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Performance simulation of a spaceborne infrared coherent lidar for measuring tropospheric wind profiles.

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An effort has begun in Japan to develop a spaceborne instrument for measuring tropospheric winds. This project is a collaboration between the Japan Aerospace Exploration Agency (JAXA), the Meteorological Research Institute (MRI, Japan) and the National Institute of Information and Communications Technology (NICT, Japan) [1,2]. The aim is to measure the horizontal wind field in the troposphere on a global scale with a precision better than 3 ms^{-1}, and a vertical and horizontal (along the satellite ground track) resolution better than 1 km and 100 km, respectively. In order to support the definition and the development of the instrument, an end-to-end simulator has been implemented including modules for i) simulating the time-dependent laser shot return power, ii) for averaging the spectral power of several returns and iii) for estimating the line-of-sight wind from the Doppler shift of the averaged spectra. The simulations take into account the satellite position and motion along the orbit track, the observational and instrumental characteristics, a 3-D representation of the relevant atmospheric parameters (i.e. wind field, cloud coverage and aerosols distribution) and the Earth surface characteristics. The simulator and the method for estimating the line-of-sight wind will be presented. We will show the results obtained for a payload composed of two 2-μm coherent LIDARs looking in orthogonal directions, and for a satellite moving on a low orbit. The precision, accuracy and the vertical and horizontal resolution of the wind estimates will be discussed.

References:

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