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Comparing impact effects of common storms and Medicanes along the coast of south-eastern Sicily

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ABSTRACT

The coastal vulnerability along the Mediterranean coasts is increasing, especially in response to the occurrence of tropical-like cyclones, known as Medicanes, which have become more intense than in the past. A peculiar case was the impact of Medicane Zorbas in September 2018 along the coasts of south-eastern Sicily, where it caused inland flooding and damages to the socio-economic activities. Here, Zorbas effects are reconstructed through post-event geomorphological surveys, interviews with direct witness and analyses of video recorded by surveillance systems or found in social media. These data allowed us to assess the flooding extent on seven coastal sectors located between Thapsos Peninsula and Marzamemi. Flooding caused by Zorbas appears to be greater than those produced by the main seasonal storms affecting the areas from 2015 to 2019; nevertheless, it is comparable with the flooding generated by Medicane Qendresa that impacted south-eastern Sicily in 2014. Wave propagation and extreme water level modelling, performed for the main storm events that occurred in the area since 2005, and analyses of data recorded by tide gauges of Catania, Porto Palo di Capo Passero and Malta since 2008, showed that Medicanes generate greater flooding than seasonal storms because they can induce higher and longer surge along the coastline. Collected data indicated that the surge generated by Zorbas reached a maximum value between about 0.8 m and 1.2 m above mean sea level (msl) along the coast of south-eastern Sicily. Results highlighted the need to better evaluate the coastal hazard related to the propagation of Medicanes, especially in the context of future climate change when these events will probably be characterized by longer duration and greater intensity than at the present.

1. Introduction

Faced with global climate change, special attention is paid to coastal vulnerability issues because most of the coasts are interested by the presence of urban settlements and economic activities. Under ongoing global warming, a global mean sea-level rise is expected for the 21st century with a likely range between 0.61 and 1.10 m at 2100 (IPCC, 2019) or even greater (Bamber et al., 2019; Jevrejeva et al., 2014; López-Dóriga and Jiménez, 2020; Rahmstorf, 2007; Rahmstorf et al., 2012). This could enhance the effects of extreme marine events that, in the future, will probably impact on the coastal landscapes currently emerged (Antonioli et al., 2020, 2017; Anzidei et al., 2021; Aucelli et al., 2017; Bonaldo et al., 2019; Marsico et al., 2017; Scardino et al., 2020; Scicchitano et al., 2018). In combination with the geomorphological coastal features, flooding connected to extreme marine events is commonly conditioned by tide excursion, storm surges, and storm waves. The combined effect due to tide height and storm surge determines a rise of the water column that enhances the storm wave inundation throughout the coastal landscape (Chaumillon et al., 2017; Holman, 1986; Stockdon et al., 2006). While the tidal oscillations are deterministic, storm surges and storm waves are driven by meteorological variations, usually related to tropical and extra-tropical cyclones

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