

Polygon “Simeiz–Katsively” – the cycles in the climatic and the geophysical characteristics of the Crimea

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Abstract. Coherent variations are established with periods of about 10-12 years and 60-70 years, which are found in processes of different physical nature and can be attributed to global cycles in the solar system, the manifestation of which in climatic and geophysical local processes is the result of a general tendency to synchronize. Coherent variations with multiple or comparable frequencies are possible in this process. Analysis of climatic characteristics on the Crimean peninsula for the period 1983 - 2005 revealed an accelerated increase (in comparison with other points of the Crimea) with the insolation of the earth's surface in Kara -Dag and an abnormal decrease in the temperature of the Earth's surface at Lantern

1. Introduction

Since there are currently no reliable methods for predicting environmental disasters, scientists are studying indirect signs of the possible activation of earthquakes, volcanoes, mudflows such as extreme events on the Sun, the dynamics of the Earth's rotation, the activation of the flow of liquid masses inside the Earth, and events in the atmosphere and magnetosphere, technogenic factors. The need to analyze the relationship of heliogeophysical characteristics and climate parameters changing in time and space has contributed to the development and practical implementation of robust mathematical methods adapted for calculating the stable characteristics of time series with a limited duration.

Such methods include multichannel power spectral density estimation procedures adapted for analysis of short data samples, frequency-time wavelet analysis. In recent years, these methods have been successfully used in the practice of studying natural processes. The information content of the analysis of local observations using wavelets was used by us in the study of insolation and temperature anomalies at Kara-Dag points, Cape Fonar, in the analysis of land surface deformations from observations at the Crimean heliogeodynamic test site included in the network of VLBI, GNSS, SLR stations. The results of the frequency-time wavelet analysis of the time series of solar insolation, temperature and deformations of the earth's surface at certain points of the Crimea, presented in this work, reveal the spatiotemporal relationship of solar, meteorological and geophysical processes with the dynamics of the Earth's rotation, solar activity.

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2 Observation

2.1 Solar insolation, the surface temperature of the Earth

To support scientific and technical developments on renewable energy, NASA has developed and successfully operates the Project for Energy Forecasting Worldwide (*POVER - Prediction of Worldwide Energy Resource Project*). Within the framework of this project, a database of terrestrial meteorology and solar energy parameters was created (*SSE - Surface meteorology and Solar Energy*) [<https://eosweb.larc.nasa.gov/sse/>]. The base consists of more than 200 satellite meteorology parameters and solar energy parameters. The 22-year-old series of climatology in it (July 1983 - June 2005) provides global total coverage over the Earth's surface (on the grid, one degree of latitude per one degree of longitude) of the data set *SSE*.

2.2 Secular variations of the geomagnetic field

The International Association for Geomagnetism and Aeronomy (*The International Association of Geomagnetism and Aeronomy - IAGA*) released the International Geomag 12th-generation standard standard field - a new version of the standard mathematical description of the main magnetic field of the Earth. To calculate changes in the parameters of the geomagnetic field in the Crimea, we used the calculator *IGRF - 12* [<http://www.ngdc.noaa.gov/IAGA/vmod/igrf.html>].

2.3 Amendments to the deformation of the surface of the Earth

In the research department *DFG (Deutsche Forschungsgemeinschaft)*, an international project was developed to support spatio-temporal support systems for monitoring global changes and for accurate navigation in space. The aim of the project is to provide a quasi-inertial reference system implemented by the agreed position of the quasar and the Earth reference system based on a common set of parameters and, in particular, on homogeneous geophysical models: "Ocean", "Atmosphere", "Hydrology".

3 Amendments to deformations of the earth's surface at Katsively

Nonlinear motion of observation stations is the main source of errors in current implementations of reference systems. The reasons for the appearance and methods for taking these displacements into account can be different, one of which is the effects of hydrophysical shells: the ocean, atmosphere, and hydrosphere, not taken into account when modeling reference networks.

As our analysis showed, the data on corrections to deformations of the earth's surface at the Katsively point, calculated on the basis of the Atmosphere and Ocean geophysical models, contain periodic components. Our time-frequency wavelet analysis the time series of amendments to the vertical deformations of the earth in the "Katsively" paragraph is shown in Fig. 1 and Fig. 2.

An analysis of the largest absolute corrections to vertical deformations using the Atmosphere model revealed a seasonal component. The period of this fluctuation is 365.3 days with 95% confidence limits (365.3, 365.1) days; the amplitude is 3.37 mm with 95% confidence limits (3.33, 3.40) mm.

