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The extreme opposite behaviour of the North Atlantic flow in the 2010 and 2012 winters

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The winters of 2010 and 2012 (November-March; year dated by January) exhibited highly contrasting conditions in the atmospheric flow over the North Atlantic-European sector. The tropospheric eddy-driven jet stream followed rather different mean paths in these two winters. In fact, their locations highlight extreme opposite behaviour. While the jet stream core was frequently within the latitude belt of 30-40ºN in the 2010 winter (south jet regime), it was often located around 55ºN (north jet regime) in the 2012 winter. Furthermore, these jet characteristics are associated with strong anomalies in the locations of the North Atlantic blocking systems and with rather different frequencies of occurrence of strong and persistent ridges over the eastern North Atlantic. These different flow states are also manifested by dynamically coherent anomalies in the Rossby wave breaking patterns (cyclonic and anticyclonic). The exceptionality of these two winters is particularly highlighted when considering a relatively long period of 140 years (1871-2010) and the 56-member ensemble of the 20th century reanalysis. Although extratropical boundary conditions do not show strong differences between these two winters, the ENSO phases were opposite. However, there is no clear evidence of remote forcing from the Pacific sea surface temperatures. Hence, these two winters can be seen as mere reflections of the full range of the North Atlantic jet variability under recent-past climatic conditions. The present study also demonstrates that the extreme opposite dynamical features in the two winters led to strong precipitation and near-surface temperature anomalies over different areas of Europe, with significant impacts on many socio-economic systems. Acknowledgments: This work is supported by European Union Funds (FEDER/COMPETE - Operational Competitiveness Programme) and by national funds (FCT - Portuguese Foundation for Science and Technology) under the projects FCOMP-01-0124-FEDER-022692 and PTDC/AAC-CLI/111733/2009.