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Determination of the geopotential difference and orthometric height difference based on the two-way satellite time transfer observations

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Based on general relativity theory, an atomic clock's running rate will change with gravity potential (geopotential). Then we may precisely determine the geopotential difference between two stations on ground if precise atomic clocks are available. There are different ways to compare the time elapse between remote two atomic clocks, one of which is the two-way satellite time and frequency transfer (TWSTFT), one of the most accurate remote time comparison techniques at present. As experiments, here we use the TWSTFT observations covering the period from December 7, 2016 to January 3, 2017 at China Aerospace Science & Industry Corporation (CASIC), Beijing. After synchronizing two hydrogen clocks at positions at the same height, the clocks were compared for a height difference of 22.2 m over a period using the TWSTFT technique. Using the EEMD method to filter out the noises, we obtained the time elapse between the two clocks. Then the height difference determined based on the TWSTFT technique is comparable with the given height 22.2 m, coinciding with the stability of the hydrogen clocks used in our experiments. This study is supported by NSFCs (grant Nos. 41721003, 41804012, 41874023, 41631072, 41429401, 41574007).