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Impact of the heat and salt content in the Atlantic on the Western Mediterranean Deep Water masses formation

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The Mediterranean region is an unique semi-enclosed basin where deep water masses form in the Northwestern basin. Atlantic waters (AW) enters the Mediterranean basin through the strait of Gibraltar with a low salinity and relatively warm water. They are coming from the upper Atlantic ocean and compose the upper layer of water through the strait of Gibraltar. A newly state of the art region climate system model (RCSM) has been developed for the MED-CORDEX initiative and is composed of an atmospheric model: Aladin (50kms), of a Mediterranean sea model: NEMO-MED8 (10 kms) and river routine model: TRIP (50 kms). This RCSM is used to investigate the impact of warm and/or salty Atlantic water entering the Mediterranean sea and their impacts on the Western Mediterranean Deep Water (WMDW) masses formation are examined.
A control simulation performed over the period 1990-2008 uses interannual and realistic the near Atlantic water masses to force the Mediterranean sea model. This simulation reproduces correctly the Mediterranean heat and salt content as well as the WMDW mass formation and the associated convective events. In parallel, sensitivity simulations with a constant climatology for the heat and salt content in the near Atlantic are then performed to assess their respective contributions on the WMDW formation. We found that upper heat content anomalies are quickly damped through an increase in latent heat loss, whereas surface salt anomalies are propagating into the Mediterranean basin. The impact on the boyancy loss is very weak, but the stratification in the Northwestern basin is changed in the sensitivity simulation. Thus anomalies in the Atlantic water masses are thus able to influence the WMDW formation processes.