

Applications of GPS in Remote Sensing Atmospheric Parameters

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GPS is a network of satellites that continuously transmit coded information, for precise positioning of the user on the surface of the earth. It is now being used in various fields like aviation, surveying, 3G communications, tracking etc. GPS has also become a unique tool for studying the Earth's atmosphere. With GPS probing, a comprehensive understanding of the characteristics/mechanisms of ionosphere and troposphere over large part of atmosphere can be carried out thoroughly. The propagation of electromagnetic waves through the atmosphere is still the subject of research. There are many sources of errors that limit the positional accuracy of GPS. Atmosphere being one such predominant source. The atmospheric conditions affect the GPS signals when they pass through the Earth's atmosphere, especially in the ionosphere and troposphere. In ionosphere, the velocity of the wave reduces due to the presence of electrons causing ionospheric time delay. Whereas in troposphere, the velocity of the wave remains constant but it bends due to variable refractive indices of the medium causing time delay in arriving at the receiver. The important atmospheric parameters in remote sensing using GPS are Total Electron Content (TEC) and Integrated Water Vapour (IWV). Due to dispersive nature of the GPS signal, a dual frequency GPS receiver can be used to remote sense the TEC along the propagation path accurately and thereby improve the positional accuracy. Water vapour which plays an important role in formation of clouds and precipitation is a key parameter for atmospheric processes over a wide spatial and temporal range. IWV can be measured using zenith tropospheric time delay, temperature, pressure and humidity. Another source of error is multipath where the signals reflected from various reflecting surfaces interfere with the direct signal adversely affecting the positional accuracy. GPS multipath signals reflected off the ocean or land can be used as a source of valuable new information about sea state, soil moisture, snowpack, and sea ice. All these aspects will be dealt comprehensively in the presentation.