

Accepted Manuscript

Denoising and retrieval algorithm based on a dual ensemble Kalman filter for elastic lidar data

Feiyue Mao, Jian Liu, Lei Wang, Shihua Chen, Chen Li

PII: S0030-4018(18)30855-1

DOI: <https://doi.org/10.1016/j.optcom.2018.09.066>

Reference: OPTICS 23505

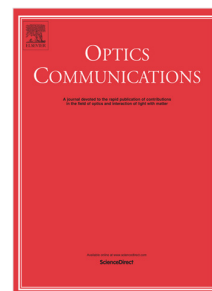
To appear in: *Optics Communications*

Received date: 16 June 2018

Accepted date: 26 September 2018

Please cite this article as: F. Mao, et al., Denoising and retrieval algorithm based on a dual ensemble Kalman filter for elastic lidar data, *Optics Communications* (2018), <https://doi.org/10.1016/j.optcom.2018.09.066>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Denoising and retrieval algorithm based on a dual ensemble Kalman filter for elastic lidar data

Feiyue Mao^{1,2,3,*}, Jian Liu¹, Lei Wang⁴, Shihua Chen⁴ and Chen Li⁴

¹ School of Remote Sensing and Information Engineering, Wuhan University, Wuhan 430079, China

² State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University, Wuhan 430079, China

³ Collaborative Innovation Center for Geospatial Technology, Wuhan 430079, China

⁴ School of Mathematics and Statistics, Wuhan University, Wuhan 430072, China

* Correspondence: maofeiyue@whu.edu.cn

Abstract: The intensity of a lidar signal decreases with transmittance and the square of detection range. Consequently, the effective measure range and retrieval accuracy are severely affected. A method for denoising and retrieval of lidar data is proposed in this study by combining dual ensemble Kalman filter (DEnKF) and Fernald methods to avoid the abovementioned issue. Compared with ensemble Kalman filter (EnKF) method, the DEnKF method provides a feedback function in the iteration; thus, the DEnKF method provides a generally improved accuracy of denoising and retrieval. We select an ensemble size of 60 and determine the covariance δ on the basis of the defined performance function. The DEnKF, EnKF and standard Fernald methods are tested using complex simulated and real signals. Results show that an aerosol backscatter coefficient retrieved through the DEnKF method demonstrates lower uncertainty in the far range (above 4 km) than the coefficients obtained through the two other methods and fits the results retrieved through the two other methods in the near range (below 4 km). In addition, the results indicate that the retrieval results are better through the DEnKF method than through the 64 min averaged signals, which can divide the standard error thrice (i.e. averaging 64 replications). Overall, the results demonstrate that the DEnKF method is effective and useful for retrieving signals with low signal-to-noise ratios, such as the far-range signals of a ground lidar and full-range signals of a space lidar.

Keywords: aerosol; lidar; denoising; retrieval; dual ensemble Kalman filter

1. Introduction

A lidar is a unique and active remote sensing system for vertically detecting atmospheric clouds and aerosols [1, 2]. Different lidar networks [3, 4], satellite lidar systems (e.g. ICESAT/GLAS and CALIOP/CALIPSO) and future lidar plans (e.g. ACE-lidar, Earth CARE/ATLID and ADM-Aeolus/ALADIN) are important in local and global climatology [5-7]. The retrieval algorithm for lidar data is becoming important whilst using lidar has become extensive and in demand [8-10].

Download English Version:

<https://daneshyari.com/en/article/12059107>

Download Persian Version:

<https://daneshyari.com/article/12059107>

[Daneshyari.com](https://daneshyari.com)