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The effect of the Mediterranean Overflow Water on the North Atlantic

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The Mediterranean Overflow Water is created due to an excess of evaporation over precipitation and river runoffs in the Mediterranean Sea. As a result, the incoming surface waters from the Atlantic become denser and saltier. These waters return to the Atlantic through Gibraltar Strait and start mixing with the surrounding waters in the vicinity of the Gulf of Cadiz forming a warm and saline tongue of water, which spreads westward. In this exchange of waters between the Atlantic and the Mediterranean, other magnitudes such as heat and salt are transported. In the last case, the salt transport between the two basins shows a variability with a period of few decades. These oscillations produce two different states, one where the Mediterranean exports salt to the Atlantic and another where the Mediterranean imports salt from it. The Mediterranean-Atlantic system alternates these two states. The aim of this study is to analyse the effects of these multidecadal oscillations on the North Atlantic.
This study is performed using data from the climate model EC-EARTH run under pre-industrial conditions, where the greenhouse gas forcing is constant. Different magnitudes such as the total salt and volume transport through Gibraltar Strait, salinity profiles in the vicinity of the Gulf of Cadiz, the net freshwater fluxes in the Mediterranean basin are studied. The analysis of the total salt transport through Gibraltar show periods where salt is imported from the Atlantic and vice versa. Our guess is that the Mediterranean Sea acts as a reservoir which alternates between exporting and importing salt from the North Atlantic through the strait. The impact of this salt transport in Gibraltar on the total salt transport of the Atlantic is studied. The results show a larger impact of the outgoing salt transport on the total Atlantic salt transport north of Gibraltar strait (in a region between 40°N-50°N). These results oppose the ones obtained when the impact of the outgoing salt transport and the salinity at depth of 1000 m were compared. In this case, the effect of the outgoing salt transport is distributed more uniformly around the strait. Besides, this region corresponds to the same region described by the first empirical orthogonal function of the salinity profile at 1000 m depth in the North Atlantic. The impact of the variability of the salt transport in the Atlantic Meridional Overturning Circulation is also discussed.
The same analysis for a historical run is currently carried through.