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Some recent progresses in understanding the Mediterranean Sea dynamics, and how Michel Crépon contributed

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Consistently will all previous analyses (except the POEM's one!) of hydrological data and with my own feelings based on a preliminary analysis of infrared images in the early 90s, an exhaustive analysis of such images has demonstrated that the surface circulation in the eastern basin was, as in the western basin, alongslope and counterclockwise (1, 2) hence forming a two-basin wide gyre. This is partly thanks to Michel Crépon (MC) who incited me, his first student in the early 70s, to use such information.

Energetic mesoscale eddies generated by unstability of the gyre in the southern part of the western basin can extend down to the bottom ($\sim$3000 m, 3) and survive up to three years. Apparently similar ones are generated in the eastern basin where they interact with every-year generated and several-year lasting wind induced eddies (1, 2). Most of these features are now correctly simulated by a group of scientists who all were students of MC.

Contrary to what nearly all modelling groups (including the MC's one!) have simulated for years, and consistently with the schematic diagrams I proposed in the mid 80s, we have shown that intermediate and deep waters in the Algerian sub-basin were also flowing alongslope counterclockwise, being sometimes entrained in the sub-basin interior by mesoscale eddies (3). The simulations of the MC's group now support such major features. Extending our ideas, we have proposed hypothetical circulation diagrams for all levels in the whole sea (4). In particular, we propose links between the zones of dense water formation and the gyre in the northern part of both basins (the so-called Northern Current) that rely mainly on a pioneering work of MC and his team

in the late 80s.

We have demonstrated that the densest water outflowing at Gibraltar since the mid 90s was no more originated from the western basin (a situation generally thought as permanent) but from the eastern basin, hence being actually much warmer ($\sim$0.3°C) and saltier (0.06) than $\sim$20 years ago. We thus show that the outflow's characteristics can vary more largely and rapidly than thought up to now (trends $\sim$+0.03°C and $\sim$+0.01 per decade), depending on the relative amounts of the different waters formed from year to year, and that shifts between the basins can lead to a somehow Mediterranean Sea Transient. Whatever, the large mesoscale variability of the outflow will certainly be explained on the basis of the pioneering work that MC performed in the mid 60s about the links with the atmospheric pressure over the whole sea.

Finally, we believe we have evidenced (5), for the first time, internal waves only studied theoretically up to now; these are waves at the inertial frequency propagating in homogeneous layers downwards with respect to the earth rotation axis, hence called gyroscopic and strongly inclined on the vertical. Our analysis is consistent with the analytical model MC performed in the mid 70s that was supported by the data analysis we did together in the early 80s.

We sincerely think that these results were obtained partly thanks to the enthusiasm of Michel and to the example he is for his students, to his willingness to participate in operations at sea, which gave him a correct feeling about the time and space variability of the forcings, and to the attention he paid, as a modeller, to observations and observers' analyses.

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