Implementation of the trigger mechanism in hydrometeorological and other environmental processes exposed to cosmic rays

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Abstract. The analysis of multiyear readings of the TiNi sensor and variations of atmospheric parameters over the same time period is presented. The detected regularities reveal a common external factor acting simultaneously on several heterogeneous environmental components independent from each other. Under certain local environmental conditions and the parameters of the acting factor, the interaction becomes resonant, which leads to the synchronization of changes in the parameters of heterogeneous components. The observed synchronism is a type of resonance arising due to the convergence of vibration frequencies of the acting factor particles and vibrations of the particles forming the components of the environment.

1. Introduction
The experimentally discovered synchronism effect of simultaneous variations of the metal states with the shape memory effect and a number of meteorological parameters opens up prospects for a new technology of monitoring the environment and those external factors that cause these simultaneous variations.

The prospectivity of the proposed technology is determined by the fact that, as shown in the works [1-4], the shape-memory metal, represented by the composite TiNi, shows high sensitivity to high-energy corpuscular fluxes. The detected synchronism of the TiNi sensor with other environmental systems (liquid, gas, wet environment, electric field) suggests that, given the high penetration ability of corpuscles, the impact on all components of the geosphere will be similar to the impact on the titanium nickelide. Therefore, revealing the mechanism of interaction of TiNi with the corpuscle flux determines the relevance of research in this direction.

2. Research methods and results
The study of the graphs with TiNi-sensor readings indicates that the standard value of the measured parameter is accompanied by peaks (figure 1), which is impossible from the thermodynamic point of view and according to the conditions of the experiment. Therefore, it was concluded that there was a large-scale factor affecting both the sensor and the environment, including meteorological conditions.
A comparison of the sensor readings and available meteorological parameters showed that they were sporadically synchronous over a long period of time (figure 2). An elementary probability calculation shows that their random coincidence can occur once in several thousand years, and in some cases (in the antiphase, figure 2b) in several tens of thousands of years, while the observation has been carried out for ten years.

The peak deviations of the sensor readings from the standard values indicates that the disturbing effect has a resonance nature, which points to the key role of vibrational processes in the interaction mechanism. Resonant interaction implies a change in the state of the systems involved in the process. Indeed, in all cases of synchronization of the sensor readings with meteorological parameters, a sudden change in hydrometeorological conditions was observed. Thus, when the sensor readings are synchronized with the values of atmospheric pressure (figure 2a), after a few hours in the meteotropic liquid (stormglass) [1] crystal growth occurs, and in three days from the moment of these anomalies the wind speed and direction change sharply, accompanied by heavy precipitation. For the similar synchronization with the values of electric field strength (figure 2b) there was a turning point, when extremely hot summer 2012 with dense long smoke due to lack of atmospheric circulation was suddenly replaced by windy weather with torrential rains. The observation point, where the data presented in figure 2b were obtained, was located directly in the area where these events occurred [5].

Figure 2c shows the period when synchronization with the values of absolute humidity of surface air was observed. This synchronization preceded a sharp intensification and a sudden change of wind direction; a significant increase in the temperature for a short period of time, as well as the interval coincidence of profiles of other meteorological parameters and indication readings, which will be described below.

The simultaneous entry of two dissimilar components into resonant interaction with an acting factor suggests that this factor has a very wide range of frequency characteristics. In addition, almost all components of the environment are nonlinear and non-stationary systems with the presence of many oscillatory processes, including gravitational, liquid, gaseous, electric, magnetic and their combinations.

Therefore, the acting factor that provides synchronization must have a universal mechanism for acting on the elements of parametric resonance and resonances of forced vibrations of higher orders n, where n is the number of the higher harmonic. The sensitive element of the sensor is the TiNi composite that has characteristic frequencies near \(10^{13}\) Hz (Debye waves) and \(10^{15}\) Hz (waves in the electron gas - plasma oscillations). The molecules that make up the atmosphere have absorption frequencies in the same range. In works [2-4] it is shown that particles of cosmic rays are able to penetrate into all components, including lead plates in the Wilson chamber. Primary cosmic radiation reaching the upper atmosphere contains particles that are transported by de Broglie waves with a frequency of over \(10^{20}\) Hz. These particles make up the «hard» component of cosmic rays, which intensively spends its energy in the atmosphere to form secondary particles that make up the «soft» component of cosmic rays. Secondary particles are transported by de Broglie waves of a lower frequency in relation to the primary ones.
Figure 2. Synchronism of sensor readings with meteorological parameters.

