Use of Satellite Data in Monitoring of the Caspian Sea Biota

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Use of Satellite Data in Monitoring of the Caspian Sea BiotaP.V. Lyushvin, S.N. Egorov, P.A. NikitinResearch Center for Earth Operative Monitoring Russia Federal Space AgencyThe Caspian Sea satellite monitoring that covers sea surface temperature (SST) and water clarity observations is performed by the NTs OMZ in collaboration with the Caspian Research Institute of Fishery (KaspNIRKh). The sea surface condition assessment, SST predetermination, ice cover edge observations in the sea, interpretation of oil product signs at the sea surface, stress conditions for the Caspian Sea biota are performed as well.Using the nearly ten-year AVHRR/NOAA satellite observational series as the base, the SST variation was plotted. From the SST variation analysis it appears that there is observed a positive SST trend of 0.1-0.4°C a year in the Caspian Sea Region. A comparison of the satellite-derived SST trend with that from observational stations of the Neftyanyie Kamni and Kuuli Mayak Region, and with the surface air temperature of the Region shows that satellite data are actually representative of the SST trend.The differences between operational SST charts constructed from both remote and contact observations are due to the difference in information water columns. For remote observations this is the upper 10-100 μm column, for contact ones (vessels, buoys) – 0.5 m column. Under wind-induced mixing conditions the difference in SST in these columns is not essential. With no mixing (foam cover) the SST may vary widely (in summer up to +3÷6°C). This results from as much as 10% of solar radiation absorption by the millimeter surface water column. When aerosols occur, insolation decreases, daylight sea water heating decays, and “running” sea surface temperature anomalies of up to -3°C in magnitude appear. Using the totality of the AVHRR/NOAA data enables the assessment of the current atmospheric distorting effect, mapping the foam-free sea surface conditions, and thereby revision of the original satellite maps of SST so that to eliminate uncertain (unexpected) temperature anomalies (anomaly borders) beyond stable temperature fronts (appearing on the charts averaged over preceding days). The joint analysis of the SST fields and water clarity allows observation of water mass boundaries, sea surface flows, signs of oil products at the sea surface. The Caspian Sea fish living is also affected by stress factors causing the biota in particular the amount of sprat, to change very rapidly. One such factor is earthquakes in this Region. When seismic activity is high, underground water and lithospheric gases (radon, hydrogen, carbonic acids, methane, hydrogen sulfide and etc.) escape from the crust fractures resulting in an abrupt change in chemistry and gaseous composition of sea water. The availability of certain of these gases, even in extremely low concentrations (less than 0.1-1 mg/l.) is incompatible with small fish living. According to the hypothesis being set up today, the earthquake forerunners are specific clouds observed for several hours over the crust fractures (cloud edges mark out fractures and replicate all their curvatures).In summer of 2004 near the eastern shore of the Middle Caspian Sea the field men found more than once sprat kills. A retrospective analysis showed that there were observed specific lined clouds over the crust fracture lines during these fish kills for several hours. In several days the earthquakes were recorded along the fracture lines. A timely satellite data-based indication of clouds making out fractures (as well as other signs of increase in seismic activity) during the period forerunning earthquakes, will allow the KaspNIRKh to predict areas of possible mass fish kill and in order to decrease an anthropogenic stress on the biota to schedule an active fishery in these areas under the quotas granted. A further stress factor for the biota is dramatic anthropogenic, chemical, biological, and dynamic changes as a result of a peak water discharge from reservoirs beyond the times of mass spawning. The satellite data show those areas of water where a peak water discharge results in discontinuous mixing of brackish sea water and fresh river water.