Geophysical Research Abstracts
Vol. 17, EGU2015-9384, 2015
EGU General Assembly 2015

Analysis of Zenith Tropospheric Delay above Europe based on long time series derived from the EPN data

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In recent years, the GNSS system began to play an increasingly important role in the research related to the climate monitoring. Based on the GPS system, which has the longest operational capability in comparison with other systems, and a common computational strategy applied to all observations, long and homogeneous ZTD (Zenith Tropospheric Delay) time series were derived. This paper presents results of analysis of 16-year ZTD time series obtained from the EPN (EUREF Permanent Network) reprocessing performed by the Military University of Technology. To maintain the uniformity of data, analyzed period of time (1998-2013) is exactly the same for all stations – observations carried out before 1998 were removed from time series and observations processed using different strategy were recalculated according to the MUT LAC approach. For all 16-year time series (59 stations) Lomb-Scargle periodograms were created to obtain information about the oscillations in ZTD time series. Due to strong annual oscillations which disturb the character of oscillations with smaller amplitude and thus hinder their investigation, Lomb-Scargle periodograms for time series with the deleted annual oscillations were created in order to verify presence of semi-annual, ter-annual and quarto-annual oscillations. Linear trend and seasonal components were estimated using LSE (Least Square Estimation) and Mann-Kendall trend test were used to confirm the presence of linear trend designated by LSE method. In order to verify the effect of the length of time series on the estimated size of the linear trend, comparison between two different length of ZTD time series was performed. To carry out a comparative analysis, 30 stations which have been operating since 1996 were selected. For these stations two periods of time were analyzed: shortened 16-year (1998-2013) and full 18-year (1996-2013). For some stations an additional two years of observations have significant impact on changing the size of linear trend – only for 4 stations the size of linear trend was exactly the same for two periods of time. In one case, the nature of the trend has changed from negative (16-year time series) for positive (18-year time series). The average value of a linear trends for 16-year time series is 1,5 mm/decade, but their spatial distribution is not uniform. The average value of linear trends for all 18-year time series is 2,0 mm/decade, with better spatial distribution and smaller discrepancies.