Water circulation and wave climate

Water circulation in the Sicily Channel has a complex dynamic (**Lermusiaux and Robinson, 2001; Drago et al., 2010**) (Supplementary Figure 1). Its vertical structure consists of a two-layer flow: in upper layers, the fresh Modified Atlantic Water (MAW) flows from west to east, while in intermediate and deep layers, the saltier and quasi-steady Levantine Intermediate Water (LIW) current flows from east to west. The MAW-LIW system constitutes the basin scale thermoaline core of the Mediterranean circulation.

The surface circulation is dominated by the inflow of MAW, which is transported from the western Mediterranean by the coastal Algerian Current; this latter splits into two branches, approaching the Sicily Channel. The southern branch, called the Atlantic Tunisian Current flows along the Tunisian shelf break. The northern branch separates into two subsequent branches, one entering the Tyrrhenian Sea, while the second one enters the Sicily Channel. The branch passing the central-northern Sicily Channel constitutes an energetic stream known as the Atlantic Ionian Stream (AIS); its meanders and eddies vary in strength, size and shape, being controlled by topographic features, coastal geometry, internal baroclinic processes, and strong atmospheric and thermohaline boundary forcings. It is also characterized by a strong seasonal variability with the formation of typical summer features around the well-known surface thermal semi-permanent, mesoscale cyclonic and anticyclonic features like the cyclonic Adventure Bank Vortex, the anticyclonic Maltese Channel Crest, the cyclonic Ionian Shelf Break Vortex. Intense increases in speed of the AIS are observed over the Adventure Bank and Malta Plateau.

The prevailing wave direction is toward ESE as the study area is influenced by the northwesterly winds blowing over most of the western Mediterranean (**Arena et al., 2015,** Supplementary Figure 2). In Supplementary Figure 2 is also reported the relative frequency of significant wave heights (**Arena et al., 2015**).

