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## North Atlantic Oscillation-related impacts on precipitation over the Italian Peninsula during the 1979-2020 period

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The North Atlantic Oscillation (NAO) has been widely recognized as one of the main patterns of atmospheric variability over the northern hemisphere, helping to understand variations on the North Atlantic Jet (NAJ) position and its influence on storm-tracks, atmospheric blocking and Rossby Wave breaking. Among several relevant teleconnection patterns identified through different timescales, the most prominent ones are found for northern Europe during winter months, when positive (negative) phases of NAO are related to wetter (drier) conditions. Although it is not well defined yet, an opposite connection is observed for the Mediterranean region, where negative NAO values are often associated with high precipitation. Therefore, the main goal of this study is to identify which regions and periods of the year are the most susceptible to abundant NAO-related precipitation throughout the Italian Peninsula. For doing so, the last 42 years period (1979-2020) was analysed using the Fifth Generation ECMWF Atmospheric ReAnalysis of the Global Climate (ERA5). The NAO index was calculated using the Mean Sea Level Pressure (MSLP) extracted from the nearest gridpoints to Reykjavik, Ponta Delgada, Lisbon and Gibraltar, with a time resolution of one hour and horizontal spatial resolution of  $0.25^{\circ} \times 0.25^{\circ}$ . Both NAO index and MSLP time series were validated for different timescales (hourly, daily, monthly and seasonal) using the Automated Surface Observing System data and the Climatic Research Unit (CRU) high-resolution dataset (based on measured data). High correlations, ranging from 0.92 to 0.98, were found for all stations, timescales and evaluated parameters. To quantify the influence of NAO over the Mediterranean region, the monthly averaged ERA5 'total precipitation' data over the Italian Peninsula [ $35-48^{\circ}$  N;  $5-20^{\circ}$  E] were used. As expected, the results concerning NAO x Precipitation presented the best correlations when analysed monthly, confirming some of the already known NAO signatures over the Italian Peninsula: higher correlations during winter and over the Tyrrhenian coast, and lower correlations during summer and over the Apennines, the Adriatic Sea and the Ionian Sea. On the other hand, the precipitation over the Alps and the Tunisian coast presented a remarkable signature of positive NAO values that, despite a lower statistical significance (85-90%), is in agreement with recent findings of observational studies. In addition, significant negative correlations were identified for the spring and autumn months over the Tyrrhenian area. Among those, the high correlations found during May are particularly interesting, as they follow the behaviour described in recent studies performed using the same high-resolution dataset (ERA5), which have identified an increased number of cyclones over the Mediterranean during this month. This connection suggests that NAO could also be used to

explore the potential penetration of the North Atlantic depressions into the Mediterranean Basin.  
Keywords: NAO; Teleconnections; ERA5; ReAnalysis; Mediterranean; Climatology.