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Forthcoming Grand Minimum of the total solar irradiance leads to the Little Ice Age

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Cyclical variation of the portion TSI absorbed by the Earth remains uncompensated by the energy emission to space over the interval of time that is determined by the thermal inertia of the World Ocean. Long-term deviations of the average annual energy balance of the Earth from the equilibrium state together with the subsequent feedback effects determine a corresponding change of the energy state and, hence, an upcoming climate variation and its amplitude, with account for the forecasted quasi-bicentennial variations of the TSI. Since the early 90s a decrease in both the TSI and the portion of the solar energy absorbed by the Earth has been observed. Since the Sun is in the phase of decline of the quasi-bicentennial variation, an average annual decrease rate of the absolute value of TSI from the 22nd cycle to the 23rd and 24th cycles is increasing. The Earth as a planet will also have a negative average annual energy balance in the future. This will lead to an additional drop in the temperature and the beginning of the epoch of the Little Ice Age after the maximum phase of the cycle 24 approximately since the second half of 2014. The influence of the consecutive chain of the secondary feedback effects: the increase in the Bond albedo and the decrease in the greenhouse gases concentration in the atmosphere by cooling will lead to an additional reduction of the absorbed solar energy and reduce the greenhouse effect influence. The start of Grand Maunder-type Minimum of the TSI of the quasi-bicentennial cycle is anticipated in solar cycle 27±1 approximately in 2043±11 and the beginning of the phase of deep cooling of the 19th Little Ice Age in the past 7,500 years in 2060±11. As a result of decrease of the TSI since the early 90s the global warming has stopped for more than 17 years. The current World Ocean level practically does not rise that additionally reflects the current state of global warming during past 17 years, which are under the direct control of the quasi-bicentennial variations of TSI.

Keywords: climate, Grand Minimum TSI, Little Ice Age, feedback effects