Anomalous Algal Bloom in the Caspian Sea: Occurrence and Reasons

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Seasonal, interannual variability and spatial distribution of algal bloom in the Northern, Middle and Southern Caspian Sea has been investigated on the basis of Aqua MODIS chlorophyll-a (Chl-a) concentration data collected from July 2002 to November 2022. Multi-year data demonstrate that over the two past decades Chl-a concentration has increased only in the Northern Caspian where the main rivers Volga and Ural enter the sea. In the Middle and Southern Caspian, it has shown weak negative linear trends. Special attention is paid to anomalous phytoplankton bloom, first of all cyanobacteria, in the Southern Caspian. Over 24 years of satellite observation, from 1999 to 2022, abnormally intense phytoplankton bloom has been detected 8 times: in 2001 (with a maximum area of about 50,000 km2), 2005, 2008, 2009, 2010, 2017, 2018, and 2021. Till present, it remains an open question what causes such outbreaks of intense algal bloom in the Southern Caspian. Generally, the literature and our studies suggest a variety of possible drivers of algal bloom, such as high sea surface and air temperature, low wind speed, high Chl-a concentration in periods preceding the development of phytoplankton bloom, atmospheric precipitation, and even dust storms. However, for the Southern Caspian we have found no clear correlation with any of these factors. Satellite monitoring of intense blooms, especially cyanobacteria, is of vital importance because cyanobacteria can produce potent toxins that can cause negative consequences for wildlife, ecosystems and even affect human health.

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