# Coordinates Trajectory Models: Basics and Implementation

**Mohammed Aljafar (Saudi Arabia)**

**Key words:**   Deformation measurement; GNSS/GPS; Reference frames; Trajectory Models, Geodesy, Velocity, GNSS

## SUMMARY

This technical paper discusses the use of trajectory models in GNSS station coordinates' time-series. The author starts by introducing initial trajectory models and their evolution to the modern state. A case study using three years of 16 Ohio GNSS stations data is provided. In the study, the author explains how the daily raw GNSS data is processed to get the daily solutions. Then, the author applies to the processed data the constant velocity model (CVM) with and without jumps, and the standard linear trajectory model (SLTM) with and without outliers. A demonstration of how the SLTM model uses the weighted least squares adjustment to estimate the model's parameters. The author describes the outlier detection method implemented in the study. The result of the case study shows that advance trajectory models fit the true position of the GNSS station. The RMSEs of the stations get smaller with more advanced models. The CVM RMSEs are larger than the CVM's with jumps RMSEs and the same applies to the SLTM. The improvements are due to the introduction of jumps then seasonal variations. If there was any acceleration, the later models would detect the change. However, in the stations selected for this study, the velocities are considered constant. There is only one station showing an outlier percentage that is above the 3% mark, which is OHCL. Since another independent analysis reflected similar behavior for this station, it is assumed that the movement in this station is not physical, and a thorough onsite examination is needed to identify the underlying reasoning.