

The Aerosol Limb Imager: Acousto-Optic Imaging of Limb Scattered Sunlight for Stratospheric Aerosol Profiling

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Abstract

The Aerosol Limb Imager (ALI) is an optical remote sensing instrument designed to image scattered sunlight from the atmospheric limb. These measurements are used to retrieve spatially resolved information of the stratospheric aerosol distribution, including spectral extinction coefficient and particle size. Here we present the design, development and test results of an ALI prototype instrument. The long term goal of this work is the eventual realization of ALI on a satellite platform in low earth orbit, where it can provide high spatial resolution observations, both in the vertical and cross-track. The instrument design uses a large aperture Acousto-Optic Tunable Filter (AOTF) to image the sunlit stratospheric limb in a selectable narrow wavelength band ranging from the visible to the near infrared. The ALI prototype was tested on a stratospheric balloon flight from the Canadian Space Agency (CSA) launch facility in Timmins, Canada, in September, 2014. Preliminary analysis of the hyperspectral images indicate that the radiance measurements are of high quality, and we have used these to retrieve vertical profiles of stratospheric aerosol extinction coefficient from 650-1000 nm, along with one moment of the particle size distribution. Those preliminary results are promising and development of a satellite prototype of ALI within the Canadian Space Agency is ongoing.