



## **Lotos-Euros data assimilation for improving forecast of PM10 and PM2.5 in the Aburrá Valley**

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Poor air quality is a persistent and growing problem in urban centers. The Aburrá Valley houses the city of Medellín and neighboring municipalities. It is the second most populous urban agglomeration in Colombia, and the third densest in the world. Air quality conditions deteriorate severely within the valley twice a year around the time of the arrival of the Inter-tropical Convergence Zone (March-April, and with lower intensity in October-November). This phenomenon occurs when the atmospheric inversion layer persists throughout the day below the rim of the canyon, thus trapping all of the urban atmospheric contaminants within the lower atmosphere. During these periods, the concentrations of particulate matter increase at levels considered health hazardous. Policy makers require specialized and scientific assessments and tools for making decisions that help in protecting the population and help to improve conditions.

This study presents a Data Assimilation approach via Ensemble Kalman Filter, for the LOTOS-EUROS Model high-resolution implementation (1 km × 1 km) for the Aburrá Valley. Three different radii for Covariance Localization were used, and the data noise was modeled via colored distribution. Ground-based stations from the Early Warning System of the Aburrá Valley (Sistema de Alerta Temprana del Valle de Aburrá in Spanish SIATA) were used as observations for the period of March-April 2016, when atmospheric contamination in the Valley reached emergency levels. This work represents the first implementation of Data Assimilation techniques in studies of Air Quality in Colombia. The model shows a considerable underestimation (by a factor close to 10) of the PM10 and PM2.5 concentration over the valley caused by the complex topography, low-resolution meteorology, and poor representation of the global emission inventories for the region. After Data Assimilation, the model performance improves significantly. Underestimation was reduced to near zero, and the long-term behavior of particulate matter agreed with observations, evidencing that it is necessary to use Data Assimilation to develop a system capable of representing and forecasting Air Quality in the Aburrá Valley.