Oliver Lopez, PhD

Geospatial data scientist with strong scientific computing skills and expertise in satellite-based remote sensing applications. Background in environmental science and engineering physics.

Research experience

King Abdullah University of Science and Technology, Saudi Arabia

2020 - now **Geospatial data scientist**

Leveraging cloud computing tools for high-resolution, large-scale geospatial analysis
Adapted satellite-based water use estimation models for use in Google Earth Engine
Improved geospatial image-based processing workflows achieving 50x+ faster computation times
Provided technical training and mentoring on geospatial data science and visualization technologies to research staff and students

2018 - 2019 **Postdoctoral fellow**

Combined high-resolution remote sensing retrievals, numerical weather prediction data, and a land surface model to estimate farm-scale groundwater abstractions
Scaled a methodology for groundwater abstraction estimation on a national scale

2013 - 2018 **PhD. Candidate**

Evaluated large-scale and long-term groundwater depletion in the Middle East using satellite gravimetry data
Combined satellite data with a land surface model to estimate groundwater abstraction

2011 - 2013 **Master research**

Hydrologic characterization of a dunefield including the analysis of the relation between grain size, porosity and hydraulic conductivity of over 50 samples of dune sand
Conceptual design of an aquifer storage and recovery system for strategic water management

2009 - 2010 **École Polytechnique - Solid Mechanics Laboratory, France**

Research intern

Applied a digital image correlation technique to cortical bone samples under compression stress
Improved the efficacy of the strain measurements by introducing micro-beads as a random pattern in the bone surface

Administrative experience

2008 - 2009 **Instituto Tecnológico y de Estudios Superiores de Monterrey, México**

Physics Laboratory instructor

Trained to demonstrate and supervise undergraduate physics laboratory experiments
Managed and evaluated groups of 15 students to conduct physics experiments

Education

2013 - 2018 **PhD., King Abdullah University of Science and Technology, Saudi Arabia**

Thesis: Monitoring arid-land groundwater abstraction through optimization of a land surface model with remote sensing-based evaporation

2011 - 2013 **M.Sc., King Abdullah University of Science and Technology, Saudi Arabia**

Thesis: Evaluation and preliminary design of a stormwater aquifer storage and recovery (ASR) system at the Wadi Khulays dunefield in Saudi Arabia

2006 - 2010 **B.Sc., Instituto Tecnológico y de Estudios Superiores de Monterrey, México**

Major: Engineering physics

Technical skills

Scientific computing

8+ years Bash, Python, R, FORTRAN
4+ years SLURM workload manager in a high performance (HPC) infrastructure
2+ years Javascript

Data science

4+ years scipy, scikit-learn, randomforest, keras, tensorflow, xarray, dask, geopandas, R-tidyverse

Data visualization

4+ years D3js, ggplot2, matplotlib, seaborn

Geospatial analysis

3+ years Cloud computing: Google Earth Engine
5+ years Command line tools: GDAL, GrADS, climate data operators (CDO), netCDF operators (NCO)
Software: ENVI, ArcGIS, QGIS

Open-source contributions

Authored geeet: Evapotranspiration (ET) models for python and Google Earth Engine

eetasks: A vscode extension for monitoring Earth Engine tasks

Contributed xarray, ipyleaflet, geemap, leafmap, py6s, geeSEBAL

Publications

Journals

In review Dufour, A., **Lopez Valencia, O.M.**, Mostamandi, S., Beck, H.E., Johansen, K., and Stenchikov, G.L.: Assessing the water budget of the Arabian Peninsula and its moisture recycling potential, under review at Journal of Hydrometeorology

El Hajj, M., Steele-Dune, S., Almashharawi, S., Johansen, K., **Lopez, OM**, Lopez Camargo, O.A., Amezaga-Sarries, A., Mas-Viñolas, A., Courault, D., Doussan, C., and McCabe, M.F.: Synergistic use of ground-based GNSS-R and Sentinel-2 imagery for soil moisture estimation across an irrigated grassland, submitted to IEEE Transactions on Geoscience and Remote Sensing

