

GNSS Reflectometry: Applications and Progresses

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Abstract

GPS technique can be characterized as follows: (1) GPS is a satellite technique; (2) GPS is an interferometric technique, meaning that if two or more GPS receivers are operated simultaneously, higher accuracy is achieved by difference; (3) GPS is a satellite microwave technique, whose signals are transmitted on microwave (L-band) carriers through the Earth atmosphere; (4) GPS can observe continuously, daily and nightly independent of the weather. These characteristics of GPS imply more and wider applications. For a long time, the delay of GPS measurements caused by the troposphere was considered as a nuisance, an error source, and now GPS can remotely sense the water vapor, temperature, pressure and electron density of the atmosphere with combining space-borne GPS occultation technique. In addition, surface multi-path is one of main error sources for GPS navigation and positioning. It has recently been recognized, however, that the special kind of multi-path delay, that from the GPS signal reflecting from the sea and land surface, could be used as a new tool in ocean, coastal, wetlands, Crater Lake, landslide and ice remote sensing. This paper will address the new remote sensing applications of GPS technique in atmosphere, ocean and land and their recent progresses.

The surface reflected GPS signals, for L-band observations, forward-scattering sensing, low-cost and simple devices useable on any type of aircraft, etc, revolutionize various ocean remote sensing applications such as wave height, wind speed, wetland, salinity, sea ice cover conditions and atmospheric

parameters determination over oceans, and even land remote sensing applications such as soil moisture, wetland and Crater Lake. Once the delay-Doppler-mapping GPS receiver is installed onboard a satellite or spacecraft, it will provide us with the unique opportunity to use GPS as a new remote sensing tool on a global scale to infer various geophysical parameters. Surface reflected GPS signals would soon become a new source of data for scientists to get better understanding of global ocean current circulation, global climate change and global warming, especially for various topographic land and larger ocean of the world.

Keywords: GPS; Reflectometry; Remote Sensing; Altimetry.