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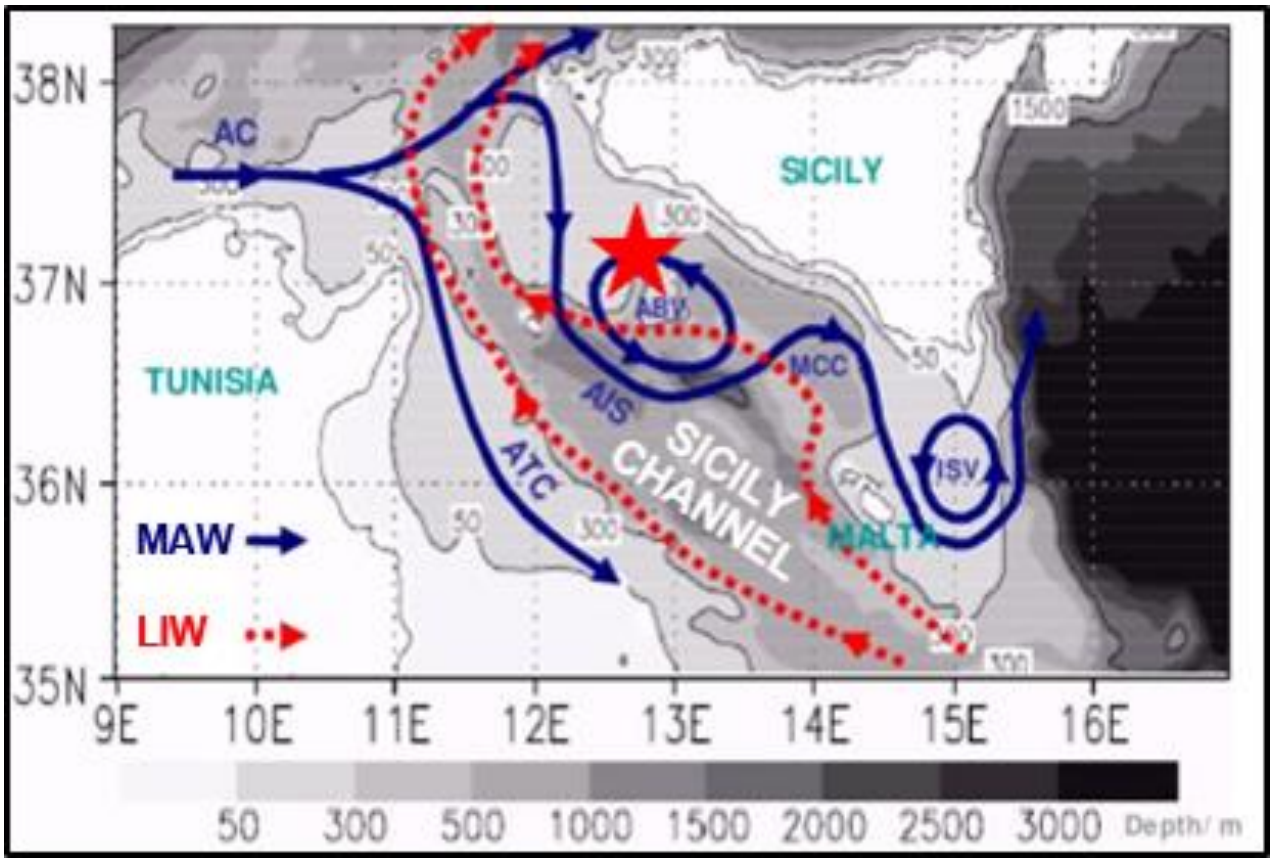
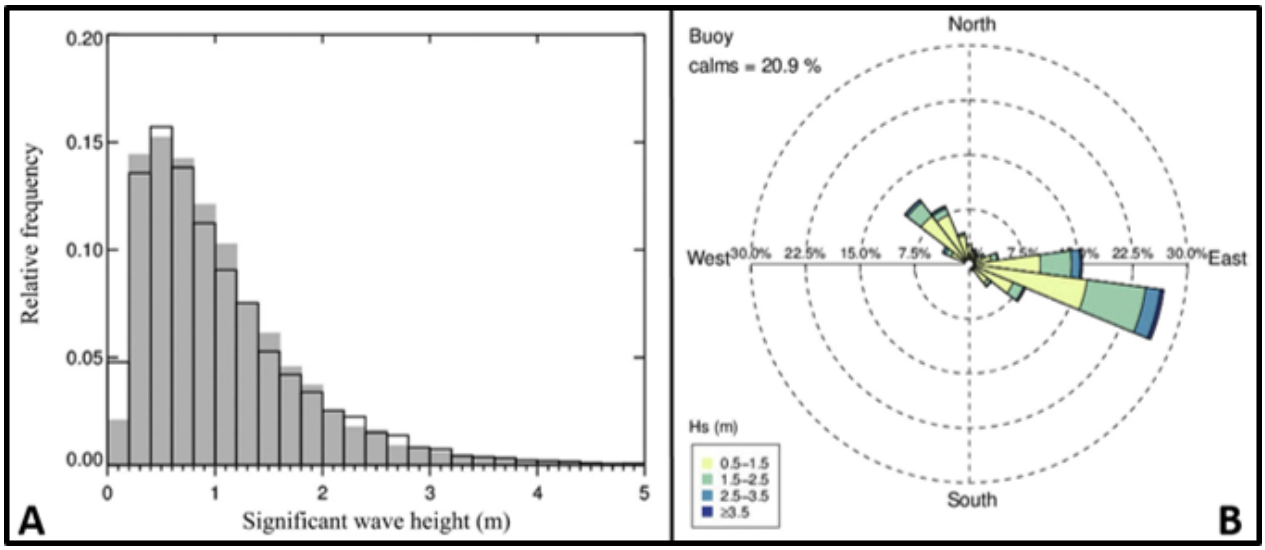
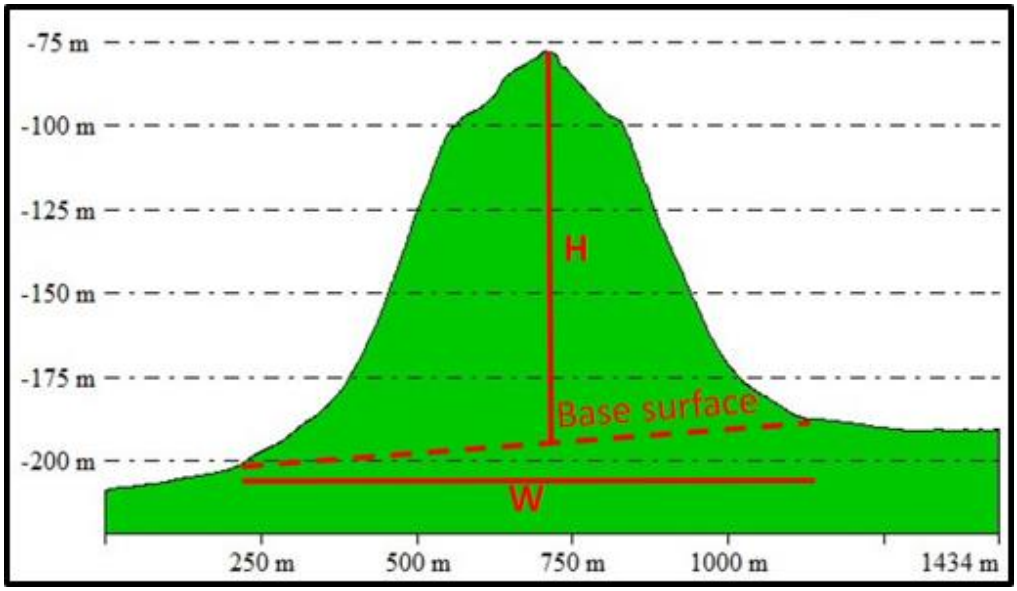


SUPPLEMENTARY FIGURE 1 General water circulation in the Sicily Channel (modified from **Lermusiaux and Robinson, 2001** and **Drago et al., 2010**). MAW: Modified Atlantic Water; LIW: Levantine Intermediate Water; AC: Algerian Current; ATC: Atlantic Tunisian Current; AIS: Atlantic Ionian Stream; ABV: Adventure Bank Vortex; MCC: Maltese Channel Crest; ISV: Ionian Shelf-break Vortex. The red star indicates the study area.



SUPPLEMENTARY FIGURE 2 Main parameters of wave climate relative to the study area (from **Arena et al., 2015**) (A) Histogram with the relative frequency of significant wave heights; filled gray relates to buoy data, black line to model data. (B) Polar plot of prevailing wave direction, which is toward ESE.



SUPPLEMENTARY FIGURE 3 Method used to calculate the average diameter (W) and maximum height (H) for volcanic cones (from **Mitchell et al., 2012**)