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Experiments of determining the geopotential difference using two hydrogen atomic clocks and two-way satellite time and frequency transfer technique

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Abstract In this study, we carried out experiments of the geopotential difference determination at CASIC, Beijing with the help of two hydrogen atomic clocks, using the two-way satellite time and frequency transfer technique. Here the ensemble empirical mode decomposition method is adopted to extract geopotential-related time-elapse signals from the original observations. The clock-comparison-determined geopotential difference in the experiments is determined, which is compared to the previously known results determined by conventional approach. Results show that the geopotential difference determined by time comparison deviates from that determined by conventional approach by about $1589 \text{ m}^2\text{s}^{-2}$, which is equivalent to 162 m in height, in consistence with the stability of the hydrogen atomic clocks applied in the experiments (at the level of $10^{-15}/\text{day}$). Since the stability of the optical clocks achieve 10^{-18} level, the geopotential determination by accurate clocks is prospective, and it is prospective to realize the unification of the world vertical height system. This study is supported by NSFCs (grant Nos. 41721003, 41631072, 41874023, 41804012, 41429401, 41574007) and Natural Science Foundation of Hubei Province of China (grant No. 2019CFB611).