



## **North Atlantic Ocean drivers of the 2015 European heat wave**

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Major European heat waves have occurred on several occasions in the past two decades, including the summer of 2015, with dramatic socioeconomic impacts and in a globally warming world, heat waves are expected to become longer, more frequent and more intense. Nevertheless, our understanding of heat wave causes remains at a basic level, limiting the usefulness of event prediction. We show that 2015 was the most extreme heat wave in central Europe in the past 35 years. We find that the heat wave was preceded by cold mid-latitude North Atlantic Ocean surface temperatures, which contributed to its development. In order to explain the genesis of the cold ocean anomaly, we consider surface heat loss, ocean heat content and wind driven upwelling. The anomaly is primarily due to extreme ocean heat loss in the preceding two winters and re-emergent cold ocean water masses. Further analysis indicates that this ocean anomaly was a driver for the 2015 heat wave as it favoured a stationary position of the Jet Stream, which steered Atlantic cyclones away from central Europe towards northern Europe. The cold Atlantic anomaly was also present during the most devastating European heat waves since the 1980s indicating that it is a common factor in the development of these extreme events.