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Tropospheric precursors and stratospheric warmings

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Prediction of the phase and magnitude of the dominant mode of Northern Hemisphere climate variability, referred to as the Arctic Oscillation (AO) or Northern Annular Mode (NAM), is considered the next most important anticipated advance in seasonal climate prediction. Nonetheless, most studies on the subject have emphasized the lack of understanding of the underlying dynamics driving AO variability and consequently its poor predictability. Many tropospheric AO events are preceded by stratospheric AO events. Here we show that hemispheric-wide AO events associated with stratospheric warmings have an identifiable regional tropospheric precursor that can be exploited for predicting large AO events weeks and even months in advance. Identification of precursors can not only advance seasonal forecasting beyond its dependence on the El Nin˜o/Southern Oscillation, but can also help modellers improve global climate model simulations of present and future winter climate, which are deficient in simulating troposphere-stratosphere coupling.