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The Winter NAO index and the strengthening/wandering of the main Atlantic pressure systems

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The North Atlantic Oscillation (NAO) is a major feature of the Northern Hemisphere climate system. The various NAO indices are not able to discern the variability associated to the magnitude strengthening/weakening of the action centers from the variability associated with the movement of these centers. Using the NCEP/NCAR reanalysis the winter positions of the Iceland low-pressure and of the Azores high-pressure systems were located. From all the local SLP minima found in the area 65W-15E, 40N-75N the lowest one was taken as the low pressure center, and from all the local maxima found in the 65W-15E, 40N-75N area the biggest one was considered the high pressure center. Six variables (predictors) were obtained that completely defined the position and magnitude of the two pressure centers. These predictors were used in a multiple linear regression model accounting for the variance of the traditional NAO index. It was found that this model explains near 90% of the NAO index variance; the main contributions for the observed variance are the pressure difference between the action centers and the latitude of the action centers. These three variables are all in phase and present a positive trend in the period under study (1958-2002), which leads to the high positive trend that has been observed in the NAO index over recent decades.