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## CLIVAR-SPAIN contributions: Atmospheric contribution to Mediterranean sea level variability under different climate change scenarios

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We investigate the contribution of atmospheric pressure and winds to Mediterranean sea level variability under different scenarios of greenhouse gases (GHG) emissions. Sea level variability is modelled with the HAMSOM model at 1/4o x 1/6o of spatial resolution in a domain covering the whole Mediterranean and a sector of NE Atlantic. The model is forced with the results of the ARPEGE climate model, which provides 6h fields of atmospheric pressure and winds with a spatial resolution of ~50km. The analysis of the results focus on low frequency processes (monthly time scales and lower) and also on extreme events. Two simulations are run for the 1960-2000 period in order to establish the quality of model results. The first one is a hindcast in which the ocean model is forced with a dynamic downscalling of ERA40 reanalysis fields. The hindcast is compared to tide gauge observations, showing good agreement: the mean correlation is larger than 0.8 and the RMS error is lower than 3 cm. The second simulation is a control run performed with the outputs of the atmospheric model obtained when it is forced with observed concentrations of GHGs. This simulation is compared with the hindcast in statistical terms, showing a good performance in reproducing the sea level variability patterns at different frequency bands. Once the reliability of the simulations is assessed, three more simulations are run for the 2000-2100 period following the B1, A1B and A2 SRES scenarios. The results for the XXI century indicate that the contribution of atmospheric pressure and winds to Mediterranean sea level would be negative, with a decrease that would be especially strong in winter. The trends obtained for the XXI century are of up to -0.8 mm/year in the central Mediterranean under the A2 scenario. Trends in summer are barely significant but positive, then leading to an increase in the amplitude of the seasonal cycle. The interannual variability also shows some changes, the most important being a widespread standard deviation increase of up to 40%. An increase in the frequency of positive phases of the NAO explains part of the winter negative trends. Also, an increase in the NAO variability would be responsible for the projected increase of the interannual variability of the atmospheric component of sea level. Conversely, the intra-annual variability (1-12 months) does not show significant changes. Concerning the extreme events, results reveal that the frequency and magnitude of storm surges would decrease. Changes would reach 50% in the number of episodes and up to 8 cm in the 50-year return levels. The analysis shows a progressive decrease in the return levels not fully explained by a negative trend in the mean atmospherically-induced sea level and a linear dependence with winter NAO. Likewise, negative events show the opposite behaviour, with an increase in their frequency and magnitude although more moderate than for positive surges.