# On the relationship of seismic processes and atmospheric disturbances during the preparation of strong earthquakes

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The seismic process and its preparation are directly related to the geophysical environment in which a change in the physical parameters of one geosphere, for example, the lithosphere, leads to disturbances in the other - the atmosphere. The effect of seismic activity on the ionosphere is known. The study of the ionospheric response of seismic events is based on the use of signals from the global navigation systems GLONASS / GPS and satellite data DEMETER (Detection of Electro-Magnetic Transmissions from Earthquake Regions, France). Thermal anomalies arising above the zones of large faults of the earth's surface were studied by A.A. Tronin satellite measurements in the infrared. In this paper, atmospheric disturbances over earthquake-prone areas of the Middle East are investigated using satellite data during the preparation of strong earthquakes and during the main seismic moment. In November 2017 and 2018, clusters of crustal earthquakes (seismic focal zones of the "nested" type) were recorded in this region. In addition, the strongest earthquakes in Iraq were registered on November 12, 2017 at 18:18:17 UTC, M = 7.3 (the coordinates of the epicenter are 34.911°N and 45.959°E), and in Iran on November 25, 2018 at 16:37:32 UTC, M = 6.3 (coordinates - 34.361°N and 45.744°E). The centers of these earthquakes were located in the seismogenic layer at depths of 18-19 km in the zone of interaction of the Arabian and Eurasian tectonic plates. The data obtained using ATOVS (Advanced TIROS Operational Vertical Sounder, NOAA / POES, USA) were used as initial information. Vertical temperature profiles were constructed for isobaric levels from 800 to 100 hPa over peak and epicentral seismic zones. A correlation analysis of temperature series corresponding to different isobaric levels was performed. Analysis of temperature profiles revealed atmospheric responses in the troposphere and lower stratosphere. The day before the strongest earthquake M = 7.3 above the peak zone, the temperature decreased by 5-7K both in the near-surface layer at the isobaric level of 800 hPa, and in the upper troposphere at the level of 300 hPa. In the lower stratosphere at the isobaric level of 100 hPa, at the same time, the temperature increased by 6K. On the eve of a strong earthquake, a temperature anomaly was observed. On the day of seismic events, the temperature in the surface layer and upper troposphere above the peak zone increased. Such an increase in temperature in the geological environment is probably associated with convection processes occurring during seismic activity. Multidirectional temperature fluctuations in the upper troposphere and lower stratosphere, identified during the preparation of the main seismic shock, can be considered as signs of an impending earthquake.