



Ensemble empirical mode decomposition as a tool of lake sediments and tree-ring width chronologies investigation

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A method named ensemble empirical mode decomposition (EEMD) was used to analyse different paleoclimatic data such as non-varved lake sediments of the Teletskoye lake and long tree-ring width chronologies from the Altai region (Altai Mountains, South Siberia, Russia) in the late Holocene (2000 years). Core of the bottom sediments from the Teletskoe lake (Altai Mountains) were investigated using scanning X-ray fluorescent analysis method with synchrotron radiation (spatial resolution is 0.1 mm). Low-frequency signals (modes) were extracted from both paleoarchives and shown: ~ 60 , ~ 100 , ~ 200 , $\sim 300-500$ and ~ 1000 -year cycles in the Teletskoye lake; $\sim 25-33$, $\sim 50-60$, $\sim 100-200$, ~ 300 and ~ 1000 year cycles in tree-ring width chronologies. A common 200-year cycle was found in both archives. Also EEMD method was used to analyse a solar-activity during late Holocene. The magnetic solar activity well associated with tree-ring width chronologies. Changes of the tree-ring width chronology on the millennial time scale coincide with similar changes of the solar activity in the Holocene. Stable relationships between solar activity and climate characteristics are found on 100-200 years time scales (Glaysberg and Suess cycles). The magnetic solar activity and paleotemperature changes are observed as solar-terrestrial relations on a large time scale. It is indicate that the temperature increase in the 19-20 centuries is largely due to the impact of solar activity on the Earth's climate system. Solar-terrestrial relations analysis shown common 200-year cycle in all presented paleoarchives.

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Key words: ensemble empirical mode decomposition (EEMD), lake sediments, tree-ring width chronologies, solar-terrestrial relations