A study on the seasonal variation of leveling data in Omaezaki region

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Geographical Survey Institute(GSI) has been carrying out leveling survey in Omaezaki region, four times per year, since 1981. This leveling survey revealed that Hamaoka(BM2595) is subsiding about 5mm/yr referred to Kakegawa(BM140-1). Though the rate of subsidence is steady for long term, it is pointed out that seasonal variation is laying over the trend. The amplitude of seasonal variation is as mach as 1cm(peak to peak). Various hypothesis has been proposed for the origin of this variation. As GPS data does not show such significant seasonal variation, it is suspected that the origin of this variation would be a factor which is uniquely related to leveling observation itself. One of such doubtful sources is atmospheric refraction. This study deals the statistic parameters of this seasonal variation for 13 unit sections, which is the leveling route from one bench mark to another neighboring bench mark. If the atmospheric refraction is the cause of seasonal variation, two characteristics would be expected. 1)The amplitude of variation is proportional to the height difference of two bench marks. 2)The phase of variation is reverse between ascending sections and descending sections. We examine 13 sections of the leveling route from Kakegawa to Sagara(SF1354) to estimate the long term trend and seasonal variation using least square method. We compared AIC(Akaike Information Criterion) values calculated from two different types of the models to examine which model is preferable. One is a linear model, which means the subsidence rate is constant and seasonal variation is random. Another model is linear function plus sine function with one year cycle, which means seasonal variation can be modelized by sine curve. We found the latter model is better than linear model in nine of the thirteen sections. However we also found linear model is preferable for other four sections. The phase of variation in the most sections agree with each other. The residual from linear trend is positive in summer and negative in winter. This means the phase does not relate whether the section is ascending or descending. The amplitude of seasonal variation seems to have no relation between the height difference in each section. Therefor the current result is negative for concluding that seasonal variation is related to atmospheric refraction.