Abstract View

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The Adriatic Sea General Circulation. Part I: Air–Sea Interactions and Water Mass Structure

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ABSTRACT

A comprehensive historical hydrographic dataset for the overall Adriatic Sea basin is analyzed in order to define the open ocean seasonal climatology of the basin. The authors also define the regional climatological seasons computing the average monthly values of heat fluxes and heat storage from a variety of atmospheric datasets. The long term mean surface heat balance corresponds to a heat loss of 19–22 W m^{-2}. Thus, in steady state, the Adriatic should import about the same amount of heat from the northern Ionian Sea through the Otranto Channel. The freshwater balance of the Adriatic Sea is defined by computing the average monthly values of evaporation, precipitation, and river runoff, obtaining an annual average gain of 1.14 m. The distribution of heat marks the difference between eastern and western Adriatic areas, showing the winter heat losses in different parts of the basin.

Climatological water masses are defined for three regions of the Adriatic: (i) the northern Adriatic where seasonal variations in temperature penetrate to the bottom; deep water (NAdDW) with σ_t > 29.2 kg m^{-3} is produced and salinity is greatly affected by river discharges; (ii) the middle Adriatic where a pool of modified NAdDW is stored during the summer season after being renewed in winter and modified Levantine Intermediate Water (MLIW) intrudes from the southern regions between spring and autumn; and (iii) the southern Adriatic where homogeneous water properties are found below 150 m (the local

maximum depth of the seasonal thermocline) and a different deep water mass (SAdDW) is found with $\sigma_t > 29.1$ kg m^{-3}, $T \approx 13.5$°C, and $S \approx 38.6$ psu. Due to river runoff waters, the surface layers of all three regions are freshened during the spring–summer seasons. The vertical distributions of dissolved oxygen vary quantitatively in the three regions showing a spring–summer subsurface maximum due to the balance between phytoplankton growth in the euphotic zone and low vertical mixing in the water column. This behavior can be reconciled with open ocean conditions except for the northernmost part of the Adriatic where well-mixed oxygen conditions prevail throughout the year.

Large interannual anomalies of both temperature and salinity are found at the geographical center of the basin in surface and deep waters (100 m).

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