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A space-time connection of Euro-Atlantic blocking to the NAO life cycle and European climates

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In this paper, a space-time connection between the winter atmospheric blocking activity in the Euro-Atlantic sector and the life cycle of the North Atlantic Oscillation (NAO) in winter during the period 1950/51-2011/12 is examined. Results show that when NAO events are in the positive phase (NAO+), blocking events exhibit an enhanced frequency along the southwest-northeast (SW-NE) direction from the eastern Atlantic to northeast Europe (SW-NE pattern hereafter), which is particularly evident during the decaying phase. However, for the negative NAO (NAO-) phase the enhanced blocking frequency is distributed along the southeast-northwest (SE-NW) direction from the central Europe to North Atlantic and Greenland (SE-NW pattern, hereafter). Especially, it is found that the blocking frequency can vary from the SW-NE (SE-NW) to SE-NW (SW-NE) pattern as NAO+ (NAO-) events transition into NAO- (NAO+) events. Finally, the causal relationship between European blocking events and the phase of NAO is also discussed.
Moreover, it is shown that for the NAO- (NAO+) phase the most marked decrease (increase) in the surface air temperature in winter over northern Europe is in its decaying phase. For the NAO+ phase the dominant positive temperature and precipitation anomalies exhibit the SW-NE oriented distribution from west Europe to northeast Europe, which are parallel to the NAO+-related blocking frequency distribution. For the NAO- phase the dominant negative temperature anomaly is in the North and Central Europe, whereas the dominant positive precipitation anomaly is distributed over the South Europe along the SW-NE direction. Thus, the NAO's phase can act as an asymmetric impact on the European climate through producing the different spatial pattern of the Euro-Atlantic blocking frequency distribution.