Geophysical Research Abstracts
Vol. 20, EGU2018-6714-1, 2018
EGU General Assembly 2018

Investigation of GPS Positioning Accuracy During The Minimum and Maximum Activity of The Solar Cycles

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The aim of this study is to investigate whether or not the solar activity affects the accuracy of GPS (Global Positioning System) positioning. The observations have been analyzed and compared to determine how the accuracy of derived relative positions of GPS stations rely on the baseline length, the duration of observing session in a minimum solar activity of 2009 and in a maximum solar activity of 2014.

For this aim, we selected seven days of each year in 2009 and 2014 from the GPS observations carried out in NOAA-CORS Network in USA with 9 stations. The GPS observations were processed in the ITRF 2008 reference frame using the Bernese 5.2 GPS software. The baseline length varies between 10 km and 110 km, session duration varies between 4 h and 24 h.

The repeatability of the daily solutions belonging to each year was analyzed carefully to scale the Bernese software cofactor matrices. The root means square (RMS) values for daily repeatability with respect to the combined 7-day solution are computed. The RMS values are less than 5 mm in the horizontal directions (north and east) and < 8 mm in the vertical direction for the minimum solar activity of 2009. The RMS values are less than 8 mm in the horizontal directions (north and east) and < 13 mm in the vertical direction for the maximum solar activity of 2014.

It can probably be some negative effect on the accuracy of the GPS measurements because of the great solar activity in 2014. Therefore, the solar activity can be considered to be intense we can determine our solutions of the GPS measurements to be less accurate. During periods with few or close to no sunspots and the solar activity can be considered low in 2009, the errors for this periods are often small and does not have any great effect on the GPS measurement.