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Hammam effect: How a warm ocean might make weather forecasting easier

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The atmosphere's chaotic nature limits short term predictability and makes defining a measure of intrinsic atmospheric predictability problematic. Moreover, turbulence injects energy at all spatio-temporal scales, thus making the detection and interpretation of observed and modelled changes in atmospheric patterns complex. The task of diagnosing changes in atmospheric predictability under anthropogenic forcing is therefore beset with difficulties. Achieving this when focusing on climate variability indices such as the NAO, PNA, AO or ENSO presents serious challenges. Instead of projecting the atmospheric dynamics onto a specific index, here we retain the phase-space trajectories describing the evolution of atmospheric motions and use them to infer the dynamical properties of the climate system. This approach can be implemented using daily data issued from long climate model simulations or reanalyses, and provides proxies for the atmosphere's inherent predictability. We specifically focus on evaluating changes in the intrinsic predictability of the atmospheric circulation over the North Atlantic under anthropogenic forcing, as represented by two dynamical systems indicators: local dimension and persistence. We use three centennial reanalysis datasets (20CRv2c, ERA20CM, CERA20C) and CMIP5 simulations over the 1851–2100 period. In the historical period, there is disagreement between reanalysis datasets. For the future period, most datasets point to an increase in the atmosphere's intrinsic predictability. The analysis of AMIP simulations with 4 K warmer oceans and 4 x atmospheric CO_2 concentrations points to the prominent role of a warmer ocean in driving this increase. This occurs through the enhancement of zonal atmospheric patterns which are more predictable than meridional configurations.