



## **Understanding Mediterranean sea level long term variability through a simple conceptual model. Local versus remote forcing.**

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Mediterranean sea level variability has been thoroughly studied during the recent years. Tide gauge records, satellite altimetry, historical hydrographic data and numerical models have all contributed to better understand the Mediterranean sea level variability at different time scales, from extreme events to long term trends. However, some questions are still open concerning the mechanisms driving the low frequency variability. Namely, the steric and atmospheric contributions by themselves cannot explain the observed variability, then pointing towards a significant contribution of vertical and horizontal mass exchanges. The role of the mass contribution is still not fully understood, partly because representativity errors in tide gauge records and steric estimates prevent an accurate quantification of the different variability components.

Here we present a simple conceptual model of the Mediterranean functioning that involves the steric contribution of the different subbasins, the mass component variability in the nearby Atlantic and the interaction between them (the model works with atmospherically-corrected sea level). The model is validated using the outputs of a 3D free surface global model and observations from altimetry, gravimetry and historical hydrographic databases. The simple model is able to explain the amplitude and phase of the observed seasonal cycle, showing how low frequency sea level variability in the Mediterranean is determined by the combination of the relative steric differences between the Mediterranean subbasins and the nearby Atlantic and by the mass variability in the Atlantic. The model also provides an explanation for the difference between Mediterranean and Atlantic long term trends published in the literature.