

Monitoring of Caspian Region Thermal Sources by NOAA/AVHRR

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Process of mineral oil- and gas-field mining is usually accompanied by burning. Satellites thermal channels can fix these sources. The part of sources has constant burning connected with technological processes. For example burning of casing-head gas. Other sources arise periodically and are caused by emergency or prospecting works. Burning of mineral oil is accompanied by emission of hotbed gases and hazardous substances, which are under the control of international agreements, including Kyoto protocol and Stockholm Convention on resistant organic matter (ROM). Kazakhstan as the participant of the Convention is obliged to give the national data on pollutant emissions on regular basis. The objective control over volumes of hotbed gases and ROM emissions is possible on base of estimation of thermal sources spectral power by satellite and accordingly volumes of combustible substances. At nighttime infrared channels of NOAA/AVHRR (band 3: 3550-3930 nm and band 4: 10300-11300 nm) fix the Earth self-radiation and give the more clear information about thermal sources. Caspian region is the territory with dynamic developing of mineral oil mining. Above 100 million tons of petroleum per one year is extracted here. Russia, Kazakhstan, Turkmenistan, Azerbaidzan and Iran divide Caspian territory on national sectors. Kazakhstan sector located at northeast coast. Daily NOAA/AVHRR monitoring of this territory within 2002 is taken as a basis for thermal sources characteristics. Some approaches to estimate burning substance volume were developed. The difference between brightness temperatures of 3 and 4 channels was used as parameter describing a thermal source. Spectral power of a hot source was defined as the sum of temperature differences of thermal anomaly's pixels. Annual monitoring of spectral power for the most powerful source chosen as test has been carried out. Monitoring has shown presence of essential nonstationary of values and significant connection of modal power with value of near earth-surface air temperature. During the cold period (January, February, November, December) values of spectral power considerably grow. The volume estimation of thermal source's burning substance requests additional researches and calibration by ground data. In simple case when hot source is burning mineral oil there is simple relation between burning substance volume, open oil surface area and constant connected with boiling temperature, viscosity and oil thermal conductivity. This relation allows evaluate oil burning volume on the base of physical constants and satellite estimation of oil mirror (visible channel of high resolution data) and thermal sources spectral power (infra-red channels of low resolution data).