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River Breezes in the Central Amazon: Cluster Analysis of Meteorological and Chemical Data Sets Collected by an Unmanned Aerial Vehicle

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Local atmospheric circulation induced by wide rivers in Amazonia can strongly affect the transport of urban, industrial, fire, and forest emissions. Herein, a copter-type unmanned aerial vehicle (UAV) operated from a boat was used to collect vertical profiles of meteorological parameters and chemical concentrations during Sep-Oct 2019 of the dry season. Sensor packages mounted on the UAV measured wind speed and direction together with concentrations of carbon monoxide (CO) and total oxidants (O_x , defined as $O_3 + NO_2$). Multivariate statistical analysis identified distinguishing patterns for meteorological variables. The occurrence of river breeze circulations was linked to meteorological conditions from in-situ measurement and satellite images. Vertical profiles of chemical concentrations both from in-situ measurements and large eddy simulations confirmed that under some conditions a river breeze can facilitate pollutant mixing perpendicular to the river orientation. The results of this study advance an urgent need to quantify the occurrence and the properties of river breeze circulations in respect to microscale chemical dispersion, air quality, and human health.