

# A new approach for studying quasi-tropical cyclones in the Black Sea

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A few years ago, leading world experts predicted an increased occurrence of hurricane-like quasi-tropical cyclones (QTCs) in the western Mediterranean and Black Sea due to climate changes [1]. In the Russian meteorological community, due attention was not paid to this. Although a cyclone of this type already appeared in the southwestern part of the Black Sea in September 2005 and was the subject of study in several publications in Russian journals [2, 3]. However, many of our scientists did not know about this at all, and of those who did, many treated this cyclone as an exotic event that has an insignificant probability of recurrence. The situation changed dramatically in the summer of 2021, when several hurricane-like cyclones appeared near the densely populated areas of the coast of the Black and Azov Seas during August–October. The most impressive of them demonstrated its “eye” just close to Sochi on 4 October 2021. These vortices were identified as QTCs by foreign meteorologists from Europe, United States and Australia and were discussed via world internet forum [tstorms.org](http://tstorms.org), in which the author has been invited to participate since 2012. Meanwhile, in Russian weather forecasts of the corresponding days, there were only warnings about strong winds and abnormal precipitation, but the phenomena themselves were not identified as QTCs.

For diagnosis of QTCs in the Black Sea, we propose to apply our approach developed as a result of collaborative Russian-American efforts. The approach uses as a basis the fundamental physical theory of the turbulent vortex dynamo (Space Research Institute RAS). It is aimed at implementing an operational real time diagnostics of the birth of a hurricane by use of atmospheric cloud-resolving numerical simulation and in combination with analysis of corresponding satellite imagery [4]. Recent discussions at the prestigious international meetings in 2021 (the 34th American Meteorological Society Conference on Hurricanes and Tropical Meteorology, the General Assembly of the European Geophysical Union, and the 4th Electronic Conference on Atmospheric Sciences – ECAS2021) have shown that the proposed diagnostics can help forecasters in identifying these dangerous storms earlier than is possible now.

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