Deconstructing seasonal forecasts for attribution of predicable signals: the 2019/20 positive NAO case

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Abstract

Seasonal forecasts of the positive NAO and mild European temperatures during December to February (DJF) 2019/20 were remarkably skilful. This skilful prediction provides a unique opportunity to identify the mechanisms behind the strong seasonal predictability. A series of attribution experiments are conducted to separate the impact of various tropical SST anomalies on the DJF 2019/20 response. In these forced SST experiments, the observed anomalies were replaced by climatology over the tropical Indian, Atlantic and Pacific Ocean basins in order to isolate the impact of regional SST forcing. Results indicate that the positive NAO signal in 2019/20 is characterized by the equilibrium response of the atmosphere to the diabatic heating induced by the SST anomalies in the Indian Ocean, in which the rotational flow balance the diabatic heating induced divergence. These response does not seem mediated by the stratosphere, nor by the eastward propagation of Rossby waves along the mid-latitude waveguide. Further deconstruction experiments suggest strong modulation of the atmospheric response to the Indian Ocean SST by diabatic heating in the Pacific basin. We conclude that the positive NAO was more predictable in DJF 2019/20 compared to other years, such as 1997/98 and 2015/16, due both to the structure and amplitude of the SST anomalies over the Indian Ocean and the absence of ENSO. Further, results from a suite of traditional attribution experiments to assess the impact of climate change on the DJF 2019/20 response is discussed.

Keywords: Seasonal forecast, Predictability, Tropical heating, Teleconnections, NAO

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