High image resolution CALIOP aerosol extinction denoising: Constructive insights for future space-based missions.

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Currently the standard noise reduction method for satellite based lidar measurements, such as CALIOP, is to average over multiple column measurements. Consequently, for non-uniform aerosols and clouds non-linear biases are introduced in the measured extinction coefficient (coeff.) due to the non-linearity of the single scatter lidar equation. For example, in order to measure daytime aerosol extinction coefficients the CALIOP measurements have to be down-sampled from 1/3 kilometer to 80 km horizontal resolution. In this presentation we report on the progress that has been made in developing a higher image resolution CALIOP extinction inference (i.e., denoising) methodology. Specifically, the proposed inference method exploits the underlying coherent spatial-temporal extinction image structure which can be separated from the random detector and solar background radiation noise; the inference is achieved through a theoretically supported mathematical optimization framework in which a cost function is minimized that includes a photon detector noise model and the single scatter lidar equation. In the presentation we will report on the challenges that had to be confronted, such as ill-defined noise sources which can cause unintended inference problems. What will be reported in this presentation will provide constructive insights into denoising future space-based lidar observations.

Bio:

Dr. Willem Marais received his PhD at ECE University of Wisconsin Madison in 2017. He is specialized in developing lidar and imager denoising and inference methodologies, and enhancing imager products through machine learning methods.