of Land Use and Land Cover Change in Chile's Aconcagua Basin. *Land*, 14(4), 750. <https://doi.org/10.3390/land14040750>

**Zambrano, F.**, Vidal-Páez, P., & Hernández, B. (2024). Comparison of crop water demand derived from sen-ET for orchards within the Aconcagua's river basin in Chile. *IGARSS 2024 - 2024 IEEE International Geoscience and Remote Sensing Symposium*, 3631-3634. <https://doi.org/10.1109/IGARSS53475.2024.10642732>

Fernández, F. J., Vásquez-Lavín, F., Ponce, R. D., Garreaud, R., Hernández, F., Link, O., **Zambrano, F.**, & Hanemann, M. (2023). The economics impacts of long-run droughts: Challenges, gaps, and way forward. *Journal of Environmental Management*, 344, 118726. <https://doi.org/10.1016/j.jenvman.2023.118726>

**Zambrano, F.** (2023). Four decades of satellite data for agricultural drought monitoring throughout the growing season in Central Chile. En R. M. Vijay P. Singh Deepak Jhajharia & R. Kumar (Eds.), *Integrated Drought Management, Two Volume Set* (p. 28). CRC Press.

Molina, J., González-Orenga, S., Vicente, O., Boscaiu, M., Llinares, J. V., **Zambrano, F.**, & Santibáñez, C. (2022). Effect of acetylsalicylic acid and ammonium sulphate on productive and physiological parameters in *Stipa caudata* under water shortage conditions. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, 50(1), 12645. <https://doi.org/10.15835/nbha50112645>

Jopia, A., **Zambrano, F.**, Pérez-Martínez, W., Vidal-Páez, P., Molina, J., & Mardones, F. de la H. (2020). Time-series of vegetation indices (VNIR/SWIR) derived from sentinel-2 (A/B) to assess turgor pressure in Kiwifruit. *ISPRS International Journal of Geo-Information*, 9(11), 641. <https://doi.org/10.3390/ijgi9110641>

Rivas, Y., Rivera, D., Gallardo, R., Lagos, E., Yevenes, M., **Zambrano, F.**, & Mendoza, J. (2020). Water availability, quality, and use in rural communities of the Chilean Coastal Range. *Journal of Soil and Water Conservation*, 75(1), 75-90. <https://doi.org/10.2489/jswc.75.1.75>

**Zambrano, F.,** Vrieling, A., Nelson, A., Meroni, M., & Tadesse, T. (2018). Prediction of agricultural drought in Chile from multiple spatio-temporal data sources. 2018, GC51H-0882. <https://ui.adsabs.harvard.edu/abs/2018AGUFMGC51H0882Z>

**Zambrano, F.,** Wardlow, B., Tadesse, T., Lillo-Saavedra, M., & Lagos, O. (2017). Evaluating satellite-derived long-term historical precipitation datasets for drought monitoring in Chile. *Atmospheric Research*, 186, 26-42. <https://doi.org/10.1016/j.atmosres.2016.11.006>

**Zambrano, F.,** Lillo-Saavedra, M., Verbist, K., & Lagos, O. (2016). Sixteen years of agricultural drought assessment of the BioBío region in Chile using a 250 m resolution vegetation condition index (VCI). *Remote Sensing*, 8(6), 1-20. <https://doi.org/10.3390/rs8060530>

## **Conferences**

I have presented at the most prestigious conferences worldwide in terms of Earth observation, such as: American Geophysical Union (AGU), European Geosciences Union (EGU) and the International Geoscience and Remote Sensing Symposium (IGARSS).

**Zambrano, F.,** Vidal-Páez, P., & Hernández, B. (2024). Comparison of crop water demand derived from sen-ET for orchards within the Aconcagua's river basin in Chile. IGARSS 2024 - 2024 IEEE International Geoscience and Remote Sensing Symposium, 3631-3634. <https://doi.org/10.1109/IGARSS53475.2024.10642732>

**Zambrano, F.,** & Duran-Llacer, I. (2024). Assessment of drought in continental Chile for 1981–2023 by climate variables of water supply and demand, soil moisture, and vegetation. IGARSS 2024 - 2024 IEEE International Geoscience and Remote Sensing Symposium, 2764-2768. <https://doi.org/10.1109/IGARSS53475.2024.10641240>

Duran-Llacer, I., **Zambrano, F.,** Rodríguez-López, L., Martínez-Retureta, R., & Arumí, J. L. (2024). Analysis of Drought in Agriculture and Natural Vegetation Areas in Central Chile. IGARSS 2024 - 2024 IEEE International Geoscience and Remote Sensing Symposium, 3643-3646. <https://doi.org/10.1109/IGARSS53475.2024.10642727>

**Zambrano, F.,** Vrieling, A., Meza, F., Duran-Llacer, I., Fernández, F., Venegas-González, A., Raab, N., & Craven, D. (2025). Shifts in water supply and demand shape land cover change across Chile. EGU General Assembly. <https://doi.org/10.5194/egusphere-egu25-20588>

**Zambrano, F.,** Meza, F., Raab, N., & Duran-Llacer, I. (2024, marzo 11). Drought's trends over continental Chile using climatic variables of water demand and supply, soil moisture, and vegetation productivity. EGU General Assembly. <https://doi.org/10.5194/egusphere-egu24-19099>

Duran-Llacer, I., **Zambrano, F.,** Gómez-Escalonilla Canales, V., Martínez Santos, P., Aliagada Alvarado, M., Rodríguez-López, L., Martínez-Retureta, R., & Arumí, J. L. (2024). The response of Groundwater-Dependent Ecosystems to drought in central Chile. EGU General Assembly. <https://doi.org/10.5194/egusphere-egu24-20738>

**Zambrano, F.,** Meza, F., & Raab, N. (2023). Water supply and demand drought indices to assess its impact over land cover change and vegetation development in continental Chile for 2000-2023 by ERA5-Land and MODIS datasets. 2023, H43F-2151. AGU Fall Meeting Abstracts. <https://ui.adsabs.harvard.edu/abs/2023AGUFM.H43F2151Z>

Meza, F., Raab, N., & **Zambrano, F.** (2023). Multivariate Drought Index Combining Meteorological Information, Remote Sensing data and Biophysical Crop Simulation Models: Application in the Araucanía Region, Chile. 2023, H43F-2148. AGU Fall Meeting Abstracts.