Mediterranean and Black seas maximum waves climatology

Francesco Barbariol¹, Arno Behrens², Alvise Benetazzo¹, Silvio Davison¹, Gerhard Gayer², Paolo Pezzutto³, Antonio Ricchi⁴, and Joanna Staneva²

¹Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine (CNR-ISMAR), Arsenale Tesa 104, Castello 2737/F, 30122 Venezia (Italy)
²Helmholtz-Zentrum Geesthacht. Zentrum für Material- und Küstenforschung GmbH, Max-Planck-Straße 1 I 21502 Geesthacht I Deutschland/Germany
³University of Turin, Department of Physics, Via P. Giuria, 1, Torino (Italy)
⁴Department of Physical and Chemical Sciences/ CETEMPS, University of L’Aquila, Italy, Via Vetoio (Coppito 1), 67100 Coppito (AQ)

Reliable wave forecasts and hindcasts, together with long-term statistical analysis of extreme conditions, are of utmost importance for monitoring marine areas. Indeed, there is general consensus that high-quality predictions of extreme events during marine storms can substantially contribute to avoiding or minimizing human and material damage, especially in busy waterways such as the Mediterranean and Black Seas. So far, however, the wave climate characterization (average and anomaly relative to the average) has focused on the bulk characterization of the significant wave height Hₚ and it has lacked a description of the individual waves, such as the maximum ones that may occur at a given location in the sea. To fill this gap, we provide the intensity and geographical distribution of the maximum waves in the Mediterranean and Black Seas over 27 years (1993-2019), by representing the average annual (1993-2018) and anomaly for 2019 relative to the average of the 99th percentile of the expected maximum wave height Hₘ and crest height Cₘ. The analysis combines wave model hindcasts available through CMEMS model setup and the wave model WAVEWATCH III®, both forced with ECMWF ERA5 reanalysis winds. Results show that in 2019 maximum waves were smaller than usual in the Black Sea (anomalies of Hₘ up to -1.5 m), while in the Mediterranean Sea a markedly positive anomaly (+2.5 m for Hₘ) was found in the southern part of the basin. The peculiar 2019 configuration seems to be caused by a widespread atmospheric stability over the Black Sea and by depressions that rapidly passed over the Mediterranean Sea.