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Towards the realization of spaceborne lidar mission program in Japan

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Various atmospheric phenomena cross borders and have undesirable effects on earth environment issues such as global warming, long-range air pollutant, acid rain, ozone destruction, and so on. An aerosol particle derives from human activities, sea spray, dust, and biogenic activities, and it play an important role in the local and global and local circulations. The aerosol particle can scattering and absorb the light and it has highly influence directly on the Earth's energy balance. Water soluble aerosol can serve as cloud condensation nuclei and it determines the initial concentration, distribution, phase of cloud. The aerosol particles can have influence indirectly on the Earth's energy balance. The chemical reactions affect optical properties of aerosol particle. It also results in the influence of the radiation budget from the microscopic view. The network of aerosol observatory as meteorological weather stations is limited. The aerosol observation form space is one of the promising methods for the earth observation. Lidar is one of the most useful active remote sensing techniques that can be used to detect small particulates. The lidar can be used to detect molecules, aerosols and clouds, water vapor, minor atmospheric constituents, and wind. The National Space Development Agency of Japan which was the predecessor of the Japan Aerospace Exploration Agency planned the Experimental Lidar in Space Environment (ELISE) loaded onto the mission demonstration satellite II. The ELISE program was a two-wavelength backscatter lidar and it was a first full-scale spaceborne lidar mission program. One of objectives of the ELISE program was to observe tropospheric and stratospheric aerosol particles, multiple-layered cloud, and cirrus. The ELISE program was aborted through some reasons. Japanese spaceborne lidar mission programs for the purposes of the atmospheric science have not been planned since the ELISE mission program. The ideas on the Japanese earth observation mission program after 2020 are discussed in the land, oceanic and atmospheric disciplines. In the atmospheric discipline, Doppler wind lidar, high spectral resolution lidar, multi-wavelength polarization backscatter lidar, scanning lidar, and differential absorption lidar for green gases are discussed as candidates for future spaceborne lidar mission programs. In presentation, we will report on the ideas of the future spaceborne lidar mission program, and also discuss the ideas with various scientific and engineering experts interested in the active optical remote sensing technique.

Keywords: spaceborne observation, lida, aerosol/cloud, wind, trace gas