A potential space-based Raman-Rayleigh lidar for *in-situ* measurement of thermospheric winds, temperature, and densities of major constituents

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We describe a Raman-Rayleigh lidar operating aboard a satellite capable of *in-situ* measurement of thermospheric winds, temperature, and densities of atomic oxygen, and molecular nitrogen and oxygen. Back-scattered Rayleigh and Raman emissions from a pulsed frequency tripled Nd:YAG laser are analyzed. The Rayleigh component is passed through a polarizer as well a Fabry-Perot cavity. The component without change in the polarization vector is due to scattering by both atoms and molecules while that with change in the polarization vector is due to scattering by molecules only. The Fabry-Perot cavity permits a determination of the atmospheric temperature and winds. The rotationally inelastic, vibrationally elastic, component of Raman scattering may be analyzed for the N_2 and O_2densities as well as their rotational temperatures. The vibrationally inelastic, rotationally elastic, Stoke and anti-Stoke components may be analyzed for the N_2 and O_2densities as well as their vibrational temperatures. Various components of the observed emissions are analyzed for the signal-to-noise as well as the relative error.