In preparation **López, O.**, Aragon, B., Li, T., McCabe, M.F.: Cloud-based agricultural crop water use monitoring across Saudi Arabia

Li T, **López Valencia OM**, McCabe, MF.: Mapping the nationwide subfield division dynamics in Saudi Arabia using machine learning and Sentinel-2 NDVI time series

Li T, **López Valencia OM**, McCabe, MF.: Mapping the crop phenology with diverse crop calendar, crop rotations and growing seasons in Saudi Arabia using Sentinel-2 data

El Hajj, M., Johansen, K., Camargo, F., **Lopez, OM**, Tu, Y., Angulo Morales, V., Lopez Camargo, Almashharawi, S., Courault, D., and McCabe, M.F.: Plant Area Index Estimation from UAV LiDAR Time-Series over Cherry Orchards

2023 Li T, **López Valencia OM**, Johansen K, McCabe MF. A Retrospective Analysis of National-Scale Agricultural Development in Saudi Arabia from 1990 to 2021. Remote Sensing. 2023; 15(3):731.

2021 Johansen, K., **López, O.**, Tu, Y., Li, T., and McCabe, M.F.: Center pivot field delineation and mapping: A satellite-driven object-based image analysis approach for national scale accounting, ISPRS J. Photogramm. Remote Sens., 175, 1-19, doi:10.1016/j.isprsjprs.2021.02.019, 2021

2020 **López, O.**, Johansen, K., Aragon, B., Li, T., Houborg, R., Malbeteau, Y., Mashhawari, S., Atlaf, M. U., Fallatah, E. M., Prasad, H., Hoteit, I. and McCabe, M.F.: Mapping groundwater abstractions from irrigated agriculture: big data, inverse modeling, and a satellite–model fusion approach, Hydrol. Earth. Syst. Sci., 24, 5251–5277, doi:10.5194/hess-24-5251-2020, 2020

López, O., Hegy, M.C. and Missimer, T.M.: Statistical comparisons of grain size characteristics, hydraulic conductivity, and porosity of barchan desert dunes to coastal dunes, Aeolian Res., 43, 100576, doi:10.1016/j.aeolia.2020.100576, 2020

2017 **López, O.**, Houborg, R., and McCabe, M. F.: Evaluating the hydrological consistency of evaporation products using satellite-based gravity and rainfall data, Hydrol. Earth Syst. Sci., 21, 323-343, doi:10.5194/hess-21-323-2017, 2017

2015 **López, O.**, Jadoon, K. and Missimer, T.M.: Method of relating grain size distribution to hydraulic conductivity in dune sands to assist in assessing managed aquifer recharge projects: Wadi Khulays dune field, western Saudi Arabia, Water, 7(11), 6411-6426, 2015

2014 **López, O.**, Stenchikov, G. and Missimer, T.M.: Water management during climate change using aquifer storage and recovery of stormwater in a dunefield in western Saudi Arabia, Environmental Research Letters, 9, 075008, 2014

2013 Rosas, J., **López, O.**, Missimer, T.M., Coulibaly, K. M., Dehwah, A. H. A., Sesler, K., Lujan, L. R. and Mantilla, D.: Determination of hydraulic conductivity from grain-size distribution for different depositional environments, Groundwater, 52 (3), 325-486, 2013

Conferences

2024 **López, O.**, Aragon, B., Li, T., McCabe, M.F.: Cloud-based agricultural crop water use monitoring across Saudi Arabia, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-6454, 2024

Li T, **López Valencia OM**, McCabe, MF.: Mapping the nationwide crop phenology stages in Saudi Arabia using machine learning and Sentinel-2 NDVI time series, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-5171, 2024

2023 Dufour, A., Mostamandi, S., Johansen, K., **Lopez Valencia, O.**, and Stenchikov, G.: Impact of Forestation and Land-use Changes on Desert Climate, EGU General Assembly 2023, Vienna, Austria, 24–28 Apr 2023, EGU23-1745, 2023.

