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Contribution of circulation changes to recent and future temperature extremes in Europe

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European surface temperatures have increased during the past decades. According to climate projections, this warming is expected to continue in future years under enhanced radiative forcings. In addition to the mean increase, changes in temperature variability are likely to occur, with more frequent extremely warm seasons such as those recently observed in the past decade (e.g. summer 2003, autumn 2006). Most of the processes driving such long-term tendencies remain unidentified. A particularly important issue is how changes in the atmospheric dynamics over the North-Atlantic and Europe (NAE) contribute to trends in both mean and extreme temperatures. While the high frequency of the positive phase of the North Atlantic Oscillation (NAO) in the 1980s-1990s suggested a possible anthropogenic forcing of the NAE dynamics, we show here that recent years reveal an inconsistency between atmospheric circulation conditions and European temperatures. A focus is made on both warm autumn 2006 and cold winter 2009/10. In both cases, we show that European temperatures were significantly warmer than expected from the sole atmospheric circulation. Then, we investigate the fate of the NAE dynamics - European temperatures relationship in future years. We use daily outputs of sea-level pressure (SLP) and 2m-temperature (T2m) of 13 models of the Third phase of the Coupled Model Intercomparison Project (CMIP3), over the three time periods 1961-2000, 2046-2065 and 2081-2100. A flow-analogues method reveals that the future European warming appears disconnected from changes in the NAE dynamics. Only in winter a slight increase of positive NAO conditions could partially contribute to the temperature trend. Finally,we show that future warm/cold extremes should likely to be associated with similar atmospheric circulations as observed during recent warm/cold extremes.