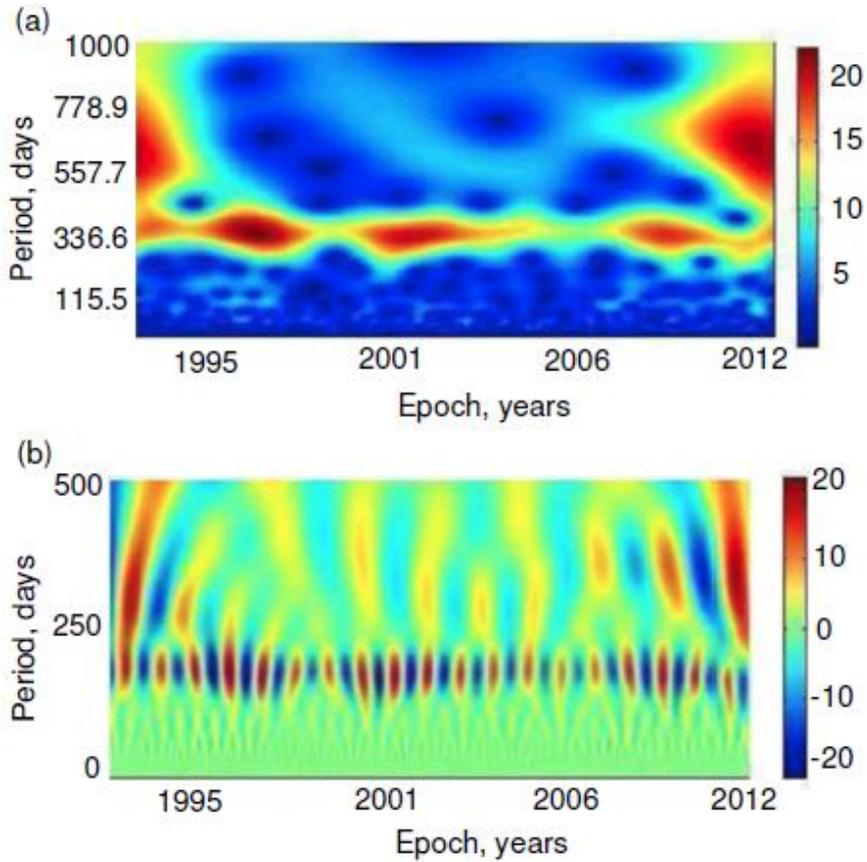


Fig. 1. Continuous frequency - time wavelet analysis (wavelets 'morl') of data on corrections to vertical deformations of the earth's surface at Katsively point: a - "Atmosphere" model; b - "Ocean" model.

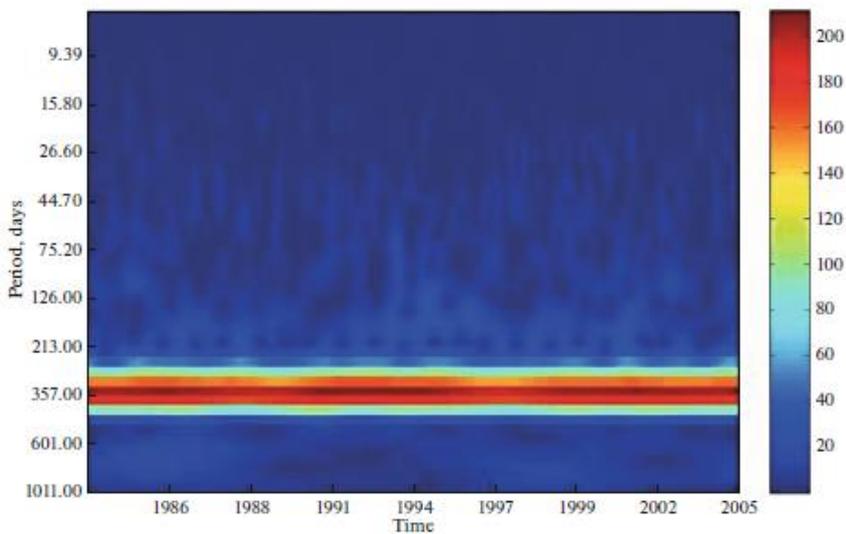


Fig. 2. The frequency-time diagram of the average insolation.

3 Conclusion

Possible changes in local climatic and heliophysical conditions are predicted using appropriate models, which, due to unresolved issues in studying the causes of changes in the Earth's rotation speed, the mechanism of solar-terrestrial connections, the ocean, atmosphere, and processes inside the Earth, are statistical in nature and need to be clarified using ground and space observations.

As a result of our analysis of data on corrections to vertical deformations of the earth at the Katsively point, calculated using the Atmosphere model, the parameters of the analytical model of seasonal fluctuations with an amplitude of 3.37 mm were found and calculated.

References

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