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GNSS High-Precision Applications for Earth Sciences: Accuracy and Limitations

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Global Navigation Satellite Systems (GNSS) are nowadays one of the most important space-geodetic technique for establishing the terrestrial reference system and for many Earth observation applications. Since processes in the Earth system are happening in time scales from extremely short (earthquakes, volcano eruptions, land slides, ...) to very long (melting of ice sheets, sea level change, plate tectonics, ...), monitoring and early warning systems must allow the detection and quantification of catastrophic events in (near) real-time on the one hand and the reliable identification of barely noticeable, but crucial long-term trends (e.g., sea level rise) on the other hand.

In this contribution we will present the impressive accuracy of GNSS but also some of its limitations and how to possibly overcome them. Some of the examples we will look into are coming from GNSS seismology (receiver performance under high dynamics), water vapor determination (high correlation between height, clock and troposphere parameters), GNSS orbit modeling deficiencies (e.g. solar radiation pressure) and local effects at fundamental sites (e.g. local ties).