Mid Ionian Jet

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The Mediterranean Sea, which is composed by a series of deep depressions, has an average depth of 1,500 m and its the deepest point has 5,267 m (Calypso Deep) and it is located in the Ionian Sea. The Ionian Sea is situated in the central portion of the Mediterranean Sea. The Strait of Otranto (800 m depth) separates the norther portion of the Ionian Sean from the Adriatic Sea and the western side is connected to the Tyeehenian Sea by the Sicily channel (Barale, 2008). The Mid Ionian Jet (MIJ) is a surface current located in the Ionian Sea. The MIJ is fed by the Atlantic Ionian Stream that flows into the Sicily straits (Bergamasco and Malanotte-Rizzoli, 2010). The MIJ has an intense meander north of the Ionian sea (39 °N), then flows across the Ionian basin in the North-South direction until turns southeast (20-22 °E) and become the Mid Mediterranean Jet that flows into the Cretan channel (Malanotte-Rizzoli et al., 1999; Bergamasco and Malanotte-Rizzoli, 2010).

The surface temperature and salinity of the MIJ was characterized by Tziperman and Malanotte-Rizzoli (1991). The average temperature during the winter month is around 15 °C (15.9 °C) in the northern (southern) portion of the current. During the summer, the sea surface temperature increases to 24.2 °C (25.2 °C) in the upper (lower) portion of the MIJ. In terms of salinity, there is considerable lower seasonal variability. The MIJ surface salinity varies between 38.6 and 38.7 during winter and between 38.4 and 38.6 during summer. The upper portion of the MIJ tend to be less saltier then than the lower area.

The MIJ is part of one of the various gyres in the Mediterranean Sea (eg. Ionian Gyre, Rhodes Gyre, Cretan Gyre). The Ionian sea is an area with elevated variability, which is favorable to the existence of various eddies. The Ionian Anticyclone is a feature enclosed by the MIJ. After reaching the southern mouth of the Adriatic Sea, the current turns southward and now called MIJ, it closes an anticyclone circulation (Malanotte-Rizzoli et al., 1999). Malanotte-Rizzoli et al. (1999) described the MIJ in two different periods. In a range of 5 years, MIJ changed from a weak and disorderly flow to a relatively strong and organized current. In the case of a strong MIJ, the Ionian Anticyclone could captures the Pelops gyre on its circulation. Because of the complex circulation in the Mediterranean Sea resulted from the interactions between eddies, and intense crossing jets, the Modified Atlantic Water, a shallow water (200 m depth) could reach the Ionian Sean and can flow even further because it can be advected by the MIJ into the Cretan passage (Malanotte-Rizzoli et al., 1999).

The atmospheric forcing can influences the seasonal and interannual cycles on the Mediterranean Sea dynamics in general, However, its response is more susceptible to occur in the Ionian Sea and eastern Levantine area. An effective response to intense wind anomalies

during winter months had been observed at some sensitivity experiments, resulting in a delay or a speed up of the seasonal cycle in these areas (Robinson et al., 2001).

In terms of very low frequency patterns, an interesting phenomenon has been observed. The Ionian sea can present two different main states in a decadal oscillation. An anticyclonic and a cyclonic state are associated with circulation patterns that are reversed from one phase to another. However, the MIJ is not reversed, but it flows in a slightly different angle and in a different location. The anticyclonic state is related to a southward MIJ that closes an anticyclonic gyre in the northern Ionian Sea. Therefore, the Modified Atlantic Water was to flow along the southeastern coast of Italy, then flow along the southwestern coast of Greece to finally arrive at the Cretan passage. On the other hand, the cyclonic phase is characterized by an intense MIJ, nearly zonal and located further south if compared to the anticyclonic state, in the center of the Ionian Sea. Therefore, the Modified Atlantic Water is advected by the MIJ from the Sicily Strait to the Cretan Passage in a much shorter route. In addition, the circulation pattern of this phase contributes to the intrusion of Levantine basin waters into the Ionian Sea. Finally, the transitional stages between the two phases are characterized by smoothed strengthening and weakening trends (AVISO, n.d.). Menna et al. (2019) characterized MIJ as an intense current during the cyclonic phase (10-20 cm/s) and weaker during the anticyclonic phase (less than 10 cm/s).

The Mediterranean Sea presents, generally, low levels of nutrient, resulting in a low phytoplankton biomass and primary production. Eastern areas on the Mediterranean Sea are more oligotrophic if compared to areas closed to the Strait of Gibraltar (Barale, 2008). Lavigne et al. (2018) analyzed the phytoplankton biomass response to the anticyclonic and cyclonic stages on the north Ionian Sea. They found that there was an no spring phytoplankton bloom during the anticyclonic stage, whist the nutrient availability was high year-round during the cyclonic phase.

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*I had some problems on setting the reference of the AVISO website on LaTeX. So I did it manually. I can send you my files if you want them.