Li, T., **López Valencia, O.**, Johansen, K., and McCabe, M.: National scale agricultural development dynamics under socio-political drivers in Saudi Arabia since 1990, EGU General Assembly 2023, Vienna, Austria, 24–28 Apr 2023, EGU23-11293,2023.

2020 Johansen, K., Tu, Y., Zilliani, M., Aragon, B., Angel, Y., Stutsel, B., Mashharawi, S., **López, O.**, Mccabe, M.: 3D Mapping of Rock Formations from Oblique and Nadir Viewing UAV Imagery, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-4068, 2020

2019 **López, O.**, Johansen, K., Li, T., Aragon, B., and McCabe, M.F.: Monitoring agricultural water use in Saudi Arabia: providing benchmark estimates from the field-scale to regional-scale, American Geophysical Union Fall Meeting, San Francisco, USA, December 2019

Johansen, K., **López, O.**, Aragon, B., Malbeteau, Y. and McCabe, M.F.: Mapping the extent of center pivots and associated irrigation: a comparison of an annual time-series of Landsat and PlanetScope

imagery, American Geophysical Union Fall Meeting, San Francisco, USA, December 2019

López, O., Johansen, K., Aragon, B., Malbeteau, Mohammed-Fallatah, E. and McCabe, M.F.: A monitoring strategy for agricultural water use in Saudi Arabia, European Geophysical Union General Assembly, Vienna, Austria, April 2019

Johansen, K., **López, O.**, Malbeteau, Y., Aragon, B., and McCabe, M.F.: Mapping extent and distribution of center pivots in Saudi Arabia using Landsat imagery, European Geophysical Union General Assembly, Vienna, Austria, April 2019

2017 Malbéteau, Y., **López, O.**, Houborg, R. and McCabe, M.F: Toward irrigation retrieval by combining multi-sensor remote sensing data into a land surface model over a semi-arid region, American Geophysical Union Fall Meeting, New Orleans, USA, December 2017

2015 **López, O.**, McCabe, M.F. and Houborg, R.: Evaluation of multiple satellite evaporation products in two dryland regions using GRACE, 21st International Congress on Modelling and Simulation, Gold Coast, Australia, December 2015

2014 **López, O.** and McCabe, M.F.: Continental-scale hydrological consistency of evapotranspiration products using GRACE, American Geophysical Union Fall Meeting, San Francisco, USA, December 2014

Houborg, R., McCabe, M.F., Rosas, J., **López, O.**, Anderson, M.C., and Hain, C.: Satellite-based evapotranspiration estimates over irrigated agriculture in a desert environment, 4th International Symposium on Recent Advances in Quantitative Remote Sensing, Valencia, Spain, September 2014

Abouelmagd, A., McCabe, M.F., El Kenway, A., and **López, O.**: An assessment of the performance of TRMM satellite data over Saudi Arabia, European Geophysical Union General Assembly, Vienna, Austria, May 2014

2013 **López, O.**, Houborg, R., and McCabe, M.F.: Evaluating water storage variations in the MENA region using GRACE satellite data, American Geophysical Union Fall Meeting, San Francisco, USA, December 2013

Abouelmagd, A., McCabe, M.F., and **López, O.**: Spatial and Temporal Precipitation Analysis over Saudi Arabia: Inferences from In-situ Rain Gauges and TRMM Derived Rainfall, American Geophysical Union Fall Meeting, San Francisco, USA, December 2013

López, O. and Missimer, T.M.: Feasibility of aquifer storage and recovery of stormwater in a dunefield in western Saudi Arabia, 8th International Society for Managed Aquifer Recharge Conference, Beijing, China, October 2013

Missimer, T.M., **López, O.** and Amy, G.: Engineered aquifer recharge and recovery systems in western Saudi Arabia, 17th Annual Water Reuse and Desalination Research Conference, Phoenix, USA, May 2013

2012 Granke, M., **López, O.**, Grimal, Q., Allain, J.M., Saïed, A., Crépin, J., and Laugier, P.: Contribution of matrix heterogeneity and pores to local strains in human cortical bone, Journal of Biomechanics, 45(S1), S474, 2012