The real interaction mechanism of the TiNi sensor with cosmic rays is possible due to the fact that the secondary particles penetrate deep into the metal, where the interference of de Broglie waves (particles) and Debye waves and plasma waves (metal) occurs. In terms of frequency, they generally differ, but, for example, regarding Debye waves, it should be noted that in the pre-martensite state, near the phase transition point, the elastic constants of TiNi become variable and depend on the
distance from the transition point. In this case, the frequency of Debye waves becomes smoothly variable; therefore, it becomes possible to fine-tune the de Broglie wave. In this case, in the vicinity of the phase transition point, the sensitivity of the TiNi atoms to external forces is so great that the coincidence of frequencies even in the high-fold n-order will lead to resonance interaction, resulting in a sharp change in certain macroscopic parameters of the metal. In our case, such a parameter that is being monitored is the rate of rearrangement of TiNi lattice during the phase transition. The apparatus, in which the sensor is built, provides stable conditions for the stability of this parameter, so its change characterizes the change in the intensity or composition of the flux particles. Being a paramagnetic, TiNi does not react to multiple electromagnetic waves in the environment, which provides it with high interference immunity.

A noteworthy circumstance is that in addition to the synchronization of parameters observed in the current time, there are also synchronizations in the interval mode. An example is the case of parameter coincidence shown in figure 2c. This type of synchronization revealed an important feature of the observed phenomenon. It consists in the coincidence of the profiles of meteorological parameters and other data at two time intervals separated from each other by exactly one lunar year. The coincidence was found for the available series of four meteorological parameters and three indicative readings: wind (wind strengthening and abrupt change in wind direction); temperature (significant temperature increase, more than 10°C in 12 hours); baric (sequence of minimum pressure values); insolation (sequence of cloud point changes); crystal formation in the stormglass solution (synchronous frontal crystal growth); the curve of TiNi sensor readings (synchronous coupled peaks) for the calendar time (synchronous coincidence of phases of full moon in one lunar year and their coincidence with coupled, practically identical peak readings of the TiNi sensor, figure 3).

**Figure 3.** Interval synchronous coincidence of the full moon phases with coupled peak sensor readings.

It is unlikely that the described interval coincidence of such a large and diverse number of parameters is random. It is also unlikely that the Moon is the determining factor causing this phenomenon. Analysis of the literature [6-8], shows that there is a large amount of evidence on the relationship of terrestrial weather with astronomical indices, including lunar cycles. The conclusions presented in these works suggest that the Moon itself cannot directly influence the observed mechanisms. In our case, we can introduce a specific physical process that provides the observed synchronization with respect to the variation in absolute humidity values presented in figure 2c.

Figure 4, taken from the works of Shavlov A.V. and co-workers [8-11], demonstrates a quasi-crystalline drop structure, which is formed not only in boundary layers-aerosols, but also in fogs and clouds. In the mentioned works it was shown that the absolute humidity is related to the concentration of quasi-crystalline drop clusters formed due to electric interdrop interaction. In this case, the peaks observed simultaneously for the TiNi sensor and the absolute humidity shown in figure 2c are explained by the fact that both the TiNi crystal composition and the quasi-crystalline wet medium
simultaneously enter into resonance interaction with cosmic rays, resulting in the synchronization of parameters.

**Figure 4.** Quasi-crystalline structure of water droplets.

In most cases, the resonant interaction of environmental components with cosmic rays occurs at higher order resonances, so the peaks of individual components of the environment have a certain average level. At the same time, the resonance interaction can occur at a resonance close to the first order. In this case, an extraordinary peak with extreme meteorological processes and consequences is inevitable.

3. Conclusions
Thus, to improve the quality of hydrometeorological and other natural processes forecasts, it is important to establish the nature of the relationship between terrestrial weather and space factors.

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