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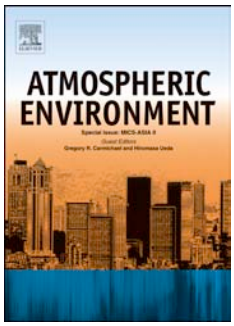

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LIDAR as an alternative to passive collectors to measure pesticide spray drift

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Abstract

Pesticide spray drift entails a series of risks and costs in terms of human, animal and environmental well-being. A proper understanding of this phenomenon is essential to minimize these risks. However, most conventional methods used in drift measurement are based on point collectors which are unable to obtain information concerning the temporal or spatial evolution of the pesticide cloud. Such methods are also costly, labour-intensive, and require a considerable amount of time. The aim of this paper is to propose a method to measure the spray drift based on lidar (LIght Detection And Ranging) and to prove that it can be an alternative to passive collectors. An analytical model is proposed to relate the measurements obtained through passive collectors and those obtained with lidar systems considering several spray application and meteorological parameters. The model was tested through an experimental campaign involving multiple ground spray tests. A lidar system and two types of passive collectors (nylon strings and water-sensitive paper) were used simultaneously to measure the drift. The results showed for each test a high coefficient of determination ($R^2 \approx 0.90$) between the lidar signal and the tracer mass captured by the nylon strings. This coefficient decreased ($R^2 = 0.77$) when all tests were considered together. Lidar measurements were also used to study the evolution of the pesticide cloud with high range (1.5 m) and temporal resolution (1 s) and to estimate its velocity. Furthermore, a very satisfactory adjustment ($R^2 = 0.89$) was observed between the tracer mass collected by the nylon lines and the coverage on water-sensitive paper sheets. These results are in accordance with the proposed analytical model and allow the conclusion that