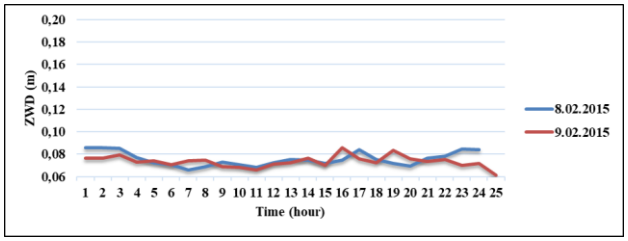

Figure 13. PM_{10} time series of Zonguldak.

4. CONCLUSIONS

In addition to the meteorological events that take place in the troposphere layer, air pollution originating from human influences also occurs. While describing the elements that cause air pollution, the factors that cause these elements are mentioned, both of which affect the human life. From these factors, the PM_{10} parameter forms the basis of this work.

The temperature, pressure and humidity values affecting the wet zenith delay are obtained from the General Directorate of Meteorology and the PM_{10} data obtained from the Zonguldak Air Quality Monitoring Station belong to the Ministry of Environment and Urban Planning. Data of ZONG GNSS station belongs to the TUSAGA-Active network obtained from the General Directorate of Land Registry and Cadastre. 2014-2015 data for the ZONG GNSS station processed with GAMIT/GlobK and GIPSY-OASIS II academic GNSS software. Results of the evaluations, the PM_{10} values were analyzed together with the changes of the ZWD values. Samples were given for days in which PM_{10} values were high and low on consecutive days with same meteorological conditions. The hourly ZWD changes of these days are observed to change at noon (11:00-13:00) and evening (18:00-21:00) during the day along with PM_{10} values. The reason for this difference is that the central heating boilers in Zonguldak city center are fed with coal twice a day at noon and evening hours.

The overall ZWD difference in days with same meteorological conditions and different PM_{10} values is changing at a range of 20-40 mm depending on the PM_{10} differences in the day, as shown in Figure 8-10. The stated ZWD value difference was 20 mm for a mean 50 $\mu g/m^3$ PM_{10} difference and 40 mm for a mean difference of 100 $\mu g/m^3$ PM_{10} in the day. The overall ZWD difference in days with same meteorological conditions and different PM_{10} values is changing at a range of 2-4 mm depending on the PM_{10} differences such as 1-5 $\mu g/m^3$ PM_{10} in the day, as shown in Figure 11-13. The result from these two comparisons is that the wet zenith delay that occurs on the days when the PM_{10} value is relatively high is greater than the wet zenith delay that occurs on days when the PM_{10} value is relatively low.

In addition to these differences in wet zenith delay and hence total zenith delay in the study area, the investigation of the effect of high PM_{10} values on positioning will also contribute to position accuracy studies. However, this study has shown that the effect of PM_{10} values on GNSS signals can be overlooked in study areas with low average PM_{10}. In today's conditions, the use of natural gas for heating purposes is gradually increasing, but consumption of coal, especially from energy production, leads to an increase in PM_{10} values. This increase in the amount of PM_{10} should not be neglected, in addition to the effects on human health and visibility, as well as the precise positioning and other application of the GNSS. In future geodetic studies, it is recommended that the PM_{10} values in the study area should be investigated.

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