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Hazard Prediction and Warning

# Assimilation of LIDAR Backscatter and Wind Data into an Atmospheric Transport and Dispersion Model

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This presentation will provide an overview of a recent investigation into the utilization of elastic backscatter LIDAR measurements to improve near range atmospheric transport and dispersion (AT&D) predictions for airborne contaminants. In many releases of chemical, biological, radiological and nuclear (CBRN) and toxic industrial materials into the atmosphere there is little or no in-situ meteorological information available. Furthermore, during experimental testing of CBRN releases using simulants it is often difficult to determine characteristics of the release such as the quantity of the material released and/or release rate. These scenarios require an analyst to make estimates of the required AT&D inputs (eg. material source term and weather conditions) to inform a resulting downwind contaminant concentration prediction. Given these limitations, it is posited that measurements collected by a LIDAR system, which can provide aerosol cloud detections and coincident wind information, could be utilized to reduce the associated uncertainty in an analyst's downwind CBRN hazard prediction or source estimate. To test this hypothesis our team utilized LIDAR measurements from the Real-time Eye-safe Visualization Evaluation and Analysis Lidar (REVEAL) instrument in a methodology that enabled the assimilation of these data into an AT&D model. Details on the characteristics of the REVEAL, and the CBRN measurement capabilities of this system will be provided in a separate presentation provided by Mr. Scott Higdon from Spectral Sensor Solutions. In this presentation we will describe the algorithm and methodologies used to directly assimilate these data into the Second-order Closure Integrated PUFF (SCIPUFF) model. This algorithm enables the development of real-time SCIPUFF downwind hazard predictions that continually update as each new LIDAR scan becomes available. The effectiveness of this real-time data assimilation approach is evaluated against available observations and overall performance for a similar operational scenario where LIDAR data were unavailable. We will also show results from a recent real-time demonstration of this capability at the S/K Challenge III field trials conducted at Dugway Proving Ground in 2016.

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