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An improved diagnosis of water mass transformation applied to a 50 years numerical simulation

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We investigated the variability of water mass transformation in the Mediterranean Sea by using an 1/8˚ ocean numerical model. This model is forced during 50 years with the air fluxes provided by five years of the ECMWF atmospheric model at a resolution of 60 km, which are distributed randomly. We computed budgets of water masses over the different basins by applying an improved Walin method. We showed the necessity to take into account the penetrative component of the solar flux with respect to depth. We found discrepancy with a factor of 2 for the budgets when compared with previous estimates by Tziperman and Speer (1994). This is consistent with recent studies showing the impact of solar penetration in the first hundred meters of the ocean and its impact on the upper layer of the ocean.

We then characterized the inter-annual variability under the random atmospheric forcing. A strong variability in the intermediate and deep water formation process is observed. Moreover some anomalous convective events arise in the Aegean basin after successive cold winters. In this region, intermediate waters (250-1400m) become denser than the underlying deeper waters leading to mixing and new dense water formation. These results are discussed in the light of the past 20 years in situ observations including the Big Transient event and its subsequent evolution.