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Remote sensing applications for diagnostics of the radioactive pollution of the ground surface and in the atmosphere

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Radioactive pollution due to its air ionization activity can drastically change the atmospheric boundary layer conductivity (what was experimentally proved during period of nuclear tests in atmosphere) and through the global electric circuit produce anomalous variations in atmosphere. As additional effect the ions created due to air ionization serve as centers of water vapor condensation and nucleation of aerosol-size particles. This process is accompanied by latent heat release. Both anomalies (ionospheric and thermal) can be controlled by remote sensing technique both from satellites (IR sensors and ionospheric probes) and from ground (GPS receivers, ground based ionosondes, VLF propagation sounding, ground measurements of the air temperature and humidity). We monitored the majority of transient events (Three-Mile Island and Chernobyl nuclear power plant emergencies) and stationary sources such as Gabon natural nuclear reactor, sites of underground nuclear tests, etc. and were able to detect thermal anomalies and for majority of cases – the ionospheric anomalies as well. Immediately after the March 11, 2011 earthquake and tsunami in Japan we started to continuously survey the long-wavelength energy flux (10-13 microns) measurable at top of the atmosphere from POES/NOAA/AVHRR polar orbit satellites. Our preliminary results show the presence of hot spots on the top of the atmosphere over the Fukushima Daiichi Nuclear Power Plant (FDNPP) and due to their persistence over the same region they are most likely not of meteorological origin. On March 14 and 21 we detected a significant increase in radiation at the top of the atmosphere which also coincides with a reported radioactivity gas leaks from the FDNPP. After March 21 the intensity of energy flux in atmosphere started to decline, which has been confirmed by ground radiometer network. We were able to detect with ground based ionosonde the ionospheric anomaly associated with the largest radioactive release on March 21.We are presenting new theoretical estimates and results of experimental measurements showing that the heat flux released during ionization of the atmospheric boundary layer under significant radioactive pollution is sufficient for recording anomalous heat fluxes using the means of remote sounding (infrared radiometers) installed on satellites, and ionospheric anomalies are generated due to changes of the boundary layer conductivity.