Intense wind-driven coastal upwelling in the Balearic Islands in response to Storm Blas (November 2021)

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Storm Blas was an intense and long-lasting storm which affected the western Mediterranean Sea in November 2021. Blas was associated with a pronounced pressure low, generating heavy rains and intense winds and showing some characteristics of a tropical cyclone. The Balearic Islands area was particularly affected since the core of the storm was moving over a 1-week-long period from the south-west of this area to just above the islands of Menorca and Mallorca.

We describe the generation of an intense wind-driven coastal upwelling in response to this storm in the Balearic Islands, mainly based on the analysis of a high-resolution regional forecast model. This model indicated that the intense north-easterly winds blowing over the region during the first days of the storm led to the development of an intense upwelling along the north-western coast of the islands of Mallorca and Ibiza, together with a reversal of the surface current. The clouds associated with the storm prevented the satellites to precisely observe the evolution of the sea surface signature of the upwelling, especially in terms of temperature. Yet, some signals of enhanced chlorophyll concentration were detected in the upwelling region.

The high-resolution Western Mediterranean Operational Prediction System (WMOP) is used to describe the characteristics of this intense coastal-upwelling event and analyse its singularity over the past 9-year time series through the comparison of different coastal-upwelling indices. While it was the most intense event in terms of local cross-shore sea surface temperature gradients, it is ranked second in terms of the intensity of cross-shelf transports, behind the upwelling event associated with Storm Gloria in January 2020. This study demonstrates the benefits of operational ocean prediction systems for the description and characterization of extreme events, in particular through the provision of time series of high-resolution model simulations in the coastal area.